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"LET KNOWLEDGE GROW FROM MORE TO MORE
AND THUS BE HUMAN LIFE ENRICHED."

ENCYCLOPÆDIA BRITANNICA

A New Survey of Universal Knowledge

Volume 4

BRAIN to CASTING

THE UNIVERSITY OF CHICAGO

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Volume 4

BRAIN to CASTING

BRAIN. If by physiology of the brain we mean the study of the biological function of that organ, the state of exact knowledge regarding it is still extremely inadequate, although there exists a vast body of detailed fact. Inferences as to function drawn from morphological and phylogenetic data are therefore a permissible and welcome help although often of the nature of suggestion rather than demonstration. It is with the vertebrate brain that the following account will be concerned.

The Vertebrate Brain.—In the vertebrate a median lengthwise nerve-cord threads the fore-and-aft series of its segments; the brain is the anterior or head portion of the nerve-cord, the rest of the cord being the "spinal-cord." In the most primitive of all vertebrates, amphioxus, which must be a close relative of the prime ancestor of the vertebrate stock, that part of the nerve-cord lying at the front end differs so little from the rest that there is nothing which can properly be termed "brain." But in amphioxus there is likewise so little differentiation of the front end segments of the creature itself that nothing there can properly be termed a "head." The existence of a brain is thus correlative with the existence of those special developments, *e.g.*, specially developed receptor-organs for distance-stimuli (tele-receptors) such as olfactory, photic, etc.; and for feeding apparatus, etc., which so commonly at the forward end characterize that end and form a head. The next earliest living fragment of the vertebrate ancestral line is a greatly higher though still quite primitive form, petromyzon. This possesses at its front end distance-receptor organs and a head. The corresponding anterior segments of its nerve-cord are specialized and developed as a rudimentary brain. As to which may be the *propter hoc* of this correlative growth and how far the neural development (brain) may be secondary or not to the development of the non-neural factors in the cephalization is difficult or impossible to know.

The brain is, however, always that part of the nervous system which is constructed upon and evolved alongside of the distance-receptors. The importance of this conjunction in this matter is that it means ability on the part of the animal to react to an object when still distant and allows an interval for preparatory reactive steps, and this can go far to influence the success of its behaviour in regard to that object. The reactions initiated and guided by the distance-receptors are all steps towards final adjustments, which latter are consummations often of critical importance for the existence of the animal (*e.g.*, attainment of food) or of its species (*e.g.*, fertilization). This time-interval and its series of steps, along with the vicissitudes of relation between things of changing position reacting one on another at a distance, conspire to give to the distance-receptor reflexes a multiformity and a complexity unparalleled by the reflexes initiated from other receptors. This interval affords much more copious opportunity for adjustment and side-connection as occasion demands. It gives freer play for the affixing of new-conditioned (*i.e.*, individually-acquired) reflexes to the primal inborn reflexes. Further, the time-interval allows opportunity for variations of behaviour to be failures and yet recovered from, and conversely, allows greater chance for successful reaction-variants to be selectively preserved.

Course of Vertebrate Evolution.—As we pass from lower vertebrates to higher we find, broadly taken, a progressive increase in the relative size of the brain. This fact stands related to two features which characterize the vertebrate evolution, and seemingly also that of other phyla as well. One of these features is that, broadly speaking, the course of vertebrate evolution has tended to produce a more and more unified individual, an individual of greater functional solidarity, although still consisting of individually living cell-units. Consistently with the two main biological requisites of the individual animal life, namely, its preservation and that of its species, the closer functional welding of the parts of the animal individual into an integrated whole seems, as we look along the vista of geological time and of geographical spread, to have been a steady outcome of evolution.

The other feature is not unrelated to the foregoing one. It is, that evolution, though with chequered history, has resulted in animal forms possessing successively greater dominance over their environment. Organisms are commonly spoken of as "lower" and "higher." The "lower" are usually the simpler, the "higher" the more complex; but the "lower" need not the less perfectly fulfil their primary biological requisites, preservation of self and species. There are brachiopods which have without visible change maintained themselves in and upon their environment from the era of the earliest fossil-bearing rocks till to-day, and they are "lower" animals. Such commerce with and maintenance in the environment must be as admirably adjusted as can be any imaginable so far as concerns persistence of life. Yet, in the course of time, evolution has produced animal forms which pursue a far richer and more manifold commerce with the environment and some of these dominate the environment more variously and extensively than others, including their own ancestry, have done. In this sense they are "higher" forms." The earliest animal forms have included none of these highest, and some of the very latest are also the very "highest" forms achieved. As judged by dominance of the environment man, although quite a recent form, is the highest as yet. The key to this evolutionary feature is furnished largely by the evolutionary history of the brain and its functions.

Increased Integration.—A factor, and in some respects a decisive one, both in the accomplishment of greater functional solidarity of the animal and of its higher mastery over the environment, is the progressive development in the nervous system of a dominant part. The organization of the central nervous system is thus enhanced as an integrator of the animal in its life of external relation. The integration combines into great unitary harmonies, reactions originally scattered and local and semi-independent acts. It organizes the several segments and segmental regions into a well-knit individual. The establishment in the central nerve-cord of, so to say, a headquarters station for receipt of calls from many directions and for dealing through subsidiary parts of the nervous system with the motor machinery of the animal as a whole, imbues the organism with individuality of a higher kind. It is this that the advent of the brain foretells. The progressive development of the brain increasingly secures advantages.

The success seems partly a matter of mere increase of centralization. The receptor apparatus of the head gets increased co-ordinative guidance of the body. The body tends to become a locomotor, and later a secondary prehensile train and a digestive appanage attached to the head, with, as inalienable possession, the reproductive organs. The brain in this respect merely takes with further specialized success the general rôle assigned to the nervous system from its earliest appearance and onward throughout evolutionary history, namely, the welding of the body's component parts into one consolidated mechanism facing as a united entity the changeful world about it. The work of this kind done for the "higher" animal by its brain presents the acme of animal integrative achievement. Hence is it that each of us, though made up of myriads of cell-lives individually feeding and breathing, and of manifoldly differing activities, constituting scores of organs, yet appears to himself a single entity, a unity experiencing and acting as one individual. That the particular bodily system which is specialized for integration, and whose sole function is integration, and that that portion of it where integrative function is at its highest should be the seat of mind, even from the dim mental beginning, and that mind should remain there localized and despite all mental growth stay restricted in seat there along millions of years, on into ourselves to-day, indicate the scope and crowning importance of nervous integration and the brain.

Control of Environment.—In regard to attainment of wider mastery over the environment, no less than in respect of organizing the individual, has phylogenetic development of the brain played a decisive part. The more numerous and extensive and the better co-ordinated the responses made by a creature to the actions of the world around upon its receptors, the more completely will the bundle of reflexes (which from one standpoint the creature in it's life of external relation is) figure the complexity of the environment and meet widely and successfully its situations. And at the root of the success of the brain as an integrator there lies something more than is represented in its expressing merely a more highly organized centralization.

Over and over again in the evolution of the brain there is instanced the importance, for the process of integration, of connecting together nerve-structures which might or do react concurrently but are originally unconnected. Concurrent activity of such related nerve-paths promotes actual architectonic welding of them (neuro biotaxis, Arisus Kappers, 1908). A responsive group of neurons tend to be drawn toward their dominant stimulators. The simultaneous components of a "reflex-figure" (Sherrington, 1906) tend to stamp in a neural pattern. The functional "reflex-figure" with its simultaneously reacting parts proceeds along with (as its structural counterpart) a neural pattern which may become innate or be an individual acquirement (*e.g.*, mammalian cortex).

A keystone of the principle of integration is that the concurrent activity of related parts results in more than the simple sum of the activity of the separate component parts. Thus, in psychical integration, the single touch gives experience of itself alone. But a double simultaneous touch (*e.g.*, compasser) gives experience of two touches, and, which is new, an untouched space between. The integration results in more than the mere sum of the components. Again, the uniocular field gives experience of some amount of "depth"; but when in combination with the other uniocular field to a binocular, there is yielded such an enhancement of the third dimension as amounts to a new result, the "depth" of stereoscopic vision. So with the visual integration illustrated by the "steps" figure, it is much more than its component lines, because whether the steps appear to "overhang" or "run up" there is always a foreground and background, *i.e.*, the whole presents more than the parts, and constitutes a "situation" with "relations." And in the vertebrate after advent of the brain the animal's reactive behaviour shows in increased measure the important quality of modifiability by experience, using this last term without of necessity any psychological connotation. Late in vertebrate development in a restricted number of forms, all mammalian and nearly related one to another, and relatively very recently evolved, this modifiability of behaviour has become greatly more effective. Its highest outcome appears perhaps as the rational guidance of human conduct.

It is not of course that either the fuller integration of the individual animal or the higher animal's wider dominance of the environment are the result entirely of the brain or of the cerebral adjunct "mind." Contributory to the latter result has been the mechanism (partly nervous) for ensuring a constant temperature-environment for the tissues of the body, enabling the individual's activity to be uninterrupted by season, and largely independent of latitude; also the gestation arrangement which protects the young within the mother until a relatively late stage, providing exceptional pre-natal care for the offspring. Nevertheless the extreme importance of the contribution by the brain is shown by the degree of dominance over the environment obtained by man as compared with that of other, even the highest other, placental mammals.

The vertebrate brain consists of a fore-and-aft series of three portions, the fore brain, mid brain and hind brain.

Hind-Brain.—The hind-brain, as traced upward from the lamprey, shows two main functional divisions. Of these, one, the basal, closely resembles the spinal cord of which it is the continuation in the posterior head segments. In air-breathing vertebrates this basal portion contains a "centre" regulating the movements which ventilate the lungs. This mechanism presents the interesting physiological feature that while "reflex" in the sense of being driven and controlled by nervous impulses arriving at it by well recognized afferent nerves, it is also activated and partly regulated by stimuli arising autochthonously within it. This intrinsic stimulation is perhaps generated and is certainly influenced by the chemical condition (degree of acidity) of the blood. Another centre in this basal part of the hind-brain is, in higher vertebrates, one which influences the general circulation of the blood, by regulating the contraction of the muscles of the arterial tubes and to some extent of the heart itself. There lie also in this region reflex centres which maintain postural contraction of the extensor muscles of the limbs and trunk in response to passive stretch of these muscles. In the erect attitude of the animal these muscles are subjected by the weight of superincumbent parts to stretch and they are termed antigravity muscles; and this hind-brain region therefore executes a crude reflex standing, traces of which can be executed even by the isolated spinal cord itself (dog). Further forward still this part of the hind-brain receives the nervous impulse from the labyrinth-organs, and enables still more perfect reflexes of standing.

Cerebellum.—The hind-brain has further an important roof-portion, the cerebellum, so called because in man, large and with paired lobes, it seems, to gross inspection, a small replica of the great cerebral hemispheres in front. The cerebellum has its cradle, ontogenetically and phylogenetically, in the primary receiving stations of the receptive nerve from the labyrinth, a proprioceptive organ largely controlling the postures of the head in regard to the vertical (line of gravity) and the posture and motions of the body in regard to motions of the head. The primitive cerebellum rests further on spinal nerve-tracts from the proprioceptors of the body muscles and limb muscles. Traced up from the fish through amphibia and reptiles to birds the relative size of the cerebellum differs in even nearly allied groups, but bears evident proportion to range and power of skeleto-muscular motility. In forms which crawl and creep it is quite small, but in the great swimmers and fliers it is large, even very large. With the mammalian series, however, a steady progress in cerebellar size occurs along with ascension to higher forms and culminates in the ape and man. Two large lateral developments are added to the pre-existent, unpaired median portion. Each of these lateral additions is functionally an annex of the new mammalian neopallium of the contralateral cerebral hemisphere, and with this latter go considerable developments in the median (palaeo) cerebellum also. The surface sheet of the cerebellum has a peculiar and characteristic minute structure, which is both in the palaeocerebellum and in the neocerebellum, although the history of the two seems so different and though the genesis of the neocerebellum is separated by some millions of years from that of the palaeocerebellum. To all appearance the neural chains of the cerebellum are a collateral path which, as regards those of the palaeocerebellum, belongs to the afferent limbs of reflex arcs actuating skeletal movements, but as regards those of the neocerebellum belong to the efferent central path of "volitional" movements.

The excitability of the cerebellar surface by electricity has been denied, but recent studies confirm that, as formerly claimed (Ferrier), considerable areas of the surface are truly excitable by electrical stimuli. The excitable field is palaeocerebellar (Ingvar, Bremer) and causes inhibitory relaxation of certain active postures, *e.g.*, of extension-abduction of limb (Bremer, Miller and Banting, Sherrington). Destruction of the palaeocerebellar region which receives proprioceptive spinal tracts causes exaggeration of the stretch-reflexes of the limb-extensors (Bremer). Disease with cerebellar defect in man produces its most obvious detectable results in the field of willed muscular acts. The accuracy of execution of the movement is impaired by overshoot, abruptness of start and stop, ill-sustained contraction, and undue liability to fatigue. Cerebellar ataxy seems to contain the following three factors (Walshe), diminished fineness of postural adjustment, excessive intensity of postural activity, and complication of the two foregoing by voluntary efforts at correction.

Function of the Cerebellum.—Acute unilateral damage of the cerebellum in man brings as characteristic symptoms (1) tendency to fall sideways toward the side of the injury, especially if the eyes be closed; (2) the hand in reaching toward a point goes too far or stops too short; (3) in alternating movement the limb on the side of the lesion cannot alternate its phases with normal quickness and accuracy, it starts late and ends late for each phase; (4) with eyes shut the limb tends unconsciously to slip from an adducted into an abducted posture; (5) the position of the limb is often misperceived, its degree of abduction being underestimated. There is, however, no impairment of skin sensations or of pain-sensation superficial or deep. Strangely enough, congenital absence, total or almost so, of the cerebellum has been authentically found in persons who have lived their lives without suspicion of any nervous defect. How the defect is compensated remains at present unanswered.

Obviously the function of the cerebellum is still obscure, although it is a large organ, weighing in man more than the entire spinal cord. Proprioceptive recepts seem at the base of palaeocerebellar function, and suggest for it an adjusting co-operation in the execution of muscular acts, the acts themselves being initiated and directed by other centres than the palaeocerebellum, probably mainly those of the mid-brain. The neocerebellar function may be inferred to be similar in character to that of the palaeocerebellum but to be adjuvant to movements of a newer physiological order (voluntary), initiated and directed by the neopallium (cerebral cortex). The neopallium in activating these movements probably activates collaterally the associated neocerebellar co-operation. The status of the cerebellum in the motor acts seems merely that of an executive instrument of them; the purpose and object of them are none of its affair. Cerebellar reactions are unconscious. Its destruction entails no loss of sensation, although cerebellar disturbance may occasion some proprioceptive mis-perception.

Mid-Brain.—The mid-brain like the hind-brain is made up of centres intrinsically its own as well as of conducting tracts merely passing through it to connect centres extrinsic to it. Its main intrinsic apparatus is collected in its roof. This receives a great afferent path from the retina, and also from the receptive centres of the hind-brain and spinal cord. It distributes efferent paths to neighbouring motor stations in the neighbourhood, including those of the eye muscles; many of these paths decussate across the mid-line. It sends also some longer paths forward to the forebrain and backward into the spinal cord. It has also rich intrinsic interconnections. By means of its mid-brain the mammal, even after destruction of the fore-brain, is able to execute and maintain the erect posture and with better adjusted muscular tone than by means of the hind-brain alone. It is able further to assume the erect posture from other positions passively imposed upon it. It can "right itself." The mere motor execution of these reflexes is a matter of high complexity. Maintenance of standing involves duly adjusted simultaneous activation of many hundreds of thousands of motor units. The "righting reflexes" themselves are "chain-reflexes." In a "chain-reflex" the result of a foregoing reflex's execution is to evoke execution of the next succeeding one. This means due and successive activations of appropriate different great combinations of motor units, reaching at last the "standing complex," which forms an equilibrium, and, until disturbed, an end-point.

The cat retaining the mid-brain but deprived of the fore-brain reacts to sounds, although without giving indication of the direction whence they come. The mid-brain is in fact a large "exchange" where messages from the retina are associated with those from various other receptive nerves of the head and, via the spinal tracts, from the body (especially skin). In responding to these messages the mid-brain uses efferent paths by which it can operate upon motor centres, especially of the eyes and mouth and also of the neck and body. Severe impairments of motility and of normal posture are therefore produced by injury of the mid-brain roof, but although relatively large in lower vertebrates it becomes relatively dwarfed in the mammalian brain. There is some evidence that in the course of vertebrate evolution along the mammalian branch, the intrinsic importance of the mid-brain as a dominating centre becomes smaller, not only relatively but absolutely. The supreme control of behaviour becomes located progressively more forward, passing from mid-brain (most fishes) to thalamus and striatum (reptiles and birds) and then to cerebral cortex (mammals).

Fore-Brain.—In the fore-brain four main constituents are strikingly distinguishable. They are, the thalamus, olfactory lobe, striatum and pallium. The latter three belong to the end-brain, so-called because it is the actual terminal piece of the nerve-cord itself.

Thalamus.—Throughout the vertebrate series the thalamus is a structure for correlating messages relayed up from receiving stations corresponding with all the various classes of receptor-organs both of head and body; eminently so with the retinal, whence the term optic thalamus. Besides providing machinery for interconnecting these and bringing their recepts (Parsons) to bear on the motor centres of mid- and hind-brain, it is itself a relay station for transmissions to the striatum. Where as in mammalia the neopallium is large the thalamus becomes a relay station for routes thither, and on an enormous scale. In lower mammals it is subdivided into regions ("nuclei") each preponderantly representative of some specific set of receptors (retinal, auditory, tactual-proprioceptive, etc.) and each in give-and-take connection with especially some one field of the neopallium (cerebral cortex). In higher apes and man the subdivisions become more complex still. The thalamus of lower vertebrates certainly mediates the simpler types of modification of behaviour by trial-and-error learning; after removal of the whole fore-brain the frog, for instance, is incapable of acquiring a very simple "maze" adjustment. But the feeding chain-reflex remains, the retinal reflex orientates the frog to the fly and if the fly moves again the simultaneous spring and snap reflex follows, to be followed if successful by the swallow reflex. The thalamus is of itself quite incompetent in the hen for the instinctive behaviour of the maternal uprearing of the chick.

In close association with the thalamus is an underlying structure, hypothalamus, among whose ascribed functions is nervous regulation of the mechanism (vascular, glandular, etc.) by which in animals of constant temperature (birds, mammals) the body temperature is maintained steady despite environmental changes, a result contributing enormously to evolutionary success. In addition to this so to say essentially vegetative function, the hypothalamic region is concerned with visceral nerve-relays, putting them in touch with taste and smell (from in front) relays. It is therefore relatively large in lower vertebrates, while the thalamus, analogous with it but in an exteroceptive and somatic rather than a visceral field, gains on it in higher vertebrates. In the bird the thalamic fore-brain independently of the cerebral hemispheres seems to operate large reflex reactions to noxa, to hunger, thirst, and temperature, and possibly elaborates mental concomitants of these. But even in the highest mammals tonic activities of the sympathetic, essentially a visceral, system are traceable to this region. The nexus between sympathetic and visceral reactions on the one hand and affective and emotional mental experience on the other makes the close relation between thalamus and hypothalamus the more significant.

The dog or cat deprived of fore-brain except thalamus does not react even when hungry to food placed before it. The muzzle has to be dipped into the food or the food put into the mouth for the feeding to occur. Food doctored with quinine, etc., is rejected. Nociceptive stimuli to skin, etc., evoke biting, barking, miaowing and withdrawal of the threatened part. Yet in all this defensive behaviour there may be little or no indication of the locality of the offending stimulus. The animal, it has been inferred, can experience "pain"; it is not, however, able to acquire the simplest conditioned reflex. Its behaviour is confined to the stereotyped inborn reflexes. Its reflex behaviour is modifiable, however, to the extent that having hurt one foot it limps upon three legs until the hurt foot is healed. Its reactions, indicative of "pain," may possibly be pseudo-affective reflexes without psychical adjunct. But there is evidence from clinical studies (Head) that "pain" is among the reactions of the thalamus. Affective and emotional disturbances have come to be recognized as part of the syndrome of thalamic disease. The inference is therefore that the cerebral seat of mind does in some measure include—and so to say overlap upon—the thalamus even in higher mammals.

Olfactory Bulb and Striatum.—Of the three great components of the end-brain (cerebral hemisphere) one is the olfactory bulb, the reflex centre for the organ of smell, whose afferent nerve is so to say the segmental nerve for this region. Another is the striatum, a large correlating centre, of easily recognizable beginnings in fish and of further development in reptilia. In birds it becomes the largest element of the hemisphere, whereas in mammals although large it is relatively dwarfed by the development of the pallium, especially the neopallium of higher mammals. Birds, therefore, offer best opportunity for detecting striatal function, the more so perhaps since in them the olfactory region is greatly reduced. In the pigeon destruction of the hemispheres other than the striata leaves the feeding, mating and rearing reflex acts, as well as walking and flying with avoidance of obstacles, intact, but open to occur with less discrimination of stimuli. Conditioned reflexes can be acquired and attached to the innate ones, feeding or "avoidance." But if the striata be destroyed, the hen loses irrecoverably her maternal behaviour of incubating and rearing. So, similarly, the hawk caged with mice turns its gaze toward them when they move, but on their ceasing to move reaction ceases on the part of the bird. Neither does their movement excite attack upon them. The bird will starve in presence of its natural prey. It seems clear that in birds the striatum operates complex though stereotyped behaviour and provides in some measure acquisition of individual modification (by experience) of such behaviour.

Passing to the lower mammals, the striatum is relatively smaller than in birds. Conformably with mammalian ancestry some of the striatum is ancient and olfactory and probably serves higher correlations of smell with taste and touch for locomotor and head reflexes involved in feeding. Another part, also ancient, receives exteroceptive and proprioceptive tracts (from thalamus) but no olfactory; it operates movements through an emissive path to the mid-brain. To these old parts there is a new addition of as yet undetermined function. The cat (Dusser de Barenne) with neopallium lost but striatum (and archipallium) retained, localized the direction of sounds. In man destructive disease within the striatum is thought responsible for the syndrome of *paralysis agitans*, characterized by tremor and tonic spasm.

Pallium (Cerebral Cortex).—In fish and many amphibia the pallium is non-existent or present but in traces. It exists clearly though rudimentarily in reptilia. In view of the great importance ultimately assumed by the pallium it is well to remember that in entire absence of a pallium, not only is complex instinctive behaviour, but also modification of innate behaviour by individual experience, clearly evidenced in fishes and lower amphibia, not to speak of invertebrata.

From early reptilian stock came, it is held, the mammalian stock, as did independently and somewhat later in geological time the birds. In the course of bird evolution the pallium has progressed little or not at all, perhaps in correspondence with the avian lack of olfactory development, the pallium tracing its origin partly to nerve centres for smell. In mammals on the other hand the pallium taken over with primitive potentialities has proceeded to large and ultimately in some forms (apes and man) enormous development. Hence a progressive divergence might be expected between the courses of development of behaviour in birds and mammals respectively. The progress of bird-behaviour to its highest types might be expected to show little *qualitative* difference from behaviour of the old palae-encephalic type. Comparison of birds with bony fishes finds in both groups a great diversity of specialized forms with specialized behaviour evolved by hereditary organization, behaviour highly and rigidly stereotyped and fixed in character and little imbued with individual plasticity. In this respect both groups resemble the insects. The fish, however, reveals more individual modifiability (*e.g.*, docility) than does the insect; and the bird on the average leads individually a more diversified life and has more power for "conditioned" moulding of innate instinctive behaviour than have fish (Herrick). Yet, there is a similarity of the behaviour of the two. Nothing essentially new in behaviour, not even in instinctive type, sunders the later group from the earlier.

Mammalian behaviour, on the other hand, in its course of evolution reveals attainment of certain additional new types of reaction, types different perhaps even radically from anything palae-encephalic. Indications of this are the replacement in some respects of "trial-and-error" learning by methods of "seeing-through" or of "stopping-to-think" about a situation. Another is the "tooldom," if one may so call it, of man. And there is the specific human behaviour involving concepts and symbolic-thinking and employing complex speech. Of all this the development of the pallium is the correlative.

Neopallium.—That pallium which the mammalian stock derived directly from its reptilian ancestry, is an associating mechanism for recepts relayed to it from olfactory organs on the one hand and receptive organs of the mouth and muzzle on the other. This, the archipallium, therefore promotes in some way the behaviour reactions in regard to feeding, including in that the food-*finding*. No sooner, however, has the mammalian career of the pallium been entered on than a further formation adds itself to the archipallium. This is the neopallium, a correlation-mechanism of still more decisive and capital importance, destined in man to exceed in size the total rest of the central nervous system. In man it is the seat of all which is exclusively human in the mind. It is a structure in which are brought together paths from less comprehensive correlating centres, *e.g.*, those of thalamus. The archipallium correlates recepts from the olfactory distance-receptor with others from the skin, mucous membrane and muscles of the mouth region. The neopallium working on a grander scale brings together recepts from all the various species of receptors, distance-receptors and others alike.

But it is never reached by any receptive nerve immediately; it is reached only through relay-systems which climb to it via successive correlating-mechanisms. The recept-patterns which enter the neopallium (cerebral cortex) are therefore always greatly changed from those furnished to the first receiving stations by the groups of receptor nerves themselves. Yet, as is clear in the more primitive mammals just as the thalamus shows some subdivision into regions individually concerned with recepts predominantly of one kind of source, retinal, auditory, cutaneous, etc., so in the neopallium connected with the underlying thalamus there are individual territories which receive patterns composed predominantly of recepts traceable to one kind—be it this, or that—of receptive source. There is thus some "localization of function" in the neopallium in correlation with some at least of the sets of receptor organs, or, psychologically put, some at least of the modalities of sense. Vision is an instance.

Developmental Stages.—It is of interest and a help toward broad evaluation of the place of the brain in the scheme of life to trace so far as we can, the steps in biological history that were specially momentous in favouring or determining the vertebrate brain's evolution onward to its capital development in man.

One of these steps is judged to have been the emancipation from an aquatic existence achieved partially by amphibia with conversion of paired fins into limbs, and development of lungs for air-breathing. The body's greater need for support in air than in water made of the limb a jointed motor prop for locomotion with movement of diverse direction and with fingers and toes for clasping and other use. The limb and the evolving nervous system conspired so to say to draw advantage from this. The conquest of the land completed by the reptilian was accompanied by relative increase of the fore-brain. The land we may regard as a habitat of more varied difficulty and opportunity. Yet, launched from that stock, the primitive mammal was completely equipped for a land existence. Its fore-brain as judged from primitive existent forms was able, and grew more so, to learn with fewer repetitions and better retention; not only so, but its warm constant body-temperature provided for cerebral and other activities uninterrupted by seasonal abeyance. One great branch of this stock, developing a mechanism (placenta) of nutrition and protection for the young within the mother's body (ultimately in the human case nine months long), entered into active and successful competition with other land-forms, and indeed upon great competition within itself. We learn, by comparison of the fossil members of this great group with its present members of similar kind, that even with regard to allied forms the cerebral neopallium has become relatively much larger since the early Tertiary period. That is to say that in this group the modern individual has relatively more neopallium than had its ancient ancestor of like form and body bulk.

From Sub-human to Human.—The ancestry proper of man is thought traceable to some shrew-like placental which became aboreal in habit. Modes of aboreal life put a premium on movements of varied range and accurate adjustment of both limbs and body, also on sight. The evolving of a limb as a tool for uses additional to locomotion gives opportunity for limb and brain to interact. Physical opportunities beget mental opportunities, and conversely. Fruits picked, insects caught, will be handled and examined under combined touch, muscular sense and sight. The hand became a testing organ additional to and of greater range than the snout. Some lemur-like type arose, followed by some monkey-like type. The brains corresponding with these are known and their increased scope of reaction and behaviour can be judged. Parts of the brain concerned with sight and manual dexterity increase greatly in transition from the lemurs up to the ape. The freeing of arm and hand from exclusively locomotor use and their employment for grasping and presenting objects to the eyes and mouth, along with correlative change of the visual axes to parallelism, greatly amplifying and enhancing stereoscopic vision, are thought to have been of great moment for advance toward the human stage of brain. A core of three-dimensional space neighbouring upon and centred at the animal then became visually, tactually and proprioceptively explorable by and familiar to experience on a scale of accuracy hitherto unapproached in animal life. Correlated with this is perhaps the curiosity characteristic of monkeys. The free hand itches to be employed. Later some form belonging to the ape-group, though not any existent ape, with anthropoid characters, came to live less in the trees and indeed far more on the ground, probably on the grasslands. With this went a greater attainment of the erect position, a more complete freeing of the arm and hand as a universal tool, and loftier point of vantage for the stereoscopic gaze. So an immediately sub-human and then, less than a half-million years ago, a human brain was reached.

Had Man Had Wings.—An inference from the above-traced course of evolution of the vertebrate brain is that the freeing of a limb-pair for more manifold use as a "tool," while the other limb-pair still assured efficient land locomotion gave an impulsion or opportunity for cerebral development which was of decisive importance in the evolution of pallial growth and function. This inference raises the surmise that, had wings arisen in the vertebrates, as actually in the insect, without cost of a limb-pair to co-exist with "land-locomotor" leg and "tool" arm, the consequent additional experience and exploitation of a great three-dimensional medium (containing, unlike water, ample oxygen) would have evolved a brain of wider components and on fuller lines than is the human. A sobering reflexion is that should such a vertebrate form fraught with transcendent promise though it were, enter now upon evolution, man's dominance, leaving no part of the planet's surface untouched, would assuredly meet it and frustrate it by extermination, or by domestication. In the latter event its breeding would doubtless be controlled and guided to serve immediate human ends at the expense of the creature's own supreme ultimate possibilities. The evolutionary retrospect of the vertebrate brain shows clearly that the particular type of brain which thus far has by the development of intelligence done most to raise the level of life is not the later-launched avian brain but the earlier-launched mammalian. Subsequent to the start of that train of development which has accomplished the better brain were, however, not only earlier inferior types still proceeded with, but a partly fresh start was made on a type second-rate in itself and sterile of prospect—and indeed in performance through aeons of trial—as a possible new source for the first-rate. It would look as though after all the upward development of mind were not—at least in this planet—an object of the scheme of things.

Lessons of Animal Behaviour.—But to return to the observed relations between the pallium and mammalian behaviour, the classical observations of Lloyd Morgan showed that the newly-hatched chick pecks at things of all sorts as well as food, and that it learns to feed by profiting from the experience of the gustatory results of its random pecking. For this behaviour in the bird the striatum in absence of pallium suffices; it forms an instance of a modifiable behaviour in which one (a pleasurable) result stamps in the step which led to it, while another (an unpleasurable) result eradicates itself by stamping out an act which leads to it. Similarly, the dog, caught by too hot a morsel, fights shy of a next one. In the case of the dog more than *striatum* is at work; the pallium is necessary. Those who study the functions of the pallium look largely to animal behaviour as their key. The behaviour tests consist chiefly in training or learning of one kind or another. A simple form of maze with alternative paths, one leading to food another not; or one evoking an electric shock, the other not. Food which can be reached only by opening the tilt-latch or other fastening of a spring. Or the learning by experience that some stimulus, *e.g.*, a sound signals the coming of food, or some other event with which in the animal's training it has been regularly associated. Such observations touch somewhat the same topics as do many of the anecdotes of sportsmen and animal-lovers. They have the difference, however, that laboratory observers control carefully the conditions surrounding an observation, simplify its factors, exclude extraneous variables, describe the resultant behaviour as objectively as possible, and arrange the experiments so as to permit quantitative statement.

In a good deal of this work it is now customary to apply the term reflex to the acts of the normal animal, *e.g.*, dog. Hitherto the application of the term reflex in physiology and in medicine has been to reactions, through the nervous system, which either in man are known to be, or in animals there is cogent reason to believe are, unaccompanied by mental experience. The extension of the term "reflex" to such an act on the part of one's dog as its coming when called by name may be taken to mean not that the observer denies that mental action attaches to the dog's behaviour, but that the observer explicitly disregards them, and is studying the behaviour solely as neuro-muscular bodily reaction, hoping thus to study the brain, much on the lines on which the spinal cord may be studied.

Reflexes.—All purely spinal and hind- and mid-brain reflexes of the placental mammal seem to be innate. They are transmitted by heredity and are the common property of the species, often of the genus. They include not only such simple acts as mastication, swallowing, the blink-reflex, the knee jerk, the scratch-reflex, crude sexual acts, etc., but standing, stepping, the falling cat's "righting" reflex, etc. They may develop only in adult maturity, but they are innate. Built up into chain-reflexes they make the basis of much instinctive behaviour.

Besides this type of reflex reaction the individual animal is able to develop other responses operating through its central nervous system. Thus, when the skin of one foot is subjected to a hurtful electric shock, retraction of the foot ensues. If along with or just preceding this, some other stimulus, *e.g.*, a sound, be given, then after a number of regular repetitions of this concurrence, the "sound" itself evokes the retraction of the foot. The response to such an associated stimulus is called an "associated" (Bechterew) or "conditioned" (Pavlov) or "individual" (Beritoff) reflex. The "associated reflex" is (dog) a response for which the neopallium is a *sine qua non*. In entire absence of the neopallium (cerebral cortex) the dog is incapable of acquiring any such responses and loses any such as it has already acquired. A dog's normal everyday behaviour is largely composed of such responses which the common happenings and experiences of its life as an individual from puppyhood onward have taught it. By loss of the pallium this stock of reactions is woefully reduced; it could not maintain even its base existence. Its behaviour is cut down to a few rigidly-fixed reactions. This is exemplified by Pavlov's decorticated dogs not able even to feed unless food were placed in the mouth; and by Dusser de Barenne's cats, although there one of them, in which the archipallium had been spared, still found its food by smell, and fed itself.

By means of the pallium any agent which acts on a receptor can by training become a signal evoking a particular movement or a secretion The training required is that the agent act several times concurrently with the act of movement or secretion, or immediately before it, or, which is much less favourable, just after it (Beritoff). The movement or secretion to which the extraneous stimulus becomes attached as a signal is called the ground-act (Beritoff) or "unconditioned reflex" (Pavlov). In using the latter term it must be remembered that the protective movement in response to a hurtful stimulus which has for instance been much used as a ground-act, for which various neutral stimuli can, by training the individual, acquire the value of signals, is not itself entirely a reflex in the usual physiological sense of that term.

It is true that in the protective ground-act there is a kernel of reaction evocable even when only the spinal cord remains and therefore purely reflex. But to this in the protective act evoked by a similar stimulus in the intact animal there is much added. In this latter case cerebral and cortical reactions are superadded to the strictly reflex. The ground-act is therefore a behaviour-response far more complex than that which is usually denoted physiologically a reflex. If we face the full biological situation it includes, instead of consisting merely of a pure physiological reflex, a large psychical reaction as well. It must, so to say, reverberate through wide regions of the pallium (cerebral cortex). Similarly, the secretion of the saliva in response to food in the mouth has been greatly used as a ground-act (Pavlov) and in terming it an unconditioned reflex we must remember that although secretion of saliva can after severe curtailment of the nervous system be obtained as a pure reflex, it yet, as obtained in the feeding response of the intact animal, is but one component of an immense reaction with emotional and other mental accompaniments inevitably involving wide regions of the pallium. These ground-acts as reactions to the essential stimulus, *e.g.*, food in mouth for salivation, are innate inherited reactions, although possessing cortical extensions. The attaching them to other stimuli, by training in the individual, constitutes the so-called "conditioned reflex" of Pavlov, the "individually-acquired reflex" of Beritoff, and also involves the pallium. An individually-acquired reflex has been proved by the experiments of Pavlov to be in every case a response involving some part of the pallium. It is like the ground-act cortical, and it can be itself the ground-response for a further individually-acquired (*i.e.*, "conditioned") reflex, which latter again is of course cortical. This last is "secondary" by Pavlov, or by Beritoff the individually-acquired reflex of higher order.

At commencement of the acquiring of an individual reflex, the response tends to be evoked not only by exact repetition of the particular stimulus, but also by other stimuli broadly resembling it though not necessarily very closely. Anrep gives interesting figures of this. The individual reflex is said then to be in the generalized stage. Further training brings greater precision, in the sense that the response occurs only to more precise repetitions of the specific stimulus. This process is "differentiation." By this means it has been ascertained that the brain of the dog can discriminate between notes only one-eighth of a tone apart; and can hear notes of much higher pitch than the highest audible to man. It exhibits discrimination between figure patterns of relatively slight difference, *e.g.*, a thicker and a thinner capital T. It fails, however, to discriminate colours although well discriminating different luminosities.

The "individually-acquired reflex" is termed a "deferred reflex" when the beginning of the conditioned stimulus considerably precedes that of the ground-response, although continued until that of the ground-response has begun. The individual reflex so acquired brings its effect, *e.g.*, salivation, only after the conditioned stimulus has endured for a time practically corresponding with that employed in the repetitions giving the training. The name "trace-reflex" is given to individual reflexes in which the conditioned stimulus is allowed to lapse before the stimulus for the ground-response begins. The "trace-reflex" "differentiates" its stimulus relatively slowly and poorly; it is also less durable. It is noteworthy that although nociceptive stimuli have inborn defensive reflexes at command, such stimuli are difficult for induction of individual acquired reflexes—the training is long and uncertain, although sometimes successful (Pavlov). This suggests paucity of nociceptive afferent connections with the cortex in spite of probable wealth of connections with the thalamus.

If some unusual stimulus is employed concurrently with an established "conditioned" stimulus and in face of this concurrence the ground-stimulus is omitted, the individual acquired reflex occurs only weakly or not at all. The stronger this foreign stimulus the greater its inhibitory effect. This inhibitory result wears off under repetition of the same "foreign" stimulus. It has been shown in Pavlov's laboratory that the degree of inhibition exerted by the "foreign" stimulus is directly proportional to the intensity of the "investigatory reflex" which it excites. By "investigatory-reflex" (Beritoff's "orientation reflex"—the reaction agrees with Head's "vigilance"), is denoted an attitudinizing of the head which is excited by all sorts of stimuli but on repetition of the same stimulus rapidly tends to die out. It may accompany various individual reflexes (Beritoff). It is destroyed by destruction of the pallium. It has been noted that incidental activity of a natural innate skin-reflex, *e.g.*, the scratch-reflex, may suffice to inhibit an acquired reflex belonging to quite another distant skin-region, *e.g.*, of forefoot (Beritoff).

Experimental Investigations.—The effect of variously-situate partial destructions of the cerebral cortex upon acquired reflexes has been studied (Pavlov). The destruction of no one single even large field of cortex precludes totally or permanently all acquisition of "individual reflexes." Pavlov regards this as conclusive against the teaching that one special field for "association" exists in the cortex. The extirpation of a part of the cortex of whatever region temporarily upsets the "conditioned" reflexes, and with selective disturbance of them. After bilateral extirpation of the occipital region (visual) the dog never again directs its movements by sight, and fails to distinguish size and distance of objects. Full and bilateral destruction of this region in man causes total blindness; but the dog after bilateral extirpation of even much additional to both occipital regions still discriminates light from dark, and good "conditioned" reflexes were acquired with light difference as stimulus. Bilateral extirpation of the temporal lobes (acoustic) precluded acquired reflexes to sounds, but only for a time; conditioned reflexes to single sounds and even with some discrimination of tone-sequences could later be established. Yet after loss of the temporal lobes the dogs, and many observers have found it so, ceased permanently to respond to their names. Bilateral destruction of the parietal and "motor-area" regions, especially impaired "acquired reflexes" trained on touch and proprioception respectively, and especially in the limbs. After bilateral removal of the frontal lobes formerly-acquired visual and auditory "conditioned reflexes" returned and new ones could be established soon after the operation (Babkin). There ensued a persistent supersensitivity of the skin.

In sum, localized damage to cortical areas affects "acquired" reflexes selectively according to the species of receptor of their stimulus (psychologically, their sense-modality) and to the topographical seat of the lesion in the field of the cortex. Pavlov concludes that the motor area of the cortex is merely the area of proprioceptive receptors. He denies to the cortex any special association area. "The cerebral cortex should be regarded as the essential organ for the maintenance and establishment of conditioned reflexes." It may be added, on the basis of older experiments, that total destruction of the pallium of only one hemisphere in the dog impairs its behaviour relatively little.

Instinctive behaviour has been defined (Lloyd-Morgan) as "that which is, on its first occurrence (in the individual) independent of prior experience; which tends to the well-being of the individual and the preservation of the race; which is similarly performed by all the members of the same more or less restricted group of animals, and which may be subject to subsequent modification under guidance of experience." It is an innate behaviour-trend which a certain more or less complex group of stimuli of external and internal origin can call forth.

The experiments of Ceni show that while in the hen the train of behaviour corresponding with incubatory and maternal rearing of the young is not obviously disturbed by destruction of the whole pallium, in the bitch on the contrary not only does destruction of the pallium *in toto* cause all maternal instinctive behaviour to disappear, but that bilateral destruction even confined to the frontal region does so. Inherited behaviour as well as individual acquired behaviour is therefore laid up in the cerebral cortex of the dog.

With those on the dog may be compared observations on the rat (Lashley) in regard to ability to learn and retention of learnt behaviour *e.g.*, for a maze or the entrance-fastening to a food box, and the effect upon them of pallial destructions. With learning of a simple maze acquisition occurs at normal rate after bilateral destruction of any one-third of the cortex, and similarly is retained. With a test in which two alleys to food are offered, one lit the other dark, the food being attainable always by the lit, never by the dark one, bilateral destruction of the occipital third (visual) of the pallium abrogates totally the successful behaviour already learned, but offers no impediment to acquiring it as quickly as in the original training With a more complex test for entrance to a food-box the learnt solution of it and its reacquisition is disturbed, but not completely abolished, by bilateral destruction of either the frontal or occipital regions.

Turning from mammals lower than the dog to others higher, the older experiments on the monkey, while showing greater impairment of motor behaviour than in the dog, gave evidence of considerable powers of recuperation. In monkeys, the destruction of the precentral gyrus "the motor area" (perhaps proprioceptive) of both hemispheres, the animals having previously been trained in habits of manipulation, revealed on subsidence of the temporary paralysis perfect retention of these habits (Lashley). Nor did even the paralysis recur on destruction of the striatum subsequent to recovery from the diplegia. Even in the man-like apes the temporary arm-paralysis caused by destruction of the cortical "excitable" area for the arm produces no permanent impairment of individually-acquired motor habits executable by that arm. The peeling and other manipulations in eating a banana, the taking and holding of a cup of water to drink from (Graham Brown and Sherrington), the learnt "hand-shake" with a visitor (Leyton and Sherrington) are all recovered. Further, the recovery is not frustrated or undone by additional removal of the arm area of the opposite hemisphere or of the post-central gyrus of the same side.

But these are relatively restricted lesions and in the man-like apes, as in man, objective study solely by means of motor-behaviour apart from speech of the effects of damage to this or that field of neopallium (cerebral cortex) becomes less and less adequate to the complexity of the phenomena if all reference to psychical accompaniment be eschewed. The fully developed pallium is mainly so to say a mental organ. To a spectator otherwise unacquainted with the play, "Hamlet" in dumb-show would convey but meagrely that play's contents. The experiments of Thorndike and others go to show that lower mammals give little evidence for their possession of images in the form of ideas; or in their learning of mazes, door-fastenings, etc., of doing so even by imitation. There is, it is found, some power of imitation, though not so much as has been generally supposed, in monkeys; and a questionable existence of image-ideas. A situation before which a cat is helpless a monkey will grasp. A chimpanzee will solve a situation by making use of some object present at hand as an implement; will recall the position of an object it has seen placed in hiding a day previous; will in some cases fetch an object, remembered though out of sight, to serve as implement suitable for solving a newly-arisen situation (Yerkes); and has been observed to pause in a waiting attitude trying, as it were, to "see" how to attain indirectly an objective unattainable directly, somewhat as a man "stops to think." It is inferred that the man-like apes form and retain memory-images not essentially dissimilar from man's memory-images.

It would seem that no gross lesion of the neopallium occurs without inflicting a certain degree of lasting disturbance upon mental reactions. It may be that that impairment will, by improved analysis of the conditions, be found to be essentially of the same kind for all regions of the pallium. Be that as it may, it is already certain that disturbances predominantly in this or that sphere of sense are related regularly to spatially separate areas of the human cortex; and that impairment of the performance of "willed" movements by the muscles, especially of limbs and face in the opposite side, results from damage of a particular pallial region, the pre-central gyrus in man just as in the ape, and more severely. Speech *per se* without any paralysis of the motor mechanisms of its production is affected very commonly by injury of the cerebral cortex. The manner and degree of the disturbance of speech so produced differs greatly in differently placed structural lesions. Their study, although difficult, affords perhaps the best opportunity for analytic examination of the mental functions attaching to the neopallium in man. They form a theme too large and also too special to be entered upon adequately here.

The "Motor" Cortex.—Electrical stimulation, so useful a physiological agent in the case of nerve-trunks and many of the nerve-centres, fails in its application to most parts of the surface of the pallium, especially in the higher animal forms. From certain, however, of the areas of the cortex it does, and especially in the highest forms, evoke motor responses with regularity. The main such area occupies in ape and man the "pre-central convolution" and is called the motor area. The movements evoked occur in the crossed half of the body. The particular muscular field yielding the motor response differs for different parts of this area, and for each such part is fairly constant. Thus flexion of the arm will be excitable from one set of points, and extension of the arm from another set; opening of the jaw from one set; movement of the tongue from another, and so on. The topography of the representation of the different parts of the body is shown in fig. 17.

One character of these movements is that they tend to spread. Thus when the point for the thumb is stimulated the movement will begin in the thumb, then under continuance of the stimulus, may spread to the fingers, then to the wrist, the elbow and shoulder, and even to the face and leg as well, so that the musculature of all one side of the body may thus be simultaneously convulsed. This spread is called the "march," because it resembles a feature, termed by Hughlings Jackson, the "march," in the epileptic seizure. Strong and prolonged stimulation of a "motor cortical" point is apt to be followed by a clonic (convulsive) spasm resembling that of the true epileptic seizure. The representation of certain fields of the musculature of the body is more liberal than that of others. Variety of movement rather than power of movement seems to demand extent of cortex. The cortical area for the thumb (gorilla and chimpanzee) is larger than those for the whole of the abdomen and chest combined. The cortical area for the tongue (anthropoids) is larger than that for the whole of the neck. Only in very few cases is the movement bilateral, *i.e.*, both right and left, from unilateral cortical stimulation One of these rare instances is that of the vocal cords which bilaterally adduct (phonation). Another is that of the eyelids, which blink for both eyes. A condition for obtaining the motor responses from this "motor" field of the pallium is that the narcosis under which the animal is necessarily placed at the time of experimenting must not be too heavy. It is known from observations in man by the surgeon (Harvey Cushing and others) that no pain or indeed other sensation attaches to electric stimulation of the "motor cortex." All that is felt, even in the fully conscious person, is some perception of the movement which is evoked. If the narcosis go beyond inducing sleep of a natural depth, no visible response to stimulation, however strong, is obtainable from the pallium, although spinal reflexes, *e.g.*, the knee jerk, are still readily elicitable by their appropriate stimuli.

It was at one time thought that the response on application of electrical currents to this cerebral surface was due to stimulation, not of the cortex itself, but of bundles of nerve-fibres under the cortex. The distinction if existent would not be of much significance, because such fibres must issue from the cortex; that it is, however, some element in the cortex itself which is excited may be regarded as established. Probably the element in question is the large nerve-cell, of which numbers are scattered throughout this excitable field. Each such large cell sends a long thread-like fibre down far beyond the confines of the forebrain itself. These cells get severally into touch with the primary motor nerve-cells in the various segments of the head and body. They form together a direct path from motor cortex to the spinal cord, etc., the *pyramidal tract*.

When this excitable field of the cortex was first investigated it was thought by some that it might prove to be as the immediate starting-place of a path executive of "willed" cuts of movement. The immediate and severe paralysis of "willed" movement, which, in man and the monkey, results from destruction of this excitable field of cortex, supported such a view. But there follows in course of no long time a remarkable "restitution" of the "willed" movements, even in the man-like apes. And this is not due to vicarious functions on the part of the corresponding area of the opposite half of the pallium (Graham Brown and Sherrington) or of the underlying striatum (Lashley). The inference is that other fields of cortex than the so-called motor and other routes than the pyramidal tract are capable of carrying out willed acts.

That the movements excited from the "motor cortex" are produced via the fibres of the pyramidal tract seems clear; they are precluded by severance of that tract below the cortex. But that they resemble truly closely "willed" acts of movement is unlikely on several grounds: (1) Severance of the afferent spinal roots supplying a limb although it does not impair the motor supply of the muscles, etc., in the least, disturbs the willed movements of the limb, very greatly indeed, rendering them so inaccurate and wild as to be worse than useless. The animal, *e.g.*, monkey, soon relinquishes use of the "deafferented" limb altogether. Electrical stimulation of the field of the motor cortex corresponding with the deafferented limb nevertheless evokes in it all the movements normally so elicitable, and with no detected departure from the normal. The willed movements are grossly disturbed; yet the motor responses of the "motor" cortex remains practically unaffected. (2) Degeneration experiments show that the spinal terminals of the fibres (pyramidal tract) from the motor cortex are scattered actually among the ultimate motor cells themselves. The motor cortex presumably, therefore, makes direct synaptic junction with the final motor cell which directly innervates the muscle. This simplicity of connection of the "motor" cortex with the muscle could hardly provide for the complexity of a "willed" movement. But it accords with the further fact that under stimulation of the "motor" cortex the rate of rhythm of response of the muscle follows the rhythmic stimulation of the cortex *pari passu* even up to 180 per sec. (Cooper and Denny-Brown). Also the time interval between delivery of the electrical stimulus to the motor cortex and the response by the muscle is only 13σ, which is less than the latent period for many spinal reflexes (Cooper and Denny-Brown). (3) Recent observations indicate that the electrical and myographic behaviour of the muscles under motor-cortex stimulation denotes conflict of excitatory with inhibitory influence, simultaneously exerted on the same muscle. The clonic after-action so characteristic of motor-cortex excitation seems traceable to alternating excitation and inhibition (Cooper and Denny-Brown). All this renders it unlikely that the "motor" cortex and the pyramidal tract descending from it to play upon the motor nerve-cells yield of themselves, at least when excited artificially (*i.e.*, electrically in experiment) movements truly resembling "willed" movements.

Two patients offered opportunity while in a fully conscious state for elicitation of movements of the right hand by electrical stimulation of the motor cortex (Cushing). As reported from their own introspection the reaction was attended by no sensation other than a secondary awareness of changed position of hand and fingers. With the anthropoid ape an impressive observation repeatedly noted is the seeming entire ignorance on the part of the animal, on its awakening from a "motor cortex" ablation experiment, of any disability precluding its performance of its willed acts as usual. Surprise at the failure of the limb to execute what it intended seemed indubitably the animal's mental attitude, and not merely for the first few minutes but for many hours. The animal was slow to realize the limb's inability. It was often many hours before repeated and various failures to execute ordinary acts for climbing, feeding, satisfying its curiosity, etc., gradually impressed upon the animal that the usual services were no longer to be expected from the limb. Even after this lesson seemed to have been learnt an emergency would call forth a new attempt and surprise at failure as though the former experience has been for the moment again forgotten. The impression conveyed is that the fore-running idea of the act intended is present and as definitely and promptly developed as usual. The surprise seems to argue unfulfilled expectation, and defect in the motor execution rather than in the mental execution of the act, raising the question whether the function of the part of the cortex ("motor") ablated in such cases be not indeed infra-mental.

For diseases of the brain *see* NEUROPATHOLOGY, INSANITY, SKULL: *Anatomy*, etc.

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ANATOMY OF THE BRAIN

The brain is that part of the central nervous system which is contained within the skull. It is the seat of consciousness and memory and it contains the receptive centres for various sensory impulses which come from the skin, joints, muscles and organs of special sense. It has the power of originating movements and also of controlling and co-ordinating the action of muscles which are primarily innervated by nerve cells in the spinal cord and lower centres of the brain itself. Further it has the faculty of correlating the knowledge acquired by experiences, and of utilizing the deductions thus obtained for synthetic mental processes.

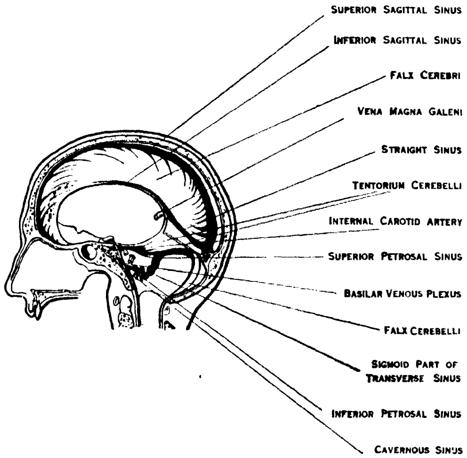


FIG. 1.—VERTICAL SECTION OF SKULL SHOWING THE OUTER MEMBRANE PARTITION AND THE VENOUS CHANNELS THROUGH WHICH THE BLOOD IS DRAINED FROM THE BRAIN TO THE VEINS OF THE NECK. THE SECTION PASSES A LITTLE TO THE LEFT OF THE MEDIAN PLANE

General Structure.—It consists of an upper main part, the *cerebrum*, and a hinder small part, the *cerebellum* (figs. 7 and 4). The lowest part of the brain, the medulla oblongata, is continuous through the foramen magnum with the spinal cord. The brain and spinal cord constitute the *central nervous system*, whereas the nerves passing to and from the central nervous system form the *peripheral cerebro-spinal system*. The nervous system also includes certain nerve-centres and nerve-fibres which, without our conscious knowledge of the processes concerned, control the vital functions of the body, such as the circulation of the blood and respiration. This system, since it acts to a large extent independently of the will, has been termed the *autonomic system*. It includes the sympathetic and parasympathetic systems. Through communicating branches the brain is capable of influencing organs which are supplied by the autonomic system, *e.g.*, the salivary glands and heart, both of which may be acted on by fear. Under ordinary circumstances, however, the functions of the internal organs are carried out in a reflex manner, and without the individual being conscious of the processes involved.

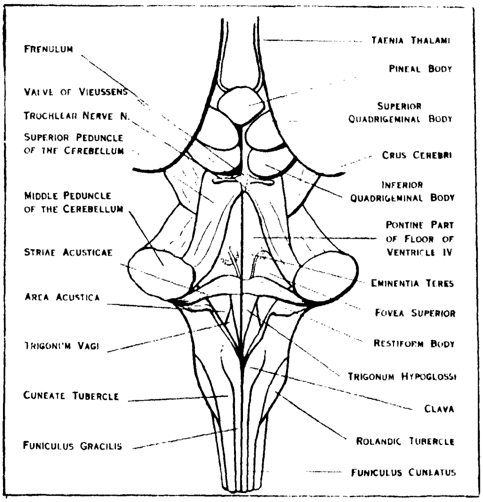
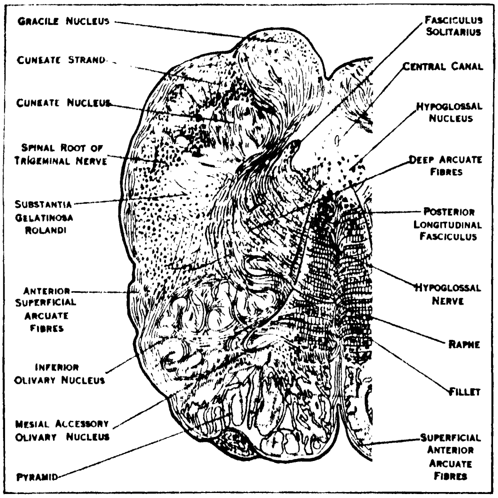


FIG. 2.—DIAGRAM OF THE LOWER PART OF THE CRANIAL CAVITY WITH CEREBELLUM REMOVED SHOWING MEDULLA, PONS AND MIDBRAIN
The floor of the 4th ventricle, or fluid-containing cavity communicating with the spinal cord, is seen from behind. Note the origins of the 4th cranial nerves and the *corpora quadrigemina*

The brain is invested by three membranes. If the membranes are removed its surface is seen to be moist and of a greyish-white colour. It is characterized by sinuous foldings of the superficial stratum or cortex. These are the gyri or convolutions, and they are separated by grooves or sulci. The main part of the brain is sub-divided by a deep longitudinal fissure into right and left hemispheres. The hemispheres are connected by transverse bands of nerve fibres called commissures. The largest of these crosses the middle of the great longitudinal fissure and is called the corpus callosum (fig. 4). In addition to the hemispheres and cerebellum, the brain comprises the inter-brain or thalamencephalon, the midbrain or mesencephalon, the pons Varolii, which forms a transverse bridge between the two cerebellar hemispheres, and finally the medulla oblongata, which is situated below the pons and cerebellum and connects these with the spinal cord.

Membranes of the Brain.—These are an outer, tough, fibrous layer, the dura mater; a thin, intermediate, web-like tissue, the arachnoid mater, and a soft, vascular inner covering, the pia mater.

The dura mater (fig. 1), lines the cranial cavity. On its outer surface are meningeal arteries and veins which serve for the nutrition of the bone. If torn in an injury to the skull an effusion of blood occurs between the dura mater and the bone, which, by exerting pressure on the underlying brain, causes paralysis of the opposite side of the body. The inner surface of the membrane which is in relation with the brain is smooth and moist. The dura mater also forms partitions between the hemispheres of the brain and cerebellum. These septa (fig. 1) are folds of the dura mater and consist of two layers, blended where they touch but separated along the attached borders of the septa to form venous channels or sinuses, by which blood and also excess of cerebrospinal fluid is drained from the brain into the great veins of the neck which carry it back towards the heart.


GRACILE NUCLEUS
CUNEATE STRAND
CUNEATE NUCLEUS
SPINAL ROOT OF TRIGEMINAL NERVE
SUBSTANTIA GELATINOSA ROLANDI
ANTERIOR SUPERFICIAL ARCUATE FIBRES
INFERIOR OLIVARY NUCLEUS
MESIAL ACCESSORY OLIVARY NUCLEUS
PYRAMID
FASCICULUS SOLITARIUS
CENTRAL CANAL
HYPOGLOSSAL NUCLEUS
DEEP ARCUATE FIBRES
POSTERIOR LONGITUDINAL FASCICULUS
HYPOGLOSSAL NERVE
RAPHE
FILLET
SUPERFICIAL ANTERIOR ARCUATE FIBRES

FROM CUNNINGHAM, "TEXTBOOK OF ANATOMY" (OXFORD UNIVERSITY PRESS)

FIG 3.—HORIZONTAL SECTION THROUGH THE LEFT HALF OF THE MEDULLA OBLONGATA

The section traverses the inferior olivary nucleus which connects with the opposite cerebellar hemisphere and shows the positions of the gracile and cuneate nuclei, where the sensory impulses coming from the spinal cord end and the superficial arcuate fibres take origin

The secretion from the pituitary gland (fig. 4) is also carried away into the general blood stream by small venules, which open into the neighboring cavernous and intercavernous venous sinuses (fig. 1). Absorption of the cerebrospinal fluid is carried out, to a large extent, by small villous processes of the arachnoid membrane which project into the venous sinuses and spaces of the dura mater, and are most numerous in the neighbourhood of the sagittal sinus (fig. 1). If this absorption is prevented or retarded the intracranial pressure of the cerebrospinal fluid rises, and one form of hydrocephalus (*q.v.*) results. In old age the arachnoid villi enlarge to form Pacchionian bodies. Between the dura mater and the subjacent arachnoid membrane is an interval called the subdural space. It contains a small quantity of fluid which serves to lubricate the smooth inner surface of the dura mater.

Beneath the dura mater is the arachnoid membrane, which is separated from the pia mater by an interval—the subarachnoid space. This is traversed by a network of delicate fibrous bands. The meshes of this network are filled by the subarachnoid cerebrospinal fluid, while the larger thin-walled cerebral arteries and veins covering the surface of the brain lie in the thin bands of fibrous tissue forming the net.

The pia mater is the delicate vascular membrane which forms the immediate investment of the brain and dips down into the fissures between the convolutions. It contains the smaller arterioles and venules which supply the subjacent cortex of the brain. A large triangular fold of pia mater (velum interpositum) is included in the great transverse fissure lying between the corpus callosum and fornix above, and the roof of the third ventricle and optic thalami below (fig. 4). This pyramidal fold contains the two great cerebral veins of Galen, which drain the blood from the interior of the brain. Vascular fringes at the margin of the fold project into the lateral ventricles, and similar fringes project from the under surface of the fold into the third ventricle. These fringes are the choroid plexuses of the lateral and third ventricles, and a similar choroid plexus is found in the roof of the fourth ventricle. They are covered by a secretory layer, called the choroidal epithelium, whose function is to secrete the cerebrospinal fluid.

In the lower part of the roof of the fourth ventricle are three openings, a median, the foramen of Magendie and two lateral, the foramina of Luschka. These form a communication between the cerebrospinal fluid in the ventricles of the brain and that contained in the subarachnoid space. Obliteration of these openings by meningitis produces an obstructive hydrocephalus, in which the accumulation of fluid is entirely intraventricular.

Ventricles.—These are cavities containing fluid situated in the substance of the brain and lined by a thin membrane, the ependyma. The true ventricles are four in number, namely, the right and left lateral ventricles, which are contained in the cerebral hemispheres; the third ventricle, situated between the optic thalami, and the fourth ventricle in the hind brain. Each lateral ventricle is connected with the third ventricle by a small opening, the interventricular foramen of Monro; and the third ventricle is joined to the fourth by a narrow channel, the aqueduct of Sylvius (fig. 4). The fourth ventricle communicates below with the central canal of the spinal cord and with the subarachnoid space by the foramina of Magendie and Luschka.

The cerebrospinal fluid, which is contained in the ventricles and subarachnoid space, acts as a mechanical support to the brain and spinal cord; it also takes the part of the tissue-fluid and lymph found in other parts of the body. (*See* NEUROPATHOLOGY.)

Medulla Oblongata.—This is situated in the lower and posterior part of the cranial cavity. It appears to be a direct continuation upwards of the spinal cord, but differs from this in the arrangement of the fibres composing the nerve tracts and in the disposition of the grey matter. It contains the important vital centres known as the cardiac, vasomotor and respiratory centres. These are situated in the lower part of the floor of the fourth ventricle (fig. 2). Longitudinal bundles of nerve fibres connect the medulla oblongata with the pons Varolii, and two diverging bundles of fibres called restiform bodies join it to the cerebellum.

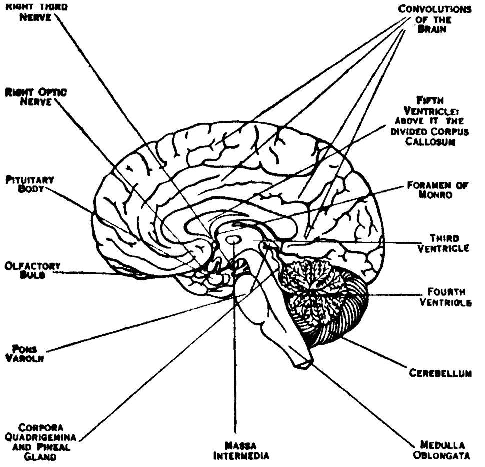
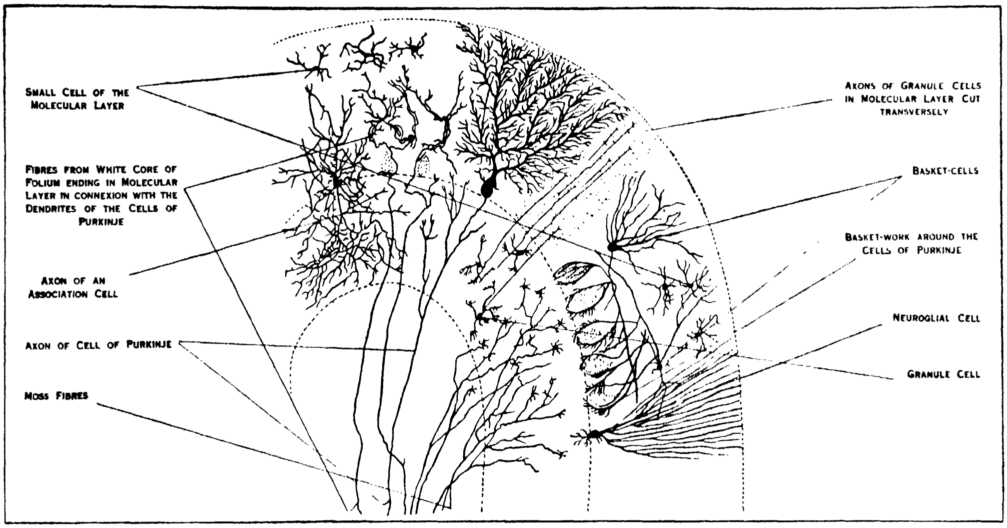


FIG. 4.—MEDIAN SURFACE OF THE RIGHT CEREBRAL HEMISPHERE

The section traverses the corpus callosum, the medulla oblongata, lowest part of the brain, and the pons varolii, which connects the cerebrum and cerebellum. The 3rd and 4th ventricles are exposed with their connecting aqueduct of Sylvius; also the communication of the 3rd with the lateral ventricle by the interventricular foramen of Monro


Small Cell of the Molecular Layer
Fibres from White Core of Folium ending in Molecular Layer in connexion with the Dendrites of the Cells of Purkinje
Axon of an Association Cell
Axon of Cell of Purkinje
Moss Fibres
Axons of Granule Cells in Molecular Layer Cut transversely
Basket-cells
Basket-work around the Cells of Purkinje
Neuroglial Cell
Granule Cell

FROM CUNNINGHAM, "TEXTBOOK OF ANATOMY"

FIG. 5.—DIAGRAM SHOWING THE ARRANGEMENT AND CONNECTIONS OF THE NERVE CELLS AND NERVE FIBRES OF THE CEREBELLAR CORTEX

The principal longitudinal tracts which connect the pons with the medulla on each side are (1) the pyramidal tract, (2) the posterior or median longitudinal bundle, and (3) the median lemniscus or fillet.

(1) The pyramidal tracts consist of motor fibres each of which descend from the motor area of the cerebral cortex through the internal capsule, midbrain and pons to the anterior part of the medulla (figs. 9 and 3). Here they form two parallel strands, one on each side of a median vertical groove. In the lower part of the medulla oblongata the greater number of the fibres of the pyramidal tract cross over to the opposite side of the spinal cord, where they form a bundle of descending fibres called the crossed pyramidal tract. The remaining fibres are continued downwards on the same side of the cord as the direct pyramidal tract. Eventually these fibres also cross to the opposite side. (*See* SPINAL CORD.) The crossing of the motor nerve fibres in the medulla oblongata is called the decussation of the pyramids; and since, with few exceptions, all motor fibres, and also sensory fibres, cross to the opposite side, each cerebral hemisphere dominates the muscles of and receives sensory impulses from the opposite side of the body.

(2) The median longitudinal bundles are paired tracts of nerve fibres, which connect the nuclei of origin of certain cranial nerves, on the same side of the brain, with one another, and also by means of decussating fibres with nuclei on the opposite side. Each bundle extends from the midbrain, through the pons Varolii to the lower part of the medulla oblongata. By means of these tracts the nuclei of origin of certain nerves controlling bi-lateral movements are correlated, *e.g.*, the muscle which draws the left eye towards the median plane will act in harmony with the muscle which draws the right eye away from the median plane.

(3) Each median fillet (fig. 4) is a longitudinal tract of ascending sensory fibres lying close to the median plane, between the pyramidal tract and the median longitudinal bundle. The fibres of the right and left tracts cross the median plane, forming the sensory decussation. This lies above the level of the motor or pyramidal decussation. The median fillets thus carry the sensory fibres coming from one side of the body to the central ganglia of the opposite cerebral hemisphere.

The sensory impulses coming from the spinal cord end in cell-stations in the medulla, the gracile and cuneate nuclei (fig. 3). It is from these that the superficial arcuate fibres, which pass to the cerebellum, and deep arcuate fibres (median fillet) take origin. The latter thus form one link or relay in the main sensory tract to the cortex. Immediately external to the pyramidal tract on the anterior aspect of the medulla is an oval swelling, the olive (fig. 9), and external to this the inferior peduncle of the cerebellum, or restiform body. The olive lies over a folded lamina of grey matter in the substance of the medulla (fig. 3); this is the inferior olive. It is connected with the opposite cerebellar hemisphere by fibres which cross the middle line and reach the cerebellum by means of the restiform body. The superficial origin of the lower cranial nerves from the 6th to the 12th is shown in fig. 9; the nuclei from which the motor fibres originate and those in which the sensory fibres terminate lie in the substance of the medulla and pons. Like the spinal nerves they are connected by tracts of nerve fibres with the opposite cerebral hemisphere.

Pons Varolii.—This (figs. 4 and 9) lies between the medulla oblongata and midbrain and forms a bridge which connects the two cerebellar hemispheres. It forms, by its posterior surface, the upper half of the floor of the fourth ventricle (fig. 2). It contains the nuclei of origin or termination, of the fifth, sixth, seventh and eighth cranial nerves. A conspicuous band of transverse fibres lies superficially and crosses beneath or ventral to the pyramidal fibres, which pass through the pons from the internal capsule and midbrain to the medulla oblongata. Some of the transverse fibres, however, lie more deeply and intersect the longitudinal fibres of the pyramidal tract. Most of the transverse fibres arise from nuclei of the pons which are connected with the cortex of the frontal and temporal lobes of the cerebrum on the same side, and crossing the midline eventually reach the cortex of the opposite cerebellar hemisphere. The most important longitudinal tracts of nerve fibres traversing the pons are the pyramidal tracts, the longitudinal bundles, and the ascending sensory fibres of the median and lateral fillets. The lateral fillet is the main auditory tract which, arising from the terminal nuclei of the cochlear nerve of the ear, ascends to the midbrain and internal geniculate body.

The Cerebellum consists of a central part, the vermis, and two lateral hemispheres. Each hemisphere is connected with the brain stem by three peduncles: (1) the inferior or restiform body of the medulla; (2) the middle or brachium pontis; (3) the superior or brachium conjunctivum. The last-named joins the cerebellum to the midbrain and conveys efferent fibres, leaving the cerebellum and ascending to the important red nucleus in the opposite side of the midbrain (fig. 6).

The cerebellum correlates sensory impulses from the internal ear, and also from muscles and other organs These efferent impulses which reach the grey matter of the cortex of the cerebellum are believed to pass thence to the dentate nucleus, a convoluted lamina of grey matter situated in the substance of each cerebellar hemisphere From this a relay of fibres ascends to the opposite red nucleus (*see* below for Midbrain). The superficial surface of the cerebellum differs from that of the cerebral hemispheres. In place of convolutions, the vermis and hemispheres of the cerebellum are crossed by numerous transverse fissures, which mark off a series of folds or folia. The general arrangement of these is seen in a median section through the vermis, which presents a branched appearance called the arbor vitae. The surface of the cerebellar hemispheres and central lobe is subdivided into lobes and lobules by deep fissures, a full description of which must be sought in textbooks of anatomy.

Microscopical Structure of the Cerebellum.—The cortex of the cerebellum consists of a superficial stratum, the molecular layer, an intermediate layer which contains the cell-bodies of branched Purkinje cells (fig. 5), and an inner deep stratum, the granular layer which rests upon the central white matter. The latter is formed by medullated nerve-fibres which course to and from the grey matter. The Purkinje cells are remarkable for their large size and extensive connections. The cell-bodies are pear-shaped and arranged in a single layer. From the outer end of each cell, processes arise which branch out in the molecular layer.

These processes are the dendrites, and the branching takes place chiefly in a plane at right angles to the longitudinal axis of the folium in which it lies. The dendrites of the Purkinje cells are intersected at right angles by parallel fibres which run in the direction of the folium. These fibres are derived from axons of the granule cells in the inner stratum of the cortex, which pass outwards and divide in the molecular layer in a T-shaped manner, into right and left branches. The bodies of the Purkinje cells are, moreover, surrounded by a network of fibres which originate from "basket" cells in the molecular stratum; and their branches are also accompanied by delicate tendril or climbing fibres, which are efferent nerve fibres from the white matter.

Although areas of the cerebellar cortex cannot be mapped out by response of particular groups of muscles to electrical stimulation, it is possible on morphological grounds, by means of experimental work and by the tracing of tracts of nerve fibres entering the cerebellum, to locate areas of the cortex according to the fibres which they receive from particular parts. Thus it is generally admitted that the head and neck are represented in the anterior part of the vermis, the trunk in the posterior part, and the limbs in the apical region of the vermis and hemispheres. References to literature on cerebellar localization will be found in C. J. Herrick, *An Introduction to Neurology* (1927) and H. Woollard, *Recent Advances in Anatomy* (1927).

The Midbrain (mesencephalon) connects the parts below the tentorium cerebelli (fig. 1) with the cerebral hemispheres above the tentorium. It is traversed by the aqueduct of Sylvius (figs. 4 and 6). The part which lies above the aqueduct, called the roof plate or tectum, is subdivided by a crucial sulcus into four rounded swellings. These are the colliculi or corpora quadrigemina. The upper pair of these bodies receives nerve fibres from the retina, which reach them through the optic tracts. They are concerned in the regulation of the movements of the eye and in the pupillary reflexes. The lower pair serves as a cell station in the path of the auditory impulses which pass from the cochlea to the cortex of the temporal lobe. The grey matter in the roof of the aqueduct receives an important tract of nerve fibres from the spinal cord, known as the spino-tectal.

A similar bundle, the spino-thalamic tract, also traverses the midbrain. Both tracts convey the more primitive sensations of pain, heat and cold to the receptive centres in the brain. These have been described by Head as protopathic sensations, to distinguish them from the finer and more recently evolved sensations of touch, which he terms epicritic. The latter ascend in the posterior columns of the spinal cord to the gracile and cuneate nuclei (fig. 3). From these a relay of nerve fibres ascends through the medulla oblongata, and crossing in this to the opposite side of the brain, passes as the median fillet through the pons and midbrain to the thalamus of the brain. From the optic thalamus another relay of fibres carries the sensory impulses to the cortex of the brain. These fibres diverge as they traverse the white matter of the brain, thus forming part of the corona radiata.

The part of the midbrain which lies ventral to or below the aqueduct forms the crura cerebri. These are two diverging limbs which ascend from the pons Varolii to the right and left cerebral hemispheres (fig. 9). The superficial part (crusta) of each crus, (fig. 6), consists of motor and sensory nerve fibres. The former constitute a part of the great pyramidal tract which descends from the motor area of the cerebral cortex to the opposite side of the spinal cord. The sensory fibres pass from the frontal and temporal lobes to the pons, and thence to the opposite side of the cerebellum. Behind, or dorsal to the crusta, is a lamina of pigmented nerve cells (substantia nigra) which separates the crusta of one side from the corresponding side of the tegmentum. The latter consists of two symmetrical halves, connected by a median raphé. This is traversed by decussating fibres, the greater number being the cerebellar fibres already mentioned as issuing from the dentate nucleus, travelling by the superior peduncle to the midbrain, and then crossing to the red nucleus of the opposite side (fig. 6).

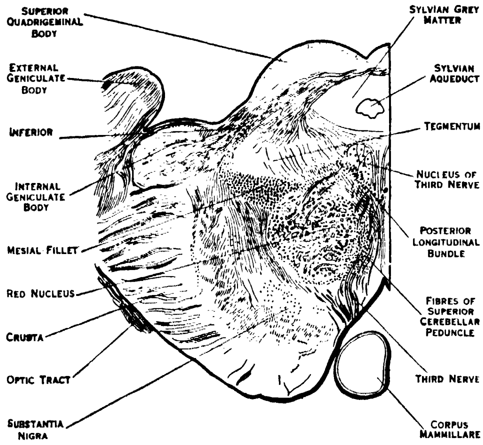


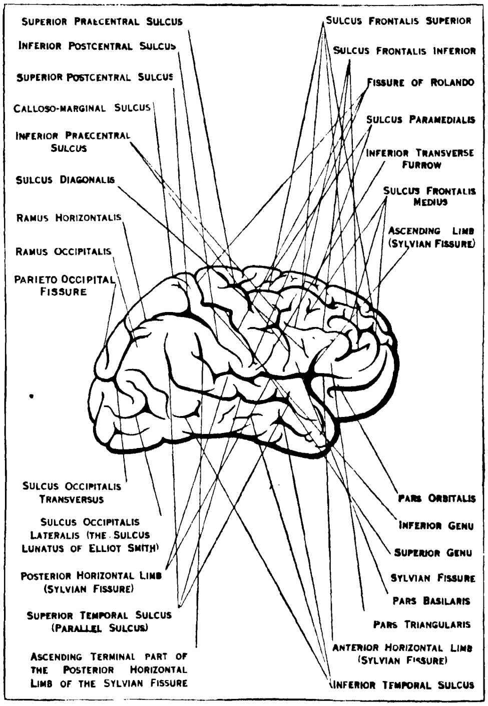
FIG. 6.—TRANSVERSE SECTION THROUGH THE MIDBRAIN, SHOWING THE LEFT HALF OF THE UPPER PART. THE MOTOR FIBRES OF THE PYRAMIDAL TRACT COURSE DOWNWARDS IN THE CENTRAL PART OF THE CRUSTA

From this important nucleus a tract of nerve fibres descends to the spinal cord, where it forms connections with the motor cells in the grey matter of the anterior cornua. (*See* SPINAL CORD.) This is the rubro-spinal tract of Monakow. The red nucleus is also connected with the central ganglia of the brain. By means of these connections, it is believed that the cerebral hemispheres control, through the red nucleus and rubrospinal tract, the more reflex movements carried out by the spinal cord, such as balancing movements and the maintenance of posture. If this controlling influence is interrupted, for instance by an injury to the midbrain, involving the red nucleus, rigidity, known as decerebrate rigidity, arises from overaction of the muscles. It disappears from any particular group of muscles if the sensory roots of the nerves coming from the corresponding area are divided.

In the tegmental part of the midbrain are also situated the longitudinal association tracts, known as the anterior and posterior longitudinal bundles; and the fountain decussation of Meynert, which connects nuclei in the superior quadrigeminal body of one side with the nuclei of cranial nerves of the opposite side of the brain; finally, the midbrain contains the nuclei and roots of origin of the third, fourth and part of the fifth cranial nerves, in the grey matter surrounding the aqueduct of Sylvius. (*See* NERVE.)

Cerebral Hemispheres.—One of the most distinctive features of the human brain is the large size of the hemispheres and the high degree of specialization in the microscopical structure of the cortex. The surface of each hemisphere is, for descriptive purposes, subdivided into lobes and lobules. Certain fissures and lines which are arbitrarily drawn between these are employed for demarcating the boundaries of these areas. The names of the principal fissures and lobes are indicated in figs. 7 and 8, and it will only be necessary to draw attention to certain of the more important. Thus the central fissure, or fissure of Rolando, is situated on the superficial surface and separates the frontal from the parietal lobe. The lateral fissure or fissure of Sylvius marks off the temporal lobe from the parietal and frontal lobes. On the median surface (fig. 8) are the calloso-marginal, the parieto-occipital and calcarine fissures, which limit the frontal, limbic, parietal and occipital lobes.

The central fissure marks the posterior limit of the important motor area of the cortex (fig. 17). Electrical stimulation of particular parts of this area produces definite movements of groups of muscles, the action of which is normally initiated and controlled by the part stimulated. Injury to the same part causes paralysis of the corresponding muscles. The cortex of the occipital lobe which surrounds the posterior part of the calcarine fissure is the visuo-sensory area for reception of visual impulses from the retina. The visuo-sensory area is surrounded by a marginal zone which extends on to the outer aspect of the occipital lobe, termed the visuo-psychic area. (*See* VISION.)

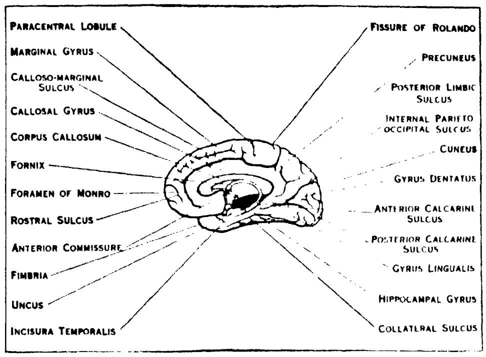

SUPERIOR PRAECENTRAL SULCUS
INFERIOR POSTCENTRAL SULCUS
SUPERIOR POSTCENTRAL SULCUS
CALLOSO-MARGINAL SULCUS
INFERIOR PRAECENTRAL SULCUS
SULCUS DIAGONALIS
RAMUS HORIZONTALIS
RAMUS OCCIPITALIS
PARIETO OCCIPITAL FISSURE
SULCUS OCCIPITALIS TRANSVERSUS
SULCUS OCCIPITALIS LATERALIS (THE SULCUS LUNATUS OF ELLIOT SMITH)
POSTERIOR HORIZONTAL LIMB (SYLVIAN FISSURE)
SUPERIOR TEMPORAL SULCUS (PARALLEL SULCUS)
ASCENDING TERMINAL PART OF THE POSTERIOR HORIZONTAL LIMB OF THE SYLVIAN FISSURE
SULCUS FRONTALIS SUPERIOR
SULCUS FRONTALIS INFERIOR
FISSURE OF ROLANDO
SULCUS PARAMEDIALIS
INFERIOR TRANSVERSE FURROW
SULCUS FRONTALIS MEDIUS
ASCENDING LIMB (SYLVIAN FISSURE)
PARS ORBITALIS
INFERIOR GENU
SUPERIOR GENU
SYLVIAN FISSURE
PARS BASILARIS
PARS TRIANGULARIS
ANTERIOR HORIZONTAL LIMB (SYLVIAN FISSURE)
INFERIOR TEMPORAL SULCUS

FROM CUNNINGHAM, "TEXTBOOK OF ANATOMY"

FIG. 7.—LATERAL ASPECT OF RIGHT CEREBRAL HEMISPHERE SHOWING THE FISSURES OF SULCI, AND THE BASILAR, TRIANGULAR, AND ORBITAL PARTS OF THE INFERIOR FRONTAL GYRUS

The middle part of the first temporal gyrus and the adjacent gyri on the lower lip of the fissure of Sylvius are concerned with hearing (fig. 7). The auditory area of the brain receives sensory impulses by way of the auditory radiation from the inferior corpus quadrigeminum and internal geniculate body of the same side. These, the lower auditory centres, are connected with the opposite ear by means of the lateral fillet.

The front part of the hippocampal gyrus, with its hook-like end the uncus, is the higher cortical centre for the sense of smell This is the most primitive of the special senses. It is closely associated with the sense of taste, and is both relatively and absolutely more highly developed in lower types of vertebrate animals than in man (figs. 8 and 16). That part of the brain which is concerned in the sense of smell is called the rhinencephalon. In addition to these, there is a large area behind the central fissure which extends forwards on to the motor area. This is the cutaneous sensory, or tactile area (fig. 16, D).



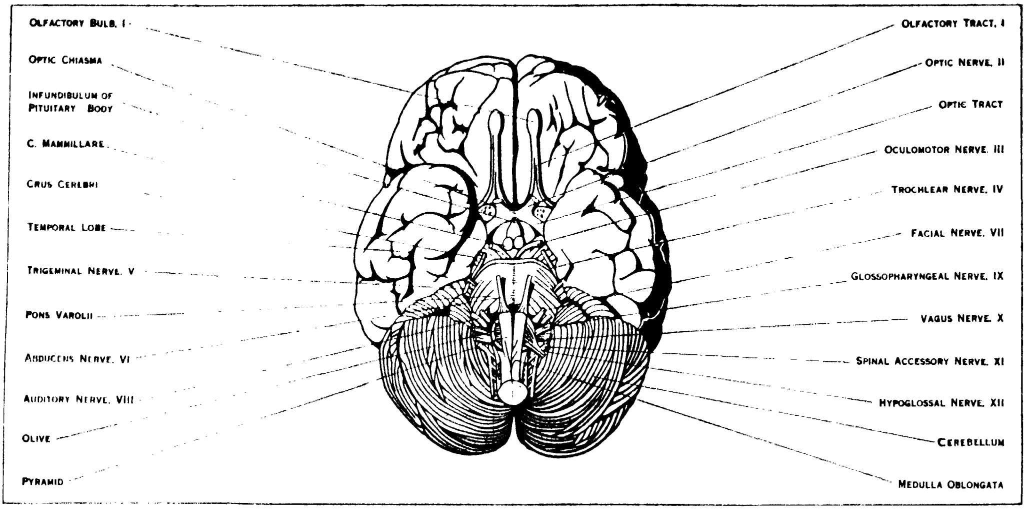
FROM CUNNINGHAM, "TEXTBOOK OF ANATOMY"

FIG 8—MEDIAN SURFACE OF THE RIGHT CEREBRAL HEMISPHERE
Illustration shows the gyri and fissures, and a section through the corpus callosum and fornix

The areas of cerebral cortex lying between the special and cutaneous sensory areas are believed to function as association centres between the different senses, and as centres in which the memory of associated sensations is stored. The prefrontal region, which is more highly evolved in man than in any other animal, is connected by association fibres with all the various sensory and motor areas, and more especially with that part of the adjacent motor area which is concerned with the movements of the eyes. It is therefore believed that this part of the cortex may control skilled movements which are dependent on impulses reaching the brain from the eyes, and which require close attention and a knowledge or memory of past experiences. For instance, such movements as those of the lips and tongue, or of the hand, which have given man the powers of speech and of writing. If the upper and lower lips of the fissure of Sylvius (figs. 7 and 10) are separated a triangular area of submerged cortex will be exposed. This is the island of Reil, or Insula. It lies over the outer aspect of the corpus striatum, and the lips of the fissure which overlap it are called the opercula insulae. In the human foetal brain, and the brains of most animals, this area of the cortex is exposed on the surface.

The basal ganglia are three masses of grey matter embedded in the cerebral hemispheres (fig. 10). The basal ganglia consist of the optic thalami, the caudate and lenticular nuclei. The optic thalamus is a receptive centre for primary sensory impulses, and an important cell station in the path of sensory fibres to the cerebral cortex. The caudate and lenticular nucleus, with the white matter which surrounds the lenticular nucleus, form the corpus striatum. The white fibres lying to the inner side of the lenticular nucleus are called the internal capsule, those to its outer side form the external capsule. The former consists of sensory fibres passing to the cortex, motor fibres of the pyramidal tract passing from it, and association fibres passing between the nuclei.

The Cerebral Cortex is the stratum of grey matter which covers the central white matter of the hemispheres. It consists of nerve cells, nerve fibres, and a supporting tissue—the neuroglia.



FROM CUNNINGHAM "TEXTBOOK OF ANATOMY"

FIG 9.—DIAGRAM OF THE BASE OF THE BRAIN, INDICATING POSITION OF THE IMPORTANT NERVES AND PARTS

It exhibits a definite stratification into layers of nerve cells and nerve fibres. In sections of the fresh brain, the main strata are easily recognizable by the unaided eye, and more especially so in the visual cortex, or area striata. Various zones may be distinguished in this way, and it is found that the naked eye appearances correspond closely with the finer details revealed by microscopic preparations. A general idea of the disposition and appearance of the cell elements and nerve fibres will be gained by reference to fig. 11, in which isolated cells are depicted on the left and the fibre systems on the right.

It will be noted that the superficial lamina, or outer fibre layer, is largely composed of nerve fibres running tangentially or parallel with the surface. Many of these fibres are branches of the peripheral processes of small and large pyramidal cells contained in the subjacent strata of the cortex; others are the terminal branches of nerve fibres passing into the cortex from the white matter. These are called corticipetal fibres, and originate from nerve cells in the central ganglia, or from other parts of the cerebral cortex. The nerve fibres of the superficial lamina, and other strata in which the fibres are arranged tangentially, serve as association fibres, connecting different areas of the cortex with one another. They also connect fibres conveying sensory impulses reaching the cortex from the central ganglia or other parts with the cells which give rise to the efferent or outgoing impulses. Certain of these efferent, corticifugal fibres spring from the basal ends of the large pyramidal cells of Betz, present in the motor region of the cortex. They course inwards through the white matter to the internal capsule, where they converge to form the pyramidal tract. Other efferent fibres pass, by the corpus callosum, to the cortex of the opposite cerebral hemisphere.

In animals the degree of lamination and differentiation of the nerve-cells in the cortex appears to correspond with the stage of evolution attained by the particular species. The cortex is thicker and more highly evolved in man and the higher types of mammals than in lower forms. Moreover, in the development of the cortex, stratification begins about the sixth month of foetal life, when the convolutions first appear, and differentiation continues, not only during the later months of foetal life, but for a considerable period after birth. The more superficial strata containing the pyramidal cells are developed latest, and the human cortex is specially characterized by the great development of these cells.

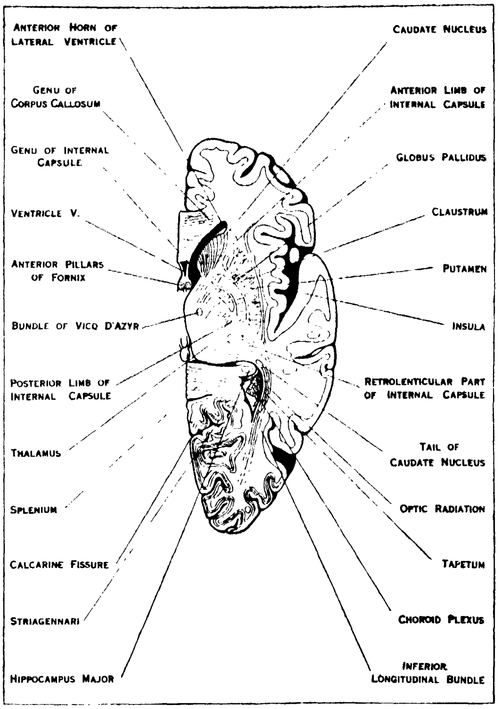
Weight of the Brain.—The weight of the brain varies with age, stature, body-weight, sex and race. It is also influenced by congestion of the blood-vessels, degenerative changes and atrophy. At birth the brain weighs approximately 380 grammes, and is 12·4% of the body weight. The entire brain, with the pia arachnoid of an adult British male, weighs approximately 1,409 g. or 49·6 oz., and of a female, 1,263 g. or 44.5 oz. The average stature and bodyweight of the female, however, is less than that of the male, and when these factors are allowed for the size and weight of the brain in the two sexes are approximately equal. The influence of age on brain weight is considerable. The growth of the brain is very rapid during the first three years, slightly less rapid up to the seventh year, when it is not far off its full weight. After this the increase is very gradual, its prime being usually attained, in males, by the 20th year, and in females somewhat earlier. From this period onward, in both sexes, there is a continuous diminution in the average brain weight of, approximately, 1 grm. per annum.

Tall people have heavier brains than short, but, relatively to their height, short people have larger heads and brains than tall. Many men of conspicuous ability have had brains of large size, *e.g.*, Cuvier (1,830 grm.), but on the other hand the brain of Anatole France, who died, aged 81, weighed, without the membranes, only 1,017 grm.; by adding 60 grm. for the weight of the membranes, and 61 grm. to allow for shrinkage due to age, his brain may be estimated to have weighed, at the age of 20, no more than about 1,138 grammes. Nevertheless, averages calculated from groups, *e.g.*, scholarship and prizemen, average, and below average ability, show statistically that there is a small, though measurable correlation between large size of head and a high intelligence. The relation becomes still more apparent when the heads of the intellectual classes are compared with those of the lower classes, and more particularly the inmates of workhouse infirmaries and congenital idiots. The microcephalic type of the latter may have brains weighing only 300 grammes.

Development of the Brain.—The central nervous system originates as an axial thickening of the ectoderm covering the dorsal surface of the embryonic area. This is the neural or medullary plate and is continuous on each side with the ectoderm, which will become the epidermis. The edges of the neural plate soon become raised, so that the axial band is converted into a longitudinal groove. This is the medullary groove and already at its anterior end shows three enlargements which are separated by a couple of constrictions. These indicate the site of the primary divisions of the embryonic brain, namely:—the forebrain or prosencephalon;

midbrain or mesencephalon; and hindbrain or rhombencephalon. There is also an indication on each side of the forebrain of the optic vesicle.

The medullary groove later becomes converted into a closed tube, which is named the medullary or neural canal, by the folding inwards and union of its edges. The union commences in the region of the neck and extends headward and tailward. The lumen of this tube is dilated at one end to form the ventricles of the brain, while in the rest of its extent it remains narrow and forms the central canal of the spinal cord. As the margins of the medullary groove unite to form the medullary canal, a continuous lamina of epithelium grows outwards on each side of the spinal cord and posterior part of the brain. This is the neural crest. It afterwards becomes segmented, and gives origin to the sensory ganglia on the posterior roots of the spinal nerves, the sensory fibres of the spinal nerves, and the ganglia and nerve fibres of the sympathetic system It also takes part in the formation of some of the ganglia and nerve fibres of the cranial nerves.



FROM CUNNINGHAM, "TEXTBOOK OF ANATOMY"

FIG. 10.—HORIZONTAL SECTION OF RIGHT CEREBRAL HEMISPHERE

Diagram shows the relations of the internal capsule to the thalamus and to the caudate and lenticular nuclei

It is of interest to note in this connection that the hypoglossal nerve which, in the adult, is a purely motor nerve for the supply of the muscles of the tongue, in the embryo has a posterior or sensory root with a rudimentary ganglion upon it (Froriep). This afterwards disappears, but its temporary presence in the embryo indicates that the nerve was primarily composed of both motor and sensory fibres and that it is homologous with the spinal nerves.

Early Stages.—In the early stages of development the brain presents certain flexures which involve the longitudinal axis of the neural tube. The first of these is the cephalic flexure, which is a forward bend round the anterior end of the notochord. It is followed by the cervical flexure at the junction of the brain with the spinal cord, which is also in a forward direction. Between is the pontine flexure, which is in the reverse direction and does not involve the whole thickness of the neural tube.

The stage with three primary vesicles soon becomes modified by subdivision of the forebrain into an anterior telencephalon and a posterior thalamencephalon; the hindbrain also divides into the metencephalon and myelencephalon. The telencephalon gives rise to the optic vesicles, olfactory lobes and hemisphere vesicles. The thalamencephalon forms the region of the brain surrounding the posterior part of the third ventricle behind the foramina of Monro. It includes the optic thalami geniculate bodies, the pineal organ and cerebral lobe of the pituitary body. The metencephalon comprises the pons Varolii, part of the fourth ventricle, and the cerebellum; the myelencephalon corresponds to the medulla oblongata.

In transverse section the developing medullary tube is seen to consist of left and right lateral plates, between which is the central canal of the spinal cord. The lateral plates are joined at their dorsal margins by a thin roof plate, and along their ventral margins by a similar thin floor plate. These close in the central canal behind and in front. A cross section of the canal at this stage of development is diamond-shaped, with the dorsoventral diameter much longer than the transverse diameter. The wide angles on each side of the diamond correspond to a longitudinal groove on the inner surface of each lateral plate. This is the sulcus limitans and runs the whole length of the spinal cord. It is continued forward on the floor of the fourth ventricle, where it forms the fovea inferior and fovea superior (fig. 2), and finally on to the sides of the aqueduct of Sylvius in the midbrain. The groove is of great regional importance, as it marks off the ventral or basal part of the brain and spinal cord, which gives origin to motor nerve fibres, from the dorsal or alar part which receives the sensory fibres.

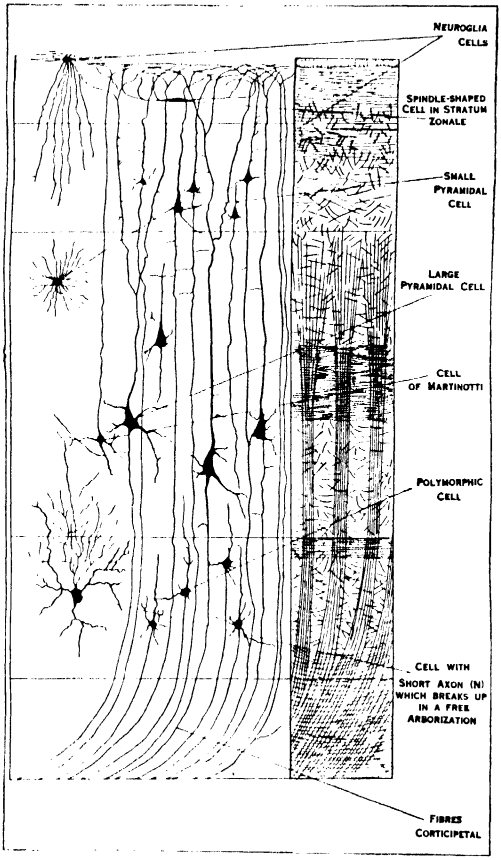
Further Differentiation.—A transverse section of the developing neural tube also shows three important zones. An inner or germinal zone; middle or mantle zone and an outer or marginal zone. The germinal zone is characterized by actively dividing nuclei. The middle zone forms the central grey matter of the cord and contains a large number of oval nuclei embedded in the supporting tissue. The marginal zone consists at first only of a fine network of supporting or neuroglial fibres. Later, it is traversed by white medullated fibres forming the columns of white matter.

These zones are present in the early stages throughout the whole extent of the neural tube, but the primary relations are considerably modified in the brain by the migration of nerve cells and nerve fibres from one zone into the other. Thus the inner zone forms the ependyma or lining membrane of the central canal of the spinal cord and ventricles of the brain. In certain situations in the brain, however, it is invaginated into the cavities of the ventricles, and modified so as to form the choroidal epithelium. Moreover, that part of the grey matter which forms the cortex of the cerebral hemispheres is situated on the surface of the brain and superficial to the white matter. This modification is brought about by the migration of nuclei from the mantle zone into the superficial strata of the marginal or outer zone. White fibres may also invade the territory of the grey matter, as in the formation of the internal capsule and pyramidal tracts. Portions of grey matter may thus be displaced from their original position, so that the primary position of the parts becomes obscured.

In the later stages of development the primary flexures of the brain become, to a large extent, straightened out, and the whole form of the brain becomes modified by the enlargement of the cerebral hemispheres.

Hindbrain and Roofplate.—In the hindbrain a remarkable change occurs in the position of the lateral walls of the neural tube, whereby their dorsal margins formed by the alar laminae become widely separated. Each lateral plate is rotated outward through an angle of 90° by a hinge movement, as in opening a book. The surfaces originally directed towards the median plane, thus become directed dorsally, and now form the floor of the lozenge-shaped fourth ventricle. The sulcus limitans still separates the basal (motor) and alar (sensory) region, but these, instead of being ventral and dorsal, are now internal and external (fig. 2.).

The roof plate also becomes greatly modified, becoming thinned out and stretched so as to form a delicate epithelial lamina, which is blended with the overlying pia mater. A part of this membrane becomes infolded just behind the cerebellum to form the choroid plexus of the fourth ventricle. The anterior part of the roof plate with the adjoining portion of the alar lamina becomes thickened to form the cerebellum, which is thus connected with the sensory tracts, and more especially with incoming impulses from the vestibular portion of the eighth cranial nerve. The median and lateral openings in the roof of the fourth ventricle are formed, secondarily, by a breaking down of the epithelial membrane. The cerebrospinal fluid is thus able to pass from the ventricles into the spaces of the subarachnoid tissue outside.



FROM CUNNINGHAM, "TEXTBOOK OF ANATOMY"

FIG. 11.—DIAGRAM OF CEREBRAL CORTEX, SHOWING THE ARRANGEMENT AND CONNECTIONS OF THE NERVE CELLS ON THE LEFT, AND OF THE FIBRES ON THE RIGHT SIDE

Midbrain and Thalamencephalon.—The midbrain in a 10 mm. human embryo is characterized by the relatively large size of its central canal and its prominent position on the surface of the brain. At a later stage, owing to the growth through it of tracts of nerve fibres, from the cerebral hemispheres, cerebellum and pons Varolii, the walls of the canal become greatly increased in thickness, and the lumen becomes relatively small (fig. 6). Moreover, in the later months of foetal life, the midbrain becomes completely covered over and concealed by the backward growth of the corpus callosum and cerebral hemispheres.

The thalamencephalon appears to undergo less change from the primary form of the neural tube than either the midbrain or hindbrain. It differs, however, in the absence of the basal or motor region, the motor functions of this part having been transferred to the motor area of the telencephalon. In the early stages of development the roof and lateral surfaces of the thalamencephalon are exposed on the superficial aspect of the brain. About the third month, however, the cerebral hemispheres, with the developing corpus callosum and fornix grow backward over the thalamencephalon, mesencephalon and cerebellum, carrying with them a covering of pia mater. This fuses with the pia mater covering the thalamencephalon so as to form a triangular fold, the velum interpositum, or tela chorioidea, from which the choroid plexuses of the third and lateral ventricles are formed.

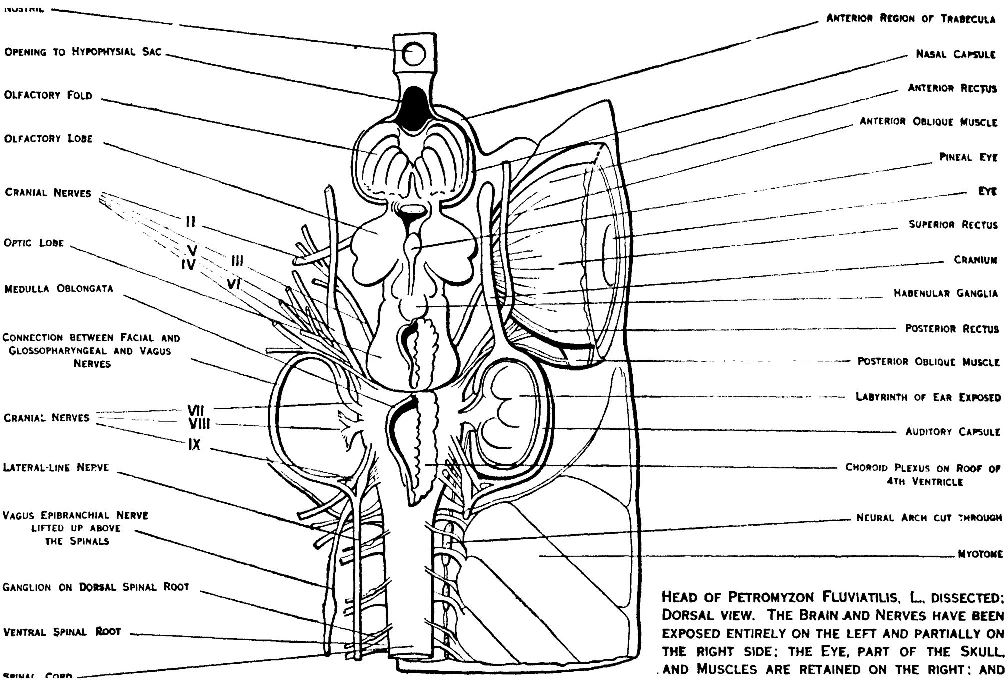
The hemisphere vesicles are at first quite small and open by a relatively large aperture, the foramen of Monro, into the third ventricle. The latter is limited in front by a thin membrane, the lamina terminalis, so named because it at first forms the anterior end of the brain. Later the hemispheres grow forward on each side of it and it is left at the bottom of the great longitudinal fissure. As the hemispheres enlarge forwards, upwards and backwards nerve fibres are developed between them, which cross in the lamina terminalis. These form the anterior commissure, the hippocampal commissure of the fornix, and the corpus callosum. The mode of development of these and of the fornix and septum pellucidum is indicated in figs. 4 and 8.

Development of the Pituitary Gland (fig. 4) (*See* DUCTLESS GLANDS).—This body is composed of two parts: an oral or anterior lobe, which is glandular in structure, and a cerebral or posterior lobe composed of neuroglia. The organ is present in all vertebrate animals, and is developed very early. Thus in the human embryo of four weeks the oral portion appears as a flattened, flask-shaped diverticulum, the pouch of Rathke, which arises from the ectoderm of the primitive mouth cavity or stomodaeum. This comes in contact with the neural ectoderm forming the floor of the third ventricle, behind the optic decussation and in front of the anterior end of the notochord. Later the neural ectoderm gives rise to a hollow diverticulum, the posterior lobe, which is connected to the brain by a funnel shaped stalk, the infundibulum (figs. 4 and 9). The infundibulum then becomes surrounded on the front and sides by the vesicular part of the pouch of Rathke. That part of the pouch which comes in contact with the cerebral lobe is called the paraneural part or pars intermedia.

The parts on each side which become applied to the infundibular part of the floor of the third ventricle are the lateral or tuberal lobes. The vesicular part of the pouch soon becomes cut off from the roof of the mouth cavity by the degeneration of its stalk. About the seventh or eighth week the vesicle becomes further modified by the outgrowth from it of numerous branching processes which invade the surrounding tissue. The processes are at first hollow and lined by epithelial cells. Later the mesodermal tissue between the processes becomes vascularized, and the lumina of the processes and the main central cavity gradually become obliterated. The cavity of the posterior lobe also disappears, with the exception of a small recess in the floor of the fourth ventricle, which corresponds to the attachment of the infundibulum. In the adult the interior of the cerebral lobe is occupied by a loose network of supporting neuroglia, and contains no nervous tissue, except fibres of the sympathetic system which accompany the vessels.

The meshes of the network contain a clear fluid. In the paraneural part or pars intermedia, the epithelium is frequently arranged in the form of closed vesicles containing colloid material and this substance has sometimes been observed in the posterior lobe and in the region of the third ventricle, close to the infundibulum, more especially in those animals in which the lumen of the cerebral lobe persists and remains in continuity with the cavity of the ventricle. The origin of the pituitary gland presents one of the most interesting problems of comparative embryology, references to the literature on which will be found in any of the standard works on zoology and embryology mentioned in the bibliography.

Pineal Organ or Epiphysis.—The pineal body of the human brain is a small conical structure (fig. 4) which springs from the posterior part of the roof of the third ventricle and projects back-



HEAD OF PETROMYZON FLUVIATILIS, L., DISSECTED: DORSAL VIEW. THE BRAIN AND NERVES HAVE BEEN EXPOSED ENTIRELY ON THE LEFT AND PARTIALLY ON THE RIGHT SIDE; THE EYE, PART OF THE SKULL, AND MUSCLES ARE RETAINED ON THE RIGHT; AND THE NASAL CAPSULE HAS BEEN OPENED IN FRONT.

wards over the superior quadrigeminal bodies. It consists of rounded epithelial cells which are arranged in an alveolar manner. Between the alveoli or follicles is a supporting tissue enclosing thin-walled blood vessels, and frequently containing also deposits of calcareous salts. These form small spherical bodies which show, on section, a concentric laminated structure. They are known as "brain sand" and in old subjects are commonly found also in the choroid plexuses, pia arachnoid and other parts of the brain.

The pineal body of man is a vestigial organ which represents a more highly evolved apparatus in lower types of living vertebrates, and probably a still more highly evolved apparatus in certain extinct reptiles such as the Ichthyosaurus. In one living reptile, the Tuatera, the pineal apparatus consists of two distinct (Sphenodon) organs—a glandular organ, the epiphysis, which is the structure present in the human brain, and a sensory organ, the "pineal eye"; this is situated in the parietal foramen, a central aperture in the vault of the skull, immediately beneath the scales covering the surface of the head.

In some of the lower vertebrate animals the pineal organ is bilateral, and it is believed that the ancestors of vertebrate animals possessed a pair of parietal eyes which may have been serially homologous with the paired vertebrate eyes. Transitional stages in the evolution of the pineal body from a bilateral to a mesial organ have been described by Cameron in the Amphibia.

Comparative Anatomy.—In the lowest types of vertebrate animals, the brain is tubular in form and resembles an early developmental stage of the brain in higher vertebrates. In the small lancelet or Amphioxus (*q.v.*) the brain consists of a median cerebral vesicle, the cavity of which is continuous with the central canal of the spinal cord. In the larval stage, an opening lined by ciliated epithelium, the neuropore, lies at the bottom of a funnel-shaped depression, the olfactory pit. Viewed from the outside, there appears to be no distinction between brain and spinal cord. In front, at the pointed anterior end of the brain, is a median pigmented area. This is regarded as the rudiment of a median eye. A thickening of epithelium in the floor of the ventricle probably represents the infundibulum of the pituitary body. There are only two pairs of cranial nerves, both of which are sensory.

Cyclostomes.—In the cyclostomes, of which the lamprey (Petromyzon) may be taken as an example, the brain is much more highly developed. There is a distinction into forebrain, midbrain and hindbrain. There are well developed eyes with optic nerves ending in optic lobes (fig. 12). In the larva the fibres of the optic nerves, instead of crossing to the optic tract and lobe of the opposite side, as in higher vertebrates, appear to pass back to the optic lobe of the same side. It is probable, however, that in the later stages of development a decussation of some of the deeper fibres occurs in the floor of the fourth ventricle. The forebrain presents on each side two hollow vesicles, namely, the olfactory lobe of large size, and a rudimentary cerebral hemisphere behind. The two cerebral hemispheres are joined across the median plane by the lamina terminalis, in which there is already evolved a small anterior commissure.

On the dorsal aspect of the thalamencephalon are two oval masses, the ganglia habenulae. The right of these is much larger than the left and from it a narrow stalk runs forward, to terminate in a minute pineal organ which contains vestiges of a pigmented retina and lens. A second pineal stalk which is even more vestigial than the right projects forward from the small left ganglion. There is also an indication of an additional outgrowth in front of the pineal organ, the paraphysis. The pituitary body is formed from a single median pouch, the pituitary sac, which opens primarily on the ventral aspect of the head, between the olfactory sac in front and the primitive mouth behind.

Later the pituitary sac sends out small follicular processes which fuse with the infundibulum and form, with the latter, the compound pituitary gland. In the course of development the original openings of the pituitary and olfactory sacs are displaced from the ventral to the dorsal aspect of the head. In the hindbrain a rudimentary cerebellum is present, which appears as a transverse bar at the anterior boundary of the roof of the fourth ventricle. The choroid plexuses are well developed and consist of three invaginations, an anterior from the roof of the third ventricle, a middle in relation with the midbrain, and a posterior from the roof of the fourth ventricle.

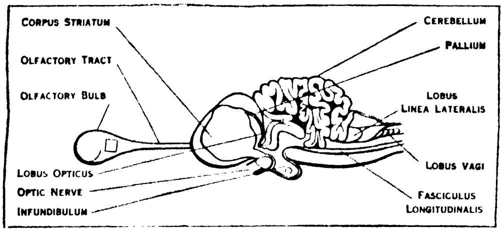


FIG. 13.—DIAGRAM OF THE BRAIN OF A PORBEAGLE SHARK (LAMNA)
The drawing shows the inner surface of the right half of the brain, which has been divided by a median longitudinal section. There is a remarkable unfolding of the wall of the cerebellum, a portion of which projects into the cavity of the 4th ventricle

Fishes.—In the Selachia, viz., cartilaginous fishes, such as sharks, dog-fish and skates, the evolution of the brain is still further advanced (fig. 13). The development is chiefly in the olfactory part of the brain and the cerebellum. Although the eyes are fully developed, smell is probably the dominant sense, since the olfactory bulbs and tracts are enormous and project as large hollow outgrowths from each side of the forebrain. There is also a remarkable development of the cerebellum, more especially in the Porbeagle shark (Lamna), in which the cerebellar cortex is highly convoluted. The cerebral hemispheres are much larger than in the lamprey, the corpora striata are developed, and a roof plate or pallium is present; but as yet there is no differentiation of cortical layers. There is only one pineal stalk. The fibres of the optic nerves cross one another without intersection of fibres.

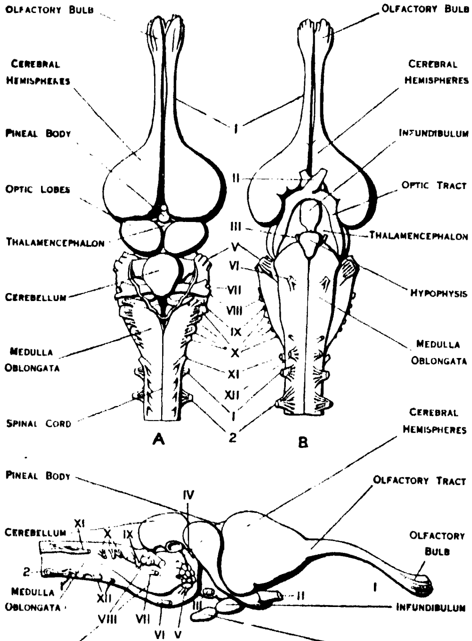


FIG. 14.—BRAIN OF ALLIGATOR. WHILE THERE IS A CONSIDERABLE ADVANCE IN THE DEVELOPMENT OF THE CEREBRAL HEMISPHERES, THE CEREBELLUM IS NOT SO HIGHLY DEVELOPED AS IN THE SHARKS
A. From above. B. From below. C. From the side

The brain of the Teleostei, or fishes having a bony skeleton, is in some respects not so far advanced as that of the cartilaginous fishes. The cerebral hemispheres and olfactory lobes are small. The optic lobes are, however, enormously developed, and the optic nerves cross one another without intersection of fibres.

In the mud fishes, or Dipnoi, the brain is elongated and tubular in form, the olfactory lobes large, and the cerebellum small. The brain, as might be expected, resembles in some respects that of the Amphibia.

Amphibia and Reptilia.—In the Amphibia the brain is tubular and does not show any distinct advance on the type characteristic of fishes, and in some respects, *e.g.*, the development of the cerebellum, is distinctly inferior to that of Lamna. The olfactory lobes are large and in the frog's brain are fused in the median plane. In the lamina terminalis is developed an anterior or ventral commissure, and above this a dorsal or hippocampal commissure. The formation of the latter corresponds to the appearance of a small mass of cells in the superficial stratum of the median wall of the pallium. This is regarded by Osborn as the first indication of the hippocampal cortex. The epiphysis which is present in the larva disappears in the adult animal. There is a well developed infundibulum and hypophysis. The optic tracts and lobes

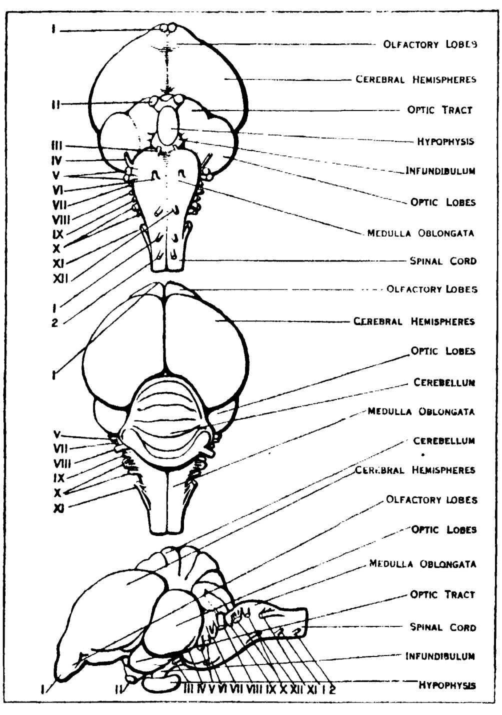


FIG. 15.—THE BRAIN OF A PIGEON SEEN FROM BELOW, ABOVE AND FROM THE SIDE
The cerebral hemispheres, optic lobes, optic tracts and cerebellum are of large size. The olfactory lobes are less developed than in the fishes and reptiles

are of large size. The cerebellum appears as a small transverse bar in the anterior part of the roof of the fourth ventricle, and closely resembles that of the human embryo at the fourth week.

In the Reptilia (fig. 14) the cerebral hemispheres are more highly differentiated. The mesial surface of each hemisphere shows an upper hippocampal zone, a lower olfactory tubercle, and an intermediate part, the paraterminal body or precommissural area. On the upper part of the outer or lateral surface is a limited area, termed by Elliot Smith the neopallium. This is the forerunner of the large sensory and motor areas of the cortex which form the main part of the cerebral hemispheres in the higher mammalia. Below the neopallium is the piriform lobe, which is olfactory in function and corresponds to the uncus of the human brain. The corpora striata are large, and there is an indication of differentiation into caudate nucleus, globus pallidus and putamen. In the Lacertilia the pineal organ is more highly developed than in any living vertebrate animal. There is, however, no evidence of its use as an organ of sight.

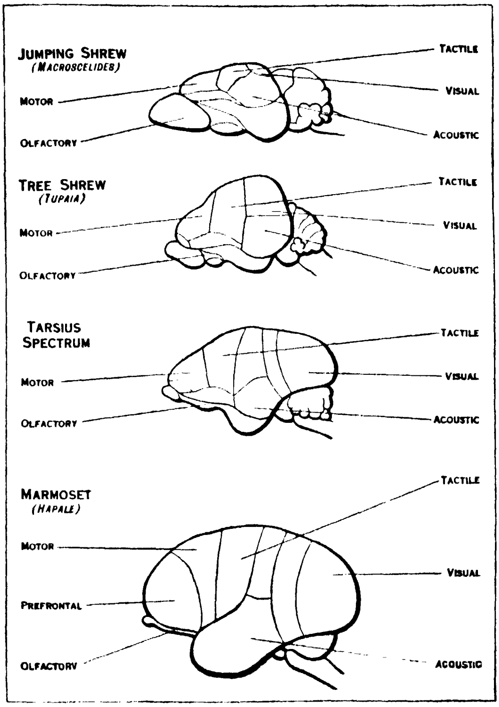


FIG. 16.—DIAGRAMS SHOWING THE EFFECTS OF HABIT ON THE BRAIN
Animals dependent on the sense of smell have a highly developed olfactory region. Those which are dependent on the sense of sight, have a highly developed and extensive visual area. In monkeys and in man there is a marked increase in the prefrontal area, which is concerned in the visual control of skilled movements

Birds.—In birds (fig. 15), the cerebral hemispheres, optic lobes and cerebellum are large. The surface of the cerebral hemispheres is smooth, and their bulk depends largely on the great size of the corpora striata. The cerebellum consists of a large central lobe or vermis, crossed by a series of parallel fissures, and on each side a small but well-defined flocculus. The olfactory lobes are extremely small, and, judging from the early development and large size of the optic vesicles and the optic nerves and tracts, vision is the dominant sense.

Monotremes.—In the lowest Mammalia, represented by Ornithorhynchus and Echidna, the cerebral hemispheres are greatly developed. They extend forward over the olfactory lobes and backwards over the thalamencephalon, midbrain and cerebellum. Convolutions and fissures appear. There are a dorsal and ventral commissure, fimbria and gyrus dentatus. The cerebellum is well developed, presenting numerous folia and a conspicuous flocculus. In the spiny ant eater (Echidna), which is nocturnal in its habits, the optic nerves are extremely small, but there is an enormous development of the olfactory bulbs and tubercles.

Marsupialia and Insectivora.—In the Marsupialia the type of brain varies much, apparently according to the habits of the different species. Thus in the Tasmanian devil (Sarcophilus), described by Elliot Smith as an "offal eating animal," there is an enormous development of the olfactory bulbs and region of the brain termed rhinencephalon; in kangaroos (Macropodidae), there is a great development of the neopallium and cerebellum.

The Insectivora are remarkable for the very large size of their olfactory organs. In the mole the optic nerves and tracts and the superior corpora quadrigemina are poorly developed. The influence on the brain of change of habit in two members of the same family, the jumping shrew and the tree shrew, is strikingly depicted in the illustrations (fig. 16). (G. Elliot Smith, *Essays on the Evolution of Man* [1927].) The accompanying drawings of the brains of higher mammals, Tarsius spectrum and the marmoset, show the increase in the visual, acoustic and tactile areas which has taken place in these animals, and especially in the latter, of the prefrontal and association areas.

Higher Mammals.—The surface of the brain in mammalian animals varies greatly with regard to the convolutionary pattern. In some the hemispheres are smooth, *e.g.*, the manatee, the lesser ant eater and the marmoset; in others, highly convoluted, *e.g.*, the whales and dolphins, and certain ungulates such as the elephant; others are intermediate in this respect. The degree of convolution is partly dependent on the size of the body. As a rule large animals have highly convoluted brains; small animals, smooth brains. There is also a definite relation between the number of white fibres in the centre of the hemispheres and the number of nerve cells in the grey cortex on the surface.

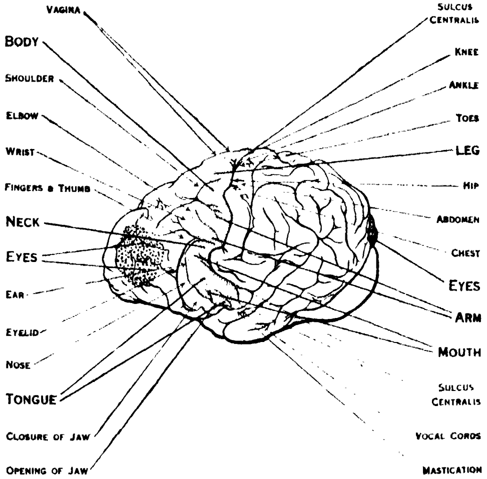


FIG. 17 —DIAGRAM OF THE TOPOGRAPHY OF THE MAIN GROUPS OF FOCI

In some animals, *e.g.*, the Cetacea, with a highly convoluted pattern, the grey cortex is very thin. In the higher types of animals it is usually thicker and much more highly differentiated. The brain of the chimpanzee (fig. 17) closely resembles the convolutionary pattern of the human brain. In most apes there is an extension forward of the peristriate (visual) area of the cortex on the outer side of the occipital lobe. This encroaches on and overlaps the parietal lobe and occipito-parietal fissure. It thus produces a transverse or lunate sulcus. This is the simian fissure or "affenspalte," and is represented in the human subject by a small and variable fissure (*S. lunatus*) which usually lies some distance behind, and external to, the external parieto-occipital fissure and is not continuous with it. The human brain is distinguished anatomically from that of the higher apes by its large size and great development of the prefrontal region. It is also characterized by a much greater complexity in the microscopical structure of the cerebral cortex. Mentally man is distinguished from the apes by the faculty of speech and by much greater power of reasoning, concentration and appreciation *See* MAMMALIA; PRIMATES.

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BRAINERD, EZRA (1844–1924), American botanist and educator, was born at St. Albans, Vt., Dec. 17, 1844. He graduated at Middlebury college in 1864 and at Andover theological seminary in 1867. Entering the faculty of Middlebury college, he was professor of rhetoric and English literature from 1868 to 1880 and professor of applied mathematics and physics from 1880 to 1886. From 1885 to 1908 he was president of the college. He made important contributions to the geology and botany of Vermont, and through extensive researches on the native species and their hybrids became the foremost botanical authority on North American violets. His experimental study of hybridity as exhibited in violets is one of the most valuable as yet made for any group of North American plants. Besides a large number of scientific papers, chiefly botanical, he published *The Violets of North America* (1921) and *Some Natural Violet Hybrids of North America* (1924). He also contributed sections on violets to standard North American floras. He died at Middlebury, Vt., on Dec. 8, 1924.

BRAINERD, a city of central Minnesota, U.S.A., on the E bank of the Mississippi river, at an altitude of 1,200ft., 128m. N.N.W. of Minneapolis; the county seat of Crow Wing county. It is served by the Northern Pacific and the Minnesota and International railways. Population in 1940 was 12,071. Brainerd is the metropolis of the Cuyuna iron range, which runs through the city, and of the agricultural population which is displacing the lumber-jacks and hunters of 1900–10. The principal industries are the railway shops and tie-treating plant of the Northern Pacific, and a pulp and paper mill with a daily capacity of 50 tons of pulp and 45 tons of finished paper.

Within easy driving distance are 700 lakes and many summer resorts.

Iron was discovered there in the year 1906. The 47 iron mines, many of which are of the open-pit type, are clustered around the villages of Riverton, Ironton, Crosby, Deerwood, Manganese, Trommald and Cuyuna, from 12 to 20 mi. N.E. of Brainerd. Brainerd was settled in 1870; was named after David Brainerd; and was chartered as a city in 1883.

BRAIN-FEVER BIRD (*Cuculus varius*), an Indian hawk cuckoo superficially resembling the Indian sparrow hawk. It takes its name from the suggested effect of its constantly reiterated cries. Like the European cuckoo (*q.v.*), it is parasitic, the usual hosts being babblers (*q.v.*). (C. F. Ss.)

BRAIN, SURGERY OF. It is common knowledge that surgery as a whole was "released" by the discoveries of Pasteur and Lister, so that the remarkable technical achievements of the surgeon to-day are the result of no more than fifty years' collective experience. Attention was at first focussed chiefly on the surgery of the abdomen and limbs, and so great and so rapid were the advances made in these spheres that something approaching technical perfection has been reached. The surgery of the brain made slower progress because the problems involved were of a much more intricate nature, cases were fewer, and accurate diagnosis, an absolute pre-requisite for good surgery, more difficult. The bony skull renders exposure difficult, access is often far from perfect, and a very small error in localization of the lesion suffices to mar the result. Add to this the fact that the tension inside the skull in tumour cases is greatly increased, so that the brain tends to bulge into the opening made and render exploration difficult, unless the pathological lesion happens to be superficial.

The Closed Cranial Box.—The brain is enclosed within a bone capsule and enveloped in membranes which protect it and carry blood vessels to it. A thin film of cerebro-spinal fluid covers it, but normally so accurately does the skull fit the brain that the convolutions impress the bone, and a plaster cast of the interior of a dried skull reproduces faintly the pattern of the brain which once inhabited it. This fact has been of great value to the comparative- and palaeo-anatomist. In spite of this close fitment, there is normally no pressure of bone on the brain. As the brain develops and expands the bone is its servant and never its master; we no longer believe that the bone may stop growing before the brain is fully developed. Thus in a case of maldevelopment of the skull with an immature brain within, we now believe the immaturity of the brain to be the primary factor. Incisions through the bone with the object of releasing a supposedly imprisoned brain have been done in the past but without profit, for the intervention was based on wrong premises.

It will be understood that there is very little room inside the skull to accommodate any extra bulk, such as a tumour, abscess, collection of blood or fluid and indeed any such addition will invariably produce recognizable effects.

Trephining or Trepanning.—The art of making openings in the skull was known to the ancients, as many recently recovered crania indisputably inform us. The methods employed have been the subject of much speculation and argument, and seem to have ranged from attrition with flint implements to drilling and cross-hatching. By trepanation, an obsolescent word, we mean the making of a hole by chisel or gouge; by trephining, the cutting out of a disk of bone by a special ring-saw. To-day the majority of surgeons use a drill and burrs, hand or electrically driven; great ingenuity is being shown in planning rapid and safe methods. It might be thought that any competent surgical engineer could easily invent some power-driven tool which would reduce the time and effort required to cut a flap of bone (which ought to be replaceable). The problem is far from simple, however, as the dura mater adheres to the inner surface of the bone sufficiently strongly to necessitate much safe-guarding, for it is essential that the brain and its coverings should remain uninjured. A number of clever appliances are in existence, but, as is often the case, the more ingenious the less generally useful are they.

The operation in most general use to-day is that known as the "osteo-plastic flap," where a flap of scalp and bone of large diameter is turned down and when carefully replaced gives an excellent cosmetic result. The exposed dura mater is then incised and the convolutions laid bare. A tumour may at once be seen but if not the brain tissue is carefully probed to detect a difference in resistance. A cyst may thus be encountered and drained. It is surprising how little disturbance this gentle exploration causes if done at a well chosen spot. The whole procedure can be carried out under local anaesthesia. Brain tissue is absolutely insensitive and can be cut without the conscious patient being aware of it. The dura mater and vessels are supplied with sensory nerves and it is only owing to this that headache is possible.

The common subtemporal decompression is done by splitting the fibres of the temporal muscle, boring or cutting through the bone, and enlarging the bony opening with nibbling forceps. The dura mater must be opened as it is so strong that, undivided, it will prevent the brain from prolapsing, and little or no relief of pressure will result. The pituitary gland tumour is attacked through a frontal flap or alternately through the nose after removal of the cartilage and bone in the nasal septum.

Head Injuries.—Head injuries are increasing in number owing to the development of mechanical transport and the accidents to all classes of the community which are its inevitable consequence. The skull possesses a considerable degree of elasticity and may be deformed for an instant by a blow without solution of continuity (*i.e.*, fracture). In that instant very serious damage may be inflicted on the brain, the problem in physics being one of hydro-dynamics on a fluid and semi-fluid content in a rigid container. Very often the skull is broken, but the immediate outlook for the patient and the longer view of his future depends very little on fracture, *per se,* but much more on the extent of the brain injury. For various reasons the floor or "base" of the skull breaks more readily than the cupola, and fractures of the cranial base are the common injuries. On the whole it may be laid down that objects of small mass and high velocity tend to produce local injury of the skull (depressed fractures), whilst those of great mass and low velocity tend to deform the skull as a whole and cause bursting fractures (Trotter and Wagstaffe) usually in the base but extending up from the point of impact. Treatment is essentially on conservative lines, except in depressed fractures.

Concussion, a condition characterised by unconsciousness and associated with shock, is the common result of severe cranio-cerebral injury. It varies in degree from momentary "stunning" (as when a boxer is knocked-out in the ring) to profound unconsciousness lasting hours or days. Delay in recovery is due to oedema of the brain, to the occurrence of minute haemorrhages dotted throughout, or rarely to a large local effusion of blood causing cerebral compression. The oedema is best treated by hypertonic salines (*see* below), the effusion by operation which, be it noted, is only occasionally indicated.

Gun-Shot Wounds and Stab Wounds.—The only pathway by which a stab can easily reach the brain is through the roof of the orbit, and many cases are on record of accidental injury by this route, for example, penetration by the ferrule of an umbrella, fall on a spike and so on. The danger of infection is great if the patient immediately survives as he often does.

In gun-shot wounds the great factor is the velocity and size of the missile. At short range the cranial capsule will positively burst in pieces, just as water will be ejected from a tub by the passage of a high velocity bullet. If the dura mater is torn (as it will be save with glancing wounds or a spent projectile) infection ensues unless an immediate operation is undertaken to excise the wound in scalp and bone and suck out spicules and diffluent brain matter. The projectile should be removed if it has not traversed too far but it must be most accurately localised by X-Rays first. The defects in the bone, results of gun-shot wounds and rarely of fractures, may call for closure by bone-grafts or celluloid plates (Sargent), but the wounds must be long healed and sterile first.

Cerebral Compression.—It has been remarked that any effusion or growth inside the skull must soon compress the brain. The grey and white matter which constitutes the brain, though soft in texture, is incompressible as water (Monro-Kellie doctrine), so that only the fluids circulating within it, blood and cerebro-spinal fluid, can be squeezed out. Severe headache is the earliest symptom, and continued violent headache in a previously healthy person is always suspicious. Vomiting is a common accompaniment, owing to anaemia of the vital centres in the medulla oblongata. Congestion of the optic nerves is usually present and will lead to blindness if the condition is not relieved by removal of the cause or alternatively by the provision of an opening in the skull to reduce the pressure (decompression).

Relief of Pressure.—The commonest cause of raised intracranial pressure is tumour of the brain, by no means a rare affection. These growths produce local destructive effects from which the situation of the tumour may be deduced (disturbance of motion and sensation of various kinds). But their outstanding feature is the headache and general misery which they induce by developing in a confined space where there is no margin for any foreign or extra bulk. The local effects of brain tumours are dealt with elsewhere (*see* NEUROPATHOLOGY) as is their nature (*see* TUMOURS). For our immediate purpose the important fact is that the majority are gliomas, arising from the supporting stroma of the cerebral tissue and possessing no capsule. This means that they cannot be enucleated without leaving tumour cells behind. Nor can a block-resection of sound tissue with the tumour enclosed be performed without inflicting severe and permanent disability on the sufferer, though this has been advocated (Dandy). Fortunately many gliomas grow very slowly so that if the main mass is removed relief for some time at least follows. Further, they show a tendency to degenerate into relatively benign cysts which may be tapped, and lastly, some types are sensitive to irradiation by X-rays or radium. The endothelioma, on the other hand, is benign and once removed does not recur, but unfortunately many lie in inaccessible positions and are extremely difficult problems technically. Pituitary tumours are also benign, but can rarely, if ever, be totally extirpated, whilst tumours arising from the auditory nerve are in similar case; fragmentary removals give most satisfactory results, and the patient often lives for years after the operation.

All intracranial tumours for one reason or another tend to interfere with vision, and indeed if left untreated, blindness is the almost uniform end. Operation to relieve pressure and save sight must be undertaken early. Generally the intervention will take the form of a decompression, a sufficiently wide opening being made in the skull and dura mater to allow the brain to bulge—a safety-valve as it were. Since the bulging brain needs protection the opening is best made beneath the temporal muscle (Cushing), and since haemorrhages may occur in the released area with consequent impairment of function the opening should be over a relatively "silent" area, such as the right temporal lobe. Up to recent years little more than this decompression was attempted but there is a growing tendency now to attack in addition the tumour itself. Even if it should be irremovable the resection of bone over it will allow more competent attack by post-operative radiation. It may be said that the results of surgery so far as concerns permanent cure leave much room for improvement, but the treatment of brain tumours is still relatively in its infancy. So far as concerns immediate relief from agonising headache, from failing vision and the like, the results are usually good.

Hypertonic Solutions.—In very bad cases the patient may be comatose and operation is not always then desirable, the brain tissue will veritably burst when the skull is opened so high is the tension. Such patients may be recalled to consciousness and better fitted for operation by the intravenous administration of hypertonic solutions. We owe this advance to Weed and McKibben who advocated the use of 15% salt solution intravenously. Fifty to one hundred c.cs. "pulls over" the excess fluid from the cerebro-spinal network and sometimes lowers tension remarkably. Glucose in 50% strength acts more slowly but for a longer time. This type of physiological medication is proving helpful in the surgery of tumours, for the fact that they cause such huge rises in brain pressure has militated against successful attack upon them. Were pressure normal, exploration and extirpation would be very much easier; hypertonic therapy marks a step in the desired direction.

Ventriculography.—A complete neurological examination calls for considerable co-operation on the part of the patient, and in those cases where a patient is too drowsy and ill to pay much heed to questions or respond to requests it is sometimes difficult to say just where a brain tumour may be. In such cases use may be made of ventriculography or cerebral pneumography. A small hole having been made, the lateral ventricle is punctured and cerebro-spinal fluid drawn off, a quantity of air equal to the amount of fluid extracted is injected and an X-ray will now show the ventricles clearly outlined. Deductions as to the position of the tumour may be drawn from the shape of the ventricle. The method is not without danger and the interpretation of the X-rays is often puzzling.

Brain Abscess.—Abscess of the brain usually forms by direct extension from a focus of disease in the skull, usually in an accessory air-sinus such as the mastoid antrum or frontal sinus. The mortality is high because the infection tends to spread into the surrounding brain tissue as a septic encephalitis. The chief sites are the cerebellum and temporosphenoidal lobes. Sometimes abscesses arise in the brain by lodgement of septic particles from the lungs when purulent bronchitis (bronchiectasis) is present. Drainage of the abscess is the only logical and successful treatment, the result depending often on the nature of the infection rather than on perfection of technical skill.

Epilepsy.—Jacksonian epilepsy, localized muscle group convulsions due to a circumscribed lesion of the motor cortex, has received much attention from surgeons. In those cases where there is indeed a focus of irritation, operation usually does good, but many apparent Jacksonian attacks are manifestations of ordinary epilepsy which has so far no discovered pathological basis.

Facial Neuralgia.—There is no medical cure for trigeminal neuralgia; the only hope lies in some form of operation designed to block the passage of impulses along the nerve. This may be attained by alcohol injections, but after about a year this needs repeating for the nerve fibres regenerate. The only permanent cure is division of the sensory root of the great ganglion of the nerve (Gasserian ganglion), a much less severe operation than the removal of the ganglion which was the custom a few years ago. It is often possible to save the fibres supplying the eye. It is usual to give alcohol injections first to accustom the patient to the idea of numbness, for in neuralgia cases the more complete and lasting the anaesthesia obtained the more complete the cure. The deadening of the skin has no ill effects, but when the eye is totally anaesthetic it is very apt to become inflamed (neuroparalytic keratitis) and requires careful attention. Protective glasses must be worn out-of-doors. Sufferers from severe neuralgia are usually well prepared for any sacrifice to be rid of the pain. No deformity follows the operations. (G. J.)

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BRAINTREE forms, with Bocking, an urban district, Essex, England; 45 mi. N.E. of London by a branch line from Witham of the L.N.E. ry. Pop. (1938) 14,800. Area 10.6 sq.mi. The church of St. Michael is fine Early English with later additions. The bishops of London had formerly a palace here, but nothing remains. Silk and crepe manufactures have superseded that of woollen cloth introduced by Flemish refugees from the persecution of the duke of Alva, but iron workers, especially fitters, are now more numerous.

BRAINTREE, a town of Norfolk county, Massachusetts, U.S.A., 34.5sq.m. in area, about ten m. south of Boston. Its villages (Braintree, South Braintree, East Braintree and Braintree Highlands) are served by the New York, New Haven and Hartford railroad. The population was 10,580 in 1920, of whom 2,276 were foreign-born whites; 16,378 in 1940 federal census. The assessed valuation of property in 1940 was $25,000.000; and the manufactured products in 1925 (chiefly shoes, nails, leather, rubber and woollen goods) were valued at $15,144,475. Braintree was incorporated in 1640, from land belonging to Boston, and was named after the town in England. In 1708 it was divided into the North Precinct (now Quincy) and the South Precinct. Quincy was separated from Braintree in 1792 and Randolph in 1793. Bog-iron was found here at an early date, and ironworks were established in 1644.

BRAKE, town of Germany, in Oldenburg, on the left bank of the Weser, about halfway between Bremen and the mouth of the river. Pop. (1939) 10.987. It was for centuries the port of Bremen, but was largely superseded by Bremerhaven. Shipbuilding and fishing are carried on.

BRAKE. A means of controlling the speed of a movement, or of totally arresting it. Nearly all brakes act frictionally, though the opposition of a piston in a cylinder can be applied for retarding purposes, converting the cylinder into an air-compressor for the while. Dynamic braking is another non-frictional method, an electric motor being caused to run as a generator, so checking the speed of a vehicle or a machine, or causing a total stop. Most friction brakes act on revolving elements, as wheels or drums, but slipper brakes pressing on flat surfaces are applied as for tramcars, mechanically or magnetically operated, and a pincer or forcep type grips each flank of a rack in some of the mountain railways. A rope also serves for the application of a brake device in a few cases.

Band-brakes.—A highly effective braking action can be obtained by the coiling of a rope around a drum, as may be seen at any docks, a man holding the free end of the rope, and allowing it to slip gradually. The more convenient application of this idea (a flexible steel band) is employed on winches, hoists, haulage and winding engines, cranes and motor vehicles; in order to increase the frictional effort and reduce heating, some kind of lining has to be fitted, as wood, leather, asbestos or one of the special compositions. The band fits externally in all ordinary examples, but when access of dirt, moisture and grit must be prevented, which is the requirement in motor-cars, an internal expanding type has the preference, the band being made in two or three parts, with a pivotal freedom. By the multiplication of power with a lever, plus the frictional effect of the band embracing a large diameter, a man by exercising moderate force at a handle or treadle can hold a load of several tons, and pay it out slowly or quickly by regulating his pressure. Fig. 1 may be noted to explain the essential features, the lever having its eye pivoted on a short shaft around which one end of the band is looped, while the other end is pinned a little way along the lever, being consequently pulled taut as the pedal is depressed. A balance-weight at the tail end frees the band when the foot releases the lever.

Electro-mechanical Brakes.—Electric cranes possess a similar kind of band-brake, but with a system of levers arranged so that a weight applies the band, excepting while the crane is working. As current is switched on, a solenoid acts on an electro-magnet and pulls the lever; directly current is switched off, or fails from any cause, the weight asserts itself again. By a hand release mechanism lowering may be done, and automatic over-winding gear is usually fitted, which has the effect of applying the brake should the load be lifted too near the jib or girders. Not only the lifting motion, but slewing, derricking and travelling motions generally have electro-mechanical brakes, an important factor in high-speed operation.

Motor-car Brakes.—A special class of brake-drum arrangement is built into many cars, with duplex shoes; for instance, the pedal actuates shoes in drums on the four wheels, while the hand-lever operates separate shoes in the rear wheel drums. The diagram (fig. 2), gives a face view of a drum, with the spring-closed shoes, and the cam which spreads them apart. Rigid rods usually transmit the power from the hand-lever or pedal, but there is a class with steel ropes, termed a cable brake, forming the connection to the front and rear drums. Servo-mechanism operated from the gear-box works through clutchplates; first the rear brakes go on as the driver depresses the pedal, and then the clutch faces engage, and through levers augment the driver's

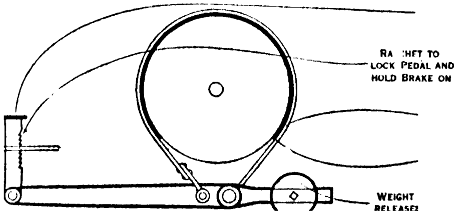

FIG. 1.—THE SIMPLE BAND OR STRAP BRAKE, FOR CRANES, HOISTS, HAULAGE ENGINES AND OTHER MECHANISMS
The driver, by pressing on the pedal, is able to control speed or effect a dead stop. The lining is of wood, leather, or asbestos fabric, greatly enhancing the grip

effort, and also put on the front-wheel brakes. Or a connection is made to the engine so as to obtain suction on a piston in a servo-motor, the valve for this coming into use as the driver gradually applies the brake. Fig. 3 shows the system of levers in the Dewandre mechanism. As the pedal is pushed over it draws lever A forward until the clearance between its boss and the pin B is taken up, the brakes going on by the pull of rod C, the top end of which is really fulcrumed at the same spot B, though shown separated for clearness. Lever D now functions and places the suction manifold in communication with the brake cylinder, and the air is instantly sucked therefrom, setting the chain taut, and pulling over the bottom end of lever A.

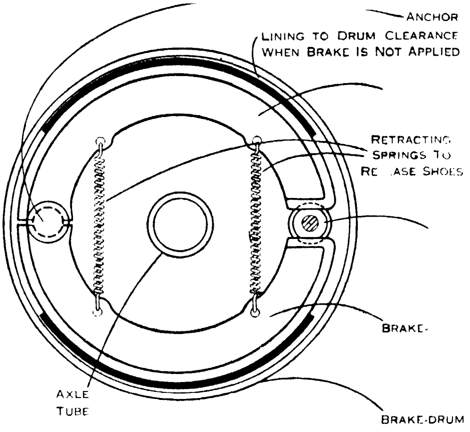
ANCHOR
LINING TO DRUM CLEARANCE WHEN BRAKE IS NOT APPLIED
RETRACTING SPRINGS TO RELEASE SHOES
BRAKE-
AXLE TUBE
BRAKE-DRUM

FIG. 2.—THE EXPANDING BAND BRAKE USED IN AUTOMOBILES
This brake can be enclosed and protected from dirt and moisture. The partial twist of the cam forces the ends of the shoes apart and thus causes the friction-lining to grip against the interior of the drum

In the Westinghouse vacuum-servo system a brake cylinder has one end open to atmosphere, the other end communicating with the engine induction-pipe through a control valve which regulates the resultant pressure on the piston. The brake levers are so devised that application of the brake pedal first brings the brake shoes into contact with the drums; then further foot pressure affects the control valve and opens the communication between induction-pipe and brake cylinder, thus causing the pressure of the atmosphere to move the piston and tighten the brakes still more. The braking force is directly dependent on the foot pressure.

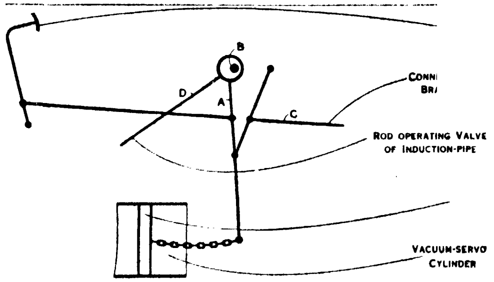

FIG. 3.—DIAGRAM SHOWING PRINCIPLE OF THE VACUUM-SERVO BRAKE
This form of power assistance is derived from the engine induction pipe, the partial vacuum drawing a piston backwards in the vacuum-servo cylinder. The piston is connected by a chain to a lever in the brake mechanism. The act of beginning to apply the brake by hand, causes the piston to suck backwards and complete the braking by power (By permission of "The Motor")

The Westinghouse power-brake acts by air from a small compressor or by gas from the explosion chamber of a petrol engine. The control may be exercised either by foot-valve or hand-valve, and the brake-cylinder for each wheel is in the form of a pair of covers, one with foot to bolt to the chassis. The cylinder diameters range from 7in. to 12in. according to weight of vehicle. Instead of a sliding piston, there is a flexible diaphragm (*see* fig. 4) that moves as the pressure comes through the pipe joined up at the back cover, and pushes the rod outwards. The latter connects to a reversing crank, and so to the brake-rod. There is a slotted link fitment to the existing hand-brake to make this independent of the power-brake. Hydraulic power has the advantages of simple flexible pipe connections to the wheels, and a perfectly compensated action, since the pressure is equal in all directions. The Lockheed system, which is fitted to numerous makes of cars, has a small pump or master cylinder attached to the flywheel housing, forcing oil along pipes and through reinforced rubber connections to a cylinder in each brake assembly. Two small pistons in each cylinder expand the brake shoes, as evident from fig. 5 (from a Brocklebank car). The shoes are pivoted at the opposite side of the circle, in the usual manner. The pistons are 1¾in. in diameter, and the normal pressure is about 100lb. per sq. in., rising to 350lb. in emergency. The fluid used is a mixture of equal parts of castor-oil and ether, and certain stabilising ingredients added.

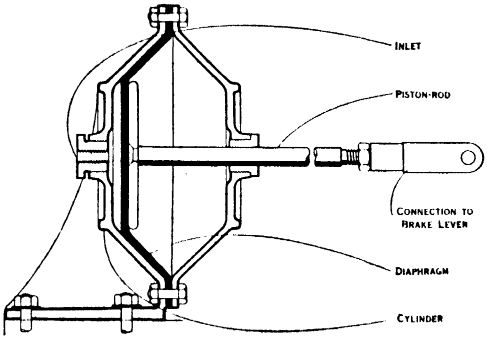

FIG. 4.—CYLINDER AND DIAPHRAGM OF WESTINGHOUSE POWER BRAKE FOR MOTOR VEHICLES
Brake power is supplied by compressed air, or by gas taken from the explosion chamber of the engine cylinders and stored in a reservoir. On applying a hand or foot lever, the pressure is admitted behind the diaphragm, and so pushes out the piston-rod to operate the brake rigging

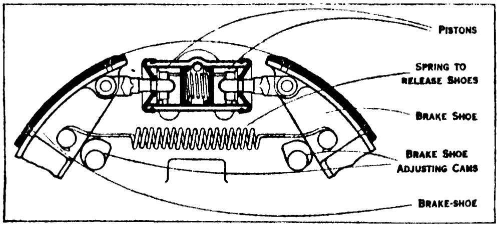

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FIG. 5.—DIAGRAM SHOWING ACTION OF LOCKHEED HYDRAULIC BRAKE
Oil under pressure is supplied to the brake mechanism in each wheel drum and, entering between the two pistons, forces them apart, so expanding the pivoted brake shoes

Railway Brakes.—These comprise hand-lever brakes for small locomotives and trucks and wagons, screw and lever for vans and tenders, etc., steam for locomotives and sometimes tenders, Westinghouse air-brakes for whole trains, and vacuum brakes. The mixed system is also employed, an air-brake being used for the engine wheels, and vacuum for the train; or a steam-brake acts for the engine and vacuum for the train. A special valve

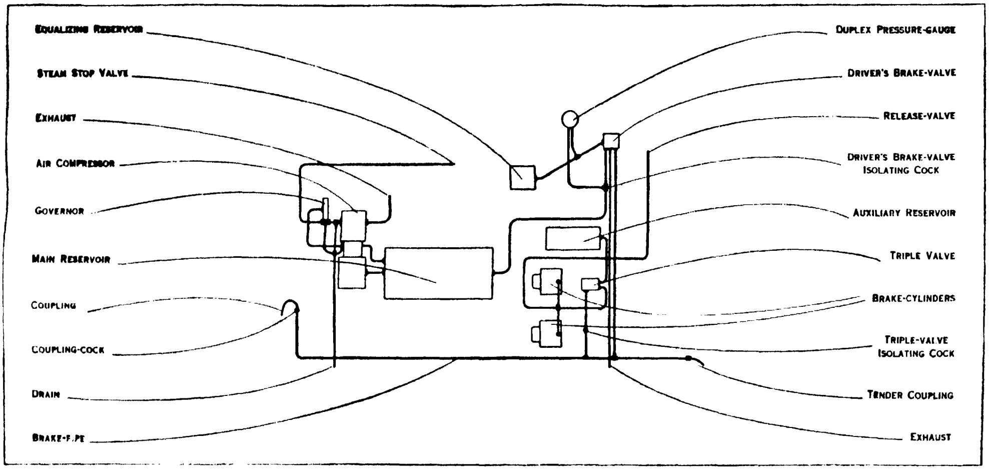


FIG. 6—ENGINE FITTINGS FOR WESTINGHOUSE COMPRESSED AIR AUTOMATIC BRAKE

The essentials of this system are an air compressor and reservoir on the engine, and an auxiliary reservoir for each coach in the train. The brake is applied by reducing the pressure in the brake-pipe, which results in a movement of pistons in the triple-valves, allowing some of the compressed air in the auxiliary reservoirs to reach the pistons of the brake cylinders, so pressing blocks on the wheels. A breakaway of the train also causes the valves to act and apply the brakes

enables air and vacuum brakes to act simultaneously. Hand action commonly occurs on wagons and vans, levers coupling up the hand-lever to the brake shoes, and on small locomotives; while the screw and lever affords more power, and is self-locking, and serves for small locomotives, the tenders and some vans. Steam is applied largely in the case of driving wheels, one cylinder actuating the rods for several shoes; a separate arrangement with flexible connection is frequently fitted to bogies; or, as alternative to the steam, the vacuum brake, or Westinghouse, takes charge of the engine wheels.

The Westinghouse automatic brake operates by compressed air furnished by a compressor on the engine, and stored in its main reservoir. The essential parts include those indicated in the diagram (fig. 6), commencing at the steam stop-valve, supplying steam through the air-compressor governor. The last-named shuts off steam when the required air pressure is reached. The compressor passes air into the main reservoir, which is directly connected by an isolating cock to the driver's brake-valve. This allows the air to pass through the adjacent feed-valve, adjusted to automatically maintain the desired pressure in the brake-pipe. Thence the air flows through feed grooves in the triple valve and into the auxiliary reservoir. Finally hose couplings connect up the brake-pipe throughout the train, with cocks to control the communication between the vehicles. The brake is applied by reducing the pressure in the brake-pipe, causing the pistons of the triple valve to move, and allow some of the air in the auxiliary reservoirs to gain access to the brake cylinders. Release occurs on restoring the air pressure in the brake-pipe, with the consequence that the triple valves close communication between auxiliary reservoirs and brake cylinders. For electric railways the brake is much the same as for steam, the only difference lying in the method of producing compressed air. The vacuum automatic brake is dependent on atmospheric pressure for its action, the brakes being normally kept off by the state of vacuum existing in the train-pipe and cylinders. An ejector on the engine produces the vacuum and maintains it constantly. As there is vacuum both above and below the pistons in the brake-cylinders, the pistons fall by gravity and the shoes remain off. But when atmospheric air is admitted to the train-pipe, by the driver or guard, or through a break-away, it closes a ball-valve in the piston so as to seal the upper side of the cylinder, and exerts pressure on the lower side of the piston, forcing it upwards and actuating the brake rods. The two conditions appear in fig. 7, the first view showing the state with brakes off, the second with the air represented by dots. The object of the "rolling ring" of rubber is to make a perfect joint or packing without friction, and the release-valve serves to enable the brake to be released by hand.

Tramcar Brakes.—The hand-brake which applies shoes to the wheels of a tramcar suffers from limitations in regard to power, hence other systems must be utilized in conjunction with it. The regenerative method (causing the motors to act as generators) imposes a powerful braking effect. Or this may be combined with the operation of slippers magnetically clinging to the rails (an alternative to mechanically-applied slippers), thus affording axle braking combined with the powerful slipper drag. And sometimes the mechanism includes wheel shoe attachments, the drag of the magnets causing an application of the wheel brake blocks. The magnet coil is usually a large wire coil having a small number of turns, while for certain conditions a supplementary shunt or fine wire coil is added, energized by current from the line. With shunt winding the car can be brought completely to rest without having to apply the hand-brake.

Other Types of Brake.—The hand-brakes are utilised on hauling and winding engines, with pedal control, but the alternative is the "post" brake, fitted especially on large engines. This consists of two strong steel girders standing upright on each side of the brake-drum, and having wood blocks that press on a portion of the periphery on each side; rods and levers perform the tightening action. There are two drums on large engines, and the equipment includes heavy weights and a steam-brake cylinder; the overwinding gear takes care of the cage, and the brakes are sufficiently powerful to hold the engines against full steam.

Magnetic brakes operate by a direct pull between friction discs or shoes embracing a cylindrical drum, controlled by an electro-magnet. The result is quick and positive, and finds use on certain classes of electrically-driven machinery. This type is distinct from the electro-mechanical brake previously described.

Weston brakes, also termed disc or clutch brakes, are worked either magnetically, or by end pressure obtained from a screw or hand or pedal gear. The brake contains a number of friction discs, all brought into contact simultaneously, and giving a high gripping power which increases directly as the number of discs employed. This kind is much used on cranes. A "load" brake is one fitted to the heavier cranes, the movement of the load causing a sufficient freedom between the discs when lowering is being performed, but if the driving motor is stopped the friction

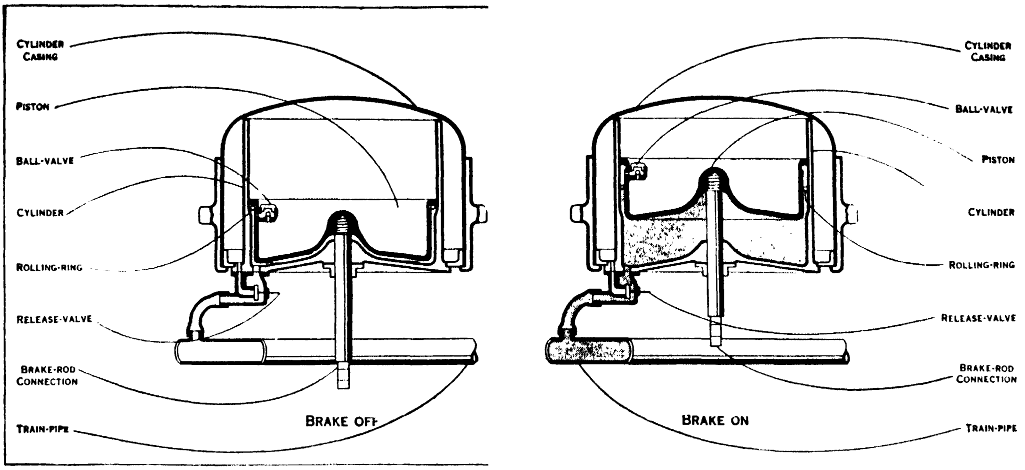


FIG. 7.—DIAGRAM OF THE VACUUM BRAKE: VACUUM CYLINDER SHOWING BRAKE OFF, AND ON

The vacuum produced in the train-pipe and the brake cylinders, allows the pistons of the latter to fall and through lever connections pull the brake shoes off the wheels. To destroy the vacuum, atmospheric air is sent into the train-pipe, and pushes the pistons up, so applying the brakes. A similar result is brought about, if the train should part, by the breaking of the coupling pipes

reasserts itself and lowering ceases, the driver thus having perfect control.

Running-in brakes afford a means of imposing a load on an engine for a period, in order to bed down the bearings and piston-rings, in imitation of the actual service of the engine, but at a reduced speed. (For brakes used as dynamometers, *see* DYNAMOMETER.) (F. H.)

Brake Shoes for Wheel-Truing.—In making brake shoes for use on mining locomotive wheels pieces of "feralun" or artificial corundum (*q.v.*) are set in the mould, creating a shoe that will prevent the formation of false flanges on the wheel by constantly and uniformly grinding the wheels to the proper profile. The abrasive pieces must be set carefully to secure the desired result. With shoes of this type, braking efficiency is unimpaired and no time is wasted in keeping the locomotive in the repair shop for the purpose of wheel-truing.

BRAKELOND, JOCELYN DE (*fl.* 1200), English monk, and author of a chronicle narrating the fortunes of the monastery of Bury St. Edmunds between 1173 and 1202. He is known only through his own work. He was a native of Bury St. Edmunds; he served his novitiate under Samson of Tottington, took the habit in 1173, and became abbot's chaplain under Samson. The picture which he gives of his master, although coloured by enthusiastic admiration, is singularly frank and intimate. The unique interest of his work lies in the minuteness with which it describes the policy of a monastic administrator who was in his own day considered as a model.

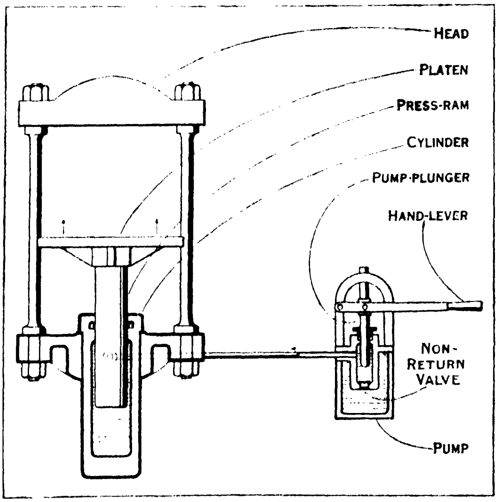
Jocelyn has also been credited with an extant but unprinted tract on the election of Abbot Hugo (Harleian ms. 1005, fo. 165), but from internal evidence this seems to be an error. He mentions a (non-extant) work which he wrote, before the *Cronica*, on the miracles of St. Robert, a boy whom the Jews of Bury St. Edmunds were alleged to have murdered (1181).

See the editions of the *Cronica Jocelini de Brakelonda* by T. Arnold (in *Memorials of St. Edmund's Abbey*, vol. i. Rolls series, 1890), and by J. G. Rokewood (Camden Society, 1840); also Carlyle's *Past and Present*, book ii. A translation and notes are given in T. E. Tomlin's *Monastic and Social Life in the Twelfth Century in the Chronicle of Jocelyn de Brakelond* (1844). There is also a translation of Jocelyn by Sir E. Clarke (1907).

BRAKEMAN, in the United States, the employee on passenger trains of the railroad who assists the conductor and is in charge of the brakes. The forward brakeman is expected to keep the signal appliances in good working order and the rear brakeman on many trains performs the duties of a flagman. The brakeman is expected also to help the conductor by announcing stations, helping passengers on and off trains and looking after their general comfort. He receives instructions from the train-master and is subject to the orders of the conductor while on the train. He must pass a physical examination with special stress laid upon eyesight and colour vision and must become familiar with signals and the terminology of train orders. Besides passenger train brakemen, there are yard brakemen who couple and uncouple cars in making up trains in the yards, and brakemen on freight trains who assist the freight train conductors. In 1920, there were approximately 927 brakemen per million of population in the United States.

BRAMAH, JOSEPH (1748–1814), English engineer and inventor, the son of a farmer, was born at Stainborough, Yorkshire, on April 13, 1748. He worked as a cabinet-maker in London, where he subsequently started business on his own account. His first patent for some improvements in the mechanism of water-closets was taken out in 1778. In 1784 he patented the lock known by his name, and in 1795 he invented the hydraulic press. For an important part of this, the collar which secured water-tightness between the plunger and the cylinder in which it worked, he was indebted to Henry Maudslay, one of his workmen, who also helped him in designing machines for the manufacture of his locks. In 1806 he devised for the Bank of England a numerical printing machine, specially adapted for bank-notes. Other inventions of his included the beer-engine for drawing beer, machinery for making aerated waters, planing machines, and improvements in steam-engines and boilers and in paper-making machinery. In 1785 he suggested the possibility of screw propulsion for ships, and in 1802 the hydraulic transmission of power; and he constructed waterworks at Norwich in 1790 and 1793. He died in London on Dec. 9, 1814.

BRAMAH PRESS, the practical application of Pascal's law that fluids transmit pressure equally in all directions. Joseph Bramah, about 1796, was able to construct a successful press, using a small pump plunger and conducting the water to a ram of much larger area. Each portion of the surface of the ram equal in area to that of the plunger therefore receives a like pressure, the difference in the two total areas greatly increasing the ram pressure. A force of a few pounds acting on the pump lever can thus be converted into hundreds of pounds force at the ram. The hand-operated presses built on this principle are extremely numerous, for various pressing and forming processes as required in the book-binding, printing, paper, leather, tobacco, tea, drug, jewellery, engineering, and electrical trades. When a larger installation is required, or the powers are high, power-driven pumps are employed, or the supply is taken from accumulators or service mains. Nevertheless, hand-actuated presses can be had up to 300 tons power. Power-actuated types comprise those for punching and shearing, riveting, flanging, forging, and bending, baling, bundling, railway wheel forcing, and some special forms utilized in celluloid, cotton, tube, and munitions manufacture.



HAND OPERATED BRAMAH PRESS, USED IN BOOK-BINDING, PRINTING, PAPER, LEATHER, TOBACCO AND SIMILAR TRADES

Water is drawn into the pump through the valve, then forced, under pressure, through the pipe to the cylinder. Here, with its increased area and consequent increased pressure, it actuates the press-ram

There are three methods now by which cost of working is lessened, by comparison with the ordinary pump or accumulator supply above mentioned. (1) Water saving; by filling the press cylinder with ordinary supply and only turning on the pressure water at the moment of action, thus saving all the pressure water possible. (2) Fitting three cylinders for a big press and using one, two, or three according to needs, giving, for instance, either 200, 400, or 600 tons pressure. (3) Eliminating pumps and accumulators by the installation of a steam-intensifier. This consists of a large steam cylinder the piston of which operates a small hydraulic plunger, so that, for example, 150 lb. steam pressure can be made to give a hydraulic pressure of 2½ tons per square inch.

BRAMANTE or **BRAMANTE LAZZARI** (*c.* 1444–1514), Italian architect and painter, whose real name was Donato d'Agnolo, was born at Monte-Asdrualdo in Urbino. He studied painting probably under Mantegna or Piero della Francesca and in Milan came under the influence of Vincenzo Foppa. He appears to have studied architecture under Luciano da Laurano who was made chief architect at Urbino in 1468. He visited several of the towns of Lombardy, executing works of various degrees of importance. He remained in Milan from 1476 to 1400 and seems to have left for Rome about 1500. About this time the Cardinal Caraffa commissioned him to rebuild the cloister of the Convent della Pace and introduced him to Pope Alexander VI. He began to be consulted on nearly all the great architectural operations in Rome, and executed for the pope the palace of the Cancelleria or chancery. Under Julius II. Bramante's first large work was to unite the straggling buildings of the palace and the Belvedere by means of two long galleries or corridors enclosing a court. Unfortunately the foundations were not well laid, and the whole is now so much altered that it is hardly possible to distinguish the original design.

Besides executing numerous smaller works at Rome and Bologna, among which is a round temple in the cloister of San Pietro-a-Montorio, Bramante was called upon by Pope Julius to begin the rebuilding of St. Peter's. Bramante's designs were completed, and before his death he had erected the four great piers and their arches and finished the cornice and the vaulting of this portion; he also vaulted in the principal chapel. He had, therefore, laid down the main lines of the building. After his death on March 11, 1514, his design was much altered, in particular by Michelangelo.

BRAMBLE: *see* BLACKBERRY.

BRAMBLING (*Fringilla montifringilla*), a finch (*q.v.*) allied to the chaffinch (*q.v.*), but slightly larger and with a more forked tail. Breeding in high northern latitudes, the brambling has a wide range in the old world and occurs in Great Britain as a winter visitor, where it is found about bramble thickets. It looks like a chaffinch, but has a conspicuous white rump, in flight, an orange-buff breast and brown (winter) or blackish (spring) head. Accidental on the Pribilof Islands, Alaska. (G. F. Ss.)

BRAMPTON or **BRANDON,** SIR EDWARD, Anglo-Jewish adventurer of the 15th century. Born in Portugal of Jewish parentage, he came to England in maturity and was baptized under the auspices of King Edward IV., whose name he adopted. From 1468 to 1472, with a brief interval, he was an inmate of the Domus Conversorum in London, with an allowance of 1½d. a day. Subsequently, he entered public life, receiving a series of military appointments, and being rewarded with grants of land and of mercantile privileges. In 1482 he was appointed captain, keeper, and governor of Guernsey, which office he retained until the fall of the Lancastrians. He became a zealous partisan of Richard III., by whom favours were showered upon him, and was knighted in 1484. After the accession of Henry VII., he retired, first to the Low Countries, and then to Lisbon. At Middelburgh, there entered into his service a Flemish youth named Perkin Warbeck, who later, when he made his bid for the throne of England, made full use of his master's recollections of the court of Edward IV. In 1488, Brampton is found, incredibly enough, again resident in the Domus Conversorum in London: but he afterwards went back to Lisbon, where he entertained the English embassage in the following year. Through their medium, apparently, Sir Edward Brampton received a full pardon from Henry VII. in 1489, and returned to England. A son of his was knighted by the king at Winchester in 1500.

(C. R.)

BRAMPTON, HENRY HAWKINS, BARON (1817–1907), English judge, was born at Hitchin on Sept. 14, 1817. Called to the bar at the Middle Temple in 1843, he joined the old home circuit and took silk in 1859. He was counsel in many of the famous trials of the reign of Queen Victoria: for example, in the Simon Bernard case (the Orsini plot); *Roupell* v. *Waite;* the Overend-Gurney prosecutions; the convent case *Saurin* v. *Star,* 1869; the two Tichborne trials (1871–74) (*see* TICHBORNE CLAIMANT, THE), and the will case of *Sugden* v. *Lord St. Leonards.* Hawkins was raised to the bench in 1876, and assigned to the then exchequer division of the High Court, not as baron (an appellation which was being abolished by the Judicature Act), but with the title of Sir Henry Hawkins. He was a great advocate rather than a great lawyer. His knowledge of criminal law was intimate, the reputation he gained as a "hanging" judge making him a terror to evil-doers. One of his earliest murder trials—the Penge case, *The Reg.* v. *Staunton and Rhodes* (1878),—aroused great controversy; four persons, two of them women, were sentenced to death but respited, one (Alice Rhodes), receiving a full pardon. For his conduct in this case, and, indeed, for the general tenor of his judicial career, he has been severely criticized by one of the greatest advocates of the Bar, Sir Edward Clarke, who was counsel in that case (see *The Story of My Life,* by Sir Edward Clarke, 1918). In 1898 he retired from the bench, and was raised to the peerage under the title of Baron Brampton. He frequently took part in determining House of Lords appeals. Brampton died in London on Oct. 6, 1907. His own *Reminiscences* (1904, 2 vols.), ed. by Richard Harris, K.C., do Lord Brampton less than justice.

BRAMPTON, a market town of Cumberland, England, 10 mi. E.N.E. of Carlisle, on a branch of the London and North Eastern railway. Population (1931) 2,635. It is situated in a narrow valley opening upon that of the Irthing. Two miles N.E. of Brampton is the castle of Naworth built in the reign of Edward III. Overlooking a deep wooded ravine, with streams to the east and west, the great quadrangular castle was naturally defended except on the south, where it was rendered secure by a double moat and drawbridge. By marriage in 1577 with Lady Elizabeth Dacre it passed into the hands of William Howard, afterward lord warden of the Marches, the "Belted Will" of Sir Walter Scott and the border ballads, who acquired great fame by his victories over the Scottish moss-troopers. The castle is the property of the earl of Carlisle and has numerous fine pictures.

Not far distant is Lanercost Priory, where in 1169 an Augustinian monastery was established. In 1311 Robert Bruce and his army were quartered here, and the priory was pillaged in 1346 by David, king of Scotland. From this time its prosperity declined until its dissolution by Henry VIII. The Early English church has a restored nave, but retains much fine carving. The chancel is ruined, but the interesting crypt is preserved. Brampton has an agricultural trade, small breweries, and manufactures a little cotton and tweed, but the majority of the population find employment as coal miners and metal workers on the neighbouring coal field.

BRAMWELL, GEORGE WILLIAM WILSHERE BRAMWELL, Baron (1808–1892), English judge, was born in London on June 12, 1808, being the eldest son of a banker. He was educated privately, and after two years in a bank, was admitted as a student at Lincoln's Inn in 1830, and at the Inner Temple in 1836. At first he practised as a special pleader, but was called to the bar at both Inns in 1838. In 1850 he was appointed a member of the Common Law Procedure Commission, which resulted in the Common Law Procedure act of 1852. This act he drafted jointly with Mr. (afterwards Mr. Justice) Willes, and thus began the abolition of the system of special pleading. In 1851 Lord Cranworth made Bramwell a queen's counsel, and the Inner Temple elected him a bencher. In 1853 he served on the royal commission to enquire into the assimilation of the mercantile laws of Scotland and England and the law of partnership, which had as its result the Companies act of 1862. It was he who, during the sitting of this commission, suggested the addition of the word "limited" to the title of companies that sought to limit their liability, in order to prevent the danger to persons trading with them in ignorance of that limitation. As a queen's counsel Bramwell enjoyed a large practice, and in 1856 he was raised to the bench as a baron of the exchequer. In 1867, with Mr. Justice Blackburn and Sir John Coleridge, he was made a member of the judicature commission. In 1871 he refused a seat on the judicial committee of the privy council. In 1876 he was raised to the court of appeal, where he sat till the autumn of 1881. His decisions were always clear; he had a straightforward manner and a gift of trenchant speech. Among his important judgments are *Ryder* v. *Wombwell* (L. R. 3 Ex. 95); *R.* v. *Bradshaw* (14 Cox C. C. 84); *Household Fire Insurance Company* v. *Grant* (4 Ex. Div. 216); *Stonor* v. *Fowle* (13 App. Cas. 20); *The Bank of England* v. *Vagliano Brothers* (App. Cas. 1891). Upon his retirement in 1881, 26 judges and a huge gathering of the bar entertained him at a banquet in the Inner Temple hall. In December of the same year he was raised to the peerage. Politically he was a strong individualist and opposed to what he called "grandmotherly legislation," and sat in appeals to the House of Lords. Bramwell died on May 9, 1892.

His younger brother, Sir Frederick Bramwell (1818–1903), was a well-known consulting engineer and "expert witness."

BRAN, in Celtic legend, the name of (1) the hero of the Welsh *Mabinogi of Branwen*, who dies in the attempt to avenge his sister's wrongs; he is the son of Llyr (=the Irish sea-god Lir), identified with the Irish Bran mac Allait, Allait being a synonym of Lir; (2) the son of Febal, known only through the 8th century Irish epic, *The Voyage of Bran* (to the world below); (3) the dog of Ossian's Fingal.

See Kuno Meyer and D. Nutt, *The Voyage of Bran* (1895).

BRAN, the material obtained from the outer coat of cereals; the ground husk of grain. It is used largely as a feeding stuff for horses, cattle, and poultry and for packing and in cleaning and polishing goods. It is used also as a human food, especially as an aid to digestion, either alone or with flour to make muffins and brown bread. The digestible matter in 1,000 lb. of wheaten bran is.

Nitrogenous substances	110 lb
Fat	27 "
Soluble carbohydrates	426 "
Fibre	22 "
Total organic matter	585 "

Thus the nitrogenous content is approximately that of wheat or s.

BRANCH, a limb of a tree; hence any offshoot, *e g*, of a river, railway, etc., of a deer's antlers, of a family or genealogical tree, or a subdivision or department, as in "a branch of learning" (Fr. *branche*, late Lat. *branca*, an animal's paw). The phrase, to destroy "root and branch," meaning to destroy utterly was made famous in 1641 by the so-called "Root and Branch" Bill (*see* Cromwell, Oliver; Clarendon, Edward Hyde, 1st Earl of). Among technical senses of the word "branch" are the certificate of proficiency given to pilots by Trinity House and, in siege craft, a length of trench forming part of a zigzag approach.

BRANCHIOPODA, one of the subclasses of the Crustacea (*q.v.*), comprising some of the most primitive existing forms of the class, distinguished by the flattened, leaf-like form of the limbs. Although, like most Crustacea, they cannot be said to have any popular English names, various members of the group have been distinguished by writers on natural history as fairy shrimps, tadpole shrimps, clam shrimps and water-fleas. Nearly all of them are inhabitants of fresh water, and they are remarkable for the prevalence of parthenogenesis (reproduction by unfertilized eggs) and for the fact that the eggs resist desiccation and can survive for long periods in the dry state. Owing to this they often make their appearance in numbers in rain pools, even in dry countries where for long periods no aquatic life is possible.

The members of the five orders named below differ much in structure. Those of the first four orders are characterized by the large number of somites, the general uniformity of the trunk-limbs, and, in the living species, by the tubular form of the heart and the "ladderlike" arrangement of the central nervous system. These characters are very primitive, but on the other hand the palpless mandibles and the reduced maxillulae and maxillae are more specialized than those of some other Crustacea.

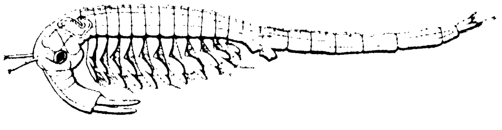


FIG. 1.—MALE OF ONE OF THE FAIRY SHRIMPS (BRANCHINECTA PALUDOSA), A MEMBER OF THE ORDER ANOSTRACA (THIS MALE IS OF MAXIMUM SIZE, X 3)

It has a circumpolar distribution and occurs in stagnant, shallow pools. The claspers of the male are formed from the second pair of antennae

The Anostraca have no carapace and the fully segmented body is almost wormlike. The males are distinguished by the modification of the antennae into large and complicated claspers which are used for holding the females. The eyes are set on movable stalks. Most Anostraca like the "fairy shrimp" (*Branchinecta*) inhabit rain pools and other temporary accumulations of fresh water, but the "Brine-shrimp" (*Artemia*) is found in the brine of salt pans in which sea water is exposed to evaporation by the heat of the sun for the manufacture of salt, and in salt lakes in which the brine is so concentrated that few other animals can live in it, such as Great Salt Lake, Utah. Brine shrimps are found throughout the world wherever conditions are suitable. Specimens from different localities differ considerably, but it has been shown that many of their variations are directly correlated with the degree of salinity of the water and probably many of the forms described are variants of a single cosmopolitan species. Brine shrimps are the only Anostraca known to be parthenogenetic, some colonies consisting entirely of females. Most Anostraca are of small or moderate size; giant among them is *Branchinecta gigas* from Grand Coulee, Ore., a full 2¾ in. long, equalling the reproduction (fig. 1) of *B. paludosa* in size.

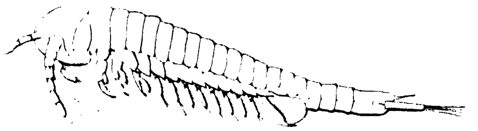
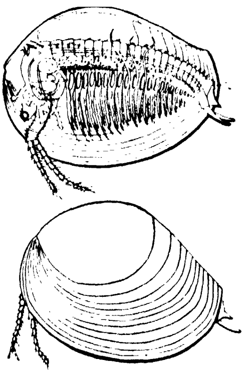


FIG. 2 — DEVONIAN FOSSIL (LEPIDOCARIS RHYNIENSIS) A MINUTE CRUSTACEAN KNOWN ONLY FROM FOSSIL REMAINS IN THE OLD RED SANDSTONE OF SCOTLAND BELONGING TO THE ORDER LIPOSTRACA
Female enlarged about x 20

Related to the Anostraca is the order Lipostraca established for the remarkable fossil *Lepidocaris* discovered in the old red sandstone of Scotland. The remains of this minute Crustacean although fragmentary are so perfectly preserved that its structure is known in greater detail than that of any other fossil Crustacean. Resembling the Anostraca in general form, it differs from them in the structure of the limbs, of which the posterior pairs are simply biramous; in the absence of paired eyes; and, most remarkably, in the claspers of the male which are formed, not by the antennae but by the maxillulae.

The Notostraca have a broad, shield-shaped carapace covering the fore part of the body and giving the animals, at first sight, some resemblance to the Arachnidan king or horseshoe crabs, with which, however, they have no near relationship. The somites and appendages are more numerous than in any other living Crustacea. The eyes are sessile on the upper surface of the head, and the antennules and antennae are much reduced, their place as "feelers" being perhaps taken by the filamentous terminal processes of the first pair of feet. The principal genus is *Apus* (*Triops*) (*see* CRUSTACEA, fig. 3), the species of which may be 2 in. or even 3 in. long. Reproduction is largely parthenogenetic and males are rare.



AFTER SARS, "FAUNA NORVEGIAE"

FIG. 3.—A CLAM SHRI
D
THE ORDER CONCHOSTRACA, ENLARGED ABOUT X 3
The lower figure represents the entire animal. In the upper figure the left valve of the shell has been removed to show the body and limbs

The Conchostraca have the carapace in the form of a bivalve shell enclosing the body and limbs and marked with concentric "lines of growth," so that it resembles very closely the shell of a lamellibranch mollusc. The large two-branched antennae are used in swimming. The paired eyes are sessile and are more or less completely coalesced into one. No Conchostraca have ever been found in the British Isles; *Estheria* and *Limnadia* are well represented in Europe and America.

The Cladocera are closely related to the Conchostraca, from which they should not, perhaps, be separated as a distinct order, and from which they differ chiefly in the great reduction in the number of body-somites and of limbs. They are the "water-fleas," everywhere abundant in ponds and lakes. Nearly all are of small size, some species which do not exceed one hundredth of an inch in length are among the smallest of living Crustacea; largest Cladoceran is *Leptodora kindtii*, from ½ to ¾ in. long, limnetic in larger lakes of the northern hemisphere, and the only member of the order having a naupliuslike larval stage. The transparency of Cladocera allows the internal structure to be studied in the living animal, making them interesting objects for microscopic examination. The Cladocera reproduce largely by parthenogenesis. The developing eggs are carried within the shell of the female. In addition to the parthenogenetic eggs, which hatch while still within the brood-chamber, the Cladocera produce, at certain seasons, another kind of eggs which require to be fertilized. These eggs have a thick shell and do not hatch at once but are cast off when the shell of the female is moulted and often a specially thickened part of the shell forms an additional protection. These "resting eggs" can survive drying or freezing without injury. They are often produced in autumn and do not hatch until the following spring; in species that live in small pools, they may be produced in spring to ensure against the drying up of the habitat in summer. The only Branchiopoda occurring in the sea are a few species belonging to three genera of Cladocera, *Evadne*, *Penilia* and *Podon*. These are cosmopolitan in their distribution, occurring in all seas. In converting the smallest aquatic and marine organisms into food material for animals higher in the scale of life, the Cladocera rank next to the Copepoda (*q.v.*) in importance.

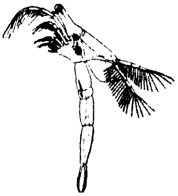
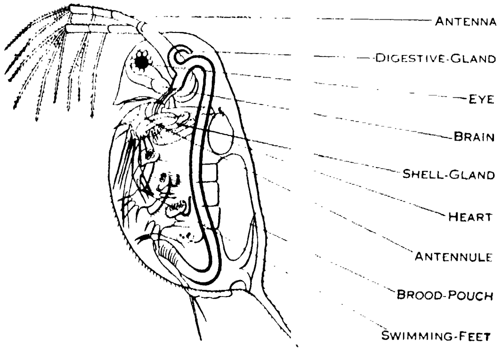


FIG. 4.—LEPTODORA KINDTII, LARGEST OF THE CLADOCERA, GROWS TO BE FROM ½ TO ¾ IN. LONG. ONE OF THE FEW PREDACEOUS FORMS PREYING ON OTHER FRESH-WATER CLADOCER AND COPEPODA

The "beating" or motion of the paired limbs in the Branchiopoda sets up a current of water along the midventral line of the body ("food groove"), from which particulate food is strained by bristles or feathered setae. Many have special provision for filtering off the fine particles of organic matter, chiefly microscopic algae, as well as coarser material and detritus, which some species may scrape or stir up from the bottom. The Notostraca and Conchostraca are primarily bottom feeders, the Anostraca and Cladocera pelagic foragers but in many cases deriving some food also from the bottom. The Notostraca are not above scavenging and eating small living organisms. A few Cladocera, of which *Leptodora* is one, are predatory, enabled by greater size and strength to capture other pelagic Cladocera and Copepoda. (*See* WATER-FLEA.) (W. T. C.; W. L. St.)



FROM PARKER AND HASWELL, "TEXTBOOK OF ZOOLOGY" BY PERMISSION OF MACMILLAN & CO.

FIG. 5.—THE WATER-FLEA (DAPHNIA), COMMONEST OF THE CLADOCERA
It occurs in large numbers in ponds, lakes and pools. Under adverse conditions (drought or frost) thick shelled "winter" eggs are produced which can resist drying or freezing almost indefinitely; enlarged about x 30

BRANCO, a river of northern Brazil and tributary of the Rio Negro, formed by the confluence of the Takutú, or "Upper Rio Branco," and Uraricoera, about 3° N. and 60° 28′ W., and flowing south by west to a junction with the Negro.

It has rapids in its upper course, but the greater part of its length of 348 mi. is navigable for steamers of light draught. The Takutú rises in the Roraima and Coïrrit ranges on the Guiana frontier, while the Uraricoera rises in the Serra de Parima, on the Venezuelan frontier, and has a length of 360 mi. before reaching the Branco. These are white water rivers, from which the Branco (white) derives its name, and at its junction with the Negro the two differently coloured streams flow side by side for some distance before mingling.

BRANCOVAN or **BRANCOVEANU,** the name of a family of Walachian hospodars which played an important part in the history of Rumania. It was of Serbian origin and was connected with the family of Branko or Brankovich. Constantine Brancovan, the most eminent member of the family, was born in 1654, and became hospodar of Walachia in 1689. In consequence of his anti-Turkish policy of forming an alliance first with Austria and then with Russia, he was denounced to the Porte, deposed from his throne, brought under arrest to Constantinople and imprisoned (1710) in the fortress of Yedi Kuleh (Seven Towers). Here he was tortured by the Turks, who hoped thus to discover the fortune of £3,000,000, which Constantine was alleged to have amassed. He was beheaded with his four sons on Aug. 26, 1714.

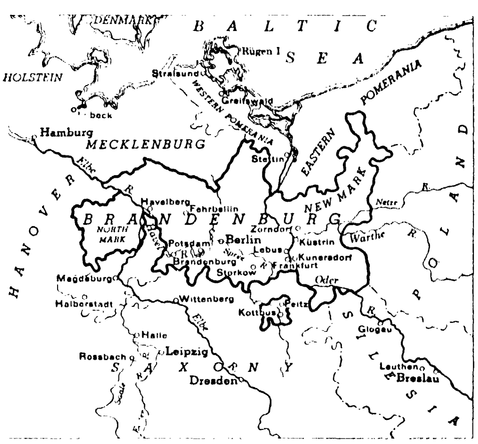
See N. Jorga, *Documents concernant le règne du prince Constantin Brâncoveanu* (1901).

BRAND, SIR JOHN HENRY (1823–1888), president of the Orange Free State, was the son of Sir Christoffel Brand, speaker of the House of Assembly of Cape Colony. He was born at Cape Town on Dec. 6, 1823, and was educated at the South African College in that city. Continuing his studies at Leyden, he took the degree of D.C.L. in 1845, was called to the English bar from the Inner Temple in 1849, and practised (1849–63) as an advocate in the supreme court of the Cape of Good Hope. In 1858 he was appointed professor of law in the South African College. He was elected president of the Orange Free State in 1863, and subsequently re-elected for five years in 1869, 1874, 1879 and 1884. In 1864 he resisted the pressure of the Basuto on the Free State boundary, and took up arms against them in 1865. This first war ended in the treaty of Thaba Bosigo, signed on April 3, 1866; and a second war ended in the treaty of Aliwal North, concluded on Feb. 12, 1869. In 1871 Brand was asked by a large party to become president of the Transvaal, and thus unite the two Dutch republics of South Africa; but as the project was hostile to Great Britain he declined to do so, and maintained his constant policy of friendship towards England. He received the G.C.M.G. in 1882. He died on July 14, 1888. (*See* ORANGE FREE STATE: *History*.)

BRAND, JOHN (1744–1806), English antiquary, was born on Aug. 19, 1744, at Washington, Durham, where his father was parish clerk. Educated at Newcastle grammar school and Lincoln college, Oxford, he took holy orders, and held various preferments, finally becoming rector of St. Mary-at-Hill and St. Mary Hubbard, London. He was for many years secretary to the society of antiquaries. His most important work is *Observations on Popular Antiquities: including the whole of Mr. Bourne's "Antiquitates Vulgares"* (1777). A new edition, embodying the mss. which he left when he died, was published by Sir Henry Ellis in 1813.

BRANDEIS, LOUIS DEMBITZ (1856–1941), U.S. jurist, was born in Louisville, Ky., on Nov. 13, 1856. He was educated in the public schools of his native city and at the Annen Realschule, Dresden, Germany. He graduated from the Harvard law school in 1877, was admitted to the bar in 1878, and practised in Boston from 1879 to 1916. He was much interested in labour legislation, acting as counsel for the people in cases concerning the power of the government to fix hours and wages in several states. In 1910 he was counsel in the Ballinger-Pinchot investigation in Congress; in 1910–11 he was counsel for the shippers before the Interstate Commerce commission in the advance freight-rate case. In Jan. 1916 he was appointed by President Wilson associate justice of the Supreme Court, being the first Jew to attain this position. His opinions on the bench reflected his liberal economic views. Of 16 major New Deal laws tried before the court while he was justice, he approved ten; he voted, however, against the NRA. He retired in Feb. 1939 and died Oct. 5, 1941. He wrote *Other People's Money* (1914) and *Business, a Profession* (Boston, 1914).

BRANDENBURG, the name of a margraviate and electorate that later became the kingdom of Prussia. The district was inhabited by the Semnones, and afterwards by various Slavonic tribes, who were partially subdued by Charlemagne, but soon regained their independence. Later Henry the Fowler defeated the Havelli, or Hevelli, and took their capital, Brennibor, from which the name Brandenburg is derived. Subsequently Gero, margrave of the Saxon east mark, pressed the campaign against the Slavs with vigour, while Otto the Great founded bishoprics at Havelberg and Brandenburg. When Gero died in 965, his mark was divided into six parts: (1) Havelberg, Brandenburg and the Altmark or Nordmark; (2) Lusatia and the Newmark; (3) the Saale region; and (4-6) Merseburg, Zeitz and Meissen. The first was the nucleus of the later margraviate of Brandenburg. After Otto the Great died, the Slavs regained much of their territory, including Brandenburg. A succession of feeble margraves ruled only the district west of the Elbe, together with a small district east of that river.



MAP OF BRANDENBURG (1640)

The Hohenzollern connection began in 1410. In 1415, Frederick of Hohenzollern was invested with the office of Elector of Brandenburg. In 1701 the title, King of Prussia, was secured by the Hohenzollerns and from this date the history of Brandenburg became merged in that of Prussia

Albert the Bear.—A new era began in 1106 when Lothair, count of Supplinburg, became duke of Saxony. Aided by Albert the Bear, count of Ballenstädt, he renewed the attack on the Slavs, and in 1134 appointed Albert margrave of the north mark. About 1140, Albert made a treaty with Pribislaus, the childless duke of Brandenburg, by which he was recognized as the duke's heir, taking the title margrave of Brandenburg. Albert was the real founder of Brandenburg. Under his rule Christianity and civilization were extended, bishoprics were restored and monasteries founded, and the country colonized with settlers from the lower Rhineland.

When Albert died in 1170, Brandenburg fell to his eldest son, Otto I. (*c.* 1130–84), who compelled the duke of Pomerania to own his supremacy, and slightly increased by conquest the area of the mark. Otto's son and successor, Otto II., having quarrelled with Ludolf, archbishop of Magdeburg, was forced to own the archbishop's supremacy over his allodial lands. His successor, Albert II. (*c.* 1174–1220) assisted the emperor Otto IV., but later transferred his allegiance to Otto's rival, Frederick of Hohenstaufen, afterwards the emperor Frederick II. His sons, John I. and Otto III., ruled Brandenburg in common until the death of John in 1266, and their reign was a period of growth and prosperity. Districts were conquered or purchased from the surrounding dukes; the marriage of Otto with Beatrice, daughter of Wenceslaus, king of Bohemia, in 1253, added upper Lusatia to Brandenburg; and the authority of the margraves was extended beyond the Oder. Many monasteries and towns were founded, among them Berlin, and the prosperity of Brandenburg formed a marked contrast to the disorder which prevailed elsewhere in Germany. Brandenburg appears about this time to have fallen into three divisions—the old mark lying west of the Elbe, the middle mark between the Elbe and the Oder, and the new mark, as the newly conquered lands beyond the Oder began to be called. When Otto died in 1267, the area of the mark had been almost doubled, and the margraves had attained to an influential position in the Empire. The *Sachsenspiegel*, written before 1235, mentions the margrave as one of the electors, by virtue of the office of chamberlain, which had probably been conferred on Albert the Bear by the German king Conrad III.

In 1258 John and Otto had agreed upon a division of their lands, but the arrangement only took effect on Otto's death in 1267, when John's son, John II., received the electoral dignity, together with the southern part of the margraviate, which centred around Stendal, and Otto's son, John III., the northern or Saltzwedel portion. John II.'s brother, Otto IV., who became elector in 1281, had passed his early years in struggles with the archbishop of Magdeburg, whose lands stretched like a wedge into the heart of Brandenburg. Otto was succeeded in 1300 by his nephew, Valdemar, who conquered Pomerellen, which he shared with the Teutonic order in 1310, and held his own in a struggle with the kings of Poland, Sweden and Denmark and others, over the possession of Stralsund. By marriage, purchase or inheritance Valdemar finally came to rule over the whole mark, upper and lower Lusatia, and various outlying districts. He died childless in 1319, and was succeeded by his nephew Henry II., who died in 1320, when the Ascanian family, as the descendants of Albert the Bear were called, from the Latinized form of the name of their ancestral castle of Aschersleben, became extinct.

Wittelsbach Dynasty.—Brandenburg now fell into a deplorable condition, portions were seized by neighbouring princes, and various claimants disputed for the mark itself. In 1323 King Louis IV. took advantage of this condition to bestow the mark upon his young son, Louis, and thus Brandenburg was added to the possessions of the Wittelsbach family, although Louis did not receive the extensive lands of the Ascanian margraves. Upper and lower Lusatia, Landsberg, and the Saxon Palatinate had been inherited by female members of the family, and passed into the hands of other princes, the old mark was retained by Agnes, the widow of Valdemar, who was married again to Otto II., duke of Brunswick, and the king was forced to acknowledge these claims, and to cede districts to Mecklenburg and Bohemia. During the early years of the reign of Louis, who was called the margrave Louis IV. or V., Brandenburg was administered by Bertold, count of Henneberg, who established the authority of the Wittelsbachs in the middle mark, which, centring round Berlin, was the most important part of the margraviate. During the struggle between the families of Wittelsbach and Luxemburg, which began in 1342, there appeared in Brandenburg an old man who claimed to be the margrave Valdemar. He was gladly received by the king of Poland and other neighbouring princes, welcomed by a large number of the people, and in 1348 invested with the margraviate by King Charles IV. This step compelled Louis to make peace with Charles, who abandoned the false Valdemar, invested Louis and his step-brothers with Brandenburg, and in return was recognized as king. Louis recovered the old mark in 1348, drove his opponent from the land, and in 1350 made a treaty with his step-brothers, Louis the younger and Otto, at Frankfurt-on-Oder, by which Brandenburg was handed over to Louis the younger and Otto. Louis made peace with his neighbours, finally defeated the false Valdemar, and was recognized by the Golden Bull of 1356 as one of the seven electors. The emperor Charles IV. took advantage of a family quarrel over the possessions of Louis the elder, who died in 1361, to obtain a promise from Louis the younger and Otto, that the margraviate should come to his own son, Wenceslaus, in case the electors died childless. Louis the younger died in 1365, and when his brother Otto, who had married a daughter of Charles IV., wished to leave Brandenburg to his own family Charles began hostilities; but in 1373 an arrangement was made, and Otto, by the treaty of Fürstenwalde, abandoned the margraviate for a sum of 500,000 gold gulden.

Under the Wittelsbach rule, the estates of the various provinces of Brandenburg had obtained the right to coin money, to build fortresses, to execute justice, and to form alliances with foreign states. Charles invested Wenceslaus with the margraviate in 1373, but undertook its administration himself, and passed much of his time at a castle which he built at Tangermünde. He diminished the burden of taxation, suppressed the violence of the nobles, improved navigation on the Elbe and Oder, and encouraged commerce by alliances with the Hanse towns, and in other ways. He caused a *Landbook* to be drawn up in 1375, in which are recorded all the castles, towns and villages of the land with their estates and incomes. When Charles died in 1378, and Wenceslaus became German and Bohemian king, Brandenburg passed to the new king's half-brother Sigismund, then a minor, and a period of disorder ensued. Soon after Sigismund came of age he pledged a part of Brandenburg to his cousin Jobst, margrave of Moravia, to whom in 1388 he pledged the remainder of the electorate in return for a large sum of money, and as the money was not repaid, Jobst obtained the investiture in 1397 from King Wenceslaus. Sigismund had also obtained the new mark on the death of his brother John in 1396, but sold this in 1402 to the Teutonic order. When, in 1410, Sigismund and Jobst were rivals for the German throne, Sigismund, anxious to obtain another vote in the electoral college, declared the bargain with Jobst void, and empowered Frederick VI. of Hohenzollern, burgrave of Nuremberg, to exercise the Brandenburg vote at the election. (*See* FREDERICK I., ELECTOR OF BRANDENBURG.) In 1411 Jobst died and Brandenburg reverted to Sigismund, who appointed Frederick as his representative to govern the margraviate. A further step was taken when, on April 30, 1415, the king invested Frederick of Hohenzollern and his heirs with Brandenburg, together with the electoral privilege and the office of chamberlain, in return for a payment of 400,000 gold gulden: the formal ceremony of investiture was delayed until April 18, 1417, when it took place at Constance.

Before the advent of the Hohenzollerns in Brandenburg its internal condition had become gradually worse and worse. The margraves were technically only the representatives of the emperor. But in the 13th century this restriction began to be forgotten, and Brandenburg enjoyed an independence and carried out an independent policy in a way that was not paralleled by any other German state. This independence was enhanced by the fact that there were few large lordships with their crowd of dependants. The towns, the village communities and the knights held their lands and derived their rights directly from the margraves. The towns and villages had generally been laid out by contractors or *locatores*, men not necessarily of noble birth, who were installed as hereditary chief magistrates of the communities, and received numerous encouragements to reclaim waste lands. This mode of colonization was especially favourable to the peasantry, who seem in Brandenburg to have retained the disposal of their persons and property at a time when villeinage or serfdom was the ordinary *status* of their class elsewhere. The dues paid by these contractors in return for the concessions formed the main source of the revenue of the margraves. Gradually, however, the expenses of warfare, liberal donations to the clergy, and the maintenance of numerous and expensive households, compelled them to pledge these dues for sums of ready money. The village magistrates came to be replaced by baronial nominees, and the peasants sank into a condition of servitude and lost their right of direct appeal to the margrave. Many of the towns were forced into the same position. Others were able to maintain their independence, and to make use of the pecuniary needs of the margraves to become practically municipal republics. In the embarrassments of the margraves also originated the power of the *Stände*, or estates, the nobles, the clergy and the towns. The first recorded instance of the *Stände* co-operating with the rulers occurred in 1170; but it was not till 1280 that the margrave solemnly bound himself not to raise a *bede* or special voluntary contribution without the consent of the estates. In 1355 the *Stände* secured the appointment of a permanent councillor, without whose concurrence the decrees of the margraves were invalid. Anarchy had reigned for a century before the Hohenzollern rule began: upper and lower Lusatia, the new mark of Brandenburg, and other outlying districts had been shorn away and the electorate now consisted of the old mark, the middle mark with Priegnitz, Uckermark and Sternberg, a total area of not more than 10,000sq.m.

THE HOHENZOLLERNS

Such was the condition and extent of Brandenburg in 1411 when Frederick of Hohenzollern became margrave. Entering the electorate with a strong force in June 1412, it was not until 1417 that his authority over it was undisputed. His claim to suzerainty over Pomerania provoked an invasion of the mark by an army of Pomeranians with their allies in 1420, when Frederick inflicted a severe defeat upon them at Angermünde; but in 1424 a temporary coolness between the elector and the emperor Sigismund led to a renewal of the attack which Frederick was unable to repulse. This reverse, together with the pressure of other business, induced him to leave Brandenburg in Jan. 1426, after handing over its government to his eldest son, John, whose weak rule induced a renewed state of anarchy.

On Frederick's death in Sept. 1440 he was succeeded in the electorate by his eldest son Frederick II., surnamed "Iron" from the rigour of his government. Suppressing the rebellious nobles with ease, he found it less easy to deal with the towns. Three strong leagues had been formed among them about 1431, and the spirit of municipal independence was most prominently represented by the neighbouring and allied towns of Berlin and Cöln. In his conflict with the towns, the elector's task was lightened by a quarrel between the magistrates and the burghers of Berlin, which he was called in to decide in 1442. He deposed the governing oligarchy, changed the constitution of the town, forbade all alliances and laid the foundations of a castle. The inhabitants soon chafed under these restrictions. A revolt broke out in 1447, but the power of the elector overawed the people, who submitted their case to the estates, with the result that the arrangement of 1442 was re-established. In 1447 Frederick was compelled to cede the old mark and Priegnitz to his younger brother, Frederick, under whose feeble rule they quickly fell into disorder. In 1463, however, when the younger Frederick died childless, the elector united them again with his own possessions and took measures to suppress the prevailing anarchy. In his dealings with neighbouring rulers Frederick pursued a peaceful and conciliatory policy. In 1442 he obtained some small additions to his territory, and the right of succession to the duchy of Mecklenburg in case the ducal family should die out. In 1445 an old feud with the archbishop of Magdeburg was settled, and in 1457 a treaty of mutual succession was made with the houses of Saxony and Hesse. Cottbus and Peitz in Lusatia were acquired, and retained after a quarrel with George Podiebrad, king of Bohemia, and the new mark of Brandenburg was purchased from the Teutonic order in 1454. An attempt, however, to secure the duchy of Pomerania-Stettin failed, and the concluding years of his reign were troubled by warfare with the Pomeranians. Frederick's interest in ecclesiastical questions was mainly directed towards quickening the religious life of his people. He obtained important concessions from Pope Nicholas V. on the appointment of bishops and other ecclesiastical matters in 1447, and in general maintained cordial relations with the papacy. About 1467 his only son, John, died, and increasing infirmity led him to contemplate abdication. An arrangement was made with his brother, Albert Achilles, to whom early in 1470 the mark was handed over, and Frederick retired to Plassenburg where he died on Feb. 10, 1471.

Dispositio Achillea.—Albert took up the struggle with the Pomeranians, which he soon brought to a satisfactory conclusion; for in May 1472 he not only obtained the cession of several districts, but was recognized as the suzerain of Pomerania and as its future ruler. The expenses of this war led to a quarrel with the estates. A subsidy was granted which the elector did not regard as adequate, and by a dexterous use of his power he established his right to take an excise on beer. Albert's most important contribution to the history of Brandenburg was the issue on Feb. 24, 1473, of the *Dispositio Achillea.* By this instrument the elector decreed that the electoral mark should pass in its entirety to his eldest son, an establishment of primogeniture which had considerable influence on the future development of the country. He then entrusted the government to his eldest son, John, and left Brandenburg. Handicapped by poverty, John had to face attacks from two quarters. The Pomeranians, inspired by the declaration of the emperor Frederick III. that their land was a direct fief of the Empire, and aided by Matthias Corvinus, king of Hungary, took up arms; and a quarrel broke out with John, duke of Sagan, over the possessions of John's brother-in-law, Henry XI., duke of Glogau. To deal with these difficulties Albert returned to Brandenburg in 1478, and during his stay drove back the Pomeranians, and added Crossen and other parts of duke Henry's possessions to the electorate. Again left in charge of the country, John beat back a fresh attack made by John of Sagan in 1482; and he became elector on his father's death in March 1486. He added the county of Zossen to his possessions in 1490, and in 1493 made a fresh treaty with the duke of Pomerania. Although he brought a certain degree of order into the finances, his poverty and the constant inroads of external enemies prevented him from seriously improving the condition of the country. John welcomed Italian scholars to the electorate, and strove to improve the education of his people. He died at Arneburg on Jan. 9, 1499, and was succeeded by his son Joachim I.

When Joachim undertook the government of Brandenburg he found highway robbery general, the lives and property of traders in continual jeopardy, and the machinery for the enforcement of the laws almost at a standstill; but in a few years the execution of many lawbreakers and other stern measures restored some degree of order. Joachim proved himself a sincere friend to the towns by issuing sumptuary laws and encouraging manufactures; while to suppress the rivalry among the towns he established an order of precedence for them. He founded the university at Frankfort-on-Oder in 1506, and he gave a new organization to the highest court of justice, the *Kammergericht*, secured for himself an important voice in the choice of its members, and ordered that the local law should be supplemented by the law of Rome. He did not largely increase the area of Brandenburg, but in 1524 he acquired the county of Ruppin, and in 1529 made a treaty at Grimnitz with George and Barnim XI., dukes of Pomerania, by which he surrendered the vexatious claim to suzerainty in return for a fresh promise of the succession in case the ducal family should become extinct. Joachim's attitude towards the teaching of Martin Luther, which had already won many adherents in the electorate, was one of unrelenting hostility. The Jews also felt the weight of his displeasure, and were banished in 1510.

The Reformation.—Ignoring the *Dispositio Achillea*, the elector bequeathed Brandenburg to his two sons. When he died in July 1535 the elder, Joachim II., became elector, and obtained the old and middle marks, while the younger, John, received the new mark. John went definitely over to the side of the Lutherans in 1538, while Joachim allowed the reformed doctrines free entrance into his dominions in 1539. The elector, however, unlike his brother, did not break with the forms of the Church of Rome, but established an ecclesiastical organization independent of the pope, and took up a position similar to that of King Henry VIII. in England. Many of the monasteries were suppressed, and a consistory set up to take over the functions of the bishops and to act as the highest ecclesiastical court of the country. In 1541 the new ecclesiastical system was confirmed by the emperor Charles V. Doubtless the elector was influenced religiously by considerations of greed. The bishoprics of Brandenburg, Havelberg and Lebus were secularized; their administration was entrusted to members of the elector's family; and their revenues formed a welcome addition to his impoverished exchequer. Nor did Joachim neglect other opportunities for adding to his wealth and possessions. In 1537 he had concluded a treaty with Frederick III., duke of Liegnitz, which guaranteed to the Hohenzollerns the succession to the Silesian duchies of Liegnitz, Brieg and Wohlau in the event of the ducal family becoming extinct; this arrangement is important as the basis of the claim made by Frederick the Great on Silesia in 1740. The treaty was declared invalid by the German king, Ferdinand I; but the elector insisted on its legality, and in 1545 strengthened his position by arranging a double marriage between members of his own family and that of Duke Frederick. Of more immediate consequence was an arrangement made in 1569 with the representatives of Joachim's kinsman, Albert Frederick, duke of Prussia, after which the elector obtained the joint investiture of the duchy of Prussia from Sigismund II., king of Poland, and was assured of the succession if the duke's family became extinct. Joachim's extravagance compelled him in 1540 to appeal for help to the estates. The estates voted him a sum of money as the price of valuable concessions, the most important of which was that the elector should make no alliance without their consent. Fresh liabilities were soon incurred, and in spite of frequent contributions from the estates Joachim left at his death in Jan. 1571 a heavy burden of debt to his son and successor, John George.

The elector's death was followed ten days later by that of his brother, John, and as John left no sons the whole of Brandenburg, together with the districts of Beeskow and Storkow which had been added by purchase to the new mark, were united under the rule of his nephew, John George. The rule of John George was popular with the nobles, and to some extent with the towns. His financial reforms and wise government greatly benefited Brandenburg. Although by faith a Lutheran he did not allow his religious tenets to involve his state in military adventures in defence of the Protestant cause. He died on Jan. 8, 1598.

Ignoring the *Depositio Achillea*, he left his dominions to a younger son, Joachim Frederick, born on Jan 27, 1546, who now became elector. Since 1553 he had held the bishopric of Havelberg, since 1555 that of Lebus; he had been administrator of Magdeburg since 1566, and of Brandenburg since 1571. Resigning these dignities in 1598, he contested his father's will, and was successful in preventing a division of the electorate. An agreement with George Frederick, the childless margrave of Ansbach and Bayreuth, paved the way for an arrangement with the elector's younger brothers, who after the margrave's death in April 1603, shared his lands in Franconia, and were compensated in other ways for surrendering all claims on Brandenburg. This agreement, known as the Gera Bond, ratified the *Dispositio Achillea*. By George Frederick's death, Joachim became administrator of the duchy of Prussia, ruled nominally by the weak-minded Albert Frederick, but he had some difficulty in asserting his position. In Brandenburg he made concessions to the nobles at the expense of the peasantry, and admitted the right of the estates to control taxation. In religious matters he was convinced of the necessity of a union between Lutherans and Calvinists, and took steps to bring this about. Public opinion, however, in Brandenburg was too strong for him, and he was compelled to fall back upon the Lutheran *Formula* and the religious policy of his father. Joachim seems to have been a wise ruler, who improved in various ways the condition of the mark. He married Catherine, daughter of John, margrave of Brandenburg-Cüstrin, and when he died, on July 18, 1608, was succeeded by his eldest son John Sigismund.

The new elector, born on Nov. 8, 1572, had married in 1594 Anna, daughter of Albert Frederick of Prussia, a union which not only strengthened the pretensions of the electors of Brandenburg to the succession in that duchy, but gave to John Sigismund a claim on the duchies of Cleves, Jülich and Berg, and other Rhenish lands should the ruling family become extinct. In March 1609 the death of Duke John William left these duchies without a ruler, and by arrangement they were occupied jointly by the elector and by his principal rival, Wolfgang, son of Philip Louis, count palatine of Neuburg. This proceeding aroused some opposition, and, complicated by religious considerations and by the excited state of European politics, almost precipitated a general war. However, in Nov. 1614 the dispute was temporarily settled by the treaty of Xanten. Brandenburg obtained the duchy of Cleves with the counties of Mark and Ravensberg, but as the Dutch and Spanish garrisons were not withdrawn, these lands were only nominally under the elector's rule. In 1609, John Sigismund had joined the Evangelical Union, probably to win support in the Rhineland, and the same consideration was doubtless one reason why in 1613, he forsook the Lutheran doctrines of his family, and became an adherent of the reformed, or Calvinist faith. This step aroused grave discontent in the electorate, and, quickly abandoning his attempts to proselytize, the elector practically conceded religious liberty to his subjects. Over the Cleves-Jülich succession, John Sigismund had incurred heavy expenses, and the public debt had again mounted up. He was thus obliged to seek aid from the estates, and in return for grants to make concessions to the nobles. The elector spent much of his time in Prussia striving to assert his authority in that duchy, and in Aug. 1618, according to the arrangement of 1569, became duke by the death of Albert Frederick. He only enjoyed this dignity for a short time, as he died on Dec. 23, 1619. He was succeeded by his eldest son, George William, brother-in-law of Gustavus Adolphus of Sweden.

The Thirty Years' War.—The new elector, born on Nov. 3, 1597, proved a weak and incapable ruler. He had married Elizabeth, daughter of Frederick IV., elector palatine of the Rhine, and sister of the elector Frederick V., afterwards king of Bohemia, and before his accession had acted as his father's representative in Cleves. Although a Protestant he was under the influence of Adam, count of Schwarzenberg, who was a Roman Catholic of imperialist sympathies. As a result the elector remained neutral during the early years of the Thirty Years' War in spite of his relationship with Frederick of the Palatinate, and the obvious danger to his Rhenish lands. The attitude was not successful. Brandenburg was ravaged impartially by both parties, and in 1627 George William attacked his brother-in-law, Gustavus Adolphus of Sweden, who was using Prussia as a base of operations for his war against Poland. This campaign was short and inglorious for Brandenburg, and the elector was soon compelled to make peace. Although alarmed by the edict of restitution of 1629, George William took no steps to help the Protestants. In 1631, however, Gustavus Adolphus marched on Berlin, compelled the elector to cede the fortress of Spandau, and to aid him with men and money. The Brandenburg troops then assisted the Swedes until after the death of Gustavus in 1632, and the Swedish defeat at Nördlingen in 1634, when the elector assented to the treaty of Prague, which was made in May 1635 between the emperor Ferdinand II. and John George I., elector of Saxony. The imperialists did nothing, however, to drive the Swedes from Brandenburg. This was the principal reason why the elector was unable to annex Pomerania when its last duke, Bogislaus XIV., died in 1637. In 1638 George William transferred his residence to Königsberg, leaving Schwarzenberg to administer the electorate. Although his harsh measures aroused some irritation, the count did something to rid the land of the Swedes and to mitigate its many evils; but its condition was still very deplorable when George William died at Königsberg on Dec. 1, 1640, leaving an only son, Frederick William. The most important facts in the internal history of Brandenburg during the 16th century were the growth of the power of the estates, the gradual decline in the political importance of the towns, and the lapse of the peasantry into servitude. These events increased the power of the nobles, but circumstances were silently preparing the way for a great increase of authority on the part of the ruler. The substitution of the elector for the pope as head of the church; the introduction of Roman law with its emphasis on a central authority and a central administration; the determined and successful efforts to avoid any partition of the electorate; and the increasing tendency of the separate sections of the diet to act independently, all tended in this direction. This new order was heralded in 1604 by the establishment of a privy council, devoted to the interests of the elector, which strengthened his authority, and paved the way for a bureaucratic government.

THE GREAT ELECTOR

When Frederick William, the "Great Elector," became ruler of Brandenburg in 1640 he found the country in a very deplorable condition. His first task was to restore order and in this he was eminently successful. He freed Brandenburg of the Swedes, and in 1647 secured his title to Cleves, Mark and Ravensberg.

The terms of the Treaty of Westphalia in 1648 are the best commentary on the general success of the elector's policy. Although he was obliged to give up his claim to the western part of Pomerania in favour of Sweden, he secured the eastern part of that duchy, together with the secularized bishoprics of Halberstadt, Minden and Kammin, and other lands, the whole forming a welcome addition to the area of Brandenburg. He was also promised the archbishopric of Magdeburg when its administrator, Augustus, duke of Saxe-Weissenfels, should die. This event happened in 1680 when he secured the lands of the archbishopric.

In his internal reforms, the elector sought to strengthen the central authority, and to mitigate the constant lack of money, which was perhaps his chief obstacle to success; a work in which he was aided by George, count of Waldeck (1620–92), who became his chief adviser about this time. He extended the powers of the state council. In foreign policy, he sought to promote an alliance against the Hapsburgs, and at first supported Louis XIV. of France. Becoming aware of the danger to Prussia from the aggressive policy of Louis, Frederick William allied himself with the Empire in 1674; but the humiliating terms of the Treaty of St. Germain-en-Laye, by which Brandenburg was forced to restore western Pomerania to Sweden, caused him to renew the French alliance in 1678 and 1681. Four years later, however, he was incensed by the anti-Protestant policy of Louis XIV., and allied himself with William of Orange.

The great elector died in May 1688. In 1640 the greater part of his territory was occupied by strangers and devastated by war. Brandenburg was merely an appendage of the Empire. Its army was useless; its soil was poor; its revenue was insignificant. At his death the state of Brandenburg-Prussia was inferior to Austria alone among the states of the Empire; it was regarded as the head of German Protestantism; while the fact that one-third of its territory lay outside the Empire added to its importance. Its area had been increased to over 40,000 sq. m.; its revenue had multiplied sevenfold; and its small army was unsurpassed for efficiency. The elector had overthrown Sweden and inherited her position on the Baltic, and had offered a steady and not ineffectual resistance to the ambition of France.

While thus winning for himself a position in the councils of Europe, Frederick William was not less active in strengthening the central authority within his own dominions. He found Brandenburg a constitutional state, in which the legislative power was shared between the elector and the diet; he left it to his successor substantially an absolute monarchy. Many circumstances assisted to bring about this change, among the chief of which were the want of harmonious action on the part of the estates, and the decline in the political power of the towns. The substitution of a permanent excise for the subsidies granted from time to time by the estates also tended to increase his independence, and the officials or *Steuerräthe,* appointed by him to collect this tax in the towns, gradually absorbed many of the administrative functions of the local authorities. The nobles and prelates generally preferred to raise their share of the revenue by the old method of a *bede,* or contribution, thus weakening the remaining bond between them and the burghers.

Education was not neglected, a trading company was established, and colonies were founded on the west coast of Africa. In religious matters Calvinists and Lutherans were placed upon an equality, but the elector was unable to impress his own spirit of tolerance upon the clergy, who were occupied with ecclesiastical squabbles while the state of education and of public morals left much to be desired. The condition of the peasantry, however, during his reign reached its lowest point, and the "recess," or charter, of 1653 practically recognized the existence of villeinage. The nobles had compensated themselves at the expense of the peasants for the powers lost to the ruler. The Thirty Years' War afforded them frequent opportunities of replacing the village *Schulzen,* or magistrates, with officials of their own; and the fact that their share of taxation was wholly wrung from the peasants made the burden of the latter much heavier than that of the townsmen.

The Kingdom of Prussia.—The new elector, Frederick III., followed in general the policy of his father. Having persuaded his step-brothers to surrender the principalities bequeathed to them by the great elector, he assisted William of Orange to make his descent on England. in 1688 allied himself with other German princes against Louis XIV., and afterwards fought for the Empire against both France and Turkey. Frederick's chief adviser about this time was Eberhard Danckelmann (1643–1722), whose services in continuing the reforming work of the great elector were very valuable; but having made many enemies, the electress Sophia among them, he fell from power in 1697, and was imprisoned for several years. The most important work of the elector was to crown the labours of his father by securing the kingly title for himself and his descendants. Broached in 1692 this matter was brought up again in 1698 when the emperor and his ministers, faced with the prospect of a fight over the Spanish succession, were anxious to conciliate Brandenburg. It was at length decided that the title should be taken from Prussia rather than from Brandenburg as the former country lay outside the Empire, and in return Frederick promised to assist Leopold with 8,000 men. The coronation ceremony took place at Königsberg on Jan. 18, 1701. The territorial additions to Brandenburg during this reign were few and unimportant, but the comparative wealth and prosperity enabled the elector to do a good deal for education and to spend some money on buildings. In 1694 the university of Halle was founded; academies for arts and sciences were established, and Berlin was greatly improved. The subsequent history of Brandenburg is merged in that of Prussia (*q.v.*).

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BRANDENBURG, the central and largest province of the *Land* of Prussia, largely the former electorate of Brandenburg. It was merged in 1701 in the kingdom of Prussia and became one of the provinces of Prussia in 1815. It has an area of 15,074 sq.mi. (or 15,415 sq.mi., with the province of Berlin). Pop., without Berlin (1939) 3,023,443. The province is a sandy plain interspersed with numerous fertile districts and stretches of pine and fir woods. It was formerly popularly known as the "sandbox of the Holy Roman Empire." It is, however, well watered by the Elbe and the Oder and tributaries, and is besides remarkable for its lakes, numbering between 600 and 700. The mineral products comprise lignite, limestone, gypsum, alum and potter's earth; barley and rye are the usual cereals; fruits and vegetables are abundant; and hemp, flax, hops and tobacco are raised. Sheep-breeding is important, and wool is exported. The climate is characteristically "continental"—cold and raw in winter, excessively hot in summer. The most important industries are textiles, metal and electrical goods, paper-making and brandy distillation.

BRANDENBURG, a town of Prussia, Germany, capital of the district and province of Brandenburg, on the river Havel, 36 mi. W. by S. of Berlin. Pop. (1939) 85,622. The town is enclosed by walls, and is divided into three parts by the river—the old town on the right and the new town on the left bank, with the "cathedral town" on an island between them. Many of the houses are built on piles in the river. "Old" and "new" Brandenburg were for centuries separate, but came under a single municipality in 1717. Brandenburg, Brennaburg (Brennabor) or Brendanburg, was originally a town of the Slavic tribe of the Hevelli, from whom it was captured (927–928) by the German king Henry I. In 948, Otto I. founded a bishopric here, which was subordinated first to the archdiocese of Mainz, but from 968 onwards to the newly-created archbishopric of Magdeburg. It was destroyed by the Wends in 983, but was restored when Albert the Bear recaptured the town in 1153. In 1539, the bishop became Lutheran, and in 1598 the see was incorporated in the electoral domains. The cathedral chapter, however, survived.

The Katharinenkirche (14th–16th centuries) is a Gothic brick church with a fine carved wooden altar and several interesting mediaeval tombs. The cathedral (Domkirche), originally a Romanesque basilica (1170), but rebuilt in the Gothic style in the 14th century, has a good altar-piece (1465), and is noted for its remarkable collection of mediaeval vestments. Other churches are the Petrikirche (14th century), the Gothardskirche, partly Romanesque (1160), partly Gothic (1348), and the Nikolaikirche (12th and 13th centuries), now no longer used. The former town hall of the "old town" (Altstadt Rathaus), built in the 13th and 14th centuries, is now used as government offices. In front of the town hall in the Neustadt, in the market-place, stands a *Rolandssäule*, a colossal figure 18 ft. in height, hewn out of a single block of stone. To the north of the town is the Marienburg, with a convent. The industries of Brandenburg include some metal-work, tin-plate products and bicycles, and woollen and jute goods.

BRANDER, GUSTAVUS (1720–1787), English naturalist, who came of a Swedish family, was born in London and became a director of the Bank of England. At his country residence at Christchurch in Hampshire he became interested in the fossils so abundant in the clays of Hordwell and Barton. A set of these, presented by him to the British Museum, was described by D. C. Solander in the beautifully illustrated work entitled *Fossilia Hantoniensia collecta, et in Musaeo Britannico deposita a Gustavo Brander* (1766). Brander was elected F.R.S. in 1754, and he was also a trustee of the British Museum.

BRANDES, GEORG MORRIS COHEN (1842–1927), Danish critic and literary historian, was born in Copenhagen, the son of a Jewish merchant. After graduating from the university of his native town, Brandes travelled much in Europe, publishing in 1868 his *Aesthetic Studies* on Danish poets. In 1871 he became reader in Belles Lettres at the University of Copenhagen, and although he was the obvious person for the professorship of aesthetics which became vacant in 1872, he was not elected because his modernism and championing of self-determination had offended many. He was known to be a Jew, he was convicted of being a Radical, and he was suspected of being an atheist.

Brandes now issued his *Main Currents of Literature in the 19th Century* (1872–75; trans. 1901–05), describing the revolt against the pseudo-classicism of the 18th century. The work has been translated into the principal European languages, and has become a classic. From 1877 to 1883, while living in Berlin, he published *Danish Poets* (1877), *Ferdinand Lassalle* (1877), *Benjamin Disraeli* (1878) and *Men of the Modern Transition* (1883). In 1897 appeared his famous study of Shakespeare (Eng. trans. by W. Archer) and two years later his *Henrik Ibsen*. In 1902 his brilliant and lucid critical work outweighed prejudice, and he received the professorship of aesthetics at Copenhagen which had been denied him 30 years before. During the World War Brandes sought to be impartial, but he openly quarrelled with his friend Clemenceau and displeased the Allies by his criticism of their colonial policy, and by his faith in post-revolutionary Russia. He died on Feb. 10, 1927. The reaction against the naturalism of Brandes was started as early as 1885 by Holger Drachmann. (*See* Danish Language and Literature.)

Since the first collected edition of his works was published in 1900, some of his best-known books have appeared. These include: *Anatole France* (1905), *Life of Goethe* (1914), *Frederick Nietzsche* (Eng. trans. 1914), *Life of Voltaire* (1916), *The World War* (1916), *Julius Caesar* (1918), *Michael Angelo* (1921), *Heinrich Heine* (1922), *Creative Spirits of the 19th Century* (1924), *The Jesus Myth* (1925) and *Hellas* (1925).

His brother, Edvard Brandes (1847–1931), a well-known critic, was the author of a number of plays and of two psychological novels: *A Politician* (1889) and *Young Blood* (1899).

BRANDING, in criminal law a mode of punishment; also a method of marking goods or animals; in either case by stamping with a hot iron. The Greeks branded their slaves with a Delta, Δ, for Δοῦλος. Robbers and runaway slaves were marked by the Romans with the letter "F" (*fur, fugitivus*); and the toilers in the mines, and convicts condemned to figure in gladiatorial shows, were branded on the forehead for identification. Under Constantine the face was not permitted to be so disfigured, the branding being on the hand, arm or calf. The canon law sanctioned the punishment, and in France galley-slaves could be branded "TF" (*travaux forcés*) until 1832. In Germany, however, branding was illegal. The punishment was adopted by the Anglo-Saxons, and the ancient law of England authorized the penalty. By the Statute of Vagabonds (1547) under Edward VI. vagabonds, gipsies and brawlers were ordered to be branded, the first two with a large "V" on the breast, the last with "F" for "fraymaker." Slaves, too, who ran away were branded with "S" on cheek or forehead. This law was repealed in 1636. From the time of Henry VII. branding was inflicted for all offences which received benefit of clergy (*q.v.*), but it was abolished for such in 1822. In 1698 it was enacted that those convicted of petty theft or larceny, who were entitled to benefit of clergy, should be "burnt in the most visible part of the left cheek, nearest the nose." This special ordinance was repealed in 1707.

Cold branding or branding with cold irons became in the 18th century the mode of nominally inflicting the punishment on prisoners of higher rank. Such cases led to branding becoming obsolete, and it was abolished in 1829 except in the case of deserters from the army. These were marked with the letter "D," not with hot irons but by tattooing with ink or gunpowder. Notoriously bad soldiers were also branded with "BC" (bad character). By the British Mutiny Act of 1858 it was enacted that the court martial, in addition to any other penalty, might order deserters to be marked on the left side, 2 in. below the armpit, with the letter "D," such letter to be not less than 1 in. long. In 1879 this was abolished. In the colonies in America, the branding of runaway slaves and petty criminals was fairly common but was abolished before the American Revolution.

In the western part of North America, as well as in all other parts of the world where live stock growing flourishes, the term means burning some distinctive letters, or other device, upon the skin of an animal as a means of identification or to indicate ownership. Only cattle and horses are usually branded. A suitable brand is one not easily altered and of sufficient size to be read easily without being large enough to detract too much from the value of the hide. During the last quarter of the 19th century, cattle on the great ranges of the western part of the United States and Canada were always branded, and laws provided for the registering of brands and for their acceptance as proof of ownership of animals. Branding of calves was done each spring. Those that were overlooked and escaped branding were known as "mavericks." Hundreds of thousands of cattle bore such famous brands as "XIT," the "Rocking Chair," "Two Circles," or "Spur," which were known over a much larger area than were the coats of arms of the great feudal lords of mediaeval Europe. (*See* also Mutilations and Deformations.)

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BRANDON, incorporated 1882, the second largest city of Manitoba, on the Assiniboine 133 mi. W. of Winnipeg. Pop. (1941) 17,383. It was originally a trading post, is served by C.N.R. and C.P.R., and stands in a rich agricultural area. It has grain mills, brickworks, creameries, etc., and is the seat of an important livestock winter fair.

BRANDON, market town, West Suffolk, England, on the

Little Ouse or Brandon river, 86½ mi. N.N.E. of London by the L.N.E. railway. Population of parish (1931) 2,427. Extensive deposits of flint are worked in the neighbourhood, and the work of the "flint-knappers" has had its counterpart here from early times. Close to Brandon, but in Norfolk across the river, at the village of Weeting, are the so-called Grimes' Graves, which are neolithic flint workings. The pits were sunk through the overlying chalk to the depth of 20 to 60 ft., and numbered 254 in all. Passages branched out from them, and, among other remains, picks of deer-horn were discovered. The town has an Early English church and a 17th-century grammar school. Dressing hare and rabbit skins is the principal local employment.

BRANDS are identification marks of products sold in trade. Their primary purposes are (1) to give buyers confidence in the articles they purchase, (2) to attach to the producer responsibility for his products and (3) to assist producers in advertising their products. There are four chief classes of brands: (1) trade marks; (2) private brands; (3) store labels; (4) copyrights. (1) Trade marks (*q.v.*) are identification marks used by manufacturers. They may be emblems, pictures, diagrams, words, or other ingenious devices. They are usually protected by statute and registered by a government bureau. (2) Private brands are similar to trade marks but they are usually owned by wholesalers or other large distributors. The private brand may also be registered in a number of the leading commercial countries but such use usually depends upon the common law for protection. The private brand is placed upon goods which a wholesaler or jobber buys for distribution. These goods may be made to his order and according to his specifications or they may be bought in the open market. (3) Store labels are applied to goods of some particular store or chain of stores. As with private brands, these goods may be bought in the open market or made to the order of the merchant. (4) Copyright (*q.v.*) applies to a particular class of labels, especially to those used by industrial or commercial associations; *e.g.*, the slogan "Save the Surface and You Save All" with the brush mark, is copyright in the United States. Members of the association which owns the copyright are permitted to use it in their advertising under restricted conditions. This use of the copyright is entirely different from its ordinary use, which is to protect works of art, books, music, etc.

While most of the present legislation pertaining to brands is of recent origin, and while the practice of placing a brand on the article has been greatly stimulated in the last quarter century, the brand idea is as old as any known institution of civilization. It marked the beginning of a philosophy in business by which the producer openly assumed a responsibility for his product to the purchaser. Through all the ages this system has stood out in striking contrast with the well-known *caveat emptor* doctrine, which implied that profit could be derived only by an equal loss to the other party to the transaction. From a legal standpoint, the consumer is protected by the brand as well as the manufacturer.

The earliest excavations showed that paving brick bore the mark of the manufacturer and also, in many instances, the mark of the slave who actually produced it. This is the same idea that still prevails with our use of the trade mark. The brick manufacturer wanted credit for his worthy product; he also wanted to hold each slave responsible for his output and the mark was valuable to him in placing responsibility. During the period when the guilds of Europe were active, the use of the brand was very highly developed and some of the legislation governing the use of identification marks was as highly perfected and as intelligently employed as in modern commerce. Infringers, however, were harshly treated. In the textile industry the punishment for infringements was to have the right hand of the infringer severed. Infringing the brand of Rudesheimer wine by substitution of an inferior article was punishable by death. There was one aspect of the guilds' practice that has never been applied in recent times. That was a penalty for the failure of a member of the guild to affix the guild's identification mark to all his products. With the disappearance of the guilds from commerce the use of brands greatly declined and it was not until 1875 that Great Britain enacted its basic trade-mark law; 30 years later a similar statute was adopted in the United States. In the last half century it has become the common practice to brand even the most staple manufactured products. (H. E. A.)

BRANDY, an alcoholic potable spirit distilled from fermented grape juice. The term is often regarded as having the same application as the German "Branntwein" or the French "brandevin." This is not correct, as in France and Germany the respective titles are applied to any spirit obtained by distillation, the significance of the word being in the first syllable "brand" meaning burnt or burning. In France, also, brandy is known as Eau de Vie, a title which is applied equally and with legal authority to spirit distilled from wine, cider, perry, cherries, plums and "marc." It is evident also that at one time the term "brandy" or "brandy wine" had a similarly wide significance in England. Thus the preamble to an act passed in 1690 in the reign of William and Mary runs, "Whereas good and wholesome brandies, aqua vitae, and spirits may be drawn and made from malted corn, etc.," and as late as 1860 the Spirits act of that year prescribed that "all spirits which shall have had any flavour communicated thereto and all liquors whatsoever which shall be mixed or mingled with any such spirits shall be deemed a British compound called 'British brandy'." This section was repealed in 1880 and during the past half century the accepted sense of the term has been restricted to spirits obtained by distillation from fermented grape juice.

The definitions in the pharmacopoeia are of interest. Thus that of the United States for 1926 describes "Spiritus Vini Vitis" as "an alcoholic liquid obtained by the distillation of the fermented juice of sound, ripe grapes and containing not less than 54% by volume of C_2H_5OH at 15·56°C. It must have been stored in wood containers for a period of not less than four years." It is "a pale amber colored liquid, having a characteristic odour and taste and an acid reaction. Specific gravity from 0·933 to 0·941 at 25°C."

The British Pharmaceutical Codex (1923) under the title "Spiritus Vini Gallici" states that "brandy is obtained by distillation from the wine of grapes, and matured by age. It occurs as a pale amber coloured liquid, having a characteristic odour and taste and, as a rule, a slightly acid reaction. Specific gravity about 0·957. It contains about 40% by volume of ethyl hydroxide. It contains minute quantities of volatile acid, aldehydes, furfural, esters and higher alcohols, to which impurities or secondary products the characteristic flavour and odour are due."

Commercial brandy, however, does not correspond exactly with these definitions. As distilled it is a colourless liquid, but storage in casks, necessary to allow the spirit to mature, results in the extraction of certain materials from the wood imparting a pale brown colour to the liquid. This colouration varies with each cask and, for purposes of commercial standardization, a varying amount of caramel is added to bring the colour up to a uniform tint.

The brandies which enjoy the greatest popular favour are those from the Cognac district and the extension of the name to include the word Cognac, *e.g.*, "Eau de Vie de Cognac," under the French law can be applied only to spirits so derived. Brandy is manufactured in other districts of France such as Armagnac, Marmande, Nantes and Anjou, the spirit of poorest quality being known as Trois-Six de Montpellier.

It is of interest that, according to Beckmann, brandy is said to have been introduced into France from Italy in 1533 on the occasion of the marriage of Henry II., then Duke of Orleans, to Catherine de Medici. At the present time production in Italy is comparatively negligible. In other wine producing countries such as Spain and Algiers brandy is manufactured, the Spanish product being of high quality and resembling the French. In Australia and South Africa production is steadily increasing, although very little brandy is exported.

Another spirit for which the title Brandy is claimed is that obtained from the marc—the grape skins and other residue of the wine press. Although possessing characteristics of its own, Marc or "Dop" brandy, as it is called in South Africa, is generally accepted and is often of good quality.

During the period when the manufacture and sale of alcoholic liquors for beverage purposes were prohibited in the United

States, there was a marked decrease in the quantity of brandy imported into this country, the figures, for example, in 1924 and 1925 being respectively 4,125 and 4,236 gallons, as compared with 510,725 in 1914.

In Great Britain and Northern Ireland also there was considerable decrease in the demand, the number of proof gallons retained for consumption from 1922 to 1927 being as follows:

1922–23	666,089
1923–24	698,504
1924–25	653,144
1925–26	635,942
1926–27	554,484

These figures can be compared with those for the years 1913–14 (1,544,153) and 1921–22 (795,694), both of which, however, included the whole of Ireland. Although doubtless this decrease was due partly to alteration in the popular taste, it may also be ascribed in some measure to the increase in duty, which in 1914 was 15s. 1d. per proof gallon in cask and in 1928 £3. 15s. 4d. full duty and £3. 12s. 10d. on spirit imported from British Dominions.

Composition.—In common with other potable spirits, brandy owes its flavour and aroma to the presence of small quantities of secondary ingredients. These are dissolved in the ethyl alcohol and water which form over 99% of the spirit. The results of the analysis of five samples of genuine Cognac brandy supplied to the Royal Commission of 1909 by Dr. P. Schidrowitz were as follows:—

Age, etc.	Alcohol % by volume.	Grammes per 100 litres of absolute alcohol.					
		Total acid.	Non-volatile acid.	Esters.	Higher alcohols.	Aldehyde.	Furfural.
1. New, 1904	61·7	85	5	82	125	8	2·3
2. New (still heated by steam coil)	56·3	22	4	61	100	3	1·2
3. Five years old, 1900 vintage	57·7	92	37	125			..
4. 1875 vintage, pale	46·7	144	37	177	261	55	1
5. 1848 vintage, brown	38·5	254	100	190	488	32	21

Ordonneau subjected 100 litres of 25-year-old Cognac brandy to fractional distillation and obtained the following:

	Grammes.
Normal propyl alcohol	40·0
Normal butyl alcohol	218·6
Amyl alcohol	83·8
Hexyl alcohol	0·6
Heptyl alcohol	1·5
Acetic ester	35·0
Propionic, butyric and caproic esters	3·0
Oenanthic ester (about)	4·0
Acetal and amines	traces

It is to one of the esters—oenanthic ester or ethyl pelargonate—that the characteristic flavour of brandy is supposed more particularly to be due. Ordonneau attributes the peculiar fragrant odour to a small quantity of a terpene which in old brandy becomes oxidized. The nature and proportion of the secondary ingredients vary, however, depending primarily upon the character of the wine employed, which in its turn is liable to many varying influences. The type of fruit and the composition of the soil are of first consideration. In the Cognac district, where the soil is mainly calcareous, the fruit is a small white grape with very acid juice, yielding a wine of inferior quality for drinking purposes. The wine produced in the Midi is also unsuitable for drinking and is distilled. This district was one of those ravaged by the Phylloxera, a disease which devastated the French vine-growing areas in the years 1875–78. Vineyards which had suffered were replanted with vines which were not appropriate to the soil, the resultant wine being of poor quality. In wines of this character, especially if they have been allowed to become sour, the proportion of acids, esters and other substances which are likely to be distilled with the alcohol and water is high. The method of distillation also has a marked effect upon the ultimate product. In the Cognac district a small "pot" still is generally used, and this, from its construction, ensures the retention in the distillate of the larger bulk of the volatile ingredients of the wine, to which the well known bouquet of Cognac brandy is due. Care is taken to carry out the distillation very slowly over a wood fire, a quantity of about 200 gallons of wine being operated upon in ten hours.

The spirit obtained from wine of inferior quality and that distilled from the marc contains a high proportion of secondary products. Occasionally this is used for blending with "clean" spirit obtained from grain, beet, etc., the consequent dilution of the secondary products yielding a so-called brandy, the analytical values of which correspond very closely with those of a good brandy. The stills used are of a much more complicated pattern, varying in type from the small pot still with a rectifying head to the elaborate distilling column from which fractions of higher or lower strength can be drawn as desired. A high degree of rectification is possible in apparatus of this character, which is often used for the production of strong spirit for industrial purposes or for the preparation of liqueurs.

Physiological Effects.—Although brandy is still used for medicinal purposes—chiefly as a stimulant and as a hypnotic—its application in this connection is decreasing and it has been replaced to some extent by whiskey. The majority of medical witnesses before the Spirit Commission of 1909 appeared to place little value upon the secondary products and ascribed to the ethyl alcohol any beneficial effects of the spirits in the treatment of disease. All alcoholic liquors have an inebriating effect due primarily to the alcohol which is common to them all (*see* ALCOHOL and SPIRITS). Each has effects peculiar to itself, however, and these must therefore be due to the secondary products which according to evidence given by Sir T. Lauder Brunton before the Spirits Commission of 1891 probably individually affect different parts of the cerebellum. Thus, after imbibing an excessive quantity of wine or brandy, a man has a tendency to fall upon his side, whilst it is a generally accepted fact that if the liquor has been mellowed by age its effects are not so potent. From these considerations it would appear that the peculiar effects of brandy drinking may be traced to those substances which, whilst present in the wine from which they pass to the brandy during the process of distillation, are themselves lost or altered in character during the ageing of the spirit. It has been proved that the higher alcohols remain practically unaltered during the maturing process. On the other hand, the furfural, aldehydes and esters undergo considerable change. They have a much more deleterious action upon the human organism and it is to them that the peculiar effects of brandy are due.

Storage and Maturation.—It is apparent, therefore, that the question of storage and maturation of brandy is of great importance. The spirit is stored in specially selected oak casks from which it extracts a certain quantity of colouring matter and tannin. It is during this period that the ageing previously referred to takes place. After storage for a varying time depending upon the quality of brandy required and the demands of trade, the spirit is transferred for blending purposes to large vats, where the necessary colouring and sweetening materials are added. In the case of pale brandies the amount added is only about 0·5 to 1%. The modern demand for a darker brandy with its suggestion of age encourages the blender to introduce a larger proportion than this. Brandy which is taken as a liqueur is prepared in this way from the best quality spirit and is stored for several years. The period during which storage is beneficial varies greatly, depending upon the character of the original spirit, the casks used and the place of storage. After this period has elapsed a process of deterioration sets in and develops rapidly. The spirit loses its good flavour and is reduced in strength by evaporation of the alcohol. Thus in one instance, possibly somewhat abnormal, a cask in 1871 contained fifty-eight gallons of brandy having an apparent strength of 112·9% proof. In 1894 the quantity had been reduced by evaporation to forty-nine gallons and the apparent strength to 56·5% proof. When, therefore, the maximum storage period has elapsed the spirit should be transferred to bottles, in which it can remain for many years unaltered. If for trade purposes complete bottling is not possible, a series of casks of varying ages is used. The spirit required is taken from the oldest cask and replaced by a similar quantity from the next and so on to the newest cask, which is refilled with freshly distilled spirit. The benefits of storage have been recognized officially in the United States of America, where, as previously indicated, the pharmacopoeia prescribes that the spirit "must have been stored in wood containers for a period of not less than four years," and in Great Britain where, under the Immature Spirits (Restriction) Act 1915, brandy cannot be delivered for home consumption unless it has been warehoused for three years.

Adulteration.—In the early years of the present century, there was considerable discussion as to the genuine character of much of the spirit sold as brandy and suggestions were made of extensive adulteration or preparation of artificial brandy by the addition of essential oils to grain or potato spirit. The subject was considered by the Royal Commission on Whiskey and Other Potable Spirits and dealt with in its Report of 1909. The information obtained did not support the suggestion as to artificial brandy, but there appeared to be considerable sophistication with neutral spirit. Thus, of 20 suspicious samples examined at the Government Laboratory, 2 gave analytical results which suggested that they were raw spirit coloured and flavoured. 15 appeared to be mixtures of grape spirit and neutral spirit, and 3 afforded no evidence that they contained other than grape spirit. Of 80 examined by a public analyst, 53 were found to be genuine and 27 were mixtures. Although the Commission expressed the opinion that "brandy" referred only to spirits derived from the grape, no standards of identification were recommended. In the previous decade, however, several prosecutions for selling spurious brandy had taken place and the magisterial opinions then expressed resulted in the unofficial adoption by some authorities of certain chemical standards. The wisdom of such a course has been questioned by other experts, it being pointed out that such requirements can readily be satisfied by the addition of artificial esters and higher alcohols to spirit not produced from the grape, a class of fraud even more objectionable than the addition of raw spirit to genuine brandy. The most satisfactory course appears to be the consideration of analytical data combined with expert opinion based upon physical characteristics. (F. G. H. T.)

BRANDYWINE, the name of a stream in Pennsylvania and Delaware, U.S.A., which runs into the Delaware river a few miles east of Wilmington (Del.). It is famous as the scene of the battle of Brandywine in the American Revolution, fought on Sept. 11, 1777, about 10m. north-west of Wilmington, and a few miles inside the Pennsylvania border. Sir William Howe, the British commander-in-chief, while opposed to Washington's army in New Jersey, had formed the plan of capturing Philadelphia from the south side by a movement by sea to the head of Delaware bay. But contrary winds and accidents delayed the British transports so long that Washington, who was at first puzzled, was able to divine his opponents' intentions in time, and rapidly moving to the threatened point occupied a strong entrenched position at the fords over the Brandywine, 25m. south-west of Philadelphia. Here, on Sept. 11, the British attacked him. Howe's plan, which was carefully worked out and exactly executed, was to deliver an energetic feint attack against the American front, to take a strong column 12m. up the stream, and crossing beyond Washington's right to attack his entrenchments in rear. Washington was successfully held in play during the movement, and General Sullivan, the commander of the American right wing, misled by the conflicting intelligence which reached him from up-stream, was surprised about noon by definite information as to the approach of the enemy on his right rear. Changing front "right back" in the dense country, he yet managed to oppose a stubborn resistance to the flanking attack, and with other troops that were hurried to the scene his division held its ground for a time near Birmingham meeting-house. But Howe pressed his attack sharply and drove back the Americans for 2m.; the holding attack of the British right was converted into a real one, and by nightfall Washington was in full retreat northward toward Chester, protected by General Greene and a steady rear-guard, which held off Howe's column for the necessary time. The British were too exhausted to pursue, and part of Howe's force was inextricably mixed up with the advancing troops of the frontal attack. The American loss in killed, wounded and prisoners was about 1,000; that of the British less than 600. Howe followed up his victory, and on Sept. 27 entered Philadelphia.

BRANFORD, a town of New Haven county (Conn.), U.S.A., at the mouth of the Branford river, 7 mi. S.E. of New Haven, on the New York, New Haven and Hartford railroad. The population in 1940 was 2,235. It has a beautiful library, built (1893–96) and endowed by Timothy B. Blackstone (1829–1900), president of the Chicago and Alton railroad 1864–99, in memory of his father, James Blackstone (1793–1886), who was born and lived all his life on a farm in Branford, where his ancestors had lived for four generations.

BRANGWYN, FRANK (1867–), R.A., English painter, was born at Bruges, and received his first instruction from his father, the owner of an establishment for church embroideries and kindred objects, who took a leading part in the Gothic revival under Pugin. When the family moved to England, Brangwyn worked for some time in Morris's studio, and then travelled to the East. Indeed, his love of Oriental decorative art exercised a greater influence on him than any early training. His tendency is essentially decorative: a colour-sense of sumptuous richness is wedded to a strong sense of well-balanced harmonious design. Among his decorative panels are "Modern Commerce" in the Royal Exchange, London; those for *L'Art nouveau* in the rue de Provence, Paris; for the hall of the Skinners' company, London; and for the British room at the Venice international exhibition, 1905. The Luxembourg museum has his "Trade on the Beach"; the Venice municipal museum, the "St. Simon Stylites"; the Stuttgart gallery, the "St. John the Baptist"; the Munich Pinakothek, the "Assisi"; the Carnegie institute in Pittsburgh his "Sweetmeat Seller"; the Prague gallery, his "Turkish Boatmen"; and the National gallery of New South Wales, "The Scoffers." Brangwyn turned his attention to many fields of applied art, and made designs for book decoration, stained glass, furniture, tapestry, metal-work and pottery. He also devoted himself to woodcuts and to etching. He was elected R.A. in 1919.

See W. Shaw Sparrow, *Frank Brangwyn and his Work* (1915); H. Furst, *The Decorative Art of Frank Brangwyn* (1924).

BRANKS or **SCOLDING-BRIDLE,** a contrivance formerly in use throughout England and Scotland for the punishment of scolding women. It seems to have never been a legalized form of punishment; but corporations and lords of manors in England, town councils, kirk-sessions and barony courts in Scotland assumed a right to inflict it. While specially known as the "Gossip's or Scold's Bridle," the branks was also used for women convicted of petty offences, breaches of the peace, street-brawling and abusive language. It was the equivalent of the male punishments of the stocks and pillory. In its earliest form it consisted of a hoop head-piece of iron, opening by hinges at the side so as to enclose the head, with a flat piece of iron projecting inwards so as to fit into the mouth and press the tongue down. Later it was made, by a multiplication of hoops, more like a cage, the front forming a mask of iron with holes for mouth, nose and eyes. Sometimes the mouth-plate was armed with a short spike. With this on her head the offending woman was marched through the streets by the beadle or chained to the market-cross to be gibed at by passers. The date of origin is doubtful. It was used at Edinburgh in 1567, at Glasgow in 1574, but not before the 17th century in any English town. A branks in the church of Walton-on-Thames, Surrey, bears date 1633, and as late as 1856 another was in use at Bolton-le-Moors, Lancashire.

See W. Andrews, *Old Time Punishments* (Hull, 1890); A. M. Earle, *Curious Punishments of Bygone Days* (1896).

BRANT, JOSEPH (1742–1807), American Indian chief of the Mohawk tribe, known also by his Indian name, THAYENDANEGEA, was born on the banks of the Ohio river in 1742. In early youth he attracted the attention of Sir William Johnson, who sent him to be educated by Dr. Eleazar Wheelock at Lebanon, Conn., in Moor's Indian charity school, in which Dartmouth college had its origin. He took part, on the side of the English, in the French and Indian war, and in 1763 fought with the Iroquois against Pontiac. Subsequently he settled at Canajoharie, or Upper Mohawk Castle (in what is now Montgomery county, N.Y.), where, being a devout churchman, he devoted himself to missionary work, and translated the Prayer Book and St. Mark's Gospel into the Mohawk tongue (1787). When Guy Johnson (1740–88) succeeded his uncle, Sir William, as superintendent of Indian affairs in 1774, Brant became his secretary. At the outbreak of the War of Independence, he remained pro-British, was commissioned colonel, and organized and led the Mohawks and other Indians allied to the British against the settlement on the New York frontier. He took part in the Cherry Valley Massacre, in the attack on Minisink and the expedition of General St. Leger which resulted in the battle of Oriskany (Aug. 6, 1777). After the war he discouraged the continuance of Indian warfare on the frontier, and aided the commissioners of the United States in securing treaties of peace with the Miamis and other western tribes. Settling in Upper Canada, he again devoted himself to missionary work and in 1786 visited England, where he raised funds with which was erected the first Episcopal church in Upper Canada. His character was a peculiar compound of the traits of an Indian warrior—with few rivals for daring leadership—and of a civilized politician and diplomat of the more conservative type. He died on an estate granted him by the British government on the banks of Lake Ontario on Nov. 24, 1807. A monument was erected to his memory at Brantford, Ontario, Canada (named in his honour) in 1886.

See W. L. Stone, *Life of Joseph Brant* (1838; new ed., Albany, 1865); Edward Eggleston and Elizabeth E. Seelye, "Brant and Red Jacket" in *Famous American Indians* (1879); a *Memoir* (Brantford, 1872); and Frederick Starr, *American Indians* (1898).

BRANT, SEBASTIAN (1457–1521), German humanist and satirist, was born at Strasbourg about the year 1457. He studied at Basle, took the degree of doctor of laws in 1489, and for some time held a professorship of jurisprudence there. Returning to Strasbourg he was made syndic of the town, and died on May 10, 1521. He first attracted attention in humanistic circles by his Latin poetry and edited many ecclesiastical and legal works; but he is now known only by his famous satire *Das Narrenschiff* (1494). Under the form of an allegory (a ship laden with fools and steered by fools to the fools' paradise of Narragonia) Brant here lashes with unsparing vigour the weaknesses and vices of his time. Although, like most of the German humanists, essentially conservative in his religious views, Brant's eyes were open to the abuses in the church, and the *Narrenschiff* was a most effective preparation for the Protestant Reformation. Jacobus Locher (1497) wrote a Latin version of the poem which bore small resemblance to the German original except for the woodcuts. Alexander Barclay's *Ship of Fools* (1509) is a free translation of the 1498 edition of Locher's work. *Cock Lorell's Bote* (printed by Wynkyn de Worde, *c.* 1510) is another imitation of the *Narrenschiff*. Cock Lorell is a fraudulent currier who gathers round him a rascally collection of tradesmen. They sail off riotously up hill and down dale throughout England. Of Brant's other works the chief is a version of Freidank's *Bescheidenheit* (1508).

Brant's *Narrenschiff* has been edited by F. Zarncke (1854); by K. Goedeke (1872); and by F. Bobertag (Kürschner's *Deutsche Nationalliteratur*, vol. xvi 1889). A German translation was published by K. Simrock in 1872, with reproductions of the original fine woodcuts. On the influence of Brant in England, *see* Aurelius Pompen, *The English Versions of The Ship of Fools, A Contribution to the History of the Early French Renaissance in England* (1925).

BRANTFORD, port of entry, Ontario, Canada, on the Grand river, and on the Canadian National, and Toronto, Hamilton & Buffalo railways, and also on the Brantford & Hamilton, and Erie and Northern Electric railways. The river is navigable to within 2½m. of the town; for the remaining distance a canal has been constructed. Agricultural implements, ploughs, engines, bicycles, stoves, pots, and railway material are made. It contains a provincial institute for the education of the blind and a women's college. The city has the statue of and is named in honour of the Mohawk chief, Joseph Brant (Thayendanegea), who settled here after leading the Six Nations (Iroquois) on the British side in the American War of Independence; the amalgamated tribes of the Six Nations still make it their headquarters. Pop. (1881) 9,616; (1921) 29,440; (1931) 30,107; (1941) 31,948.

BRANTING, KARL HJALMAR (1860–1925), Swedish statesman, was born in Stockholm Nov. 23, 1860, and had a distinguished scientific career as a student at Stockholm and Uppsala. In 1884 he associated himself with the Radical newspaper *Tiden* and shortly afterwards became editor. From 1886 to 1917 he was editor of the *Socialdemokraten*, between 1887–90 and 1892–96, being obliged, for economic reasons, to combine his editorship with work on the Liberal newspaper *Dagens Nyheter*.

When the Social Democratic Labour Party was formed in 1889, Branting was generally considered the greatest intellectual force in the movement. He wished to make the movement a power which, on the one side, would be useful to the working-classes in their economic struggle, and on the other of service to political democracy. It is chiefly due to Branting that the Swedish trade-union movement has always been of a pronounced social-democratic character, and as an organization still keeps in close touch with the Social Democratic Party. The first task of the new party was to mobilise the working-classes in support of adult, equal and direct suffrage, and Branting became a leader in the franchise movement. As early as 1890 he linked up the policy of the Labour Party with that of the progressive middle-class party and made co-operation between them possible. The result was a Liberal-Socialist government in 1917, and in 1918 the constitutional reform which facilitated the spread of social democracy throughout Sweden. He became leader of the party in 1907.

As early as 1897 Branting was a member of the second chamber, where till 1902 he was the only Social Democrat. In face of a powerful Chauvinistic group, Branting, strongly supported by the Labour Party, demanded a peaceful settlement of the question of the separation of Norway from the Swedish crown, and his contributions to the cause of peace when the union was dissolved in 1905, together with his work in the same cause during and after the World War, qualified him for the Nobel Prize which was awarded him in 1921. During the World War he energetically supported the demand for strict neutrality on the part of Sweden, although he displayed a marked sympathy for the Allies.

At the end of the War great hopes were placed on Branting's ability to re-unite the ranks of international social democracy. An attempt had been made in this direction in 1917 at the Swedish-Dutch conference known as the Stockholm Conference, over which Branting presided. He was chairman of the first post-war conference of the Socialist International, held in Bern 1919, and was a member of the permanent international commission for reconstruction within the International.

Branting was appointed delegate to the Peace Conference in Paris in the spring of 1919 and at the negotiations concerning Åland 1919–21. After the entry of Sweden into the League of Nations, Branting was the first representative of his country on the League Assemblies, and in 1922 was a member of the Council.

His defence of the Council of Ambassadors on the occasion of the Corfu incident and his handling of the English-Turkish conflict over Mosul enhanced his reputation.

Branting was Minister of Finance in the Liberal-Socialist cabinet of 1917, and in the spring of 1920 formed Sweden's first Social Democratic ministry. The parliamentary elections in the autumn went against him, but after the election of 1921 he formed a Government which remained in power until April 1923, when it was defeated over the unemployment relief question. After the election of 1924 Branting formed his third ministry, but on Jan. 25, 1925, M. Sandler was appointed prime minister in his place, on account of Branting's ill-health. He died in Stockholm, Feb. 24 1925.

BRANTÔME, PIERRE DE BOURDEILLE, SEIGNEUR AND ABBÉ DE (*c.* 1540–1614), French historian and biographer, was born in Périgord about 1540, or earlier. He was the third son of the baron de Bourdeille. His mother and his maternal grandmother were both attached to the court of Marguerite of

Valois, and at her death in 1549 he went to Paris, and later (1555) to Poitiers, to finish his education. He was given several benefices, the most important of which was the abbey of Brantôme, but he had no inclination for an ecclesiastical career, and became a soldier. He travelled extensively in Italy; in Scotland, where he accompanied Mary Stuart (then the widow of Francis I.); in England, where he saw Queen Elizabeth (1561, 1579); in Morocco (1564); and in Spain and Portugal. He fought on the galleys of the order of Malta, and accompanied his great friend, the French commander Philippe Strozzi (grandson of Filippo Strozzi, the Italian general, and nephew of Piero), in his expedition against Terceira, in which Strozzi was killed (1582). During the wars of religion under Charles IX. he fought in the ranks of the Catholics, but was influenced by the ideas of the reformers. He spent his last years in writing his remarkably frank and naïve *Memoirs*. He died on July 15, 1614.

Of the several editions of the works of Brantôme that by Lalanne for the Société de l'Histoire de France (12 vols., 1864–96) is perhaps the best.

Lalanne's edition has the great merit of being the first to indicate the Spanish, Italian and French sources on which Brantôme drew, but it did not utilize all the existing mss. It was only after Lalanne's death that the earliest were obtained for the Bibliothèque Nationale. At Paris and at Chantilly (Musée Condé) all Brantôme's original mss., as revised by him several times, are now collected (*see* the *Bibliothèque de l'école des Chartes*, 1904).

BRANTÔME, town of south-west France, in the department of Dordogne, 20m. N. by W. of Périgueux by steam-tramway. Pop. (1936) 1,117. The town, built on an island in the river Dronne, it has remains of an abbey founded by Charlemagne about 770 and afterwards destroyed by the Normans. The oldest existing portion is a square tower (11th century). The church, which it overlooks, was originally domed in the Périgord style, but revaulted in the Angevin fashion in the 13th century. The ruined cloister dates from the 15th century. The abbey buildings (18th cent.), now serve as *hôtel-de-ville*, magistrature and schools. The chronicler Pierre de Bourdeille (1535–1614) came into possession of the abbey, from which he took the name of Brantôme.

There are several old houses (12th–14th cents.), a church (15th cent.) and a curious "elbowed" bridge (16th cent.). Several caves, partly natural in origin, are inhabited, and many used as storehouses. Truffles are the chief article of commerce; and there are quarries of freestone in the neighbourhood. The dolmen known as Pierre-Levée, to the east of the town, is the most remarkable in Périgord.

BRANXHOLM: *see* HAWICK.

BRANXTON or **BRANKSTON,** a village of Northumberland, England, 2m. S.E. of Coldstream and 10m. N.W. of Wooler. It was on Branxton Hill, immediately south of the village, that the battle of Flodden (*q.v.*) was fought between the English and the Scots on Sept. 9 1513. During the fight the Scots' centre pushed as far as Branxton church, but "the king's stone," which lies N W. of the church and is popularly supposed to mark the spot where James IV. fell, is some three-quarters of a mile from the scene of the battle; it is probably an earlier monument. Pop. of parish (1931) 171.

BRAOSE, WILLIAM DE (d. 1211), lord of Brecknock, Radnor and Limerick, spent the early part of his life fighting the Welsh in Radnorshire. He stood high in King John's favour, received many honours, and was even given the custody of Prince Arthur. But John and he quarrelled, probably over money (1207). In 1208 John began to suspect the fidelity of the whole family, and William had to fly to Ireland. After a number of attempted reconciliations, he was outlawed (1210) and died at Corbeil (1211).

See *Foedera*, i. 107; *Histoire des ducs* (ed. Michel), Wendover; Kate Norgate's *John Lackland*.

BRASCASSAT, JACQUES RAYMOND (1804–1867), French painter, was born at Bordeaux; he studied art in Paris, where in 1825 he won a *prix de Rome* with a picture ("Chasse de Méléagre") now in the Bordeaux gallery. His reputation as an artist was made in animal painting. His "Lutte de taureaux" (1837), in the *musée* at Nantes, and his "Vache attaquée par des loups" (1845), in the Leipzig museum, were perhaps the best of his pictures. He died in Paris on Feb. 28, 1867.

BRASDOR, PIERRE (1721–1799), French surgeon, regius professor of anatomy and director of the Academy of Surgery, whose name was long attached to a ligature of his invention. He was an ardent advocate of inoculation. He died in Paris on Sept. 28, 1799.

BRAS D'OR, an irregular landlocked and tideless gulf or lake, 50m. long by 20m. broad, almost separating Cape Breton island (Nova Scotia, Canada) into two parts. A ship canal goes across the isthmus (about 1m. wide). The gulf is connected with the Atlantic by the Great and Little Bras d'Or channels, divided by Boulardeire island. The gulf or lake is itself divided into two basins, the inner or Great Bras d'Or lake, from 12 to 60 fathoms deep, the outer or Little Bras d'Or lake, in places nearly 700ft. deep. The picturesque and well wooded shores attract tourists. Sea fishing (cod, mackerel, etc.) is the chief industry.

BRASIDAS (d. 422 B.C.), a Spartan officer during the Archidamian War, the first decade of the Peloponnesian War (*q.v.*). He was the son of Tellis and Argileonis, and won his first laurels by the relief of Methone which was besieged by the Athenians (431 B.C.). During the following year he seems to have been eponymous ephor (Xen. *Hell.*, ii. 3, 10), and in 429 he was sent out as one of the three commissioners to advise the admiral Cnemus. As trierarch he was wounded in the assault on the Athenian position at Pylos (Thuc. iv. 11, 12).

In the next year, while Brasidas mustered a force at Corinth for a campaign in Thrace, he frustrated an Athenian attack on Megara (Thuc. iv. 70–73). Immediately afterwards he marched through Thessaly with a force of helots and mercenaries, and, refusing to join the Macedonian king Perdiccas in a private war, set about breaking up the Athenian empire in the North. During the winter he won over to alliance with Sparta the cities of Acanthus and Stagirus, and, most important of all, the Athenian colony of Amphipolis. An attack on Eion was foiled by the arrival of Thucydides, the historian, at the head of an Athenian squadron. In the spring of 423 a truce was concluded between Athens and Sparta, but Brasidas refused to give up Scione, which, the Athenians declared, revolted two days after the truce began, and occupied Mende shortly afterwards. Therefore fighting still continued in Thrace. An Athenian fleet recovered Mende and blockaded Scione, which fell two years later (421 B.C.). Meanwhile Brasidas joined Perdiccas in a campaign against the Lyncesti, which was at first successful, but ended in a quarrel between Brasidas and Perdiccas, who promptly concluded a treaty with Athens (*C.I.G.* i. 42).

In April 422 the truce with Sparta expired, and Cleon was sent to recover Thrace. By the skilful generalship of Brasidas the Athenian army was routed at Amphipolis and Cleon was slain, but the Spartan general also fell. He was buried at Amphipolis and the sacrifices which had formerly been offered to the Athenian founder were transferred to him (Thuc. iv. 78–v. 11). Brasidas and Cleon had been leaders of the war-party, and their deaths enabled Athens and Sparta to conclude the Peace of Nicias (421 B.C.).

Brasidas was the only commander of genius whom the Spartans produced during the Archidamian War. His charm and eloquence, qualities unusual in a Spartan, and his diplomatic treatment of the cities caused the allies of Athens to regard Sparta more favourably and paved the way for widespread revolt after the disaster in Sicily.

See in particular Thucydides, ii.–v.; what Diodorus xii. adds is mainly oratorical elaboration. A fuller account is given in the histories of Greece (*e.g.*, those of Grote, Beloch, Busolt, Meyer and Bury).

BRAŞOV (Ger. *Kronstadt*, Hung. *Brassó*), a town of Transylvania, Rumania, centre of the old Saxon district known as the Burzenland, and capital of the Rumanian dept. of Braşov. Pop. (1939) 61,829, of which Magyars, Rumanians and Germans were in about equal parts. Braşov is beautifully situated on the slopes of the Transylvanian Alps, in a narrow valley, shut in by mountains, and presenting only one opening on the northwest towards the Burzen plain. The town is entirely dominated by the Zinne, a mountain rising 1,276 ft. above the town (total altitude 3,153 ft.).

Braşov consists of the inner town, which is the commercial centre, and the suburbs of Blumenau, Altstadt and Obere Vorstadt, inhabited respectively by Germans, Magyars and Rumanians. To the east of the inner town rises the Schlossberg, crowned by the citadel, erected in 1553. To the north is the ruined tower of the Teutonic Order. Under it the old city wall, with its bastions, is intact. The Protestant church, popularly called the Black Church, owing to its smoke-stained walls, caused by the great fire of 1689, is the finest in Transylvania. It is a Gothic edifice and was built in 1385–1425. In the square in front of it is the statue of Johannes Honterus (1498–1549), "the apostle of Transylvania," who was born in Braşov, and *established here the first printing-press in Transylvania. In the principal square of the inner town stands the town hall, built in* 1420 and restored in the 18th century, with a tower 190ft. high. Braşov is an important commercial and manufacturing town. Lying near five passes of the Carpathians (Bran, Predeal, Bratocea, Oituz, Buzeu), it developed from the earliest time an active trade with Walachia, Moldavia and the Balkan States. Its chief industries are iron and copper works, wool-spinning, distilleries, turkey-red dyeing, leather goods, paper, cement and petroleum refineries. The manufacture of the wooden bottles used by the peasantry in Hungary and in the Balkan States is carried on. Braşov was founded in 1211 by the Teutonic Order expelled in 1225. It was refounded soon after by Saxon settlers, remaining a main Saxon centre until modern times. Originally situated in the plain, it was withdrawn into the valley after the first Turkish invasions, about A.D. 1400. It played a leading part in the introduction of the Reformation in Transylvania in the 16th century. The town was almost completely destroyed by the big fire of 1689. During the revolution of 1848–49 it was besieged by the Hungarians under General Bem from March to July 1849, and several engagements between the Austrian and the Hungarian troops took place in its neighbourhood. On account of its position it is an excellent tourist centre, being surrounded by beautiful mountains and having several mineral baths in the vicinity.

BRASS, a river, town and district of southern Nigeria, British West Africa. The Brass river is one of the deltaic branches of the Niger, lying east of the Rio Nun or main channel of the river. From the point of divergence from the main stream to the sea the Brass has a course of about 100m., its mouth being in 6° 20′ E., 4° 35′ North. Brass town, formerly a flourishing trading settlement at the mouth of the river, is no longer much used by ship traffic. The capital of the Brass tribes is Nimbé, 30m. up river. The Brass river, called by its Portuguese discoverers the Rio Bento, is said to have received its English name from the brass rods and other brass utensils imported by the early traders in exchange for palm oil and slaves. The Brass natives, of the pure negro type, were noted for their savage character. In 1856 their chiefs concluded a treaty with Great Britain agreeing to give up the slave-trade in exchange for a duty on the palm oil exported. Finding their profitable business as middlemen between the up-river producer and the exporter threatened by the appearance of European traders, they made ineffective complaints to the British authorities. The establishment of the Royal Niger Company led to greater bitterness, for the company's regulations were practically prohibitory for native trade. The Brass men determined on reprisals, and on January 29, 1895, the natives, Christian and pagan, attacked and sacked the company's station at Akassa on the Rio Nun. Forty-three of the prisoners taken back to Nimbé were killed and eaten by the pagan section. The Christian chiefs took no part in this feast and sent back their prisoners (25 in number). In the following March a punitive expedition destroyed Nimbé; 300 natives were killed or wounded. A heavy fine was imposed on the Brass chiefs and the king, Koko, was deposed. The trade regulations of which complaint had been made were removed in 1900 on the establishment of the protectorate of Southern Nigeria.

See the *Report by Sir John Kirk on the Disturbances at Brass* (*Africa*, No. 3, 1896); Sir W. N. Geary, *Nigeria under British Rule* (London, 1927).

BRASS, an alloy consisting mainly if not exclusively of copper and zinc; in its older use the term was applied rather to alloys of copper and tin, now known as bronze (*q.v.*).

The brass of the Bible was probably bronze, and so also was much of the brass of later times, until the distinction between zinc and tin became clearly recognized. It is quite likely that from very early times brass was made accidentally, owing to the admixture of zinc ores with those of copper, but was not recognized as distinct from bronze. The Latin word *aes* signifies either pure copper or bronze, not brass, but the Romans comprehended a brass compound of copper and zinc under the name of *orichalcum* or *aurichalcum*, into which, according to Pliny, copper was converted by the aid of *cadmia* (a mineral of zinc). One of the earliest examples of Roman brass is a coin of date 20 B.C. containing 17·3% of zinc. There was considerable production of brass in the Low Countries commencing about A.D. 300, and it became an important article of commerce. There are ecclesiastical brasses, or "lattens," still to be seen in many churches, particularly in East Anglia. The word latten is a corruption of the French word *laiton;* and till about 1550 latten was always imported from Flanders and Germany. One of the earliest lattens in England is at Stoke d'Abernon and commemorates Sir John Daubernon (*c.* 1277). The composition of these lattens is approximately 66% of copper, 1–3% of tin, up to 7% of lead, and the remainder of zinc.

There is good evidence of the manufacture of brass in England in the 16th century, for Queen Elizabeth by patent granted to William Humfrey and Christopher Schutz the exclusive right of working calamine and making brass. This right subsequently devolved upon a body called "The Governors, Assistants and Societies of the City of London of and for the Mineral and Battery Works," which continued to exercise its functions down to the year 1710. The word "battery" refers to the process of hammering brass into sheets, which was the normal method in England for some 200 years; but by the latter half of the 18th century this method began to be superseded by the rolling-mill, and it is now obsolete. Till 1850 brass was still being made by the calamine process, in which copper shot were heated with calamine and charcoal. The resulting partially-brassed shot were then melted, mixed and cast. This process, however, had been going out of favour since 1781, when James Emerson patented the production of brass from copper and zinc metals, which is the method now in use.

Copper and zinc will alloy in all proportions, but there are several distinct series, known technically as "solid solutions," which are distinguished by the letters of the Greek alphabet, the *alpha* brass having the greatest percentage of copper and being the sole constituent of all wrought brasses containing over 64% of copper. It is to this constituent that brass owes its malleability and general usefulness. The *beta* mixture contains less copper and is of a much harder nature, and as this constituent increases the brass becomes less amenable to cold work, though it can be easily worked hot. The other solid solutions contain less and less copper.

Brass: Malleable and Non-malleable.—The brasses may be conveniently divided into two groups by the test of malleability, the dividing line being about the composition of 55% copper and 45% zinc. All the higher copper alloys are workable either hot or cold and in some cases both hot and cold, while the remainder are not malleable at all.

The unworkable brasses are known as the white brasses and are not of great industrial importance. The 50% mixture is much used in a crushed or granulated form for purposes of brazing, and those with lower percentages of copper can be cast and used for sliding parts, since though brittle they offer considerable resistance to frictional abrasion. They also form the basis of certain alloys used for die-casting, a form of casting which has come into much prominence since the war.

The malleable brasses may be further divided into the cold working and the hot working alloys. The dividing line is not precisely drawn, but commercially it is not usual to work alloys of less than 62% copper cold since an excessive amount of annealing would be needed. Hot working above 62% copper is attended with considerable difficulty on account of the very brittle nature of these alloys when just below red heat, and it does not give the fine structure of the metal and the smooth surface which is obtained with cold work.

The most widely used of the brasses are those of 70% copper and from 62 to 66% copper. The former, which is known as cartridge metal and is the most suitable for extreme amounts of work, has a tensile strength, in the cast state, of 15 to 16 tons per sq.in. and 60% elongation; when cold worked, of 30–40 tons and 10% elongation or less; when cold worked and annealed, of 21 tons and up to 70% elongation. The general mechanical properties of brass vary widely; indeed it is this wide range which makes brass such an important alloy. By variation of the composition, or by the amount of cold work put upon the metal, or by the degree of annealing, a tensile strength of from 15 to 45 tons per sq. in., an elongation of from 3% to 70%, and a hardness of from 60 to 150 Brinell can be obtained with all the intermediate degrees. It is readily drawn into fine wire, rolled into strips as thin as ·001 in., drawn into tubes and extruded as rods or sections.

Colours of Brass.—The alloys of copper and zinc give a remarkable series of colours, of which the most notable are those with about 80% of copper, since they simulate gold, and have names which were once familiar, such as Dutch metal, Mannheim gold, pinchbeck (invented by Christopher Pinchbeck, a London clockmaker, in 1732), and others too numerous to mention. The colours due to composition vary from that of pure copper through yellow to dull white. Brass is susceptible of a fine polish, but tarnishes on exposure to the air; the brilliancy of the surface can however be preserved if the metal is thoroughly cleansed by "dipping" in nitric acid and "lacquered." The brasses also lend themselves to a variety of chemical and heat colour finishes which are quite different from the natural colours of the alloy. Recent research work suggests the possibility of producing a thin, almost invisible oxide film by heat treatment at about 100°C. as a protection against tarnish.

There is a series of alloys which are commonly classed as brasses since brass is their foundation, but they contain other metals also. (*See* also ALLOYS; COPPER; ZINC.)

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BRASSARD, originally a piece of defensive armour covering the upper arm (Lat., *brachium*—arm; French, *bras*—arm), now a badge or armlet worn on the upper arm.

BRASS BAND MOVEMENT. By this name is generally known a movement which has had enormous influence in cultivating and developing musical tastes and aptitudes among the working-classes in England. Originating not far short of 100 years ago in the rival performances of town and village bands, it has since attained, under the stimulating influence of organized competition for substantial prizes, remarkable dimensions. To-day nearly every village has its band and in the larger towns are often to be found several, the total number in existence being put at over 5,000. Most of the large works and collieries have their own organizations, and many of them are known throughout the length and breadth of the land.

Among such bands, Foden's motor works, Munn & Felton's works, Black Dyke, Wingate's temperance, and Carlisle St. Stephen's have all distinguished themselves in recent years by winning the championship, Foden's having topped the record by doing this in three successive years twice; among famous bands of earlier days may be mentioned Meltham mills, Leeds forge, Wyke, Besses o' th' Barn and Kingston mills.

A large number of contests are held in different parts of the country during the summer months but the two meetings which stand out pre-eminently are those held annually at Belle Vue, Manchester and the Alexandra Palace, London—whither the London meetings were transferred in 1937 after the burning down of the Crystal Palace (where they had formerly been held) in 1936. The Crystal Palace meetings began in 1860, then after a few years' existence lapsed until they were re-established in 1900 by Mr. J. Henry Iles, who has been prominently identified with the movement for many years.

Under the title of the National Band Festival these contests constitute for all concerned the most important and exciting event of the musical year, the chief prize being a thousand guinea trophy (held for one year) plus a money prize of £50 and medals for each player, for the champion band. As many as 200 bands often take part in this festival.

As regards the music performed, this consisted formerly almost entirely of arrangements and transcriptions of compositions of very varying orders of merit, but of recent years the standard has been greatly improved; a tendency which has been furthered by the sympathetic co-operation of leading British composers, such as Elgar, Holst, Bantock, Ireland, Bliss and Holbrooke, who have all written special works for the brass band combination. This consists, in the case of a full band, of about 24 instruments, including cornets, horns, trombones, euphoniums and basses.

BRASSEUR DE BOURBOURG, CHARLES ÉTIENNE (1814–1874), Belgian ethnographer, was born at Bourbourg, near Dunkirk. From 1848 to 1863 he travelled as a missionary, chiefly in Mexico and Central America. He published in 1857–59 a history of Aztec civilization, and from 1861–64 edited a collection of documents in the indigenous languages. In 1864 he was archaeologist to the French military expedition in Mexico, and his *Monuments anciens du Mexique* was published by the French government in 1866. He translated into French the *Popol Vuh*, a sacred book of the Quiché Indians, and wrote a Quiché grammar. In 1871 he brought out his Bibliothèque Mexico-Guatemalienne, and in 1869–70 gave the principles of his decipherment, much disputed, of Indian picture-writing in his *Manuscrit Troano, études sur le système graphique et la langue des Mayas*.

BRASSEY, THOMAS (1805–1870), English railway contractor, was born at Buerton, near Chester, on Nov. 7, 1805. At the age of 16 he was apprenticed to a surveyor, and on the completion of his term became a partner of his master, eventually assuming the sole management of the business. His first engagement as railway contractor was entered upon in 1835, when he undertook the execution of a portion of the Grand Junction railway, on the invitation of Joseph Locke, who soon afterwards entrusted him with the completion of the London and Southampton railway, a task which involved contracts to the amount of £4,000,000 sterling and the employment of a body of 3,000 men. At the same time he was engaged on portions of several other lines in the north of England, and in Scotland. In conjunction with his partner, W. Mackenzie, Brassey undertook, in 1840, the construction of the railway from Paris to Rouen, of which Locke was engineer. A few years later he was engaged with his partner on five other French lines, and on his own account on the same number of lines in England, Wales and Scotland. In the following year he engaged in the construction of railways in Holland, Prussia, Spain and Italy. One of his largest undertakings was the Grand Trunk railway of Canada, 1,100 miles in length, with its fine bridge over the St. Lawrence. In this work he was associated with Sir M. Peto and E. L. Betts. In the following years divisions of his industrial army of some 75,000 men were found in almost every country in Europe, in India, in Australia and in South America. Besides railway works, he originated a great number of subsidiary establishments, coal and iron works, dockyards, etc. Brassey died at St. Leonards on Dec. 8, 1870. *See* Sir Arthur Helps *Life and Labours of Mr. Brassey* (1872).

He left three sons, of whom the eldest, THOMAS (1836–1918) was created a baron in 1886 and earl in 1911 on the coronation of George V. He was educated at Rugby and Oxford, entered parliament for Hastings as a liberal in 1868, and devoted himself to naval affairs. He was civil lord of the admiralty (1880–83), and secretary to the admiralty (1883–85). He carried out a number of important enquiries, into wages and conditions of labour in the dockyards, shipbuilding, and design, and into the details of administration in the dockyards. In 1893–95 he was president of the Institution of Naval Architects. In 1894 he was a lord-in-waiting, and from 1895 to 1900 was governor of Victoria. In 1908 he was appointed lord warden of the Cinque Ports. Among Lord Brassey's publications, his inauguration of the *Naval Annual* (1886 onwards), and his encyclopaedic work on *The British Navy* (1882–83) are the most important. He died in London on Feb. 23, 1918, and was succeeded as second earl by his son Thomas Allnutt Brassey, who died in 1919.

BRASSICA, a plant genus of the family Cruciferae (*q.v.*), including the cabbage, mustard (*qq.v.*) and other well-known plants.

BRASS MANUFACTURES. The manufacture of brass is usually, although not always, associated with the fabrication of copper and copper base alloys in general.

The manufacture of copper and its alloys, including brass, is essentially a heavy industry and the normal products of copper and brass mills are the basic forms of the metal industry, namely, sheet, strip, rod, tube, bars and plates.

Brass is a generic term applied to the most widely used and industrially important copper base alloys. There is a large number of commercial brass alloys but in general the brasses can be classified in three broad groups.

Group I comprises the binary alloys of copper and zinc containing in excess of 63% copper. Alloys in this group, where the copper content range is between 63% and 95%, are, structurally, single-phase, solid solutions of copper and zinc. Brasses in this group known as alpha brasses are characterized by excellent cold working properties and are widely used in applications requiring extreme ductility and ease of forming and drawing.

Group II comprises those alloys of copper and zinc in which the copper range varies from 55% to 63%. Structurally these alloys exhibit two phases, the alpha phase, which is typical of the alloys in Group I in combination with a beta phase, a phase richer in zinc than the alpha phase.

The alpha-beta brasses are excellent hot working metals and in general are characterized by higher strengths and lower ductilities than the alpha brasses. They find their principal applications in engineering fields as structural materials and are seldom used for spinning, stamping or drawing, or other fabrication requiring cold working or deformation substantially beyond the point of original manufacture.

Group III may be considered as including a large range of special or modified brasses in which third and fourth constituents have been added to the basic copper-zinc alloys for the purpose of usefully modifying their properties.

The added elements may serve to improve physical properties, such as tensile strength, increase corrosion resistance, render the material more readily machineable, or in some instances to modify the colour of the basic alloy.

Typical of these special brasses are the aluminium brasses in which aluminium has been added to increase the corrosion resistance of the brass; the leaded brasses, where lead has been added to improve machining properties; the so-called manganese bronzes, where manganese and iron have been added to increase the tensile strength of certain of the alpha-beta brasses; nickel brass, or, as it is called commercially, nickel silver, in which nickel has been added to brass for the purpose of obtaining a desirable white colour in material usually to be subsequently silver or nickel plated. Following is an outline of certain basic operations, namely casting, annealing and pickling, employed in the fabrication of brass. Other basic operations such as hot and cold rolling, cold drawing, extrusion and piercing will be discussed in connection with types of finished products, such as sheet and strip, rod and bar, and tubes.

Castings.—It has often been said that the heart of the brass industry is its casting shop. Here are produced from basic raw material the specially shaped castings required in the production of its many manufactures. The most rigid control must be exercised along all fronts to secure the quality necessary to the production of brass products.

Raw material used consists of cathode copper, *i.e.*, copper refined electrolytically, scrap copper from its own mills or purchased on the market, zinc, pure aluminium, lead and other virgin metals. In addition to pure metals large quantities of both processing and purchased scrap brass are used.

Regardless of the source of the scrap extreme precautions are taken to keep it segregated according to its composition. Scrap which is secured from without is carefully analyzed and then placed in special bins to be utilized later for the casting of alloys whose composition it most closely approximates. Purchased scrap is usually passed over a magnetic separator so that all iron and steel which may be present are removed. The presence of iron in most brass alloys is not desired in amounts above 0·10%.

Depending upon the type of equipment used for melting furnaces, charges will vary from 100lb. to 10,000 pounds. The composition of the alloy is determined to a large extent by the care with which these charges are weighed. Usually separate departments are set up within the casting shop under the direct supervision of a chemical control department. For any given composition the necessary amounts of copper, zinc and scrap are carefully weighed. Usually an excess of 0·5% of zinc is added as this much is lost due to volatilization during the melting period. Every effort is made to keep the scrap as free from oil, dirt and grease as possible. These on burning produce gas which may be trapped when the metal is solidifying.

The furnaces used for melting vary from the pit-crucible type used for small-sized castings and for sand castings to electric furnaces of the induction type which usually hold between 1,000 and 2,500lb., to the reverberatory furnace which holds up to 10,000lb. and which is extensively used for making large castings for the production of heavy sheet and plate. Large-sized oil and gas-fired, tilting crucible furnaces are also used extensively. These are particularly useful because of their flexibility, it being possible to change from one alloy composition to another at a minimum cost.

Electric furnaces are lined with special refractories depending on the composition to be melted. Such linings are quite expensive and usually separate furnaces are set aside for casting special mixtures. Electric furnaces are highly adapted to big production runs of a particular alloy or alloys within a narrow composition range.

During melting of the metal considerable care is taken to protect the molten metal from the atmosphere and a cover of charcoal is used. The cover produces a reducing atmosphere at the surface and prevents undesirable oxidation of the molten metal.

Moulds used for the making of castings for the production of wrought brass products are usually cast iron. Their shape is determined by the shape of casting required. For the manufacture of tubing or rod, castings may vary from 2in. to 30in. in diameter and from 12in. to 96in. in length.

Moulds may be of the air cooled type or the water cooled type. The latter is very extensively used for the production of large-sized castings. Cooling is effected by circulating water through a chamber between the outer casing of the mould and an inner plate usually made of copper or bronze.

Moulds are dressed with mixtures of oil and rosin, graphite or black lead. These dressings serve to produce cleaner surfaces on casting and to protect the casting surfaces of the mould.

The temperature at which the molten metal is poured is very carefully controlled by means of thermal couples which are immersed in the molten metal, readings either being taken visually or recorded on special equipment.

To standardize rate at which the metal is poured, special pouring boxes, cups or funnels are used. These serve two purposes: one to regulate the rate of rise of the molten metal in the mould, and second to prevent the molten metal from impinging on the mould wall and forming bad spots on the casting.

When brass changes from the liquid to the solid condition shrinkage takes place. In order to compensate for this shrinkage the casting is fed by adding liquid metal during the entire period of solidification. Occasionally mould extensions made of clay or of cement are used to furnish additional space to hold metal for feeding the shrink. These extensions are often called "hot tops" or "dozzles."

The top end of castings containing the "pipe" or the "gate" is removed to solid metal either by sawing or with heavy shears prior to any working of the metal.

Annealing.—Annealing consists of heating a metal to a temperature which renders it soft and suitable for further cold work.

Annealing operations are usually conducted in furnaces of the muffle type but of many forms of construction.

In a commercial sense it is, of course, necessary that annealing furnaces be so constructed that uniformity of temperature is maintained within the muffle.

Many designs of furnace incorporate a control of the furnace atmosphere for the purpose of preventing the excessive oxidation or tarnishing of metal during the annealing operation. The term "open fire" annealing is frequently used to designate annealing operations in which no effort is made to prevent oxidation of the metal. Controlled atmosphere annealing ordinarily designates an operation in which excessive oxidation or scaling is prevented by suitable control of the furnace atmosphere, and bright annealing is a term descriptive of those annealing operations which are conducted under conditions so controlled as to prevent even tarnishing of the metal.

The design of annealing furnaces varies from a mechanical point of view with the particular type of product being handled and the necessities imposed by engineering and manufacturing considerations.

There are continuous type furnaces, batch type furnaces, strip annealing furnaces and many others of special design which are in common commercial use.

In the United States there is a wide use of electrically heated annealing muffles. Gas and oil-fired furnaces are also commonly and widely used.

The use of wood and coal as a fuel for the firing of brass annealing furnaces has within recent years rapidly disappeared in the United States, but it is still encountered in small plants both there and in Europe.

Pickling.—Pickling is a term applied in the brass industry to the cleaning of annealed metal by acid solutions. Ordinary pickling practice on copper and brass products consists in immersing the annealed metal in a sulphuric acid solution, usually containing about 10% by weight of sulphuric acid. The function of the acid is to combine chemically with the metallic oxides formed in annealing operations and to remove dirt, combustion products and other impurities from the surface of the metal.

Such a cleaning operation is essential before cold working operations can continue, as otherwise subsequent cold working would result in the imbedding of oxides and metals in the surface of the metal, rendering it unsuitable for most commercial applications.

While sulphuric acid is the chemical used for ordinary pickling operations, there are several pickling or finishing solutions commonly used in the brass industry.

A solution of sodium or potassium bichromate in a water solution of sulphuric acid is frequently employed as a "bright dip" Such a bright dip is used, not essentially as a pickle, but rather to give a lustrous, clean finish to metal or metal parts after they have been subjected to their final processing operation.

Nitric acid solutions are also frequently used for the same purpose and other chemicals appropriate to the composition of special alloys are sometimes used when the constituents of such special alloys necessitate such treatment.

Sheet, Strip and Plate.—Brass sheet, strip and plate are manufactured by either hot rolling or cold rolling or combinations of these two forms of working. As a general rule the dimensions of the finished product will to a large extent influence the manner in which it is produced, *e.g.*, thick, wide and long plates are usually produced by hot rolling only, while thin sheet and strip are produced by a combination of the two forms or by cold rolling alone.

While no clear cut line of demarcation between sheet and strip exists, generally thin brass over 22in. wide furnished in flat lengths is considered sheet, and brass under this width furnished in flat lengths or coils, strip.

Each of the brass alloys possesses a temperature range in which it is most plastic. Some brasses, as mentioned above, hot work much easier than others. These are usually hot rolled with only enough cold rolling to secure close dimensions. Preliminary to hot rollings castings of the proper shape are heated to the optimum hot working temperature and held at this temperature for several hours to insure uniformity of heating. These castings, or cakes as they are called, are fed to a pair of driven rolls which exert pressure on the plastic cake, causing it to be elongated and thinned. This rolling operation takes place so rapidly that it is possible to reduce a 4in. or 5in. thick casting to $\frac{3}{16}$ in. with only one heating. In hot rolling, no hardening of the metal takes place so it is not necessary to anneal.

In cold rolling much the same operations take place with the exceptions that the castings or bars are narrower, not as thick, and the operation is performed at room temperature.

When a metal is cold rolled the crystals or grains of which it is composed are elongated in the direction of the working; as working increases these crystals become fragmented The combination of fragmentation and elongation of the grains results in the metal becoming very hard. When this condition is reached, it becomes necessary to anneal the bar before further cold work can be done. It is usual practice to cold roll a bar 50%, *i.e.* from 2in. thick to 1in. between anneals

Annealing temperatures of from 800–1350°F and exposure times of from 30 minutes to two or three hours are standard practice. The temperature and time utilized depend upon the amount of metal being annealed and the degree of softness required. The hardness of annealed brass is proportionate to its grain size, *i.e.*, small grain size brass is harder than large grain size material. After annealing the brass is pickled and is then ready for further cold rolling.

Usually in the production of brass sheet, strip and plate, it is necessary to remove the surface at some intermediate point, such as by milling, in order to insure a finish surface which will be free of imperfections. This surface removal is called "overhauling" or "scalping."

Brass sheet or strip is furnished to the trade in both hard and soft conditions. If furnished hard its final operation consists of a definite amount of cold rolling, *e.g.*, quarter hard brass is brass which has been cold rolled so as to produce a reduction in thickness of 10%; half hard, 20%; hard, 35% and extra hard, 50%. Soft brass sheet or strip is annealed to various degrees of softness, *i.e.*, different grain sizes. If the brass is going to be further worked to produce articles and is subsequently going to be polished and plated, a grain size of 0·030 to 0·050mm. average diameter will probably be specified. If surface characteristics of the finished article are of no importance, a larger grain size will be selected. In most cases a balance will be struck between ease of working and smoothness of finished surface. The grain size giving the best combination will usually be selected.

Rod, Bar and Shapes.—Brass rod, bar or shapes may be produced by hot rolling, hot rolling and cold drawing, cold rolling, cold rolling and cold drawing, extrusion, and extrusion and cold drawing.

The hot rolling process for the manufacture of rods, bars and shapes of brass is similar in principle to that employed in the production of sheet and plate with the exceptions that castings of 4in. or 5in. round or square cross-sections and up to 60in. long are used and the rolls used are grooved to produce the cross-sectional shape desired. Roll stands for rods, etc., as for sheet and plate, are so made that the direction of the rolls can be reversed quickly, thus allowing rolling to proceed from either side. In the manufacture of brass wire and small diameter rods, it is possible to hot roll in one preheating from a 4in. square or round to ¼in. round. This operation is performed at high speed

As a general rule only alpha and beta and lead-free alpha brasses are manufactured by the hot rolling process and this process is used only when the cross-section of the shape desired is relatively simple. For complicated cross-sections, such as hexagons, triangles, T-shape and others, the hot extrusion method is utilized. This method of working is very flexible and adapted to the production of extremely complicated shapes of all types.

Castings used are cylindrical and dimensions will vary depending upon the capacity of the extrusion equipment.

All brass alloys can be extruded some with greater ease than others. In contrast to the hot rolling operation brasses containing lead can be extruded without difficulty.

The extrusion operation consists essentially of pushing a casting, which has been heated to its most plastic range, through an alloy steel die. The shape of the opening in the die determines the cross-section of the extruded product. The extrusion of brass is similar to the extrusion of toothpaste from its container. In one case brass rod, bar or shapes are pushed out at a glowing red temperature and in the other a ribbon of "toothpaste" at room temperature.

Both the hot rolling and extrusion methods are used as intermediate steps for the production of rods and bars. It is impossible to produce materials to very close gauge tolerance with either of these processes; in addition strengths are low. Practically all brass rod, etc., are purchased to very close dimensions. In order to secure both the close dimensions and higher strengths it is necessary to cold work the material. This is done by cold drawing.

In the cold drawing operation a piece of equipment known as a bench is used. Fixed at one end of the bench is a holder which contains the die. The remainder of the bench, which may be 50ft. or 60ft. long, contains an endless chain operating similarly to a conveyor belt. Fixed to one point on this endless chain is a pair of vise-like jaws. First, the rod or bar to be drawn has one end swaged to a smaller diameter than the size to which it is to be drawn. This reduced end is then inserted through the die and clamped or engaged with the jaws. Power is then applied and the rod, etc., are drawn through the die assuming the cross-sectional shape of the die. This operation is then repeated until the required cross-section is secured. Usual reductions of area are of the order of 25% for each operation, *i.e.*, from 1in. diameter to ⅞in. diameter. Very often such large reductions are required that it becomes necessary to anneal frequently as cold drawing, like cold rolling, hardens the brass rapidly. Brass rods, etc., are furnished in both hard and soft conditions. Brass rods of less than 80% copper content, etc., are even more sensitive to "season cracking" than brass sheet so it is necessary to relieve strains as soon after the cold working operation as possible. This is done by low temperature annealing and by springing or straightening operations. Both of these latter operations consist essentially of whipping the product by fixing one end and flexing the other. This operation readjusts the strains sufficiently to eliminate danger of cracking.

Cold rolling is used only when the composition of the material is such that it is not economical to extrude or it cannot be hot rolled. Alpha brasses containing lead as a free-cutting constituent cannot be hot rolled. While they can be extruded in the larger sizes and less complicated sections, the process is slow and expensive. Accordingly, it is usual practice to cold roll to some intermediate size and then cold draw to the finish size.

The cold rolling of rod is similar to the hot rolling process except that working speeds are slower and cross-sections of castings are smaller. As in any cold working operation the metal becomes hard and it is necessary to anneal frequently to soften.

Tubes.—In the manufacture of brass tube there are six methods by which intermediate sizes of tube can be secured. The method which is utilized for the production of the tube is determined by the nature of the brass alloy and the use for which the tube is intended. These processes are: 1. Extrusion; 2. Piercing—"Mannesmann" Process; 3. Hollow Shell Castings; 4. Cup Drawing; 5. Brazing; 6. Lockseam construction. With the exception of the lockseam method these are all preliminary methods and in order to produce commercial size tube to close dimensions it is necessary to cold draw.

Of the above methods, extrusion is the youngest and is rapidly replacing the others as a method of manufacture for tube.

1. The extrusion of tube is similar to the extrusion of rod, etc., with the exception that prior to any extrusion a mandrel is forced through the hot casting forming thereby a cylindrical hole whose diameter conforms to the inside diameter of the extruded tube. The mandrel remains in this hole and simultaneously with the completion of this piercing operation the casting is pushed through the die and over the mandrel. The outside diameter of the tube or shell is controlled by the die and the inside diameter by the mandrel. The operation is rapid, taking from 15 to 30 seconds for the actual extrusion.

2. In the piercing operation, castings are used which vary from 2in. to 6in. or larger in diameter and up to 50in. long. These castings are placed in a furnace and heated uniformly to the optimum hot working temperature of the alloy, and then are placed between two revolving rolls which are so constructed as to present to the surface of the castings or billets inverted broad vee surfaces. These rolls are so adjusted that rolling of the billet occurs and elongation results. Due to the shape of the rolls a small opening is made at the centre of the billet during the rolling operation. This opening is further enlarged and controlled roughly as to tolerances by entrance therein of a pointed steel mandrel which is rotating at high speed counter-clockwise to the revolving billet. The beginning of rolling of the billet and the entrance therein of the mandrel point are coincidental.

This operation is very rapid and is extensively used for the production of intermediate tube sizes of red brass; 85% copper, 15% zinc; Muntz Metal 60% copper, 40% zinc; and others.

3. The hollow shell method involves the use of special castings which are secured by pouring molten metal into a cylindrical mould with a removable core through its middle. The core controls the inside diameter of the casting. The shell or hollow casting is reduced to smaller sizes by suitable cold drawing operations.

4. The "cup drawn" shell or tube is produced by deep drawing, *i.e.*, pushing a flat piece of metal through a die by means of a round nosed punch. One of the disadvantages of this method is that there is a definite weight limitation to the tube that can be produced. It is practically impossible to produce a tube of 1in. diameter much more than 15 to 20ft. long. Any of the other methods mentioned above can produce tubes of this size up to 60ft. long.

5. At one time all of the brass tubes supplied were made by the brazing method. Today (1940) less than 0·5% are produced this way. The method consists essentially of taking flat strip of the proper gauge and drawing it through a forming die of the desired shape and then brazing the contiguous edges with a solder known as spelter, consisting of 50% copper and 50% zinc.

6. The lockseam method is similar to the brazing method with the exception that the contiguous edges are lockseamed. Soft solder, *i.e.*, lead-tin alloy, may or may not be applied to the joint depending upon the ultimate use of the tube.

The cold drawing of extruded and pierced shells, hollow shell castings, cup drawn and brazed tubes is performed on equipment identical to that used in the cold drawing of rod, etc. The operation in the main is similar except to control the inside diameter of the tube there is introduced into the tube at the moment of drawing either a polished steel plug attached to a rod of smaller diameter than the plug or a polished steel mandrel of uniform cross-section. The mandrel method of maintaining inside diameters is most widely used in England while the plug method is used in the United States. The outside diameter of the tube is controlled by the die. As in other cold working operations it is necessary to anneal the tubes as they become hard so that further cold drawing operations can be performed.

Since 1933 a new process for cold working extruded shell to smaller sizes has been developed. This method is known as "tube reducing." It consists essentially of swaging or forging a tube over a tapered mandrel. Simultaneously with the swaging the tube is automatically rotated slowly. Very large reductions can be effected in single operations due to the uniform working of the metal that occurs.

Forgings.—Hot and cold forging processes for making small brass parts are rapidly supplanting sand castings.

Brass alloys containing from 55%–62% of copper can be readily hot forged into very intricate shapes to close dimension limits thus eliminating the necessity for very much machining as is the case with sand castings. Such articles as faucet handles, sprinkler heads, window and door fittings and many others are produced in this manner.

Brass containing in excess of 64% of copper can be cold forged very easily into many shapes and articles. This method is used in the manufacture of pins, bolts, screws, and the like. Most often automatic equipment is used Wire of the proper diameter is fed into the special machines and upsetting, cold heading and threading operations are performed. (*See also* BRASS.)

Statistics, United States.—Brass scrap remelted in the United States in 1938 amounted to 153,100 short tons, valued at $24,668,400; the comparable figures for the preceding year were 206,400 tons and $41,677,000. Of the amount retreated in 1938, 75,000 tons represented new clean scrap and 78,100 tons old scrap. The copper content of old and new scrap averages about 70%. Unmanufactured brass exported from the United States in 1938, in the form of ingots, bars and rods, plates and sheets, totalled 3,645,637lb. valued at $677,809. Exports and values for preceding years were as follows: 1937, 17,373,035lb. ($2,573,245); 1936, 2,712,758lb. ($462,535); 1935, 2,329,353lb. ($382,681); 1934, 1,855,305lb. ($327,685). Imports of brass manufactures into the United States in 1937 were valued at $305,000. Imports of old brass for remanufacture were negligible, amounting in that year to less than $500 (R. A. W.; E. S. B.)

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BRATHWAIT, RICHARD (1588–1673), English poet, son of Thomas Brathwait, was born in 1588 at his father's manor of Burneshead, near Kendal, Westmorland. He entered Oriel college, Oxford, in 1604, and remained there for some years, pursuing the study of poetry and Roman history He removed to Cambridge to study law and afterwards to London to the Inns of Court. On the death of his elder brother, Sir Thomas, in 1618, Richard became the head of the family and an important personage in the county, being deputy-lieutenant and justice of the peace.

Richard Brathwait's most famous work is *Barnabae Itinerarium or Barnabee's Journall* (1638), by "Corymbaeus," written in English and Latin rhyme. The title-page says it is written for the "traveller's solace" and is to be chanted to the old tune of "Barnabe." The story of "drunken Barnabee's" four journeys to the north of England contains much amusing topographical information, and its gaiety is unflagging. Barnabee rarely visits a town or village without some notice of an excellent inn or a charming hostess, but he hardly deserves the epithet "drunken." At Banbury he saw the Puritan who has become proverbial,

> Hanging of his cat on Monday
> For killing of a Mouse on Sunday.

Brathwait's identity with "Corymbaeus" was first established by Joseph Haslewood. In his later years he removed to Catterick, where he died on May 4, 1673.

Brathwait wrote many other works, a full bibliography of which is given in Joseph Haslewood's edition of *Barnabee's Journall* (ed. W. C. Hazlitt, 1876). *See* also J. Corser, *Collectanea* (1860).

BRATIANU, ION (1864–1927), Rumanian statesman, was born at Florica, Rumania, on Aug. 20, 1864, the son of Ion C. Bratianu. He was educated at the Polytechnic school in Paris and on returning to Rumania became an engineer on the state railways. In 1895 he was elected a deputy as a Liberal. In the following year he was appointed minister of the interior in the Cabinet presided over by D. Sturza, whom he succeeded as prime minister and chief of the Liberal party when the latter retired in 1909. He remained in power until Jan. 1911, when he resigned, but in 1913, after the signature of the Treaty of Bucharest, he again formed a Cabinet. At the opening of the World War Bratianu was in power and it was his Government that guided Rumania's destinies throughout the period. He resigned on Jan. 29, 1918, rather than sign the terms of the peace imposed by the Germans. In Dec. 1918, however, he was again called to power following upon the decision of Gen. Coanda's Government to denounce the separate peace signed with the Central Powers.

Bratianu was chief Rumanian delegate at the Peace Conference in Paris, but he refused to sign the Peace Treaty as a protest against the minority clauses in the treaty and against the division of the Banat of Temesvar between Rumania and Yugoslavia; Bratianu, in accordance with the treaty of alliance concluded between Rumania and the Allies in 1916 claimed that province entirely for Rumania. In consequence he resigned and remained in opposition until Jan. 1922, when he became prime minister again. Bratianu followed closely the policy of consolidation inaugurated by his father, and most of the chief reforms, such as the introduction of universal suffrage, agrarian reform and the settlement of the Jewish question, were enacted during the period when he was in power. From 1922 onwards Bratianu was now practically a dictator; he had with him in the government his brother, Vintila Bratianu, who was minister of finance. The economic policy of the Government, with its suspicious attitude towards foreign capital, was strongly criticized, and Bratianu resigned in March 1926, only to be recalled by the king in June. Bratianu was thus able to "make" the elections, and secured a substantial majority. He supported the king in the plans for the regency when Prince Carol was excluded from the succession, and stoutly opposed proposals for the return of the prince after the king's death. Bratianu was twice married His second wife was a sister of Prince Stirbey, who was prime minister for a short period in 1927. He died on Nov 24, 1927. His brother Vintila succeeded him as prime minister, but was displaced at the end of 1928 by Jiuliu Maniu, leader of the Peasant party.

BRATIANU or **BRATIANO, ION C.** (1821–1891), Rumanian statesman, was born at Pitesci in Wallachia June 2, 1821. He entered the Wallachian army in 1838, and visited Paris in 1841 for purposes of study. Returning to Wallachia, he took part in the Rumanian rebellion of 1848, and acted as prefect of police in the provisional government formed in that year. The restoration of Russian and Turkish authority shortly afterwards drove him into exile He took refuge in Paris to work in favour of the proposed union and autonomy of the Danubian principalities. In 1854, however, he was sentenced to a fine of £120 and three months' imprisonment for sedition, and later confined in a lunatic asylum; but in 1856 he returned home with his brother, Dimitri Bratianu, afterwards one of his foremost political opponents. During the reign of Prince Cuza (1859–66) Bratianu was one of the liberal leaders. He assisted in 1866 in the deposition of Cuza and the election of Prince Charles of Hohenzollern, under whom he held several ministerial appointments during the next four years. He was arrested for complicity in the revolution of 1870, but soon released. In 1876, aided by C. A. Rosetti, he formed a Liberal cabinet, which remained in power until 1888. (For an account of his work in connection with the Russo-Turkish War of 1877, the Berlin congress, the establishment of the Rumanian kingdom, the revision of the constitution, and other reforms, *see* RUMANIA.) After 1883 Bratianu acted as sole leader of the Liberals, owing to a quarrel with C. A. Rosetti, his friend and political ally for nearly forty years. His long tenure of office, without parallel in Rumanian history, rendered Bratianu extremely unpopular, and at its close his impeachment appeared inevitable. But any proceedings taken against the minister would have involved charges against the king, who was largely responsible for his policy; and the impeachment was averted by a vote of parliament in February 1890. Bratianu died May 16, 1891.

For his writings and speeches see *Din Scrierile şi cuvintarile lui I. C. Bratianu*, 1821–91 (1903, etc.), edited with a biographical introduction by D. A. Sturza. A brief anonymous biography, *Ion C. Bratianu*, appeared at Bucharest in 1893.

BRATISLAVA, Czechoslovakia, after 1939 capital of "Slovakia," is situated at the base of the outlying spurs of the Little Carpathians on the left bank of the Danube where the river is bridged and narrows to pass through the Theben gorge. This strategic situation has been of importance in the development of the town and, though little is known of the early history of the site, the present town, founded about A.D. 1000, is doubtless not the first settlement. Soon after its establishment strong fortifications were built and, with the advance of the Turks and the conquest of Buda, it was selected as the Hungarian capital in 1541. This function was retained until 1784, while the Hungarian parliament continued to meet here till 1848. From this time until the end of World War I, it was overshadowed by Vienna, but the creation of the Czechoslovakian republic revived its prosperity and it was the chief Danubian port of the former republic as well as its greatest railway junction. Flanked by hills and surrounded by vineyards and parklands the town bears the stamp of its frontier position particularly in its architecture, in the mixture of its population, of whom about 40% are Czechs and Slovaks, 28% German and 22% Magyar (pop. [1930] 123,852), and in the wealth of educational establishments of all grades.

Supported by many-sided industrial activities such as weaving, milling, iron and leather-working, the manufacture of chemicals, explosives, paper, furniture, tobacco, edible and industrial fats and shipbuilding, and by an active commerce in the grain and wine of its region, it has made a big effort to overtake Vienna as a distributing centre for Balkan trade. In this connection the annual Orient Fair is of importance, and for the effective handling of traffic the port facilities have been greatly enlarged; new quays, railway-sidings and warehouses have been constructed and the scheme of development aims at the creation of a harbour capable of dealing with 3,000,000 tons a year. Bratislava was the seat of the former International Danube Commission which, under the Treaty of Versailles, controlled navigation on the Danube.

The town itself is an interesting combination of old and new. The fire-scarred shell of the old royal palace on the Schlossberg, a plateau 270ft. above the Danube, dominates everything. Other noteworthy buildings are the Gothic cathedral, the town hall and museum and the Franciscan church, all dating from the 13th century. Bratislava was formerly known as Pressburg.

BRATLANDSDAL, a gorge of southern Norway in Stavanger *amt* (county), formed by the Bratland torrent issuing into Lake Suldal. A remarkably engineered road traverses the gorge and the scenery is among the most magnificent in Norway.

BRATTICE. In mining, a partition in an airway, constructed to regulate ventilation. A brattice is built of varying materials, according to the nature of the mine; it may be of stone or brick or strong boards. The term is in familiar use both in Britain and the United States, and its origin is found in the German word *brett,* a board. A brattice must be airtight, and when it is constructed of a timber framing it is covered with a "brattice cloth" made of tarred canvas. Sometimes a brattice is made with a sliding door to allow of varying regulation of the air current. *See* MINING, METALLIFEROUS.

BRATTISHING, in architecture, an ornamental cresting, usually pierced, and occasionally taking the form of a battlement (*q.v.*). The term is generally used of open work forms of great richness, especially foliated forms. It is also used of any richly pierced work in metal.

BRATTLE, THOMAS (1658–1713), American merchant and official of Harvard college, was born June 20, 1658 at Boston. Little is known of his career in business, except that he amassed a considerable fortune and made several generous gifts to Harvard. He was made treasurer of the college in 1693 and held this office until his death; under his supervision the financial assets of the college were notably augmented. Brattle was an accomplished amateur mathematician and astronomer and took an abiding interest in the forms of religious worship. He leaned toward the Church of England and for this reason incurred the displeasure of Cotton Mather (*q.v.*). Brattle declined to be drawn into serious religious controversies and instead proceeded quietly to organize, with others, the Brattle Street church in Boston. This edifice was completed in 1699. He was an influential protester against the persecution of "witches" in 1692 and in that year circulated a pamphlet "giving a full and candid account of the delusion called witchcraft." He died May 18, 1713.

His brother, WILLIAM BRATTLE (1662–1717), graduated from Harvard in 1680 and became tutor in the college shortly thereafter. With John Leverett (afterward president of Harvard), he shared almost complete responsibility for directing the curriculum and routine of the college. For many years he was pastor of the First Church in Cambridge, and during the two years after his brother's death (1713–15) he was treasurer of Harvard.

BRATTLEBORO, a village of Windham county (Vermont), U.S.A., on the Connecticut river in the south-eastern part of the State, eight mi. from the Massachusetts border. It is served by the Boston and Maine and the Central Vermont railways. The population in 1940 was 9,622. It is an attractive village, situated in a hilly, heavily wooded country, and has some houses dating from the 18th century. There are numerous and varied manufactures. The village was settled about 1753, and was named after William Brattle (1702–1776), a Massachusetts loyalist, one of the original patentees. It was incorporated in 1763.

BRATTON, JOHN (1831–1898), American Confederate soldier, was born March 7, 1831 at Winnsboro, S.C. and was educated at South Carolina college. Upon the outbreak of the American civil war he enlisted in the Confederate army and advanced rapidly through the ranks until he was appointed brigadier general June 9, 1864. He was mentioned several times for courageous action, was wounded twice, and on one occasion was a prisoner of the Union army. After the war he entered public life and was elected comptroller of South Carolina. He died at Winnsboro in Jan. 1898.

BRAUCHITSCH, WALTHER VON (1881–   ), German general, was born in Berlin Oct. 4, 1881, the son of a cavalry officer. After attending a military academy he was commissioned lieutenant in 1900. During the World War (1914–18) he was an officer of the German general staff. He became inspector of artillery in 1932, commander of the East Prussian army district in 1933, and army group commander in 1937. In Feb. 1938 he succeeded Gen Werner von Fritsch as commander-in-chief of the German army and in this position directed all German troops after the outbreak of war in 1939.

BRAUN, KARL FERDINAND (1850–1918), German physicist, was born at Fulda on June 6 1850 and was educated at Marburg and Berlin. In 1877 he was appointed a professor at Marburg and after appointments at Strasbourg, Karlsruhe and Tübingen, became in 1895 professor of physics and director of the Physical Institute at Strasbourg. He made researches into the electrical phenomena of cathode rays and the problems of wireless telegraphy. In 1909 he received, with Marconi, the Nobel Prize for physics. He died in New York April 20 1918.

BRAUN, LILY (1865–1916), German Socialist and writer, was born at Halberstadt. The daughter of Gen. von Kretschmann, she was brought up in an atmosphere of Prussian militarism, but was nevertheless drawn to the Socialist movement. In 1896 she married Heinrich Braun, a Socialist writer and politician. In connection with her interest in Socialism she visited England and met leading members of the Fabian Society. Much of her written work deals with the place of women in politics; *e.g., Die Frauenfrage* (1901); *Frauenarbeit und Hauswirtschaft* (1901); and *Die Politik und die Frauen* (1904). *Im Schatten der Titanen* (1908) is drawn from the life of her grandmother, Jenny von Gustedt, a natural daughter of Jerome Bonaparte. This, with her *Memoiren einer Sozialistin,* published in two volumes, *Lehrjahre* and *Kampfjahre* (1910 and 1911) gave her a European reputation. The *Memoiren,* cast in the form of a novel, was largely autobiographical, and pictured the growth of the German Social Democratic movement at the end of the 19th century. Among her other books are *Die Liebesbriefe einer Marquise* (1912) and *Lebensucher* (1915).

Her son, OTTO BRAUN (1897–1918), who fell in the World War, showed a precocious genius. *Aus nachgelassenen Schriften eines Frühvollendeten* (1919) containing poems, essays and pages from his diary, edited by Julie Vogenstein, displays an amazing maturity and has found many readers outside Germany.

BRAUN, OTTO (1872–   ), German statesman, entered the Prussian Diet in 1912 as a representative of the Social-Democrats and became a member of the *Reichstag* in 1920. From 1918 to 1921 he was Prussian minister of agriculture and an opponent of the landowners. He was Prussian prime minister 1920–21, 1922, and 1925–33, and was a leader of the Social Democrats until their suppression by Hitler in 1933.

BRAUNAU: *see* Broumov.

BRAUNER, BOHUSLAV (1855-), Czech chemist, was born May 8 1855, at Prague. He studied chemistry at Prague and also under Bunsen at Heidelberg and Roscoe in Manchester, where, in 1881, he was elected Berkeley fellow of Owens college. In 1883, he was appointed lecturer and in 1890 professor of chemistry at the Czech University of Prague. Brauner devoted himself mainly to the field of modern inorganic chemistry, with special reference to the grouping of the elements in Mendeleyev's periodic system, and did important work on the atomic weights and chemistry of the rare elements. He became a fellow of the Bohemian Scientific Society, a member of the Czech Academy, and a corresponding member of the American Academy of Science.

The results of his extensive chemical research have been issued in numerous publications, the chief of which are as follows: *On Fluorescence* (1877); *On the Atomic Weight of Beryllium* (1878 and 1881); *Contributions to the Chemistry of the Rare Earths* (1882 and 1883); *On the Atomic Weight of Cerium* (1885); *Experimental Studies on the Periodic Law* (1889); *On the Volumetric Determination of Tellurium* (1890); *On the Constitution of Certain Metallic Chlorides* (1889); *Observations on Argon* (1895); *A Method of Preparing Argon in Large Quantities* (1895); *Revision of the Atomic Weight of Cerium* (1903).

BRAUNSBERG, a town of Germany, capital of a subdivision of the district of Königsberg, East Prussia, 38 mi. S.W. of Königsberg, on the Passarge, 4 mi. from its mouth in the Frisches Haff. Pop. (1939) 21,007. The castle of Braunsberg was built by the Teutonic knights in 1241, and the town was founded ten years later. In 1284, the bishop of Ermeland, who resided there, permitted it to join the Hanseatic League. After numerous vicissitudes it fell into the hands of the Poles in 1520, and in 1626 was captured by the Swedes who kept possession till 1635. It fell to Prussia by the first partition of Poland in 1772. It is a local agricultural centre. Its numerous Roman Catholic institutions include a philosophical and theological high school.

BRAVO, the name for a hired assassin such as was formerly common in Italy (It. for "brave"). The word had at first no evil meaning but was applied to the retainers of the great noble houses or to the cavalier-type of swashbucklers familiar in fiction. In later Italian history, especially in that of Venice, the *bravi* were desperate ruffians who for payment were ready to commit any crime.

BRAVURA (Ital.), bravery, a term used in music to signify a passage or composition of a brilliant character demanding exceptional powers, with corresponding courage and assurance, on the part of the performer. Thus in the old operas and oratorios a vocal number of this kind would be described as an *aria di bravura.*

BRAWLEY, a city of Imperial county, Calif. (U.S.A.), about 22m. from the Mexican border and 10m. from the southern tip of the Salton Sea. It is on Federal Highway 99 and the Southern Pacific Railway. In 1901 a single Indian *wickiup* was the only habitation on the site; in 1910 the population was 881; in 1930, 10,439; and in 1940 it was 11,718 federal census. The city is 119ft. below sea-level. The temperature ranges from 30° to 115°, with little humidity. The annual rainfall is less than 2in. Brawley is a shipping point for the fruits, vegetables, grain, livestock and other products of the rich Imperial valley. Brawley is the largest shipping point for perishable products in the world.

The city was laid out on the same basic plan as Washington, with wide streets radiating from a central plaza containing the city hall and surrounded by hotels, churches and other public buildings. Brawley was incorporated in 1908. It has a commission form of government.

BRAWLING, in British law, the offence of quarrelling, or creating a disturbance in a church. During the early stages of the Reformation in England religious controversy too often became converted into actual disturbance, and the ritual lawlessness of the parochial clergy very frequently provoked popular violence. To repress these disturbances an act was passed in 1551, and an act of 1553 added the punishment of imprisonment until the party should repent. The Places of Religious Worship Act, 1812, still makes it an offence to disturb congregations for religious worship permitted by that statute. The acts of 1551 and 1553 were partly repealed in 1828 and wholly repealed as regards laymen by the Ecclesiastical Courts Jurisdiction Act 1860, which is now the statute chiefly relied upon. Under that act, persons guilty of riotous, violent, or indecent behaviour, in churches and chapels of the Church of England or Ireland, or in any chapel of any religious denomination, or in England in any place of religious worship duly certified, or in churchyards or burial-grounds, are liable on conviction before two justices to a penalty of not more than £5, or imprisonment for any term not exceeding two months. This enactment applies to clergy as well as to laity, and a clergyman of the Church of England convicted under it may also be dealt with under the Clergy Discipline Act of 1892 (*Girt* v. *Fillingham,* 1901, L.R. Prob.176). When Mr. J. Kensit during an ordination service in St. Paul's Cathedral "objected" to one of the candidates for ordination, on grounds which did not constitute an impediment or notable crime within the meaning of the ordination service, he was held to have unlawfully disturbed the bishop of London in the conduct of the service, and to be liable to conviction under the Act of 1860 (*Kensit* v. *Dean and Chapter of St. Paul's,* 1905, L.R. 2 K.B.249). The public worship of protestant dissenters, Roman Catholics, and Jews in England had before 1860 been protected by a series of statutes beginning with the Toleration Act of 1689, and ending with the Places of Worship Registration Act 1855 and the Liberty of Religious Worship Act 1855. Obstructing a clergyman or minister officiating in a place of divine worship is a misdemeanour under the Offences Against the Person Act, 1861, and riotous, violent, or indecent behaviour at a burial is a like offence under the Burial Laws Amendment Act 1880.

In the United States similar acts may be punished as breaches of the peace.

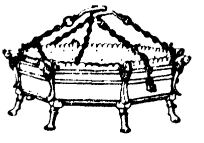
BRAY, SIR REGINALD (d. 1503), British statesman and architect, was the second son of Sir Richard Bray, one of the privy council of Henry VI. Reginald was born in the parish of St. John Bedwardine, near Worcester, and was receiver-general and steward of the household to Sir Henry Stafford, second husband of Margaret, countess of Richmond, whose son afterwards became King Henry VII. During the reign of Henry VII. he was made high treasurer and chancellor of the duchy of Lancaster. In Oct. 1494 he became high steward of the university of Oxford, and he was a member of the parliament summoned in the 11th year of this reign. His taste and skill in architecture are attested by Henry VII.'s chapel at Westminster and St. George's chapel at Windsor. He directed the building of the former, and the finishing and decoration of the latter, to which, moreover, he was a liberal contributor, building at his own expense a chapel still called by his name and ornamented with his crest.

BRAY, THOMAS (1656–1730), English divine, was born at Marton, Shropshire, in 1656, and educated at All Souls college, Oxford. Henry Compton, bishop of London, sent him in 1696 to organize the Anglican Church in Maryland, and he was in that colony in 1699–1700. He interested himself in missions among the American Indians, and was one of the founders of the Society for the Propagation of the Gospel. He also projected a successful scheme for establishing parish libraries in England and America, out of which grew the Society for Promoting Christian Knowledge. From 1706 till his death in Feb. 1730 he was rector of St. Botolph-Without (Aldgate, London). Of his writings the best known is his *Catechetical Lectures* (1696).

BRAY, a village in Berkshire, England, situated on the right bank of the Thames near Maidenhead. There are numerous riverside residences in the locality. The name is celebrated as that of a well-known ballad, "The Vicar of Bray," which tells how a vicar held his position by easy conversions of faith according to necessity, from the days of Charles II. until the accession of George I. Tradition ascribes the song to George I.'s reign, but the story is usually supposed to have first grown around Simon Aleyn, who remained vicar from 1540 to 1588. Population of the civil parish of Bray (1931) 3,096.

BRAY, urban district, Co. Wicklow, Eire, 12 mi. S.S.E. of Dublin on the Great Southern railway. Pop. (1936) 10,111. A harbour was constructed by the urban district council (the harbour authority) to accommodate ships of 400 tons. There is some industry in brewing, milling and fishing, but the town is almost wholly dependent for its prosperity on visitors from Dublin and elsewhere. Its popularity is largely based on the beauty of its surroundings, and it is rapidly increasing in size. About 1170 Bray was bestowed by Richard de Clare or Strongbow, earl of Pembroke and Strigul, on Walter de Reddesford, who took the title of baron of Bray and built a castle.

BRAZIER, a metal receptacle for holding burning coals or charcoal, much used in southern Europe and the East for warming rooms (from the Fr. *brasier*, which comes from *braise*, hot charcoal). Braziers are often elegant in form, and highly artistic in ornamentation, with chased or embossed feet and decorated exteriors.



INDIAN COPPER BRAZIER, 17TH-18TH CENTURY IT HAS IRON BANDS AND IS BRASS MOUNTED

BRAZIL, a republ of South America, the largest political division of the continent. It is somewhat larger than the United States, excluding Alaska, is nearly three times the size of Argentina, and 65 times the size of England. Its extreme dimensions from north to south are 2,695 mi. and from east to west 2,691 miles. According to the latest calculations its area is 3,286,170 sq.mi., comprising about three-sevenths of the entire South American continent.

GEOGRAPHY AND GEOLOGY

Boundaries.—Brazil is bounded by all of the South American republics except Chile and Ecuador, and its territory also touches that of the three Guianas. During the better part of the colonial period the boundaries between Brazil, or Portuguese America, on the east and Spanish South America on the west were supposed to be the line fixed by the Treaty of Tordesillas (1494), which in turn was based on the line of demarcation drawn by Pope Alexander VI a year earlier. The Portuguese were persistent trespassers in early colonial times and their land hunger led them to encroach widely on the Spanish claims. By treaties signed by Spain and Portugal in 1750 and 1777 this expansion of Brazil to the westward was recognized and the boundaries then adopted still serve in great part to separate Brazil from its neighbours.

BY COURTESY OF THE PRESBYTERIAN BOARD OF FOREIGN MISSIONS

BRAZILIAN WATER WOMAN

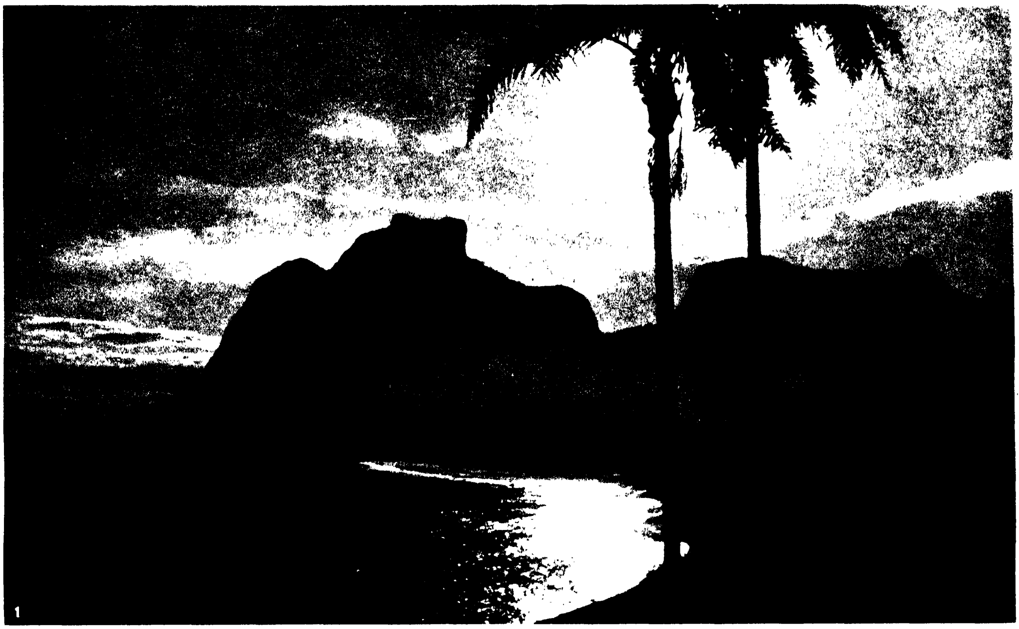
The boundary of Uruguay was settled by treaty in 1851, but was subsequently modified in 1909 when Brazil voluntarily agreed to share with Uruguay the joint control over the waters of Lake Mirim. The line between Brazil and Argentina was defined by the treaty of 1847, but a long and heated controversy arose over the ownership of a region known as Misiones adjoining the upper Uruguay river. The dispute was referred to the arbitration of President Cleveland, whose decision, handed down in 1895, favoured in the main Brazil's contentions. The boundary with Paraguay was settled by treaty in 1872. By this instrument certain territorial readjustments demanded by Brazil as a result of her victory in the Paraguayan War were recognized. A thorny dispute with Bolivia over the Acre territory was settled by the Treaty of Petropolis in 1903 through the efforts of the Baron of Rio Branco, the distinguished minister of foreign affairs. This valuable rubber district, comprising over 57,000 sq.mi., was ceded to Brazil, which in turn paid Bolivia £2,000,000 sterling and agreed to build a railway around the rapids of the Madeira river, thus giving Bolivia's rich hinterland direct access to the Amazon river. The boundary with Peru was definitely fixed by the treaty of 1910, which supplemented the treaties of 1851 and 1858. Ecuador has long claimed to border on Brazil, but her assertion has been disputed by both Peru and Colombia. In 1904 Brazil negotiated a boundary treaty with Ecuador which was to become effective only in case Ecuador could settle its boundary controversy with Peru. Hope that Ecuador might be contiguous to Brazil all but vanished when in 1927 Peru and Colombia fixed their boundaries without reference to the claims of Ecuador. A protracted controversy with Colombia, which at one time involved fully a third of the great state of Amazonas, was settled in Brazil's favour by the treaty of 1907. The boundary line with Venezuela, defined by treaty of 1859, was settled by protocols signed in 1905. The disputed boundary between Brazil and British Guiana, which involved the possession of territory of some 12,000 sq.mi., was submitted to the arbitration of the king of Italy. The decision, rendered in 1904, awarded Brazil nearly two-thirds of the area in question. The Brazilian boundary with Dutch Guiana was determined by the treaty of 1906. The boundary with French Guiana (*see* GUIANA), which had long been a subject of dispute, was settled by arbitration in 1900, the award, almost wholly in favour of Brazil, being rendered by the government of Switzerland.

PHYSICAL GEOGRAPHY

Major Physical Divisions.—A glance at the relief map of Brazil reveals two very irregular divisions of the surface: the great river basins of the Amazon on the north and the La Plata on the south, which are practically connected by low elevations in Bolivia, and a vast highland or upland region filling in the eastern projection of the continent and extending westward almost to the Bolivian frontier and southward to the plains of Rio Grande do Sul. In addition to these major divisions, which might simply be described as the Brazilian highlands and lowlands, there are a narrow coastal plain and an irregular elevation north of the Amazon and lying only partly in Brazil, known as the Guiana highlands.

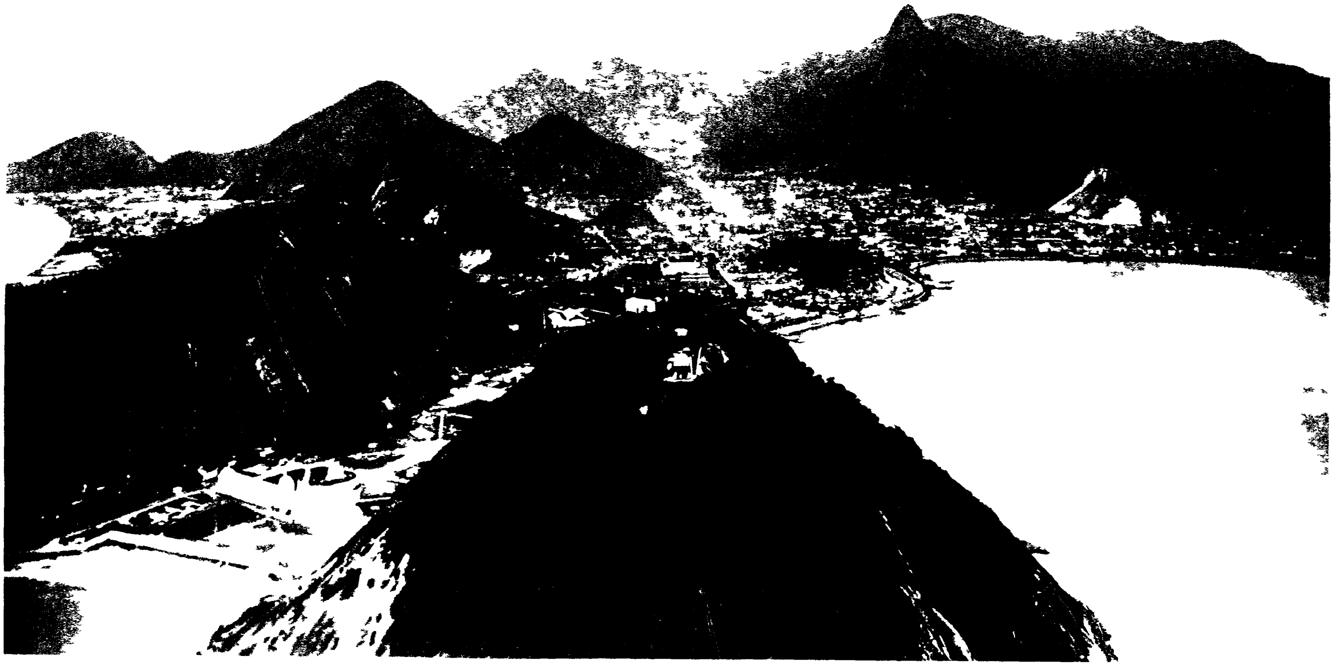
The Lowlands.—The Amazon river (*q.v.*) and its tributaries drain over a third of the area of Brazil in addition to large parts of the neighbouring republics. The two immense states of Amazonas and Pará lie almost entirely within its basin. Most of this area has an elevation of less than 800 ft. and is subject to heavy rainfall. As a consequence large regions are annually flooded. This abundant moisture, together with the equatorial heat, gives rise to the tropical forests or *selvas*. Nowhere else in the world are to be found woodlands of equal extent. The La Plata basin, on the other hand, is less heavily forested, its surface more varied, and its Brazilian sections have a much higher elevation. The southern half of Mato Grosso and large sections of the states of São Paulo, Paraná, Santa Catharina and Rio Grande do Sul are drained by the La Plata river system.

The Brazilian Plateau.—The most important physical division of Brazil is the great Brazilian plateau. It comprises over half the area of the republic. It is larger than the Argentine republic, is 7 times as large as France and 12 times as large as the British Isles. In contrast to the sparsely populated Amazon basin it is rightly characterized as the "real Brazil." In extent, population and resources it is in truth an empire in itself. In form it consists of an elevated tableland, from 1,000 to 3,000 ft. above sea level, traversed by a number of comparatively low mountain chains. The most eastern of these, known as the Serra do Mar, or Coast range, follows the Atlantic coast for nearly 1,000 miles. Though in reality little more than the eastern edge of the great plateau, as seen from the ocean it appears as a practically unbroken range of mountains. From the first it has constituted a barrier to the economic penetration of Brazil and even today is crossed by only two standard-gauge railways, and one of these, the São Paulo railway, has to use cables to make the ascent. Many sections of the Serra do Mar bear local designations. Its loftiest peak is generally designated Pedra Açu (7,323 ft.), in the beautiful Orgão mountains, which form such an impressive background to the harbour of Rio de Janeiro. The second of the mountain systems, which is separated from the Serra do Mar by a number of river valleys, is the Serra da Mantiqueira.



RIO DE JANEIRO AND NEIGHBOURHOOD

1. The coast near the harbour of Rio de Janeiro with its mountainous background as seen by moonlight
2. The Avenida do Mangue and the Mangue canal in Rio de Janeiro. The Avenida do Mangue has two roadways, lined with double rows of palms, between which runs a canal, constructed by the city for drainage purposes
3. A street in Rio de Janeiro, bordered with tall palms



PHOTOGRAPH COPR. E. M. NEWMAN R. M. P. B. E

PART OF THE HARBOUR OF RIO DE JANEIRO AND THE SURROUNDING MOUNTAINS

To the right is the Bay of Botafogo, a portion of the Harbour of Rio de Janeiro; to the left is the Atlantic Ocean. The high peak in the background is the Corcovado, from the summit of which a view of unparalleled grandeur is obtained.

The central or Goyana system lies much farther to the west, between the basins of the Tocantins and São Francisco rivers. The importance of the Brazilian plateau can hardly be overestimated.

Thanks to this highland region, partly wooded, partly open prairies or *campos*—immense areas lying geographically within the torrid zone—constitute a satisfactory and, in some cases, ideal habitat for the white race.

The Guiana Highlands and the Coastal Plain.—In addition to the great Brazilian plateau there is a mountainous region in the extreme northeast, known as the Guiana highlands. The Brazilian section belongs physically to an isolated mountain system extending eastward from the Rio Negro and the Orinoco to the Atlantic. It is in part forested and in part a hot, stony desert. Up to the present it has been a negligible factor in the progress of Brazil. The narrow coastal plain extends from Cape São Roque on the north to Rio Grande do Sul on the south. It is of varying width, and in some parts of the coast, where the Serra do Mar rises directly from the Atlantic, it disappears altogether. In the extreme south it widens greatly and is merged into an extensive rolling grassy plain characteristic of the neighbouring republic of Uruguay. On this ribbon of littoral are to be found some of the most important cities of the republic, and together with the great plateau it contains nine-tenths of the population of Brazil.

Rivers and Lakes.—Outside of the two great river systems of the Amazon and the Rio de La Plata (*qq.v.*), the rivers of Brazil are limited to the numerous small streams and three or four large rivers which flow from the great plateau into the Atlantic. Some of these rivers are navigable for a considerable portion of their course and from the earliest times they have afforded means of penetration into the interior. On the other hand their usefulness has been impaired by sand bars at their mouths, by frequent rapids and falls, and by the lowering of the water level during the dry season. The Parnahyba ("Bad River") flows northward some 900 mi., draining the entire state of Piauhy. Though broken by rapids it is navigable for some 400 mi. in sections. Of much greater importance is the São Francisco (*q.v.*), the largest river lying entirely within Brazil. Its total length is some 2,500 mi., and though broken by rapids and cataracts its course is navigable in its upper sections for nearly 1,000 mi. and for 148 mi. in its lower reaches. The chief obstacle to navigation is the 260-ft. high Paulo Affonso falls, around which the government has constructed a railway. The falls have an estimated potential horsepower of over a million. The São Francisco takes its rise in southern Minas Geraes, flows in a northeasterly direction across Baía, then turns to the southeast, entering the Atlantic at the junction of the states of Alagoas and Sergipe.

Of the rivers flowing into the Atlantic south of the São Francisco only three demand passing notice. The Jequitinhonha rises in northeastern Minas Geraes and crosses a section of southern Baía. It has a length of some 500 mi., 84 of which are navigable. The Doce also rises in Minas Geraes but reaches the sea through the state of Espirito Santo. Its deep cut through the Serra do Mar has made possible the construction of a railway along its course from the port of Victoria up into the enormously rich iron deposits of Minas Geraes. Its lower reaches are navigable for 138 miles. The Parahyba do Sul (*q.v.*) enters the Atlantic about 30 mi. north of Cape São Thomé in the state of Rio de Janeiro. It rises in the state of São Paulo and flows across the state of Rio de Janeiro, through a broad fertile valley producing coffee and sugar. Its length is 658 mi. with navigable stretches totalling 147 miles. The remaining streams emptying into the Atlantic are confined for the most part to the narrow coastal plain.

The Brazilian sections of the rivers constituting the Rio de La Plata system are of great importance. Of the Paraguay, which rises near the centre of Mato Grosso, 880 mi. are in Brazil. Of these some 600 mi. are navigable. Until the completion of the trans-Brazilian railway the Paraguay was practically the sole means of access to the great interior state of Mato Grosso. The Paraná ("Mother of the Sea") is a Brazilian river for over a third of its total length (2,800 miles). With its tributaries it drains southwestern Minas Geraes and almost all of São Paulo and Paraná west of the Serra do Mar. The southern parts of Mato Grosso and Goyaz also lie partly in its basin. The Paraná is navigable in long stretches above and below the Sete Quedas ("Seven Falls"), one of the three most famous cataracts in Brazil.

The Uruguay, the third great river of the La Plata system, rises in the Serra do Mar, flows northwestward, forming the boundary between Santa Catharina and Rio Grande do Sul, and later southwestward, forming the boundary between Brazil and Argentina. One-third of its total length of nearly 1,000 mi. lies entirely outside of Brazil. Navigation in the Brazilian section is greatly impeded by rapids.

Brazil is ill supplied with lakes. Such as exist are to be found in the coastal plain; for the most part they are lagoons and inland channels formed by uplifted beaches. The most famous are Lagoa dos Patos and Lagoa Mirim, both along the coast of Rio Grande do Sul state. The former is 124 mi. long and 37 mi. wide. At its northern end is the state capital, Porto Alegre, and at its mouth the important seaport of Rio Grande do Sul. Lagoa Mirim, which is slightly smaller, lies partly in Uruguay, and the two countries exercise condominium over its waters.

The Coast.—The coast-line of Brazil, 3,642 mi. in length, is indented with a number of almost landlocked bays, forming spacious and accessible harbours. The largest and most important are the Baía de Todos os Santos, or simply Baía, serving the metropolis of northern Brazil, and the magnificent harbour of Rio de Janeiro, or Guanabara, beside which stands the capital of the republic. These two harbours are freely accessible to the largest ships afloat. Other important harbours are those of Pernambuco, Espirito Santo, Paranaguá, and São Francisco. Pará, Santos and Rio Grande do Sul are river ports situated near the sea on rivers having the same name. Manaus, the capital of Amazonas, may also be listed among Brazilian ports. Though it lies 850 mi. from the sea, the great depth of the Amazon renders it accessible to transatlantic liners. (P. A. M.; X.)

Geology.—The older rocks in Brazil consist of intrusive masses and metamorphic rocks—granite, gneiss, quartzite, marble and crystalline schist—which, taken together, have been called the Brazilian complex. They cover in the aggregate a large area, and they are exposed conspicuously in the mountain ranges in the eastern part of the country and in the ranges that border the basin of the Amazon on the north, along the boundary between Brazil and the countries north of it—Venezuela and the Guianas. At some places they are overlaid by Palaeozoic sedimentary beds, which have been greatly disturbed. These Palaeozoic beds contain the veins of quartz that carry the gold now mined in Brazil and that were the source of the gold found in the old placers. They include also great deposits of iron and manganese, and some geologists suppose that they are the place of origin of the diamonds and the other precious stones now mined in Brazil. Silurian, Devonian and Carboniferous beds are exposed in the basin of the Amazon, which in its lower course follows the axis of a syncline composed of them. Rocks of Permian age cover an enormous area in Brazil. They consist mainly of sandstone and shale of detrital origin, but they include also extensive beds of limestone, which are cut here and there by eruptive dikes. The Permian beds in southern Brazil contain seams of coal and the remains of plants, some of which belong to the Glossopteris flora, found also in Argentina, as well as in India, Australia and southern Africa. Traces of Permian glaciation, such as erratic boulders, scratched pebbles and glacial till, are found in southern Brazil. The Triassic rocks are soft, reddish sandstone, generally in horizontal beds, which are at some places intruded by dikes of basic eruptive rock. They cover large areas in southern Brazil. Cretaceous marine beds are found in a narrow belt along the coast north of Baía and they cap hills and cover large areas inland. The Tertiary beds consist of deposits laid down along the shore and in lakes. At several places they contain lignite and bituminous shale. Aeolian deposits of Tertiary sand and clay cover large areas in Brazil, especially in the basin of the Amazon. The remarkable stone reefs along the northeast coast are ancient beaches that have been hardened by the infiltration of carbonate of lime; they are not coral reefs. (G. McL. Wo.)

CLIMATE

General Considerations.—Brazil lies almost entirely within the torrid zone, less than one-twelfth of its area extending south of the tropic of Capricorn. It is often assumed, therefore, that the climate is predominantly tropical. But happily for Brazil the effects of latitude are modified by a number of other factors, such as altitude, prevailing winds, rainfall and distance from the sea. As a consequence there are considerable variations of climate, ranging from tropical in the Amazon valley and along the coastal belt as far south as Santos, to subtropical and temperate throughout large parts of the great Brazilian plateau and the three southern states of the republic.

Conditions in the North.—The climatic differences correspond in a general way to the great topographical divisions already noted. The low, forest-clad valley of the Amazon is a region of high temperature with little variation throughout the year. The average temperature is around 80° F. and the average rainfall probably falls little short of 80 inches. The period of heavy rains extends from February to June, and the principal dry season from July to October. Easterly winds, which are deflections of the trade-winds, blow up the Amazon valley with great regularity, especially in the dry season. They are warm and moisture-laden. The westerly winds, which blow from the Andes, are cool and dry. They are felt when the sun is north of the equator. The climate of the Amazon valley has the reputation of being unhealthy. The ravages of tropical diseases, especially malaria, have retarded the exploitation and settlement of this region. But in recent years science has robbed the valley of its worst terrors. In a lengthy report submitted to the president in 1913 Dr. Oswaldo Cruz, the distinguished physician who freed Rio de Janeiro from the scourge of yellow fever, indicated that this immense region can be made a reasonably safe habitat for the white race if the same sanitation methods are employed as have been used in Rio de Janeiro, Cuba and the Panama Canal Zone.

The Coastal Plain.—Here high temperature and great humidity are the rule until the tropic of Capricorn is passed, although, thanks to the prevailing winds, the temperature is somewhat lower than in regions of corresponding latitude in Africa. The year is usually divided into a winter (*inverno*) and summer (*verao*), corresponding roughly to the wet and dry seasons, although rain may fall during any month of the year. Going southward there is a slow decrease in the temperature, while the difference between winter and summer becomes more accentuated. Frost and occasionally snow are encountered in the three southern states during July and August, and when the cold southwest storms blow from the Argentine pampas the temperature in the state of Rio Grande do Sul may drop as low as 22° Fahrenheit. The rainfall tends to decrease in volume, going from north to south.

The Brazilian Plateau.—The climatic conditions of the great Brazilian plateau differ widely from those of the Amazon valley and the coastal plain. There is much less uniformity in temperature, the difference between night and day being much greater than in localities in the same latitude along the coast. The upland region occupying the eastern projection of the continent and consisting of Piauhy and the inland parts of Ceará, Rio Grande do Norte, Parahyba and Pernambuco, frequently suffers from lack of rainfall. In some years the rainy season, which normally lasts from January to May, fails altogether. In such years terrible droughts occur. Crops fail, the livestock perishes and the exodus of a whole population takes place. In the great drought of 1877–80 a large part of the inhabitants of Ceará moved up into Amazonas. The government has endeavoured to cope with this recurring menace through extensive storage and irrigation works. The climate in this portion of Brazil is not unsuited to Europeans. Though the sun temperature is high, the nights are always cool and refreshing. South and southwest of this semi-arid plateau lie the tablelands of Minas Geraes, São Paulo and Rio de Janeiro. In this favoured region, the very heart of Brazil, live nearly 40% of the inhabitants, though it constitutes only about 12% of the area of the republic. Rainfall is adequate and the climate ranges from subtropical to temperate. The fertile soil and healthy climate have in recent years attracted a main stream of European immigration into this region, resulting in a marked increase in the white population. The states of Paraná, Santa Catharina and Rio Grande do Sul, lying within the south temperate zone, have a delightful climate and abundant rainfall. Large sections of the great interior states of Mato Grosso and Goyaz are included in the Brazilian plateau. Lying open to the sun and wind, these upland regions have a cool, bracing atmosphere even where the high sun temperature prevails. So healthy is the highland portion of Goyaz considered that the government has set aside 5,560 sq. mi. for the future capital of the republic.

The accompanying table, based on data from the official *Anuário estatístico* for 1938, indicates temperature and rainfall at representative points in different parts of the country.

Average Temperature (Fahrenheit) and Annual Rainfall

Locality	Mean Maximum Temp.	Mean Minimum Temp.	Annual Rainfall (in.)
Amazon and Plata basins:			
Manaus	89·24	75·56	68·0
Belém	88·88	72·14	110·4
Cuyabá	90·68	68·0	54·7
Littoral:			
Olinda (Pernambuco)	83·48	73·94	60·4
Ilheus (Baía)	82·52	69·08	83·2
Rio de Janeiro	78·26	67·82	41·2
Santos	79·10	65·48	90·2
Highlands:			
São Lourenço (Minas)	80·06	53·6	63·4
Piquete (S. Paulo)	80·42	59·36	69·0
Curityba	73·22	53·06	53·2
Santa Luzia (Goyaz)	82·76	57·56	71·1

Fauna and Flora.—The most noteworthy and characteristic examples of Brazilian fauna are to be found in the Amazon valley and are dealt with in AMAZON: *Flora; Fauna* (*q.v.*). While the Atlantic littoral and the Brazilian highlands are moderately rich in animal life all the important species found here are likewise represented in the Amazon basin. This last statement is somewhat less true of the Brazilian flora. Along the coastal plain and in the subtropical and temperate regions of the republic are many kinds of trees and plants rarely if ever found in the Amazon valley. Especially is this true of the economic plants and fruits of Brazil, both indigenous and exotic, such as coffee, sugar-cane, tobacco, maize, rice, maté and a great variety of palms. A brief account of these plants will be found later in this present article in the section dealing with agricultural resources and industries; while other details are available in the articles devoted to the individual states. (P. A. M.; X.)

PEOPLE

The Indian.—Brazil was discovered and settled by the Portuguese, who gave the country its language and basic racial type. The first explorers found a widely scattered Indian population, relatively low in the scale of civilization. Lack of white women quickly led to a fusion of the early colonists with Indian women and to the creation of a mestizo or *mameluco* type, some traces of which yet remain in northern Brazil. The pure Indian of the coast was either killed off or absorbed into the population, and today full-blooded Indians are found only in the more sparsely populated areas of the interior.

APPROXIMATE RACIAL COMPOSITION OF BRAZIL
(Based on estimates by Charles A. Gauld, in *Journal of Geography*, April, 1941)

Indians and Mestizos (pure Indians, 2·2%)	17·7%
Negroes and mulattoes (full-blooded Negroes, 5 to 12%)	37·2%
Whites (chiefly Portuguese stock, 12·8%; chiefly Italian stock, 8·9%; other South European stock, 8·4%; chiefly German stock, 2·6%; miscellaneous and uncertain, 11·7%)	44·4%
Japanese and other Orientals	0·7%
	100·0%

The Negro.—Introduction of African slaves into Brazil began late in the 16th century, and, although the slave trade was outlawed in 1831, it continued until after 1850. The census of 1872 showed 19·7% Negroes and 38·3% "mixed" (*i.e.*, mulattoes) out of a total population of 9,930,478. The 1890 census gave 14·6% and 32·4%, respectively. No subsequent census has enumerated racial groups, and close calculation of present proportions is impossible due to the influx of white immigrants and to the higher infant mortality rate among Negroes. The only official figures indicating racial distribution are the birth reports for the federal district, where 74·6% of the births in 1937 were white, 18·8% mulatto, 5·1% Negro, 1·5% others and unknown. Unofficial estimates of racial distribution are approximations only. (*See* accompanying table.)

The Immigrant.—The racial character of the people is by no means uniform throughout the country. Whites predominate in the southern states, Indians in the Amazon and mulattoes and Negroes in the central and northern coast states. The rapid increase of white population in the south has been due to the stream of European immigration which has poured into that section. The introduction of immigrants from Europe dates from 1818, when a colony of Swiss was located at Nova Friburgo, near Rio de Janeiro. Between 1820 and 1889, some 880,616 immigrants entered the country. Since the latter date the rate has been tremendously accelerated, with a total of 3,722,798 in the 48 years from 1889 to 1937 inclusive. The newcomers have either been located in so-called "colonies," where they remain under government tutelage until they become financially independent, or placed on the large plantations under formal contract.

Italians have constituted the largest single group, 32·6% of all immigration from 1820 to 1937, followed closely by Portuguese (30·3%), then by Spaniards (12·9%), Germans (4·9%), Japanese (3·9%) and Russians (2·5%).

The Portuguese, Italians and Spaniards have been readily absorbed, but owing to the concentration of the German elements in a few areas, their assimilation has been slow, giving rise to serious doubts on the part of many as to their loyalty to their adopted country.

Recent legislation therefore has imposed restrictions on new immigration.

Only 2% of the total of any given nationality entering in the 50-year period 1884–1933 may enter in any one year, and no foreign nuclei or colony may have more than 25% of any one nationality or less than 30% of Brazilians.

States and State Capitals	Area (sq. mi.) 1940	Population Census 1920	Population Census 1940
Distrito Federal	451	1,157,873	1,781,567
Alagoas (Maceió, mun., 91,358)	11,031	987,748	957,628
Amazonas (Manaus, mun., 109,302)	705,017	363,166	438,008
Baía (Salvador, mun., 294,253)	204,393	3,334,465	3,938,909
Ceará (Fortaleza, mun., 182,241)	57,371	1,319,228	2,101,325
Espírito Santo (Vitoria, mun., 46,057)	16,543	457,328	758,535
Goyaz (Goiânia, mun., 48,884)	255,266	511,919	832,866
Maranhão (São Luiz, mun., 86,546)	133,674	874,337	1,242,721
Mato Grosso (Cuyabá, mun., 54,770)	570,286	246,612	434,265
Minas Gerais (Belo Horizonte, mun., 211,650)	226,170	5,888,174	6,798,647
Pará (Belém, mun., 208,706)	526,241	983,507	956,870
Parahyba (João Pessoa, mun., 95,386)	21,591	961,106	1,432,618
Paraná (Curityba, mun., 142,873)	77,180	685,711	1,248,536
Pernambuco (Recife, mun., 352,727)	38,322	2,154,835	2,694,616
Piauhy (Teresina, mun., 68,520)	94,819	609,003	826,320
Rio de Janeiro state (Nictheroy, mun., 143,394)	16,372	1,559,371	1,862,900
Rio Grande do Norte (Natal, mun., 55,242)	20,236	537,135	774,464
Rio Grande do Sul (Porto Alegre, mun., 275,678)	105,088	2,182,713	3,350,120
Santa Catharina (Florianópolis, mun., 47,149)	36,679	668,743	1,184,838
São Paulo (São Paulo, mun., 1,318,539)	95,459	4,592,188	7,239,711
Sergipe (Aracajú, mun., 59,460)	8,319	477,064	545,962
Território do Acre (Rio Branco, mun., 16,264)	57,153	92,379	81,326
Serra dos Aimorés*	3,435	....	67,103
	3,286,170†	30,644,605	41,565,083

*Territory in dispute between Minas Gerais and Espírito Santo.
†Includes 5,065 sq mi. of lake area in Rio Grande do Sul.

Population Statistics.—The census of 1920 gives a population of 30,635,606, including 1,565,951 foreigners. The density of population for the country as a whole was 9·3 per square mile in contrast with 649 per square mile for England and Wales and 44.2 in 1940 per square mile for the United States. The population is very unevenly distributed, being largely concentrated on a relatively narrow strip of coastal plain and the eastern portion of the central plateau.

The three states of Amazonas, Mato Grosso and Pará, comprising over half the area of the country, contain less than one-twentieth of the population.

On the other hand, were the entire republic as thickly populated as the state of Rio de Janeiro the total population of Brazil would exceed 400,000,000.

The accompanying table gives the names, areas and population of the 20 states, the territory of Acre, and the Federal district, together with the names and population of their capitals.

POLITICAL ORGANIZATION

Organization of the Government.—The overthrow of the monarchy on Nov. 15, 1889 resulted in the creation of a Federal republic under the name of the United States of Brazil (Estados Unidos do Brasil).

The new republic's first constitution, promulgated Feb. 24, 1891, was amended in 1926 and superseded by a new constitution in 1934, one which was, however, in many respects a restatement of the old. In the main these constitutions followed the constitution of the United States of America.

A federal form of government was established and relations between national and state governments carefully defined, with the latter possessing all rights not expressly denied them, including that of levying export taxes. The trend was toward greater centralization, however. Thus, the amendments of 1926 gave the federal government the right to intervene in the states for a variety of reasons. The constitution of Nov. 10, 1937, however, in effect abolished states' rights and established a definitely centralized government.

The Executive Power.—Under the constitution of 1937, the president is the supreme authority of the state. His position, already great under the previous constitution, has been immensely strengthened.

"The president of the republic, the supreme authority of the state, co-ordinates the activity of the representative organs of higher grade, directs internal and foreign policies, furthers legislative policies of national interest, and superintends and administers the country" (paragraph 73). He has the right to propose legislation, to veto projects passed upon and sent to him by the parliament, subject only to a two-thirds over-riding vote in both houses, and to nominate a successor. The president is selected by an electoral college for a six-year term or by a plebiscite if the incumbent president exercises his right of nomination.

Aspirants for the office must be native-born Brazilians at least 35 years of age. The president is assisted by a cabinet of ministers who head the departments of justice and internal affairs; foreign relations; treasury; transport and public works; agriculture; navy; war; labour, industry and commerce; education and public health; and aviation, the last-named having been created by decree of Jan. 20, 1941.

Legislative Power.—The legislative power is exercised by a national parliament, with the collaboration of the council of national economy and of the president.

The parliament, composed of a chamber of deputies and a federal council, convenes annually on May 3 for a four-month session, but sessions may be prolonged, suspended or convoked by the president.

Members of the chamber of deputies are elected by electoral boards in the municipalities and serve four-year terms. All tax legislation and any increased appropriations must be discussed first in the chamber of deputies.

The federal council comprises one representative for each of the 20 states, chosen by its legislative assembly for a six-year term, and ten members appointed by the president. Legislation relating to international treaties, foreign and interstate commerce, and the regulation of ports and coastal navigation must originate in the council. The executive, however, possesses the right of legislative initiative and only he can initiate laws concerning taxes or involving increase in expenditures. Other bills may be proposed upon motion of at least one-third of the members of either house.

The president shares legislative functions, too, through power to issue decree-laws and through other controls. The national economic council, made up of representatives of various branches of national production, was in 1941 in an embryonic stage, and many of its activities remained to be determined by legislation. Its broad purpose however, is to further a system of planned economy and to eradicate labour disputes through creation of syndicates.

As it stands, the council is now *consultative* only, but under article 63, it may assume legislative powers in matters under its jurisdiction through a plebiscite held at the initiative of the president. "Thus," comments the great scholar Martin, "is laid the legal basis for the gradual transformation of Brazil into a corporative state in fact as well as in name."

Judicial Power.—The judiciary consists of a federal supreme court of 11 judges, state courts organized and appointed by the states, and military judges and tribunals. The courts may declare unconstitutional federal laws and acts of the president, but if the law or act is subsequently confirmed by two-thirds of both chambers of parliament, the decision of the courts is nullified.

State and Local Government.—Under the constitutions of 1891 and 1934 Brazilian government was federal in form and in practice. The 20 states enjoyed a large measure of autonomy, and direct federal control was exercised only in the federal district and in Acre territory.

The constitution of 1937 expressly declares Brazil to be a federation, but actually it enormously abridges the rights of the states The president has the right to intervene upon any of numerous pleas. States may not contract external loans without consent of the federal council. Their right to levy export taxes, once a principal source of revenue, is restricted, and such taxes may not exceed 10% ad valorem. Educational control, formerly vested chiefly in the states, is practically taken from them. The central government has the right under some circumstances to merge two or more states into one, or even to reduce a state to the status of a territory.

Education.—During the colonial era in Brazil, education was greatly neglected, and almost the only schools were those maintained by the Jesuits. After the expulsion of the Jesuits from Portuguese territory, attempts were made by the Portuguese government to develop a system of elementary schools, but with scant success. The transfer of the Portuguese court from Lisbon to Rio de Janeiro in 1808 had little effect on elementary education; the Portuguese monarch did, however, stimulate higher education, founding two schools of medicine, one at Bahia, the other at Rio de Janeiro, a military academy, a school of arts and two of arts and crafts.

With the independence of Brazil a move for public education slowly got under way, and a law of 1827 prescribed the founding of elementary schools, although actual achievement was quite limited. In 1834 control of primary and secondary education was turned over to the provinces (the later states), and only higher education and the elementary and secondary schools of the capital city were financed by the imperial government. Four years later the imperial high school (*lyceu*), later the Collegio Pedro II, was founded in Rio de Janeiro and came to serve as a standard for secondary schools in the provinces. By 1845 three normal schools were in existence, at Nictheroy, Baía and Ceará

As late as 1872 Brazil with a population of 10,500,000 (including 1,500,000 slaves) had only 130,000 pupils in elementary schools. Various attempts to improve the situation were largely abortive, and at the fall of the empire there were no more than 250,000 pupils out of the 13,000,000 population. At that time the proportion of new pupils was 18 to each 1,000 inhabitants; by 1920 it had risen to 41 and to 52 in 1929.

The greatest strides in education have been made since 1930. To a large degree the groundwork had been laid in the 1920s, but the subsequent period was marked by reorganization and by increased federal participation in the control of education. The constitution of 1934 required that a minimum of 10% of municipal and 20% of state revenues be devoted to the maintenance and development of the educational system. Especially after 1937 the federal government put stress on the "Brazilianization" of immigrant and immigrant-descended groups who had clung to their mother tongue.

Teaching in foreign languages was prohibited and other, similar steps taken.

Under the republic education is free, but until 1937 it was not compulsory except by state action. An official investigation in 1922 disclosed that 71% of the children of school age in the entire country were without school facilities, ranging from 95% in two states (Goyaz and Piauhy) to 43% in Santa Catharina and 41% in the federal district. The proportion of illiteracy among persons over 15 years of age was 79·1% in 1872 and 64·9% in 1920. By 1932 this had been reduced to 52·1% and in 1940 was officially declared to be less than 50%.

As it is at present constituted, the educational system of Brazil is a composite of federal centralization and state autonomy with a strong trend toward the former. The ministry of education and the national council of education have supervision over secondary schools, certain universities and professional schools, research institutes, and commercial and vocational institutions. The national council itself is advisory in nature.

Primary Education.—The states still retain control over elementary and rural education, but the national policy has been to foster uniformity through subsidies and advisory services. Normal schools are mainly under state control. From a total of 12,742 schools with 1,249,440 pupils in 1920, Brazil's elementary school system has expanded until in 1936 there were 36,661 schools and 2,670,000 pupils, and, in 1940, 43,500 schools with an estimated 3,400,000 pupils.

Secondary Education.—Secondary education is under national control. Most of the secondary schools are privately conducted but under an increasingly close government supervision The liberal arts high school course is five years in duration, but university preparation requires an additional two years. This latter, the *collegio universitário*, is usually under direct university control. Secondary school enrolment in 1930, it is officially asserted, did not exceed 30,000 in the regular secondary schools and 60,000 in all special schools; by 1936 the total was 200,000.

Higher Education.—Brazil has nine institutions of higher learning, including universities embracing several different branches. The leading university is the Federal university of Brazil in the environs of Rio de Janeiro, created in 1937 as a successor to the old University of Rio de Janeiro. The universities offer advanced work in such fields as engineering, law, medicine, fine arts, education and business. In addition, the federal and state governments maintain several research institutes and professional schools of mining, agriculture and the like. Notable among these last are the Minas Gerais State School of Mines, at Ouro Preto, and the São Paulo Biological institute.

Museums, Art Galleries and Libraries.—Several museums and other institutes of note are located in Rio de Janeiro. The National museum occupies the Quinta da Boa Vista, once the residence of the Emperors Pedro I and Pedro II. The National library, founded in 1808, is among the best in South America, and numbers among its treasures one of the original Gutenberg Bibles. The National Academy of Fine Arts possesses collections of the old masters as well as many works of Brazilian artists, notably those of Pedro Americo de Figueiredo. The Botanical Garden contains over 5,000 species of plants from all over the world. Away from Rio de Janeiro the Museu Paulista (Paulista museum), on the outskirts of São Paulo, is noted for its superb natural history collections.

Learned Societies.—No country in all Latin America has so many active and long-established learned societies as Brazil. The Brazilian Academy of Letters, founded in 1889, is modelled on the French academy. The Brazilian Historical and Geographical society, founded in 1838, is the oldest historical society in South America and the oldest such national organization in the New World. Most of the states maintain historical and geographical societies of varying calibre, the best being that of São Paulo.

RELIGION, CHARITY AND PUBLIC ASSISTANCE

Under the empire the Roman Catholic Church had been recognized and supported by the state, but with the advent of the republic (1889) Church and state were entirely separated. Civil marriage, the civil registration of births and deaths, and the secularization of cemeteries followed. Yet the overwhelming majority of the Brazilians are at least nominally Catholic, as is also true of the bulk of the immigrants. Ecclesiastically Brazil is divided into 17 archdioceses, 54 dioceses, 23 prelacies and 2 prefectures. The archbishop of Rio de Janeiro was raised to the dignity of a cardinal in 1905. Complete religious toleration has long prevailed in Brazil, and Protestantism has made some progress, especially in education. Official statistics show 646 Protestant churches and 167,457 actual members in 1935. A third of all Protestants are members of the German Evangelical church.

Until recent years charity and social assistance were primarily in the hands of the Roman Catholic church, but federal and state government activity and expenditure in this field are rapidly increasing.

FINANCE

The Monetary Unit.—The monetary unit of Brazil is the milreis, usually rendered for larger transactions in terms of contos, or thousands of milreis. At the beginning of the 20th century, the gold milreis was valued at 27*d.*, but gold was the actual basis only for international and a few other transactions. Between 1900 and 1910 the paper milreis sank to below 6*d.* at times, but was valued at 31·8 cents, approximately 16*d.*, from 1910 to 1914. Following the war of 1914–18, it declined to an average of 11·76 cents for the period 1921–25, rising to 14·44 cents in 1926, but declining almost immediately thereafter. In 1926 and 1927 the government undertook to put the national finances on a gold basis, and in the latter year established a gold milreis of 200 mg. of gold 9/10ths fine (equal to 6*d.*). This quickly proved impossible of maintenance, however, and the paper milreis, the actual standard of value, gradually depreciated.

On Aug. 12, 1931, when the milreis had sunk to less than 60% of its theoretical value, the government inaugurated a system of exchange control and required that all foreign exchange transactions be conducted through the Bank of Brazil. Since that date some type of exchange control has intermittently been enforced. In addition to the official foreign exchange market, there has been a so-called free market, with the milreis valued at lower than the official rate, and sometimes two or more such free markets (three in 1941). Exporters have been required to sell a certain percentage of their export bills to the Bank of Brazil at the official rate; the remainder they were permitted to dispose of in the free market, where more milreis to the unit of foreign currency could be realized. The percentages have varied from time to time and according to the type of commodity covered. In 1937 a 3% tax on all foreign exchange was imposed; a year later this was raised to 6%. In June 1941, the official milreis was valued on the New York money market at 16½ to the dollar; three different types of free milreis ranged in value from 20·7 to 19·77 to the dollar.

On Dec. 31, 1940 the amount of currency in circulation, as reported by the Bank of Brazil, was 5,185,000 contos, 53% more than in 1928.

Public Revenues and Expenditures.—From the beginning of Brazil's existence as an independent state until recent years the national treasury has depended upon customs duties for its chief revenues. This dependence, however, has become relatively less, as the needs of an increasingly centralized government have compelled the tapping of new sources of income. In 1935 customs duties provided 35·8% of all federal revenues, consumption and excise taxes 20·5%. Four years later (1939), the proportions were almost exactly equal, and, following the outbreak of war in Europe in 1939 and its disruption of international trade, the 1941 budget calculated consumption and excise taxes to yield nearly 17% more than customs duties (*see* below). The income tax, instituted in 1924, was for a time of but minor importance; it has now, however, so increased that it yields over 10% of all revenues.

Until 1937 the federal government levied no export duties, such taxes being within the province of state finances. It had however, in 1941, the right to levy on coffee exports, while state export taxes were restricted to 10% ad valorem and under a decree of 1940 were to be progressively, and finally entirely eliminated over the four-year period 1940–43.

In terms of milreis, government receipts and expenditures have quadrupled since 1927 and are over six times their respective totals for 1922. Since 1927, when there was a surplus of 13,000 contos, expenditures have steadily exceeded revenues. The following table shows the distribution of revenues and of expenditures for the years 1938 to 1941, those for the last two years being based on budget estimates, and the total of federal receipts and expenditures for the years 1935 to 1941 (in thousands of contos).

Revenue Sources	Percent			
	1938	1939	1940	1941
Customs duties, port taxes, dock dues	27·1	27·2	26·4	23·9
Consumption taxes	22·0	27·2	26·4	28·0
Stamp taxes on commercial and other paper	6·1	7·1	7·3	8·0
Industrial revenues	10·8	11·5	12·8	12·5
Income taxes	7·4	8·5	9·4	10·5
Others	6·4	5·4	7·3	6·1
Extraordinary revenue (*i.e.*, mining, taxes on industry and professions)	20·2	13·1	10·4	11·0
	100·0	100·0	100·0	100·0
Distribution of expenses				
Finance (including public debt service)	29·0	30·5	27·3	28·5
Transportation and Public Works	26·3	24·5	24·7	25·3
War	19·2	18·7	18·3	17·6
Navy	11·2	7·3	7·5	7·2
Education and Public Health	5·6	7·5	7·3	7·0
Justice	3·4	3·7	4·6	4·6
Agriculture	2·4	3·1	3·9	3·0
Labour, Industry and Commerce	1·6	2·7	3·9	3·7
Foreign Relations	1·2	1·5	1·5	1·4
Others	0·1	0·5	1·0	1·7
	100·0	100·0	100·0	100·0

Total Expenditures and Revenues (*in thousands of contos*)

Year	1935	1936	1937	1938	1939	1940	1941
Revenues	2,723	3,127	3,462	3,879	3,795	4,209	4,125
Expenditures	2,872	3,226	4,143	4,735	4,334	4,421	4,881
Annual Deficit	149	98	681	855	539	212	756

External and Internal Debts.—Brazil's record on debts was, on the whole, quite a creditable one until 1931. During the 1920s, however, both the federal and the state governments indulged in an orgy of foreign borrowing, for the purpose of internal improvement and for the maintenance and control of the price of coffee. In 1931 and 1932, however, the federal and state governments, as well as several municipalities, defaulted on their bond issues. Partial service was resumed in 1934, but suspended again in 1937. As of April 1, 1940 a new amortization plan was put into effect. Under it annual payments of principal and interest approximating $20,000,000 were pledged for a four-year period. On March 31, 1940, the total foreign debt, as officially reported in sterling, was £255,785,330, of which £154,401,458 was federal, £77,135,973 state, and £24,247,899 municipal indebtedness. Sterling bonds represented £156,199,273, dollar bonds £89,065,036 (or approximately $432,540,000). The remainder was payable in francs or in Dutch florins. In addition to the foregoing, there is a funded debt of about 4,250,000 contos, and a floating debt.

Foreign Investment.—Foreign capital, especially British, has had an important role in Brazilian economic development. In 1939, on the basis of London stock-exchange quotations, British investment in Brazil was computed at £259,417,990. Other estimates, based on actual rather than stock-market value, place direct investment alone at $500,000,000 (not including the above-noted bond issues), consisting chiefly of railways, meat-packing plants, gold-mines, department stores and fazendas. Direct United States investment is much less, and is estimated to be around $200,000,000, over a third of it in electric power, the balance chiefly in meat-packing, automobile assembly plants, and miscellaneous manufacturing, rubber plantations, and manganese properties.

DEFENCE

Army.—As of 1938 the army consisted of 5,475 officers, 1,053 reserve and 299 probationary officers, and 74,284 privates, organized into 56 infantry, 20 cavalry, 32 artillery, 16 engineering, and 7 aviation units. There were 3 military schools and 1 military academy, 1 staff college, and 30 other educational institutions, and 21 military hospitals, sanatoriums and laboratories, and 10 arsenals and arms factories.

In 1940 and 1941 very heavy increases were made in the Brazilian military establishment. Late in 1940 unofficial sources estimated the Brazilian army as 79,820 officers and men, with a reserve of 258,313, a fourth of which was state militia.

Navy.—As of 1938 the navy consisted of two 19,000-ton battleships, the "Minas Gerais" and the "Sao Paulo," each with a personnel of about 1,100, 2 small cruisers, 8 torpedo-boat destroyers, 4 submarines, 2 tenders, 4 minelayers, 3 monitors, 4 despatch boats, 3 tankers, 9 other auxiliary boats, and a naval training ship, with a total tonnage of 81,958 and normal complements of 6,192 officers and men. The total naval personnel was 1,116 officers and 15,251 warrant officers and ratings. By 1941, one new cruiser and several auxiliary boats had been added, and official policy was for further naval expansion.

Aviation.—The army and navy formerly maintained separate air forces; but on Jan. 20, 1941, a new cabinet portfolio was created, the ministry of aviation, with full control of military and civil aviation. The government maintains an aircraft factory at Lagoa Santa (Minas Gerais), where 40 military training planes were built in 1940, using motors imported from the United States. Brazil had 214 military and naval planes in 1940. A hundred additional planes were on order in 1941.

Government policy is to build up a reserve force of air line aviators. In addition the army air force has in the past been used to supplement the civil air-mail service, carrying mail at regular rates to isolated points of the interior. In 1941, there were 512 regular landing fields in the country.

RESOURCES, PRODUCTION AND TRADE

Brazil is essentially an agricultural country. Of its 2,000,000,000 ac. only some 4% is actually cultivated, the remainder being grazing, forest and economically valueless land. Between one-half and two-thirds of the cultivated area lies in the three states of São Paulo, Minas Gerais and Rio Grande do Sul. Most of the rest is to be found in the states of the extreme south and along the coastal plain.

Cereals and Starches.—Cereals—maize, wheat, oats, barley and rye—are grown in Minas Gerais and in Rio Grande do Sul and in other southern states. Brazil is second in western hemisphere production of maize, which contributes 17% of all agricultural values, and usually provides a slight export surplus. Potatoes and beans are grown extensively in many parts of the country, while large quantities of manioc, an indigenous tuber from which a flour is milled, and rice are raised extensively along the coastal plain. Rice production has more than doubled since 1930, and Brazil is now the leading grower in the Americas.

Sugar.—Sugar has been cultivated in Brazil since 1502. In the 17th and 18th centuries Brazil was the principal source of world supply, and through most of the 19th century sugar provided a fifth of all export values. Domestic markets, however, absorb (1941) most of the annual output. Pernambuco is the leading sugar state, but São Paulo, Minas Gerais, Rio de Janeiro, Alagoas and other states are also heavy producers.

Cotton.—Cotton cultivation has shown phenomenal advances in recent years. In the early 19th century it contributed heavily to export values, accounting for 29·4% in 1866 and 24·3% in 1872. Production continued to increase but not in proportion to population, and from 1891 to 1930 less than 3% of all exports was cotton. With the 1930 coffee crisis, however, new emphasis was placed on cotton, and in 1939 Brazil ranked as fourth in world production, supplying 7½%. The northeastern states and São Paulo are the heaviest producers, and cotton accounts (1941) for 20% of all exports.

Coffee.—Coffee has long dominated the agricultural picture in Brazil. It was first introduced into Brazil in 1727 and by the 19th century had become an important factor in the economic development of São Paulo state. Between 1831 and 1840, it supplied 43·8% of all export values, increasing to 64·5% in the decade from 1891–1900. From 1901 to 1920 around 52% of exports was made up by coffee. The proportion then rose to 69·6% for 1921–30, and 71·6% and 73·1% in 1931 and 1932. In succeeding years, however, owing to world over-production, coffee progressively declined as an export factor, accounting for only 39·9% of exports in 1939 and 32·11% in 1940, the lowest proportion in over a century. The industry was stabilized to some extent, however, by the Inter-American Coffee Quota agreement of 1940, under which Brazil was allotted a quota of 60% (9,300,000 bags of 132 lb.) of the coffee imports of the United States and 7,813,000 bags for export elsewhere. Under pressure of the glut in world markets, Brazil resorted to destruction of parts of the coffee crop and to other measures, and furthered intensive investigations, with some success, into the use of coffee in plastics. In June 1941 the first coffee-plastic factory commenced operations.

Brazil is the world's leading coffee producer, growing two-thirds of the entire world crop, and far outstrips her nearest rival, Colombia. Over two-thirds of Brazil's coffee is grown in São Paulo, half the remainder in Minas Gerais. Espirito Santo and Rio de Janeiro states are also important producers. Around 55% of coffee exports go to the United States. (*See* COFFEE.)

Other crops.—Cacao, in which Brazil is the world's second producer, is grown in the more tropical sections of the country, especially in Baía state. Other agricultural crops include tobacco, bananas and tea. Tea was first introduced into Minas Gerais in 1840. For a time its cultivation expanded with some rapidity, but declined after 1888. In 1938 São Paulo and Minas Gerais produced 162 metric tons, a quantity adequate for domestic demands, with some surplus for export.

Forest Industries.—Over half the area of Brazil is forest, and from this as yet scarcely tapped treasure house comes a relatively small but nonetheless important portion of Brazilian income. The largest single forest commodity is timber. Pine from the southern states makes up 80% of the volume and a seventh of the value of the annual output of wood. Cedar and a variety of cabinet-woods are also important.

Aside from timber the most important forest-product is carnauba wax. This wax, produced commercially only in Brazil, is extracted from the leaves of the carnauba palm in the semi-arid northeastern states of Ceará, Rio Grande do Norte and

Agricultural Production of Brazil
(Principal cultivated crops)
In thousands of metric tons, with value in 1,000s of contos.

Crop	1931–35 Average		1938		1939	
	Weight	Value	Weight	Value	Weight	Value
Coffee	1,480	1,758	1,326	1,893	1,324	1,894
Raw cotton	184	539	437	1,504	420	1,487
Corn	5,471	987	6,081	1,428	5,033	1,304
Rice	1,204	308	1,327	772	1,502	876
Manioc	4,075	420	5,355	553	6,509	680
Sugar cane	16,222	355	16,092	307	18,970	475
Oranges	982	311	1,238	307	1,248	368
Beans	719	222	835	358	784	337
Cottonseed	430	154	1,047	354	1,001	342
Tobacco	98	108	79	175	87	216
Potatoes	363	135	330	138	330	133
Cacao	103	110	136	130	147	147
Bananas	1,431	110	1,539	113	1,162	116
Castor seed	90	36	171	87	126	64
Wheat	151	56	170	82	183	90
Grapes	56	214	82	212	90	184
Alfalfa	145	34	156	43	147	41
Coco nuts	64	23	71	83	92	34
Pineapples	126	22	144	25	138	26
Rye	17	5	17	6	21	8

Baía. In 1939, 11,443 tons (43% over the 1931–35 average), valued at 119,627 contos, were produced, 74% of the export going to the United States. A similar palm, whose exploitation as a source of wax is very recent, is the uricuri, found in the same general area.

Next to carnauba in value is the Brazil nut, which grows in Pará, Amazonas and other sections of the Amazon basin. From 30,000 to 40,000 tons are produced annually (1939: 35,102 tons, valued at 61,644 contos). The babassu palm, the coconut, and the citicica tree contribute valuable vegetable oils.

Paraguay tea, or yerba maté (herva-mate in Portuguese), called Brazilian tea in Brazil, is extensively exploited for domestic consumption and for export to Argentina. Increased development in Argentina, however, has resulted in a one-third reduction from the 1929 output of 127,400 tons.

Seventeen different medicinal plants are systematically exploited. These include cinchona, copaiba, derris and timbó (both of them for their heavy rotenone content), and pyrethrum.

Livestock.—The livestock industry in Brazil is nearly as old as the country itself, dating from 1530. In 1822 Brazil had 5,000,000 head of cattle, but until the 20th century hides and some dried meat were the only livestock products exported. The first exportation of fresh beef was in 1914; two years later, under the stimulus of war demands, the annual total had risen to 33,700 tons of frozen beef. Shortly thereafter large-scale canning began, and, in 1939, beef exports totalled 83,200 tons, of which 38,200 tons were canned. Meat is the most important primary product of Brazil, with an annual output valued in excess of 2,250,000 contos, or some 15% more than that of coffee. Livestock is raised in nearly all parts of the country, but the great centres of the industry are in the central and southern states.

Fisheries.—The fishing industry is still in its infancy. There are vast fishing banks and grounds in the rivers and sea, wherein may be found an eighth of the 20,000 known species of fish. An estimated 31,300 boats of all sizes are engaged in fishing for piracurú, a six-foot fish of the Amazon, sea-cow (manatee), albacore, and many other varieties of fish and other marine animals, mostly for domestic consumption. Dried shrimp, oysters, and frozen and canned fish are exported in fair quantities.

Mineral Wealth.—Brazil's mineral resources are among her least developed assets. Although more than 20 important metals are found, only gold, iron and manganese are produced in any quantity (1939 production values, 214,206 contos, 191,000 contos, and 25,000 contos, respectively). Bauxite is being developed. The greatest mineral assets are iron and coal. In 1940 credits were obtained from the United States to erect a huge steel mill with a capacity to produce two-thirds of the domestic demand, using Brazilian coal. In 1939, 1,046,975 tons of coal, valued at 54,288 contos, was mined. Other non-metallic production included cement (159,000 contos value in 1939), salt (32,890 contos), diamonds (23,560 contos), rock crystal (10,096 contos) and mica (7,891 contos).

Geological investigations have disclosed the presence of probable oil-bearing substrata in Baía, Alagoas and Acre territory, but prospecting was without success until 1939, when oil was brought in at Lobato in Baía state. In 1940 the production of the new field was estimated at 40,000 bbl.

Manufactures.—For over half a century the avowed policy of the Brazilian government has been to encourage manufacturing through protective tariffs. A government partial census in 1938 showed there were 65,000 employers and 1,200,000 workers in various industries. Foodstuffs (27·6%), piecegoods (25·3%) were the most important products, followed by glass, porcelain and ceramics; leather goods; metallurgical goods; chemical products; apparel; paper and cement. Virtually the entire production value of 12,000,000 contos is for domestic consumption, with only nominal amounts of foodstuffs and miscellaneous articles going to neighbouring countries. São Paulo accounts for 46·5% of manufactured values, the federal district, 19·4%, with Rio Grande do Sul, Minas Gerais, Rio de Janeiro, Pernambuco, Paraná and Santa Catharina producing almost all the remainder.

Foreign Trade.—Brazil's exports are practically without exception primary products. The country has long depended heavily on coffee as its principal source of foreign exchange, but the trend since 1932 has been toward development of diversified exports. Coffee has made the United States Brazil's chief customer, putting that country far in the lead. The United States, too, has long led as a supplier of Brazilian imports, but usually by a narrow margin, followed closely by Great Britain and, during the 1930s, Germany. Brazilian imports, with the exception of wheat, from Argentina, and fuels, are almost entirely manufactured goods. The Netherlands West Indies is a principal supplier of petroleum. The European countries and the United States send mainly manufactured articles, although considerable fresh and canned fruits are also imported from the United States. The accompanying tables indicate the principal countries of destination and origin of exports and imports and the chief commodities involved.

Foreign Trade of Brazil, 1938, 1939, 1940

	1938	1939	1940
Total exports (in contos of reis)	5,096,890	5,615,519	4,960,518
Total imports (in contos of reis)	5,195,570	4,983,632	4,964,140

Six leading export (% of whole)				Six leading import commodity groups (% of whole)			
	1938	1939	1940		1938	1939	1940
Coffee	45·1	39·8	32·1	Machinery and tools	21·2	19·9	15·1
Cotton	18·2	20·7	16·9	Wheat	10·4	7·1	9·5
Meats	1·7	1·8	9·4	Steel and iron goods	7·3	8·9	8·9
Hides and skins	4·1	4·4	4·4	Automobiles	4·7	5·7	6·3
Cacao	4·2	4·0	3·9	Coal, coke, etc	5·9	4·7	5·8
Carnauba wax	2·6	2·1	3·4	Chemicals and pharmaceuticals	4·5	5·8	5·6

Principal countries of origin and destination (% accounted for by each)

Exports				Imports			
Country:	1938	1939	1940	Country:	1938	1939	1940
United States	34·3	36·2	42·3	United States	24·2	33·6	51·8
Great Britain	8·8	9·6	17·5	Argentina	11·8	8·4	10·8
Argentina	4·5	5·5	7·2	Great Britain	10·4	9·3	9·4
Japan	4·6	5·4	5·7	Neth. West Indies	3·2	3·4	4·9
France	6·4	6·3	4·3	Germany	24·9	19·2	1·8
China	0·5	3·0	3·6	France	3·2	2·8	1·6
Germany	19·1	12·0	2·2	Belgium	1·0	4·2	1·5

Railways.—Railway development in Brazil has been impeded by a number of obstacles, the most important being the plateau escarpment which follows the coast. From a beginning in 1854 of 14 km., Brazil's total railway mileage had risen to 34,095 km by 1937, with over 1,000 km. under construction and nearly 9,000 km. "under study." Much of this has subsequently been put into operation, while study and construction have been begun on new projects. Around 77% of the railway mileage is concentrated in the south and southeast, especially in Minas Gerais and São Paulo, while in the north, Pará has but 376 km., and Amazonas 5 km. Acre territory is entirely without railway facilities.

Around 60% of the railway mileage is operated by the federal government, 10% by state governments, and 30% by private corporations. Three companies out of the 55 different lines control in excess of 3,000 km. each: the Rede Viação Mineira (3,782 km.), the Central Railway of Brazil (3,093 km.), and the Leopoldina (3,086 km.). All three radiate from Minas Gerais state. To the south there are connections with the Uruguayan and Argentine systems and, through the latter, with Paraguay.

The most potentially important new railway construction in recent years is that under way (1941) between Corumbá, on the upper Paraguay river, and Santa Cruz de la Sierra (Bolivia). In 1937, in fulfilment of the treaty of 1903 under which Acre was acquired from Bolivia, Brazil agreed to pay £1,000,000 and to advance further funds necessary for the construction of a railroad from Bolivia to Corumbá, whence it would eventually connect with the Atlantic seaboard at Santos. Despite financial difficulties, construction of some sections was begun. The project was expanded with United States financial aid in 1940 as a result of recommendations made by the Inter-American conference at Havana, and now involves the integration of several Bolivian and Brazilian lines into a new transcontinental railway from

Santos through Corumbá and Bolivia to the port of Arica in northern Chile.

Highways.—The advent of the automobile and the truck marked the beginning of a new era in Brazilian land transport. A sharp interest in improved highway facilities has been particularly evident since 1930. Between that year and 1938, the highway system was expanded at the rate of more than 32 km. daily, from 113,276 km. to 209,325 km. Most of the roads, however, are dirt, and very few, concrete. The states of the south and southeast have the largest extension of roads, but developments under study and construction are expected considerably to increase the proportion in the northern states. São Paulo and Minas Gerais, with 43,059 km. and 38,329 km., respectively, lead. In 1939, 202,812 automotive vehicles were registered, a 19% increase over the previous year, and two-thirds greater than the 1926 total. The greatest concentrations are in and around São Paulo and Rio de Janeiro. The ratio of automobiles to trucks is 1·6 to 1 as compared with 6·2 to 1 in Argentina and 3·8 to 1 in the United States.

Shipping Routes and Facilities.—Brazil possesses innumerable natural anchorages, 53 of which are important from the standpoint of shipping activity. Santos is the most important port for overseas shipping, leading Rio de Janeiro by a narrow margin. Each handles approximately one-third of the total overseas tonnage entering Brazilian ports. Rio de Janeiro, however, is first in coastwise shipping. Recife, Porto Alegre, Baía and Manaus rank next in total volume of overseas tonnage handled.

Inland waterways play an important role in Brazilian transportation. In the Amazon basin they are the major, and frequently the sole, means of communication other than air. The rubber, Brazil nut, timber and other forest industries are absolutely dependent upon water transportation. The country has 36,916 km. of navigable rivers.

Brazil's merchant marine, with a tonnage in excess of 500,000 in 1939, ranks third in the Americas. Coastwise traffic, but not that on the Amazon, which has been open to commerce of all nations since 1867, is restricted to Brazilian ships. The state-operated Lloyd Brasileiro is the only Brazilian navigation company with a regular overseas service.

Aviation.—With the immense distance and the inadequate communications between even the more populous centres, Brazil offers a promising field for air transport. The first commercial air line began operations in June 1927. Two years later, four companies were maintaining regular service over routes aggregating 7,245 km. in length, and by 1938 there were eight companies with lines over 52,809 km. in extent. In addition, the military air mail, under direction of the ministry of war, handled mail over 14 different routes totalling 19,709 km., reaching remote parts of the interior.

Inter-American service is maintained primarily by the Pan American Airways, with tri-weekly flights north and south from Rio de Janeiro to and from New York and Buenos Aires. The German-owned Syndicate Condor, with a transatlantic service to Natal in north-eastern Brazil, operates several routes within the country and southward to Uruguay and Argentina. Until early in 1941 it likewise connected with affiliated lines in Peru and Bolivia. A French transatlantic service, formerly maintained by way of Dakar and Natal to Rio de Janeiro and thence to Argentina was suspended in 1940, but the Italian "LATI" line shortly replaced it.

Telegraphs, Wireless, etc.—In 1938 Brazil had 61,801 km. of telegraph lines and over 173,000 telephones. In that same year there were 65 radio broadcasting stations, of which 28 were in São Paulo state, 13 in the federal district, and six in Minas Gerais.

Submarine cables link Brazil with the United States and other parts of the western hemisphere and with Europe. A cable laid on the bed of the Amazon connects Manaus with Pará, some 850 mi. distant.

(L. W. Be.; A. S. G.)

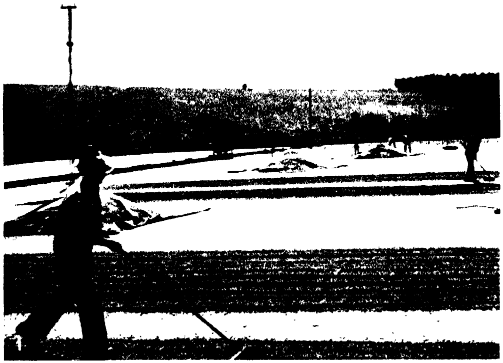
HISTORY

Discovery and Settlement.—The discovery and early settlement of Brazil appear in the larger perspective of history as episodes in the great movement of Portuguese colonial expansion to the east. Vasco da Gama's discovery of an all-water route to the Indies and Spice islands by the Cape of Good Hope in 1498 led the Portuguese crown to despatch to India an imposing armada under Pedro Alvares Cabral, whose sailing directions had been drawn up by the great Vasco himself. To avoid the calms off the Gulf of Guinea Cabral bore so far to the west that on April 22, 1500, the mainland of South America was sighted and the region was promptly claimed by Portugal, as it lay well within the zone assigned Portugal by the Treaty of Tordesillas (1494). (The coast of Brazil had been touched early in the year 1500 by the Spanish navigator Vicente Yáñez Pinzón but the Spanish crown made no effort to follow up the discovery.) Portugal's new possession was at first called the "Island of the True Cross," a name soon abandoned in favour of Brazil after the valuable dye-wood in which the country abounded. The tidings of Cabral's discovery aroused great enthusiasm and further explorations were undertaken. According to the generally accepted account the first of these expeditions, which set sail on May 10, 1501, had as its pilot Amerigo Vespucci (*see* VESPUCCI, AMERIGO), who had already been once and possibly twice to the New World. As the little fleet sailed along the coast of Brazil—whose immense extent was for the first time realized—Vespucci, calendar in hand, baptized the different points on the coast with the names of the saints on whose days they were discovered. A majority of these names (*e.g.*, Cape São Agostinho, São Francisco River) have remained to the present day. It is probable that the spacious bay of Guanabara was entered on Jan. 1, 1502, and named Rio de Janeiro.

For over a quarter of a century following Vespucci's voyage, interest in Brazil all but ceased. No precious metals were discovered and the energies of the Portuguese were increasingly absorbed by the establishment of a great empire in the East. Portugal's enemies and rivals, especially the French, were quick to take advantage of this neglect. Swift corsairs from Honfleur and Dieppe loaded their ships with the valuable Brazil wood and even attacked Portuguese vessels returning from the Indies. Brazil became a sort of no man's land over which the Portuguese crown wielded only a shadowy control. This apathy ended, however with the accession of John III (1521–1557) and the centre of gravity in colonial affairs gradually shifted from Asia to America.

The first systematic effort to establish an organized government in Brazil was made in 1532. Brazil was divided into 15 hereditary captaincies or fiefs, extending 50 leagues along the coast and an indefinite distance inland. These grants were distributed to favoured persons, chiefly courtiers, who took the name of *donatarios*. Their rights and privileges were extensive. They were authorized to found cities, issue land grants, levy internal taxes, and appoint municipal officers. To the crown was reserved the right to impose export taxes and the monopoly of Brazil wood and spices. The captaincy system failed to realize the hopes of the crown. Only 10 of the fiefs were occupied by their owners and of these only two were really successful. The most flourishing of the settlements was that of São Vicente, south of the present city of Santos. This had been granted to Martim Affonso de Souza, who in 1530 had explored the coast as far south as the La Plata estuary and had penetrated for some distance into the interior. By the middle of the century the captaincy had a population of some 5,000, including the growing port of Santos and the town of São Paulo, over the edge of the Serra do Mar, on the fertile plateau of Piratininga. In northern Brazil Duarte Coelho had converted the captaincy of Pernambuco into a great sugar-producing region. But the remaining captaincies were for the most part tragic failures. The donatarios were generally incompetent and tyrannical and the struggling settlements were powerless against attacks of hostile Indians or the depredations of French corsairs.

Royal Control.—At length fully alive to these perils King John determined to substitute for the inefficient rule of the donatarios a unified, centralized administration. Brazil was brought directly under royal control through the appointment of a governor general. The first to hold this office was Thomé de Souza, a Portuguese noble who had gained wide experience in India. In 1549 he took up his new duties at Baía, which remained the capital of Brazil for the next 200 years. The governor general was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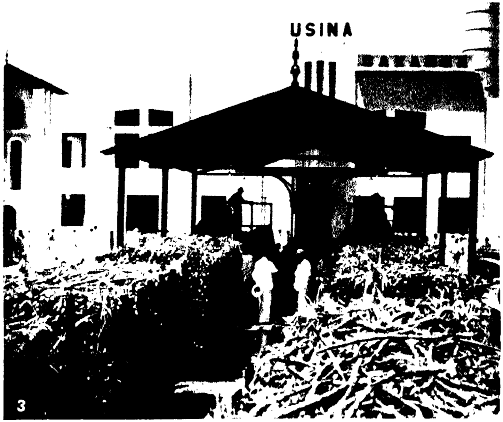

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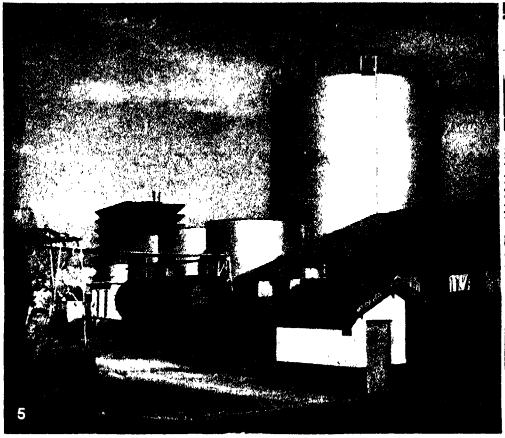
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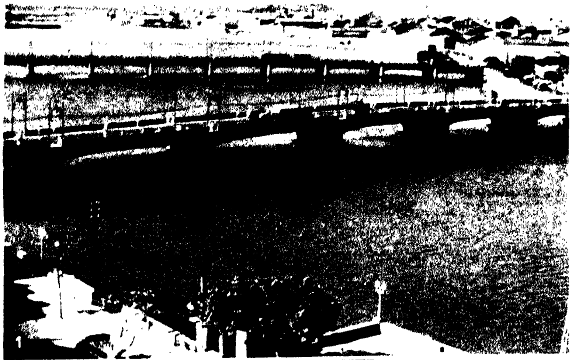
PHOTOGRAPHS, (1, 3, 4 6) CHARLES PERRY WEIMER FROM THREE LIONS, (2) ROSAS FROM THREE LIONS

BRAZILIAN AGRICULTURE AND INDUSTRY

1. A coffee drying yard at Ribeirão Preto
2. Planting additional rubber plants in an existing bed
3. A sugar-cane plant at Recife (Pernambuco)
4. A U.S. meat packing plant near São Paulo
5. Cotton-seed oil plant at São Paulo
6. A textile factory in Rio de Janeiro

BRAZIL



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PHOTOGRAPHS, (1-3, 6) CHARLES PERRY WEIMER FROM THREE LIONS, (4) E. M. NEWMAN FROM PUBLISHERS PHOTO SERVICE, (5) EWING GALLOWAY

CITIES OF BRAZIL

1. The Ponte Mauricio de Nassau (foreground) and the Ponte Puarque de Macedo (background) link two parts of Recife (Pernambuco)
2. The oldest street in Bahia
3. Cross in front of São Francisco church, Bahia
4. General view of Santos and the harbour
5. Praça Floriana in Rio de Janeiro, with its waved mosaic sidewalks. In the background is Monroe palace
6. A busy commercial street of Rio de Janeiro. The building of the A.B.I. (Brazilian Press association) is at the right

granted wide powers in civil and criminal affairs. The donatarios were obliged to surrender their political and judicial rights, though they were allowed to keep possession of their fiefs until they were acquired by the crown. Local officials, responsible to the governor-general, were placed over the captaincies, and strategic points along the coast were fortified. In the cities municipal organizations, similar to those in Portugal, were established. Brazil now began to attract settlers in increasing numbers. By 1600 Baia and Pernambuco each had a population of 2,000 whites, with over twice as many negro slaves and converted Indians.

A factor of great importance in the progress of the colony was the labour of the Jesuits. At the instance of John III. several fathers accompanied the first governor-general, Thomé de Souza, to Baia. Among them was Manuel Nobrega, the first of a long line of missionaries who devoted their lives to the protection and conversion of the Indians and to the raising of the moral level of the colonists. At the site of the present city of São Paulo, Nobrega established a school for the training of missionaries. Here he was joined by José de Anchieta, whose heroic labours among the Indians won for him the title of the "Apostle of Brazil." As rapidly as the Indians were converted they were settled in villages or "aldeas," similar to the missions in Spanish America. The activities of the Jesuits soon aroused the antagonism of the colonists, particularly the "Paulistas," the name given to the hardy and tough-fibred settlers of São Paulo. The colonists demanded an abundant labour supply and as white labourers were lacking they proceeded to enslave the Indians and to force them to work on their plantations. Both the Jesuits and colonists appealed to the crown; the former won a partial victory by the decree of 1574, which granted to the Jesuits full control over the Indians in the "aldeas" while permitting the colonists to enslave Indians captured in legitimate warfare. In the north the storm centre of a somewhat similar conflict was Father Antonio Vieira, who in the 17th century established a chain of missions in the Amazon valley. Naturally the restrictions on Indian labour stimulated the introduction of negro slaves, a movement which steadily gathered momentum after the middle of the 16th century.

Dutch and French Aggression.—Brazil had hardly been brought under royal authority before a determined effort was made by the French to establish a permanent colony. The prime mover in this enterprise was a French adventurer and soldier of fortune named Nicholas de Villegagnon, who contrived to enlist the support of Admiral Coligny and even Calvin by the assurance that the future colony would be an asylum for Huguenots and other Protestants. King Henry II. lent his sanction and in 1555 the French took possession of the beautiful harbour of Rio de Janeiro, which the Portuguese had strangely neglected to occupy. But Villegagnon failed to rise to his opportunities. He showed little skill as a colonist. His promise of religious toleration was broken. Attempts at forceful conversion to Catholicism alienated the support of the Protestants. Rumours of these dissensions reached Europe and checked what might have become a great migration from France and Geneva. Meanwhile the Portuguese had come to realize the extent of the French menace. A large force under Mem de Sá, the governor general, blockaded the entrance to the harbour and forced the French garrison to surrender. To ward off future attacks Mem de Sá in 1567 founded the city of Rio de Janeiro. Although subsequent attempts were made by the French to gain a foothold in Brazil—notably by Duclerc and Admiral Duguay Trouin in 1710 and 1711—the hope of establishing "Antarctic France" as a pendant to the French colonies in North America was never realized.

From 1580 to 1640 Portugal was united to Spain, and as a part of the Spanish colonial empire Brazil was naturally exposed to attacks by Spain's enemies. Among these were the Dutch, who had just succeeded in establishing their independence. In 1630 a fleet sent out by the Dutch West India Company captured Pernambuco, the metropolis of the rich sugar growing district in the north. As governor of its new possession the company chose Count Maurice of Nassau-Siegen, a prince of the House of Orange, and perhaps the ablest man in the Netherlands. His statesmanlike programme included the creation of a great colonial empire, reconciliation between Dutch and Portuguese, the grant of religious toleration, and the limited participation of the colonists in the government. Imposing public works were erected in the capital, rechristened Moritzstadt. Distinguished artists and scientists were invited to make known to Europe the resources and beauties of Brazil. But the directors of the company, intent on a policy of greed and gain, refused to support their enlightened governor and he resigned in 1644. A rebellion launched by a wealthy plantation owner, João Fernandes Vieira, proved beyond the power of Maurice's incompetent successors to crush and in 1661 the Dutch renounced all claim to Brazil.

Expansion and Reforms.—Reference has already been made to the "Paulistas," as the inhabitants of the captaincy of São Paulo were called. Of part Indian blood, the Paulistas comprised the most enterprising element in colonial Brazil. With the object of securing Indian slaves and discovering mines and precious metals they organized great expeditions into the interior, known as *bandeiras*. At times these expeditions were veritable treks or migrations, in which entire families took part and which lasted for a period of years. Though some of the most remote portions of Brazil were explored by the bandeiras, it was not until 1693 that gold deposits were discovered in what is now the State of Minas Gerais The stampede or gold rush which took place anticipated in many ways the days of '49 in California or those of '51 in Australia. In the hitherto unbroken wilderness towns sprang up as if by magic, while large sections of the littoral were denuded of their inhabitants. The yield of the mines during the 18th century probably exceeded 50,000,000 pounds sterling. Diamonds were discovered in the early 18th century in Minas Gerais and became a royal monopoly. Though many famous stones were found, no figures for the total diamond output are available.

In the latter half of the 18th century the Marquis of Pombal, the famous prime minister of King José I, introduced into Brazil a number of reforms which profoundly affected the social, administrative, and religious life of the colony. The last rights of the donatarios were absorbed by the Crown, the capital was transferred from Baia to Rio de Janeiro, the Indians were placed on a legal equality with the whites, immigration from the Azores and Madeira was encouraged, two privileged companies were created, a monopoly of the diamond fields was established. The act for which Pombal is best known was the expulsion of the Jesuits from Brazil in 1760. Through their protection of the Indians and their various commercial ventures they had stirred up widespread resentment, and when they attempted to thwart some of Pombal's reforms the all-powerful minister banished them from both Portugal and Brazil with brutal thoroughness. The value of many of Pombal's reforms is more than questionable but it can hardly be denied that they tended on the whole towards the development of the capabilities and resources of Brazil.

THE INDEPENDENCE OF BRAZIL

Despite its isolation Brazil could not escape the effects of the revolutionary and Napoleonic epoch in Europe. Brazil is the only instance of a colony becoming the seat of government of its own mother country. When in 1807 Napoleon resolved upon the invasion and conquest of Portugal the prince regent, afterwards Dom John VI., realizing the futility of resistance, decided to take refuge in Brazil. After creating a regency he sailed from the Tagus on Nov. 29, 1807, accompanied by the royal family and a horde of nobles and functionaries. After a short sojourn at Baia the court arrived safely at Rio on March 7, 1808. The colonists, convinced that a new era had dawned for Brazil, welcomed their sovereign with tremendous enthusiasm. Their expectations were in a measure realized, for the prince regent promptly decreed a number of reforms which radically changed the status of the colony. The harbours of Brazil were opened to the commerce of all friendly nations, thus abolishing the old Portuguese commercial monopoly. A ministry with four portfolios and a council of State were installed in Rio. A supreme court of justice, a court of exchequer and royal treasury, the royal mint, the Bank of Brazil, the royal printing office were established A royal library, a military academy and medical and law schools were founded. Industries were encouraged, foreign scholars and artists received a hearty welcome, immigrants were brought in at Government expense. The changed status of Brazil was reflected in the decree of Dec. 16, 1815, by which the Portuguese dominions were designated the "United Kingdom of Portugal, Brazil, and the Algarves."

In the year following, the insane queen, Dona Maria I, died, and the prince regent became king as John VI.

Steps Towards Independence.—Although Dom John enjoyed a certain degree of personal popularity his government, corrupt and extravagant, aroused much opposition, which was still further increased by the fermentation of liberal ideas produced by the French revolution. In Pernambuco a revolt broke out in 1817, and was put down with difficulty after a republic had been formed which lasted for 90 days. Still more critical was the situation in Lisbon. After the departure of the French, Portugal had been governed by an arbitrary and tyrannical regency. The growing discontent found vent in the revolution of 1820. The regency was swept aside and the Côrtes, which had not met for over a century, was summoned for the purpose of drawing up a constitution. The presence of Dom John in Portugal was imperative if the revolutionary movement was to be kept in hand. On April 22, 1821, he appointed his son Dom Pedro regent and two days later set sail for Lisbon. The tasks confronting the young prince were truly formidable. Antagonisms between the Portuguese and Brazilians were becoming increasingly bitter, republican propaganda was active, and, worst of all, Dom Pedro had to face the responsibility of a separation of Brazil from Portugal as a result of the short-sighted policy of the Côrtes at Lisbon. The majority of this assembly were in favour of restoring Brazil to her former status of colonial dependence. Without waiting for the Brazilian deputies they proceeded to undo most of the reforms introduced into Brazil by Dom John. Fearful lest Dom Pedro might head a movement for independence, the prince was ordered to return to Europe "in order to complete his political education."

These acts aroused great indignation in Brazil. Supported by the majority of the Brazilians Dom Pedro openly defied the Côrtes by his refusal to return to Lisbon. In Jan. 1822 he formed a ministry in which the chief portfolios were held by two distinguished Paulistas, José Bonifacio de Andrada e Silva and his brother, Carlos Antonio. The former, known as the "Patriarch of Independence," was a scholar of European reputation and proved at this critical juncture a tower of strength to the young regent. Events followed rapidly. On June 3 Dom Pedro convoked a legislative and constituent assembly. On Sept. 7, on the plain of Ypiranga, near the city of São Paulo, he solemnly proclaimed the independence of Brazil, and on Dec. 1, 1822, was crowned emperor. With the co-operation of Lord Cochrane, an able British naval officer who had entered Brazilian service, the strong Portuguese garrisons were forced to return to Europe. Before the end of 1823 independence had become an accomplished fact, although Portuguese recognition was not secured until 1825.

THE BRAZILIAN EMPIRE (1822–1889)

The first years of Brazilian independence were difficult. The nation was without experience in self-government and the emperor, though able and patriotic, was inclined to be despotic and arbitrary. When the constituent assembly, on which the nation had pinned such high hopes, proved unmanageable Dom Pedro dissolved it in 1823 and sent the Andrada brothers into exile. Fortunately he realized that the days of absolutism were passed; a new and liberal constitution, drawn up by the council of State, was submitted to the municipal councils of the provinces and sworn to with great solemnity by the emperor on March 25, 1824. By this stroke of policy he saved himself and Brazil. The remaining years of Dom Pedro's reign witnessed a growing estrangement between the monarch and his subjects. Parliamentary government was little to the emperor's liking and the opposition generally commanded a majority in the chamber of deputies. Brazil became involved in a disastrous war with Buenos Aires resulting in the loss of the Provincia Cisplatina (the present republic of Uruguay). Finally, worn out by attacks from both within and without parliament, Dom Pedro formally abdicated on April 7, 1831, in favour of the heir apparent, Dom Pedro II., then only five years of age.

The Regency (1831–1840).—The next decade proved the most agitated period in Brazilian history. From 1831 to 1835 a triple regency laboured in vain to put down the Civil War in the provinces and check the lawlessness and insubordination in the army. In 1834 an important amendment (the so-called *Acto Addicional*) was made to the Constitution. A measure of decentralization was granted the provinces through the creation of provincial assemblies with considerable local power. Provision was made for a sole regent to be elected for four years. For this office in 1835 an able and energetic priest by the name of Diogo Antonio Feijó was chosen. For two years the regent struggled heroically against the force of disintegration, but he was forced to resign in 1837 and was succeeded by Araujo Lima. As the end of the decade approached sentiment began to crystallize in favour of a declaration of majority of the young Dom Pedro. The Brazilians as a whole, impatient with the regency, hoped to find in the person of the emperor a symbol to which the entire nation might rally. On July 23, 1840, both houses of parliament passed a declaration that Pedro de Alcantara had attained his majority.

The reign of Dom Pedro II., with its duration of practically a half century, constitutes perhaps the most interesting and fruitful epoch in Brazilian history. To an extent true of few monarchies in the 19th century the prestige and progress of the nation were due to the enlightened statesmanship of its ruler. Yet Dom Pedro cared little for the trappings of royalty. Though not without personal distinction he was always simple, modest and democratic. He possessed an insatiable intellectual curiosity and was never more happy than when conversing with scholars. He was generous and magnanimous to a fault. One of his favourite occupations was inspecting schools. He was wont to declare, "If I were not emperor I should like to be a school teacher." Yet this kindly, genial and scholarly ruler took his prerogatives and duties as sovereign with great seriousness and in all matters of first importance he was the final arbiter. According to the constitution of 1824 the emperor had the right to dissolve the chamber of deputies, to select the members of the life senate from triple lists submitted by the province, and to appoint and dismiss ministers of State. That parliamentary life in Brazil was pitched upon such a high plane, that the highest officials in the State generally left office poorer than when they entered it; that the machinery of government functioned smoothly year after year was due in large measure to the tireless vigilance of the emperor.

Dom Pedro's government maintained an active interest in the affairs of the Plata republics, especially of Uruguay, which it sought to control through indirect measures. Opposed in this by the Argentine dictator Rosas (*q.v.*), Brazil aided in his overthrow in 1852. In 1864 Brazil intervened in Uruguayan internal affairs and, in so doing, brought about war with Paraguay. In alliance with Argentina and Uruguay, Brazil successfully waged the costly and bloody Paraguayan war of 1864–70 (*see* PARAGUAY), eventually overthrowing the famed Paraguayan dictator López. With occasional lapses the empire's relations with the United States and with Europe were exceedingly cordial. Pedro personally did much to cement these international friendships, visiting Europe in 1876 and 1888 and the United States in 1876.

The outstanding economic and social problems with which the empire had to grapple were connected with the institution of slavery. Partly as a result of pressure from Great Britain Brazil had agreed to abolish the slave trade in 1831, but it was not until 1853 that this odious traffic completely ceased. In the '60s agitation began in favour of the abolition of slavery as such. Dom Pedro was opposed to slavery but he had to reckon with the determined resistance of the slave owners. Finally in 1871 a bill for gradual emancipation, sponsored by the Viscount of Rio Branco, was passed by parliament. The importance of this act lay in the provision that henceforth all children born of slave mothers should be free. But this concession did not satisfy many of the abolitionists, who, led by a brilliant young lawyer and writer, Joaquim Nabuco, demanded that abolition be immediate and complete. In 1883 Nabuco wrote a remarkable book (*O Abolicionismo*), in which he endeavoured to prove that slavery was poisoning the very life of the nation. The propaganda began to bear fruit. In 1884 Ceará and Amazonas freed their slaves; in 1885 all slaves over 60 years of age were liberated. Finally, complete emancipation without compensation to the owners was decreed on May 13, 1888. Some 700,000 slaves, valued at approximately £40,000,000 were freed.

The Collapse of the Empire.—At first sight the overthrow of Dom Pedro seems inexplicable. Under his wise guidance Brazil had made very real progress. His half century of rule had witnessed a growth in population from four to 14 millions, a fourteenfold increase in public revenues and a tenfold increase in the value of the products of the empire. Railroad mileage in 1889 exceeded 5,000; the same year over 100,000 immigrants landed in Brazil. But despite this impressive economic progress there were grave causes of dissatisfaction. Propaganda in favour of a republic, launched in 1871, had gained many recruits. The great landowners who had lost their slaves without compensation withdrew their support from the monarchy. The clergy, another prop of the throne, had been antagonized by the punishment of several recalcitrant bishops. Isabella, the heiress to the throne, and her husband, the Comte d'Eu, were unpopular. Most serious of all, important elements in the army turned against the monarchy, largely because Dom Pedro insisted that they stay out of politics. A conspiracy was hatched by these disgruntled military elements and on Nov. 15, 1889, a revolt of a portion of the army was the signal for the complete collapse of the empire.

Dom Pedro formally abdicated and with his family was banished to Europe.

THE REPUBLICAN PERIOD

During the next few years Brazil passed through a difficult period of adjustment. The leader of the revolt against Dom Pedro II was a prominent military figure, Marshal Deodoro da Fonseca For the next 14 months Brazil was ruled by a military autocracy in which Deodoro, now chief of the Provisional Government, was virtually supreme.

Decisions of great importance were reached. Church and State were separated, civil marriage was introduced, and a constituent assembly was summoned which adopted in 1891 a constitution modelled closely on that of the United States.

The Presidencies.—As president, Deodoro employed the same dictatorial methods that he had followed as head of the provisional régime. He kept in power a most unpopular ministry and was constantly at loggerheads with congress. On Nov. 3, 1891, he forcibly dissolved this body and proclaimed himself dictator. But opposition to this *coup d'état* was so widespread that on Nov. 23, 1891, he felt constrained to resign in favour of the vice-president, Marshal Floriano Peixoto. But Floriano, likewise one of the conspirators against Dom Pedro, differed little in his methods of government from his predecessor. Of the meaning of constitutionalism in the strict sense of the term he had scant understanding. The growing opposition to Floriano finally culminated in 1893 in a naval revolt and military uprising that were put down the following year only with the greatest difficulty.

The vast majority of the Brazilians are naturally averse to militarism, especially when it is accompanied by violence and corruption. The advent, therefore, of a civilian as president was hailed with undisguised relief. Prudente de Moraes Barros, who assumed office in 1894, was a distinguished lawyer of São Paulo and a republican of long standing. Though his intentions were excellent and his ability and honesty unquestioned, his administration was rendered largely sterile through the opposition of the disgruntled military elements and the necessity of putting down a rebellion of the ignorant and fanatical population in the hinterland of Baía. His successor Manuel Ferras de Campos Salles (1898–1902), former president of the State of São Paulo, is chiefly remembered for his striking success in saving Brazil from the financial collapse threatened by the orgy of extravagance, inflated currency and peculation which had followed the overthrow of the monarchy. While still president-elect, Campos Salles in 1898 negotiated through the Rothschilds a funding loan of £10,000,000, interest on which was to be suspended for three years and amortization payments for ten. Thanks to the able and economical administration of Campos Salles and the marvellous recuperative power of the country, the credit and finances of Brazil were again placed on a sound foundation. Francisco de Paula Rodrigues Alves (1902–06), likewise a Paulista, is generally regarded as Brazil's ablest civilian president. During his term of office the capital was transformed into one of the world's most beautiful cities. Under the direction of the distinguished physician and scientist, Dr. Oswaldo Cruz, Rio was completely freed from the scourge of yellow fever. As noted at the beginning of the present article some of Brazil's most thorny boundary controversies were settled during the presidencies of Campos Salles and Rodrigues Alves by the able minister of foreign affairs, the Baron of Rio Branco, son of the viscount of the same name

The history of Brazil during the two decades, 1906–26 must be summarized very briefly. President Affonso Penna (1906–09) took an important step towards the stabilization of the exchange through the creation of the so-called Caixa de Conversão, or Bank of Conversion, whose function was to redeem inconvertible paper currency through the issue of convertible notes secured through the deposit of gold. Unfortunately this project had to be abandoned on the outbreak of the World War. Dr. Penna died in 1909 and was succeeded by the vice-president, Dr. Nilo Peçanha. The campaign of 1910 was fought with great bitterness. The official candidate, Marshal Hermes da Fonseca, the nephew of Deodoro da Fonseca, was opposed by a civilian, Dr. Ruy Barbosa, a noted lawyer and publicist, and the most eloquent public speaker in Brazil. Though the conviction was general that Dr. Barbosa had received a majority of the votes cast, the official machine easily secured the election of Hermes da Fonseca. The administration of the new president (1910–14) represented a step backward in the political life of Brazil. The high standards set by the first three civilian executives were largely abandoned.

Brazil and the World War.—Happily a change for the better came with the election of Dr. Wenceslau Braz (1914–18), a former governor of Minas Geraes. The administration of President Braz is indissolubly associated with Brazil's reaction to and participation in the World War. From the outset of the struggle the sympathies of the majority of the Brazilians inclined toward the Allies. On April 11, 1917, Brazil broke off relations with Germany following the torpedoing of the steamer *Paraná* off the coast of France. On June 1 Brazil revoked its decree of neutrality in the war between Germany and the United States as a mark of "continental solidarity" and friendship with the United States. Following the sinking of more Brazilian ships war was declared on Oct. 26. Brazil's participation in the war was confined to the despatch of a part of its fleet to European waters and the sending of a medical mission and a number of aviators to the western front. Brazil's chief contribution, however, was the placing of its food supplies and other resources unreservedly at the disposal of the Allies and the United States. Brazil participated in the Peace Conference and was given a temporary seat on the Council of the League of Nations.

Brazil Since the World War.—In the election of 1918 a new precedent was established in Brazilian political life by the reelection of Rodrigues Alves. Unfortunately the new executive was too ill to accept office and died on Jan. 16, 1919. In the new election, held in April, the successful candidate was Dr. Epitacio da Silva Pessôa, a lawyer of note, and head of the Brazilian delegation at the Versailles Peace Conference. His presidency, coinciding with the wave of post-war prosperity, was an era of reckless expenditures accompanied by an immense increase in both the internal and foreign debt of Brazil. Large sums were absorbed by the Brazilian Centenary Exposition, which was celebrated with great brilliancy in 1922. The presidency of Dr. Arthur Bernardes (1922–26) was beset with difficulties. The collapse of the post-war boom found Brazil in financial extremities. The new executive endeavoured to carry out a policy of strict economy. Governmental expenses were cut down, the prosecution of costly public works was postponed, new sources of revenue, such as the income tax, were created. Unhappily the success of this programme of retrenchment and reform was compromised by a dangerous flare-up of militarism. In the closing weeks of Dr. Pessóa's administration a military group made a desperate but fruitless attempt to prevent Dr. Bernardes' inauguration. Another revolt was launched, in July 1924, at Sao Paulo city. This, too, was suppressed, but only after heavy loss of life and much property damage.

In 1926, Dr. Washington Luis Pereira de Souza, minister of justice in the two preceding administrations, was elected president without a contest. Four years later, however, when the administration-sponsored candidate was officially declared winner, a revolt headed by Dr. Getúlio Vargas broke out. For the first time under the republic, a revolution was successful, and Vargas became provisional president. His administration too was menaced by armed risings on several occasions, but these were rigorously suppressed.

Essentially, the country's difficulties were economic, accentuated by a policy of subsidizing coffee production. Too, the tremendous powers which the states possessed, coupled with the fact that two states, São Paulo and Minas Gerais, had practically monopolized political control in the past, served as steady irritants to the country as a whole. In 1934, a new constitution, which gave the central government greater powers, was promulgated. Three years later, as the country prepared for new presidential elections, Pres. Vargas suddenly seized practically absolute power and set up still another constitution, under which he continued as president (Nov. 10, 1937). This so concentrated power in Vargas' hands that he was able to suppress not only disorders but all manifestation of popular will as well. Brazil had never been truly a democracy, but Vargas stripped it of most of the trappings through which it might eventually hope to become one. On the other hand, considerable social legislation was enacted, with very positive benefits to the labouring man. Press and mail censorship were imposed, and many regarded Brazil as on the threshold of totalitarianism. Trade unionism was to all intents and purposes suppressed.

Vargas' policy, from his accession to power, was one of increasing curtailment of states' rights and of emphasis upon nationalism. More and more the states were subordinated to the central government, politically, economically and socially. The ruinous coffee policies of the past were done away with, manufacturing was encouraged, as was diversification of agricultural production.

In its foreign policy, the Vargas government seemed alternately to flirt with the "democracies" and with Italy and Germany. The 1937 coup d'etat leaned heavily on the fascist Integralistas, but once in complete control Vargas vigorously repressed that party. After outbreak of war in Europe in 1939 his government supported Inter-American solidarity; in Jan. 1942 it broke relations with the axis powers, and on Aug. 22, 1942, declared war on Germany and Italy.

ART, SCIENCE AND LITERATURE

Painting, Sculpture and Music.—The Brazilian people have the natural taste for art, music and literature so common among the Latin nations of the old world. As early as 1816 Dom John VI invited a company of distinguished French painters, headed by Lebreton, the secretary of the Ecole des Beaux Arts of Paris to take up their residence in Rio de Janeiro and to implant in Brazil the best French artistic traditions. Dom Pedro II was a liberal patron of art and early in his reign was founded the Academia de Bellas Artes, now known as the Escola Nacional de Bellas Artes. Free instruction in the fine arts is given in this school. Among Brazil's better known painters should be mentioned Pedro Americo de Figueiredo, who specialized in historical and allegorical subjects. In sculpture Rodolpho Bernadelli has done excellent work. A conservatory of music was established as early as 1841. The composer Carlos Gomez (1839–96) enjoyed world-wide fame, his opera, *O Guarany*, having been produced in most of the European capitals. Alberto Nepomuceno (1846–1920) wrote a number of operas which have achieved success both in Brazil and Europe.

Science. Until recent years scientific exploration and investigation had been largely conducted by foreigners. Of the scholars who were both explorers and scientists may be mentioned W. L. von Eschwege, J. B. von Spix, C. F. von Martins, Prince Max zu Neuwied, Karl von den Steinen, A. de St. Hilaire, Louis Agassiz and the English botanists A. R. Wallace and H. W. Bates. Geological investigations of immense and lasting value have been carried on by the American scientists Charles Frederick Hartt, Orville A. Derby and John Casper Branner. Among Brazilian scientists may be noted the geographers Home de Mello, Belfort Mattos and Delgado de Carvalho, and the botanist João Barbosa Rodrigues. Scientific explorations of great value have been performed by Gen. Mariano da Silva Rondon. Brazilians have achieved notable success in the study of tropical diseases. Dr. Oswaldo Cruz, as noted elsewhere, banished yellow fever from the capital. Dr. Vital Brasil, director of the Butantin Institute near São Paulo, has been remarkably successful in discovering serums against the bites of venomous reptiles. The Instituto Oswaldo Cruz near Rio and the Pasteur Institute at São Paulo afford both Brazilians and foreigners opportunities for the study of tropical diseases.

Literature.—Down to the middle of the 18th century Brazilian literature was naturally dominated by Portugal, for Brazil was intellectually as well as economically a colony. The 80 years from 1750 to 1830 may be regarded as a period of transition, during which Brazilian literature gradually acquired an autonomous character. Between 1830 and 1870 came a period of romantic transformation, when French influence was distinctly in the ascendant. Since 1870 there has come into existence a new school which, distinctly hospitable to foreign influences, is in the broadest sense national.

The three most famous writers of the colonial and transitional periods are Gregorio de Mattos Guerra, Basilio da Gama and Santa Rita Durão. The era of romantic transformation is represented by Brazil's greatest lyric poet, Gonçalves Dias. The romantic movement also produced the Brazilian novel. Here the outstanding figures are José de Alencar, who glorified the Brazilian Indians (*Guarany* and *Iracema*) and Escragnolle de Taunay, whose novel *Innocencia* has been translated into six foreign languages including the Japanese. The reaction in France against the romantic school had its counterpart in Brazil. Parnassianism included among its votaries the poets Theophilo Dias, Raymundo Correia, Alberto de Oliveira and Olavo Bilac. Naturalism is represented by the novelists Machado de Assis, Aluzio de Azevedo, Julio Ribeiro and Raul Pompeia. Later developments do not readily lend themselves to analysis. In general the emphasis has shifted to national and regional themes. Graça Aranha, in his novel *Chaanan*, has chosen as his subject the Brazilian melting-pot. Euclydes da Cunha, in *Os Sertões*, has produced a poignant and arresting study of the hinterland (*sertoes*) of Baia. Coelho Netto was a neo-romanticist who drew upon Brazilian history and tradition for the plots of his many novels. José Verissimo (1857–1916), Monteiro Lobato and Sylvio Romero (1851–1914) were brilliant essayists. The last-named writer was also the author of the standard history of Brazilian literature.

In historical literature Brazil has produced a number of writers of high standing. Francisco Adolpho Varnhagen (Visconde de Porto Seguro) is the author of the most authoritative history of the colonial period. João Manoel Pereira da Silva has treated especially the critical years from 1822 to 1840. João Capistrano de Abreu has produced some short historical studies of great merit. Joaquim Nabuco's (1849–1910) magisterial biography of his father, Nabuco de Araujo, is really a history of the reign of Dom Pedro II. Manoel de Oliveira Lima (1867–1928) has covered every epoch of Brazilian history. His most notable single work is the history of Dom John's residence in Brazil (1808–21).

BIBLIOGRAPHY.—The most satisfactory general works on Brazil are H. G. James, *Brazil After a Century of Independence* (1925) and R. Nash, *Conquest of Brazil* (1926), although neither is entirely up to date. A. de St. Hilaire, *Voyage dans l'intérieur du Brésil* (8 vol., Paris, 1830–51) is a vast compendium of botanical, political, geographic and other information. Among 19th century travelers' and foreign residents' accounts, T. Ewbank, *Life in Brazil* (1856), L. Agassiz, *Journey to Brazil* (1868); and D. P. Kidder and J. P. Fletcher, *Brazil and the Brazilians* (1879), especially the last, stand out. Interesting and informative 20th century travel accounts include E. M. Tomlinson, *Sea and Jungle* (1912 and later eds.); A. H. S. Landor, *Across Unknown South America* (2 vol., 1913); Theo. Roosevelt, *Through the Brazilian Wilderness* (1914); D. Holdridge, *Pindorama* (1934) on the Amazon basin as a whole, and his *Feudal Island* (1936) on Marajó; E. P. Hanson, *Journey to Manáos* (1938).

History.—The best historical works in English are: P. A. Martin, "Brazil," in A. C. Wilgus (ed.), *Argentina, Brazil and Chile since Independence* (1935), and his adaptation and translation (*History of Brazil*, Chapel Hill, 1939), of J. P. Calógeras, *Formação Histórica do Brasil* (1935). R. Southey, *History of Brazil* (3 vol., 1817–22), on the colonial period, and J. Armitage's continuation of Southey to 1831 (2 vol., 1836) are still highly regarded. T. C. Dawson, *South American Republics* (1904), C. E. Akers, *History of South America since 1854* (3rd ed., 1930), and A. C. Wilgus (ed.), *Colonial Hispanic America* (1936) include valuable material on Brazil. M. W. Williams' scholarly *Dom Pedro the Magnanimous* (1937) and B. Harding's more popular *Amazon Throne* (1941) deal with the empire period.

Among the many important histories in Portuguese are: J. M. Pereira da Silva, *Hist. da Fundação do Imperio* (7 vol., 1864–68); F. A. Varnhagen, *Hist. do Brasil* (2nd ed., 1877, later eds.); F. do Rocha Pombo, *Hist. do Brasil* (10 vol., 1905); T. Monteiro, *Hist. do Imperio. A elaboração da independencia* (1927); A. de Escragnolle Taunay, *Hist. geral das bandeiras paulistas* (6 vol., 1924–30); P. Calmón, *Hist. da civilização brasileira* (1935; Sp. tr., Buenos Aires, 1937). Two valuable German works are also in recent Portuguese translations: H. Handelmann, *Geschichte von Brasilien* (1860) and H. Wätjen, *Das hollandisch Kolonialreich in Brasilien* (1921).

Constitutional history and government are treated in M. Fleiuss, *Hist. Administrativo do Brasil* (2nd ed., 1925); H. G. James, *Constitutional System of Brazil* (1925), and E. Hambloch, *His Majesty the President of Brazil* (1935). No real studies of the Vargas period have been published.

Diplomatic history is covered in L. F. Hill, *Diplomatic Relations between the U.S. and Brazil* (1932); A. K. Manchester, *British Preeminence in Brazil* (1933); P. A. Martin, *Latin America and the War* (1925); J. F. Rippy, *Latin America and World Politics* (3rd ed., 1938); W. R. Manning (ed.), *Diplomatic Correspondence of the U.S.*, in two series, one on the period 1808–31 (3 vol., 1925), the other in some 16 vol., including a special Brazil volume, on the period 1831–60 (12 vol., 1930 to date), are a vast repository of important documents.

Among other specialized accounts, R. Simonsen, *Hist. Económica do Brasil* (2 vol., 1935), a truly great work, and his *Brazil's Industrial Evolution* (Eng. ed., 1939); and J. F. Normano, *Brazil, a Study of Economic Types* (1935) treat economic phases. J. D. M. Ford, *A*

Tentative Bibliography of Belles-lettres (1931) and I. Goldberg, *Brazilian Literature* (1922), are helpful in the intellectual field.

Geography, Resources, etc.—The sections on Brazil in such works as E. Reclus, *Nouvelle Géographie Universelle* (1875–94); Wilhelm Sievers, *Sud und Mittelamerika* (1903); and A. H. Keane, *Central and South America* (1909), though outdated in some respects, are still valuable. The Brazilian sections of O. Schmieder, *Länderkunde Südamerikas* (1932) and his *Brazilian Culture Hearth* (Univ. of Calif. pub. in geog., vol. 3, no. 3, 1929) are excellent.

See also Pierre Denis, "Amérique du Sud," in *Géog. Univ.*, vol. xv, pt. ii, ed. De la Blanche et Gallois (Paris, 1927) for valuable facts.

Annuals and Other Periodicals.—The Min. of For. Affairs annual volume *Brazil* (in Eng.) and the *Anuário estatístico do Brasil* are the most voluminous sources of current and recent statistical information. The Pan American Union's *Annual Economic Survey of Latin America* and its other publications; the American Brazilian Assoc.'s *Brazil* (monthly) and *News Bulletin* (weekly); *Inter-American Quarterly; Pan American News* (bi-weekly); *Foreign Commerce Weekly* (U.S. Dept. of Comm.); and the reports of the department of Overseas Trade are excellent (P. A. M.; X.)

BRAZIL or **BRASIL,** a legendary island in the Atlantic Ocean. The name signifies the red dye-woods used in the middle ages, and *Insulae purpurariae* are mentioned by Pliny. It first appears as the *I. de Brazi*, one of the larger islands of the Azores, in the Venetian map of Andrea Bianco (1436). When this group became better known and was colonized, this island was renamed Terceira. Probably the familiar existence of "Brazil" as a geographical name led to its bestowal upon the vast region of South America, which was found to supply dye-woods. But the "Island of Brazil" retained its place in mid-ocean, some hundred miles to the west of Ireland, both in the traditions of the forecastle and in charts. In J. Purdy's *General Chart of the Atlantic* "corrected to 1830" the "Brazil Rock (high)" is marked with no indication of doubt, in 51° 10′ N. and 15° 50′ W. In a chart of currents, dated 1853, A. G. Findlay gives the name, but in his 12th edition of Purdy's *Memoir Descriptive and Explanatory of the N. Atlantic Ocean* (1865), the existence of Brazil and some other legendary islands is discussed and rejected. (*See* ATLANTIS.)

BRAZIL, a city in the western part of Indiana, U.S.A., 16 mi. N. by E. of Terre Haute; the county seat of Clay county. It is on Federal highway 40, and is served by the Central Indiana, the Chicago and Eastern Illinois, the Cincinnati, Indianapolis and Western, and the Pennsylvania railways. Pop. (1940) 8,126. It is in the heart of deposits of clay and shale, and of the "Brazil Block district" of the Indiana coal-fields, so called because this coal breaks into almost perfect rectangular blocks. The manufactures include sewer-pipe, bricks, furniture, tin cans, boilers, engines, mine-fans, and mining machinery. First settlement, 1844; town incorporated 1866; chartered as a city, 1873.

BRAZILNUT, the pleasing, edible seed of a large South American tree, *Bertholletia excelsa,* useful also for valuable timber. The fruit is globular, 4–6 in. in diameter, hard-walled, and contains 8–24 nuts or seeds, arranged like sections of an orange. The harvest is from January to June. The tree is not hardy where frosts occur, and although once established in Florida, it failed to survive. Under test in several tropical countries of the British empire, it offers small inducement to commercial planters, because of its habits of tardy and light bearing. It is also called Paranut, niggertoe, butternut, creamnut and castanea.

BRAZIL WOOD, a dye wood obtained largely from the shrub or small tree, *Haematoxylon brasiletto* of the family Leguminosae. Most of the commercial dye wood comes from Nicaragua, but the plant ranges from Mexico to Colombia and Venezuela. There are other less important woods commercially distinguished as Brazil wood belonging to other groups of the Leguminosae and yielding the same tinctorial principle. Brazil wood is imported for the use of dyers in billets of large size, and is a dense compact wood red brown in colour, bright when cut, but becoming dull on exposure. The colouring-matter of Brazil wood, brazilin, $C_{16}H_{14}O_5$, crystallizes with 1½ H_2O, and is soluble in water; it is extracted for use by infusion or decoction of the coarsely powdered wood. When freshly prepared the extract is yellowish; but by contact with the air, or the addition of an alkaline solution, it develops a brick-red colour. This is due to the formation of brazilein, $C_{16}H_{12}O_5.H_2O$, the colouring matter used by the dyer.

BRAZING AND SOLDERING, the process of uniting two metallic surfaces together by means of a fused metallic material joining them (*cf.* WELDING); usually distinguished as hard soldering or soft soldering. In each the melting temperature of the solder is lower than that of the metal or alloy to be united. This is more markedly so in the case of soft solder, which makes a joint without producing discoloration by heat, an important advantage in tinware. Hard solder, or brazing spelter, makes more intimate union with the work, hence the result is stronger. But soft solder is quite satisfactory for tinware, lead, plumbing, pewter, Britannia metal, while brass, copper, iron and steel may be soldered for some purposes, or brazed together when greater strength or resistance to heat becomes essential; aluminium is not so simple to solder as the other materials. There are a great many recipes for the compositions of solders, according to the class of material to be joined, and numerous types of joints. A flux is always necessary to ensure chemical cleanliness.

For brazing, heat must be obtained from a clear fire, a blowpipe or blast flame, the grip of red-hot tongs, or by having the spelter molten in a bath. The flux, such as borax, is applied while the joint is hot, and the spelter put on in convenient shape—thin sheet, strip, wire, or small lumps, which melt and run freely between the faces. A handy form of brazing medium is sold combined with the flux, pieces being broken off and used without the need for separate fluxing. If the flow is not certain to spread properly between a joint, notwithstanding a jarring action being given to help matters, it is preferable to sandwich the spelter in, and draw the parts together by means of wire bound round or with the tongs, while clamps are utilized for some articles, such as the thinned ends of band-saws which are held overlapping in exact position during the process. Dipping into a molten bath affords the best mode of even penetration for some joints, notably those of cycle frames.

Should parts not fit together rigidly, or extra strength be required, additional resistance to bending or twisting stresses can be gained by putting pegs through a joint, inserting liners in tubular joints, or serrating faces so that the spelter runs into the grooves and forms so many keys. Rather thin metal, such as in copper-pipes and fittings made for ships, distilleries, breweries, etc., is brazed up with "clamped" joints for extra security and resistance to the internal pressure of steam or other fluid. One edge is left plain, the other has notches cut, as evidenced from the detail in fig. 1, and each alternate "clamp" is lifted slightly so as to enable the other plain edge to be slipped in. After hammering or closing the joint neatly, it is jarred to bring about a slight freedom for the spelter to flow into. The employment of a solution of borax and water as a flux also ensures perfect preparation of the faces. Joints are also thinned, as well as clamped, in order that the total thickness shall not much exceed that of the sheet, if at all. The other view shows a copper three-way or T-piece brazed up with clamped joints. Annealing has sometimes to be done, after brazing, and hammering a joint neatly, to obviate risk of cracking.

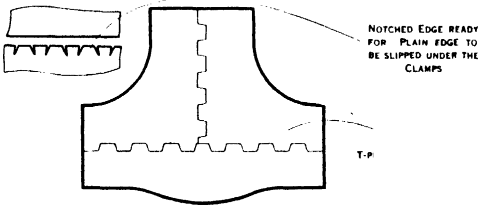

NOTCHED EDGE READY FOR PLAIN EDGE TO BE SLIPPED UNDER THE CLAMPS
T-P

FIG. 1.—THE NOTCHED CLAMP JOINT, USED EXTENSIVELY IN COPPERSMITHING

An example of support afforded in a joint appears in fig. 2, in which case a great force tends to tear the parts asunder. This is a tool used in a metal-turning lathe, and made up with a long shank of mild or of low-carbon steel, to which is brazed a tip of the expensive high-speed cutting steel. This rests on a ledge on the shank, and is often additionally locked by fitting it on a vee surface instead of flat, so as to resist side movement. The brazing compound is sandwiched in, the parts bound with brass wire, and heat applied in the fire or gas-blast.

Electric brazing is performed by gripping the parts in the electrodes of an electric welder type of machine. The spelter and flux are applied, and the current switched on raising the joint to a sufficient heat for fusion.

The lower temperature that suffices for soft soldering rather simplifies the methods. A copper soldering-bolt may be pressed on the work to cause the solder to run, or drawn along to make it flow from a stick in the required direction. The blowpipe gives a delicate and perfectly controllable flow, and small joints are preferably made with its help. Sweating is a convenient mode of uniting some specimens, heat being applied throughout the area. Pouring from a ladle is done when a considerable quantity of solder must be applied; this is so in regard to water-pipes having to withstand a good pressure.

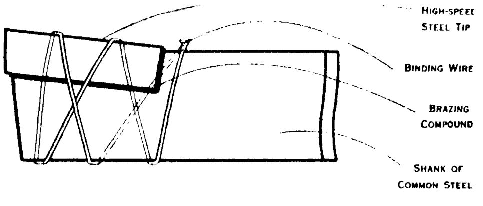


FIG. 2.—BRAZING A HIGH-SPEED STEEL TIP ON TO A LATHE TOOL

Support has to be given to some objects which do not retain their relationships naturally, including certain frames, and pipes, complicated by overhanging details. Clay, charcoal blocks, or screw clamps variously take care of these subjects; fig. 3 represents a divided clamp which locates pipes in their setting for a wiped joint. If faces are not bright, they must be filed, ground, scraped or shaved, or polished with emery-cloth, and a flux is requisite to clear away oxide. Fluxes include rosin, sal-ammoniac, tallow, chloride of zinc solution (killed spirits), or one of the proprietary pastes sold in tins. "Tinning" is a process required for two reasons: to prepare faces in iron, copper, and brass ready for adhesion of the solder, and to cover the nose of the soldering-iron so that oxidation will not occur while it is being used. A flux is applied to the cleaned metal in either instance, and the solder allowed to run thoroughly.

Although as a rule a thin film of solder is all that is necessary to give strength to a joint, the wiped joint of the plumber constitutes an exception. One end of a pipe is opened out with a conical bobbin driven in, the matching end is coned (fig. 3) and the surfaces shaved clean. Pouring is done from a ladle, using a thick cloth to control the plastic mass and wipe it into a neat shape. Blacklead may be rubbed on surfaces to which solder must not adhere, or a mixture termed "soil" or "smudge."

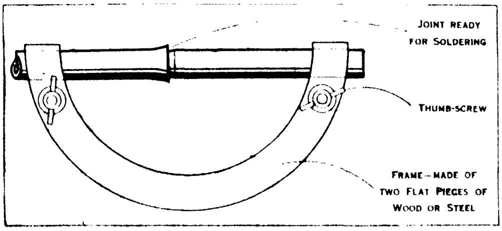

JOINT READY FOR SOLDERING
THUMB-SCREW
FRAME—MADE OF TWO FLAT PIECES OF WOOD OR STEEL

FIG. 3.—METHOD OF HOLDING PIPES IN POSITION FOR MAKING A JOINT

The tinsmith uses soldering machines to hold cans, etc., in certain attitudes, while being soldered, while in the large canning factories for fish, fruit, or vegetables automatic machines are installed, which pass tins along by conveyors, and the fluxing and soldering are effected with great rapidity. Some will do 40,000 or more cans per ten-hour day, that is 80,000 ends.

The following give a few of the very many solders in use:—

Coarse Solder	Lead 3 parts, Tin 1 part
Plumber's Solder	Lead 2 parts, Tin 1 part
Fine Solder	Lead 1 part, Tin 1 part
Tinman's Solder	Lead 2 parts, Tin 3 parts
Ditto, fine	Lead 1 part, Tin 2 parts
Pewterer's Solder	Lead 4 parts, Tin 3 parts
Bismuth Solder	Lead 1 part, Tin 1 part, Bismuth 1 part
Hard Solders	Copper 2, Zinc 1; Copper 1, Zinc 1; Copper 3, Zinc 1.
For Silver	Copper 1, Brass 1, Silver 19; Brass 1, Silver 2.
For Gold	Gold, silver, and copper or brass in varying proportions according to the carat of the gold to be soldered.

(F. H.)

BRAZZA, PIERRE PAUL FRANÇOIS CAMILLE SAVORGNAN DE, COUNT (1852–1905), French explorer and administrator, founder of French Congo, was born on board ship in the harbour of Rio de Janeiro on Jan. 26, 1852. He was of Italian parentage, the family name being de Brazza Savorgnani. Through the astronomer Secchi he was sent to the Jesuit college in Paris, and in 1868 obtained authorization to enter as a foreigner the marine college at Brest. In the Franco-Prussian War of 1870–71 he took part in the operations of the French fleet. In 1874 when the warship on which he was serving was in the Gabun, Alfred Marche and the marquis de Compiègne arrived at Libreville from an expedition in the lower Ogowé district. Interested in the reports of these travellers, de Brazza conceived the idea of exploring the Ogowé, which he thought might prove to be the lower course of the Lualaba, a river then recently discovered by David Livingstone. Having meantime been naturalized as a Frenchman, de Brazza in 1875 obtained permission to undertake his African scheme, and with the naval doctor, Noel Ballay, he explored the Ogowé river. Penetrating beyond the basin of that river, he discovered the Alima and Likona, but did not descend either stream. Thence turning northwards the travellers eventually regained the coast at the end of Nov. 1878, having left Paris in Aug. 1875. On arrival in Paris, de Brazza learned of the navigation of the Congo by H. M. Stanley, and recognized that the rivers he had discovered were affluents of that stream.

De Brazza was anxious to obtain for France some part of the Congo. The French Ministry, however, determined to utilize his energies in the Niger basin. Their attention had been drawn to the Niger through the formation of the United African Company by Sir George Goldie (then Mr. Goldie Taubman) in July 1870, Goldie's object being to secure Nigeria for Great Britain. A new expedition was fitted out, and de Brazza left Paris at the end of 1879 with orders to go to the Niger, make treaties, and plant French flags. When on the point of sailing from Lisbon he received a telegram cancelling these instructions and altering his destination to the Congo. This was a decision of great moment. Had the Nigerian policy of France been maintained the International African Association (afterwards the Congo Free State) would have had a clear field on the Congo, while the young British company might have been crushed out by French opposition; so that the two great basins of the Niger and the Congo would have had a vastly different history.

Acting on his new instructions, de Brazza, who was again accompanied by Ballay, reached the Gabun early in 1880. Rapidly ascending the Ogowé he founded the station of Franceville on the upper waters of that river and pushed on to the Congo at Stanley Pool, where Brazzaville was subsequently founded. With Makoko, chief of the Bateke tribe, de Brazza concluded treaties in Sept. and Oct. 1880, placing the country under French protection. With these treaties in his possession Brazza proceeded down the Congo, and at Isangila on Nov. 7 met Stanley, who was working his way upstream concluding treaties with the chiefs on behalf of the International African Association. De Brazza spent the next eighteen months exploring the hinterland of the Gabun, and returned to France in June 1882. The ratification by the French chambers in the following November of the treaties with Makoko (described by Stanley as worthless pieces of paper) committed France to the action of her agent.

Furnished with funds by the French Government, de Brazza returned in 1883 to the Congo to open up the new colony, of which he was named commissioner-general in 1886. This post he held until Jan. 1898, when he was recalled. During his period of office the work of exploration was systematically carried out by numerous expeditions which he organized. De Brazza's administration was severely criticized; but that its comparative failure was largely due to inadequate support from the home authorities was recognized in the grant to him in 1902 of a pension by the chambers. Both as explorer and administrator his dealings with the natives were marked by consideration, kindness and patience, and he received the title of "Father of the Slaves." His efforts to connect the upper Congo with the Atlantic by a railway through French territory showed that he understood the chief economic needs of the colony. After seven years of retirement in France de Brazza accepted, in Feb. 1905, a mission to investigate charges of cruelty to natives brought against officials of the Congo colony. Having concluded his enquiry he sailed for France, but died at Dakar, Senegal, on Sept. 4, 1905. His body was taken to Paris for burial, but in 1908 was reinterred at Algiers.

See D. Neuville et Ch. Bréard, *Les Voyages de Savorgnan de Brazza, Ogôoué et Congo, 1875–1882* (1884), and *Conférences et lettres de P. Savorgnan de Brazza sur ses trois explorations dans l'ouest africain de 1875 à 1886* (1887); A. J. Wauters, "Savorgnan de Brazza et la conquête du Congo français," in *Le Mouvement géographique*, vol. xxii., No. 39 (Brussels, 1905). Giacomo or Jacques de Brazza (1859–83), a younger brother of Savorgnan and one of the men he employed in the work of exploration, published, in collaboration with his companion A. Pecile, *Tre Anni e mezzo nella regione del Congo e dell' Ogowe* (1887). (G. T. G.)

BRAZZA (Serbo-Croatian Brač), an island in the Adriatic sea, forming part of Dalmatia, Yugoslavia. Pop. (1931) 17,317. With an area of about 200 sq. mi. Brazza is the largest of the Dalmatian islands; it is also fertile and the most thickly populated. Though rugged and mountainous, it yields an abundance of olives, figs, almonds, saffron, and chrysanthemums from which an insect powder is produced, as well as wines of good quality. The corn crop, however, barely suffices for three months' food. Other local industries are fishing, silkworm-rearing, stone, slate and marble quarrying, and the working of asphalt deposits. The most important among the 26 villages on the island is Milna (Population 3,206), which has a good harbour, and is provided with shipwrights' wharves, where coasting vessels are built. It has also a steam flourmill. The island has been dominated in turn by the pirates of Almissa, by Ragusa, Venice, the Holy Roman Empire, Hungary, Bosnia, Russia and Austria, with one brief period of autonomy. In 1918 it was incorporated with Yugoslavia; in 1941 it was occupied by the Italians.

BREACH, in general, a breaking or an opening made by breaking; in law, the infringement of a right or the violation of an obligation or duty. The word is used in various phrases: *breach of close*, the unlawful entry upon another person's land (*see* Trespass); *breach of covenant or contract*, the non-fulfilment of an agreement to do or not to do some act (*see* Damages); *breach of the peace*, disturbance of the public order (*see* also Breach of the Peace); *pound-breach*, taking by force out of a pound things lawfully impounded (*see* Pound); *breach of promise of marriage*, the non-fulfilment of a contract mutually entered into by a man and a woman that they will marry each other (*see* Marriage); *breach of trust*, any deviation by a trustee from the duty imposed upon him by the instrument creating the trust (*q.v.*). In military science, a break or opening in the wall of a fortress, caused by bombardment by the artillery of the besieger or by his mines, and utilized by his storming parties in the assault. Also applied, loosely, to a penetration of an entrenched defensive position.

BREACH OF THE PEACE is any act or conduct bringing about a disturbance of the public peace or tranquillity. (*See* also Affray and Riot.) The matter generally becomes important before any substantive breach or offence is committed, for in such a case, where a breach of the peace is threatened, justices have power to intervene by binding over the offender. They have a like power for abusive language tending to a breach of the peace. At common law and under the statute of Edward III., and by the commission of the peace granted to justices, recognizances may be required on the part of the accused and also sureties for good behaviour. Apparently a peer of the realm cannot be bound over by justices but only by the High Court. (*See* also Arrest.)

BREADALBANE, JOHN CAMPBELL, 1st Earl of (*c.* 1635–1717), son of Sir John Campbell of Glenorchy, Bart., and of the Lady Mary Graham, daughter of William, earl of Airth and Menteith, was born about 1635 He took part in the abortive royalist rising under Glencairn in 1654, and was one of those who urged Monk to declare a free parliament in England to facilitate the Restoration. He sat in the Scottish parliament as member for Argyllshire from 1669 to 1674. As principal creditor he obtained in Oct. 1672, from George, 6th earl of Caithness, a conveyance of his dignities, lands and heritable jurisdictions; and after the latter's death he was created on June 28, 1677, earl of Caithness and viscount of Breadalbane. In 1678 he married the widowed countess of Caithness. In 1680 he invaded Caithness with a band of 700 men and dispossessed the earl's male heir. The latter, however, was subsequently confirmed in his lands and titles, and Campbell on Aug. 13, 1681, obtained a new patent creating him earl of Breadalbane and Holland, viscount of Tay and Paintland, Lord Glenorchy, Benederaloch, Ormelie and Weick in the peerage of Scotland, with special power to nominate his successor from among the sons of his first wife. In 1685 he was a member of the Scottish privy council. Breadalbane was the most powerful man in Scotland after Argyll, and it was of high moment to King William to gain him and obtain his service in conciliating the Highlanders. Breadalbane at first carried on communications with Dundee and was implicated in the royalist intrigue called the "Montgomery plot," but after the battle of Killiecrankie in July 1689 he made overtures to the Government, took the oath of allegiance, and was entrusted with a large sum of money by the Government to secure the submission of the clans. On June 30, 1691, he met the Jacobite chiefs and concluded with them secret articles by which they undertook to refrain from acts of hostility till October, gaining their consent by threats and promises rather than by the distribution of the money entrusted to him, which, it was believed, he retained himself.

On August 27 a proclamation was issued offering indemnity to all who should take the oath of allegiance before Jan. 1, 1692, and threatening all who should refuse with a military execution and the penalties of treason. All the chiefs took the oath except MacIan, the chief of the MacDonalds of Glencoe, who postponed his submission till December 31, and was then prevented from taking the oath till Jan. 6, 1692, through the absence of a magistrate at Fort William. This irregularity gave Breadalbane an immediate opportunity of destroying the clan which had for generations lived by plundering his lands and those of his neighbours. Accordingly, together with Argyll and Sir John Dalrymple (afterwards Lord Stair), Breadalbane organized the "Massacre of Glencoe," when the unfortunate MacDonalds, at the moment when they were lavishing hospitality upon their murderers, were butchered in cold blood on Feb. 13, 1692. Breadalbane's astuteness, however, prevented the disclosure of any evidence against him in the enquiry afterwards instituted in 1695. He was imprisoned in Edinburgh castle in September on the ground of earlier negotiations with the Jacobite chiefs, but he was released when it was known that he had been acting with William's knowledge.

Breadalbane did not vote for the Union in 1707, but was chosen a representative peer in the parliament of Great Britain of 1713–15. His co-operation with the English Government in securing the temporary submission of the Highlands was inspired by no real loyalty, and he encouraged the attempted French descent in 1708, refusing, however, to commit himself on paper. At the Jacobite rising in 1715 he excused himself on September 19 from obeying the summons to Edinburgh on the ground of his age and infirmities; but nevertheless the next day visited Mar's camp at Logierait and afterwards the camp at Perth. He had taken money for the whole 1,200 men he had promised and only sent 300. His 300 men were withdrawn after the battle of Sheriffmuir, and his death, on March 19, 1717, rendered unnecessary any enquiry into his conduct

BREADALBANE district, Perthshire, Scotland, bordered on the north by Atholl, east by Strathtay, south by Strathearn and west by the districts of Argyll and Lorne, and occupying some 1,020 square miles. Ben Lawers (3,984ft.), Ben More (3,843ft.) and Ben Lui (3,708ft.) are the principal peaks. Loch Tay is the chief lake, and the rivers are the Orchy, Dochart, Lochay, Lyon, Almond and the upper Tay. The population mostly centres in Aberfeldy, Fortingall, Kenmore and Killin. It is a land of deer forests, shooting and fishing; only a little soil in glens and straths is cultivable.

The large Breadalbane vine is at Killin.

BREAD AND BREAD MANUFACTURE. Bread is the staple food product prepared by the baking of flour, although the term is also used as the symbol for food itself. Bread-baking, or at any rate the preparation of loaves or cakes from flour or parched grain by means of heat, is one of the most ancient of arts. At Wangen and Robenhausen have been found the calcined remains of cakes made from coarsely ground grain in Swiss lake-dwellings that date back to the Stone Age. The cakes were made of different kinds of grain, barley and one-grained wheat (*Triticum monococcum*) being among the ingredients. This bread was made, not from fine meal, but from grain crushed between hard surfaces. (*See* FLOUR AND FLOUR MANUFACTURE.) Perhaps the earliest form of bread, if that word may be used, was prepared from acorns and beech-nuts. To this day a cake prepared from crushed acorns is eaten by the Indians of the Pacific slopes. The flour extracted from acorns is bitter and unfit to eat till it has been thoroughly soaked in boiling water. The saturated flour is squeezed into a cake and dried in the sun. Pliny speaks of a similar crude process in connection with wheat; the grain was evidently pounded and the crushed remnant soaked into a pulp, then made into a cake and dried in the sun. Virgil (*Georgics*, i. 267) refers to the husbandman first toasting and then crushing his grain between stones.

How did the lake-dwellers bake their cakes of bruised grain? Probably the dough was laid on a flat or convex-shaped stone, which was heated, while the cake was covered with hot ashes. Stones have been found among prehistoric remains which were apparently used for this purpose. In ancient Egyptian tombs cakes of durra have been found, of concave shape, suggesting the use of such baking-slabs; here the cake was evidently prepared from coarsely cracked grain. In primitive times milling and baking were twin arts. The housewife crushed or ground the grain and prepared the bread or cakes. Professor Maspero says that an oven for baking bread was to be found in the courtyard of every house in Chaldaea; close by were kept the grinding stones. That bread prepared by means of leaven was known in the days of the patriarchs may be fairly inferred from the passage in Gen. iii., where it is said of Lot that he "made a feast, and did bake unleavened bread." Whether the shewbread of the Jewish tabernacle was leavened is an open question, but it is significant that the Passover cakes eaten by Jews today, known as matzos, are innocent of leaven. Made from flour and water only, they are about 12in. in diameter, and resemble water biscuits.

The White Bread of Egypt.—The ancient Egyptians carried the art of baking to high perfection. Herodotus remarks of them, "dough they knead with their feet, but clay with their hands." The practice of using the feet for dough kneading, however repulsive, long persisted in Scotland, if indeed it is yet defunct. The Egyptians used for their bread, wheat, spelt, barley and durra. It is certain that even in ancient Egypt white bread made from wheat was used by the rich. The form of the bread is revealed by ancient monuments and also by remnants of bread found in ancient tombs. A common shape was a small round loaf, like a muffin. Other loaves were elongated rolls, and sprinkled on the top with seeds like modern Vienna bread.

The history of baking in classical Greece and Italy can be clearly traced. Athenaeus in his *Deipnosophists* minutely describes many different kinds of bread, which may be assumed to have been currently used in Greece. According to Pliny (*Nat. Hist.* xviii. II. s. 28) Rome had no public bakers till after the war with Perseus (171–168 B.C.). That long after public bakehouses came into use the Romans and other urban dwellers in Italy continued to make a great deal of bread at home is certain. In Pompeii several private houses had their own mill and bakehouse. That city must also have possessed bakers by trade, as loaves of bread have been found, round in form, and stamped with the maker's name, possibly to fix responsibility for weight and purity. In the time of the republic, public bakehouses were under the control of the aediles. Grain was delivered to the public granaries by the *Saccarii*, while another body called *Catabolenses* distributed the grain to the bakers. The latter were known as *Pistores* or "pounders," a reminiscence of the primitive time when grain was pounded by a pestle in a mortar. Slaves were largely employed in the irksome work of grinding, and when Constantine abolished slavery the staff of the *Pistrinae* was largely recruited from criminals. The emperor Trajan incorporated about A.D. 100 the college of *Pistores* (millers and bakers), but its members were employers, not operatives. The work of a bakery is depicted in a set of bas-reliefs on the tomb of a master *pistor* named Eurysaces, who flourished about a century before the foundation of the college. Juvenal, in his famous satire, said that the Romans required only two things, *panem et circenses*, bread and circuses.

Early Regulation of Sale.—In the middle ages bakers were subjected to special regulations in all European lands. These regulations were supposed to be conceived in the interests of bread consumers, and no doubt were intended to secure fair dealing on the part of bread vendors. The legislators appear, however, to have been unduly biased against the baker, who was often beset by harassing restrictions. Bakers were formed into guilds, which were under the control, not only of their own officials, but of the municipality.

In London the bakers formed a brotherhood as early as 1155, and were incorporated in 1307. There were two distinct corporate bodies concerned with bread-making, the Company of White Bakers and the Company of Brown Bakers; these were nominally united in 1509, but the union did not become complete till the middle of the 17th century. In Austria, bakers who offended against police regulations respecting the sale of bread were liable, until comparatively recent times, to fine, imprisonment and even corporal punishment.

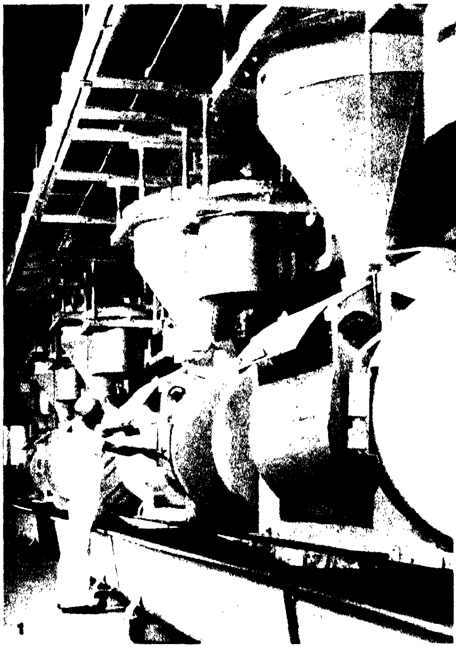
In Turkey the lot of the baker was hard. Baron de Tott, writing of Constantinople in the 18th century, says that it was usual, when bread went to famine prices, to hang a baker or two, which was promptly done. A barbarous punishment, inflicted in Turkey and in Egypt on bakers who sold light or adulterated bread, consisted in nailing the culprit by his ear to the door-post of his shop.

In France a decree of 1863 relieved bakers from many of the restrictions under which they previously suffered, but it did not touch the powers of the municipalities to regulate the quality and sale of bread. It left them the right conferred in 1791, to enforce the *taxe du pain*, the object of which was to prevent bakers from increasing the price of bread beyond a point justified by the price of the raw materials; but the right was exercised on their own responsibility, subject to appeal to higher authorities, and by a circular issued in 1863 they were invited to abolish this *taxe officielle*. In places where it exists it is fixed every week or fortnight, according to the average price of grain in the local markets.

In England an act of parliament was passed in 1266 for regulating the price of bread by a public assize, and that system continued in operation till 1822 in the case of the city of London, and till 1836 for the rest of the country. The price of bread was determined by adding a certain sum to the price of every quarter of flour, to cover the baker's expenses and profit; and for the sum so arrived at tradesmen were required to bake and sell 80 quartern loaves or a like proportion of other sizes, which it was reckoned each quarter of flour ought to yield.

In America.—Wheat came to North America with the Spaniards, and the first wheat crop was harvested in Mexico in 1530 from grain planted by a servant of Cortez. The first settlers in

BREAD AND BREAD MANUFACTURE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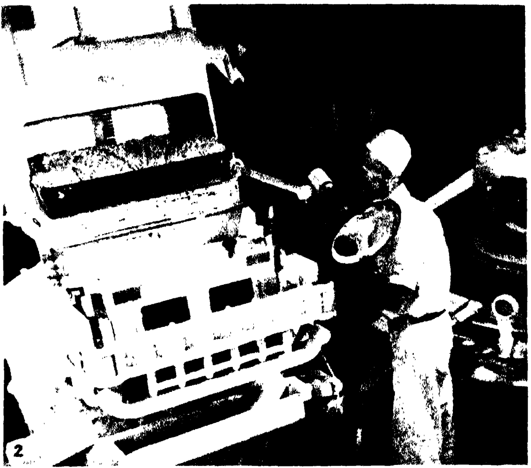
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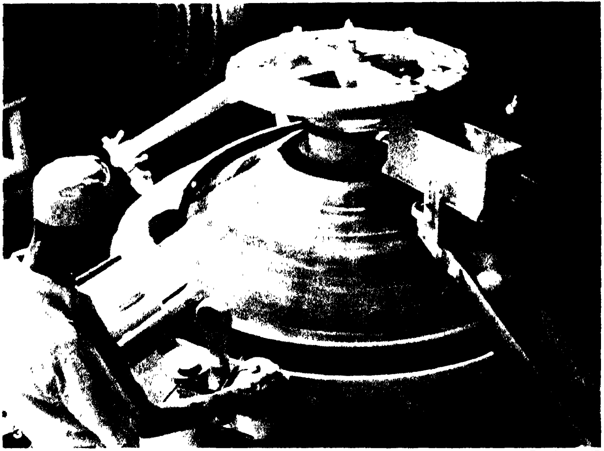
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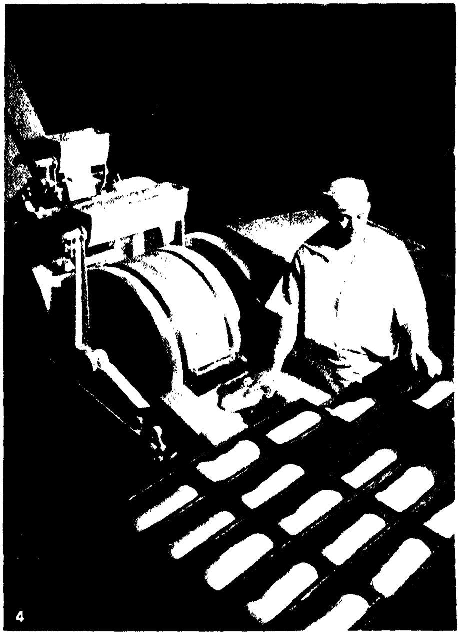
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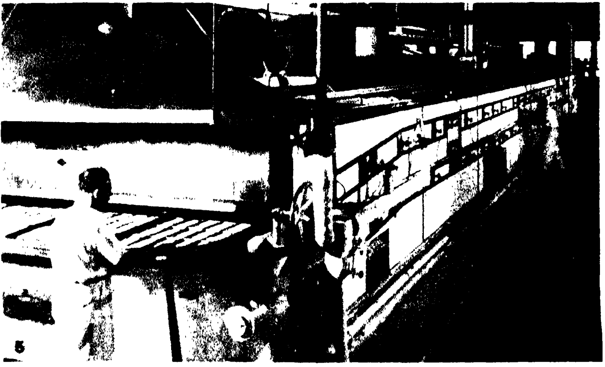
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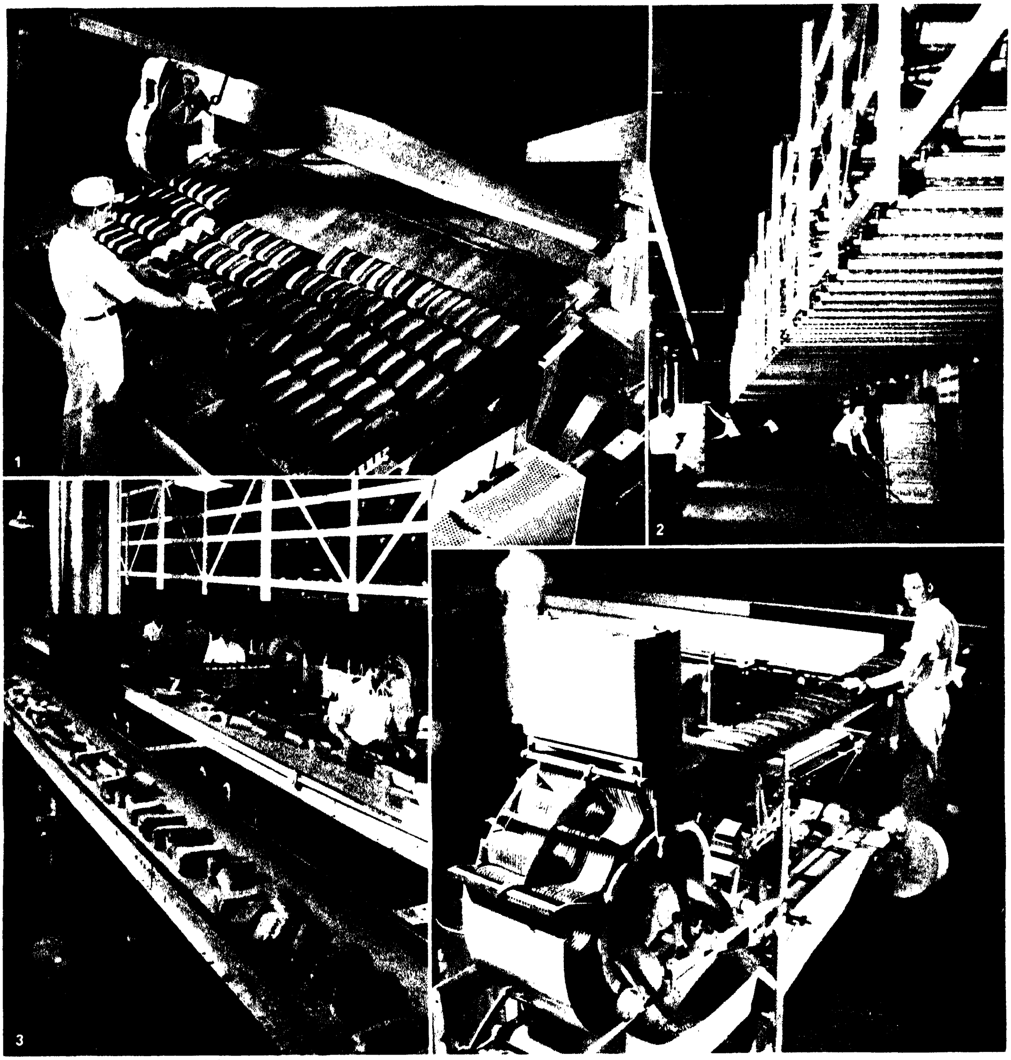
BY COURTESY OF BOND BREAD BAKERS

PRELIMINARY STEPS IN BAKING OF BREAD

1. Mixing machines, each of which mixes enough dough in one operation for approximately 1,000 loaves
2. A divider, which cuts the dough into exact sizes for the loaves
3. The rounder, which shapes the loaf-size pieces of dough into flour-sprinkled balls
4. After a "quick" rising in a ı enters the moulding machine, where shaped into loaves
5. Feed end of a travelling o\ are placed after a controlled second ı



BY COURTESY OF BOND BREAD BAKERS

FINAL STEPS IN BREAD MANUFACTURE

1. Delivery end of a travelling oven, which bakes approximately 3,600 loaves an hour
2. Cooling racks for the freshly baked bread
3. After cooling for two hours, the loaves pass on conveyors to the slicing and wrapping machines
4. Automatic slicer

America found the Indians grinding corn and making bread from it, a practice emulated by the early colonists at Plymouth in New England. The Pilgrims also brought wheat, harvested a crop about 1621, and baked bread in community ovens. Shortly after 1626 Peter Minuit, first governor of New Amsterdam, established a mill on Manhattan island, now New York city. Stones were used for grinding wheat in America until after the Civil War (1861–65), when they were replaced by rollers. Until the time of the World War, most bread was baked in the home, but since then commercial baking has largely supplanted that of the housewife. (See *Bread Manufacture* below.)

Sale by Weight.—Among acts regulating the manufacture and sale of bread in Britain are one of 1822 (Sale of Bread in the City of London and within 10mi. of the Royal Exchange), and the Bread Act of 1836, as to sale of bread beyond 10mi. of the Royal Exchange. The acts require that bread shall be sold by weight, and in no other manner, under a penalty not exceeding 40 shillings. This does not, however, mean that a seller is bound to sell at any particular weight; the words quartern and half-quartern, though commonly used and taken to indicate a 4lb. and 2lb. loaf respectively, have no legal sanction. That is to say, a baker is not bound to sell a loaf weighing either 4lb. or 2lb.; all he has to do, when a customer asks for a loaf, is to put one on the scale, weigh it and declare the weight. When bread is sold over the counter it is usual for the vendor to cut off and tender a piece of bread to make up any deficiency in the loaf. This is known as the "overweight."

When bread is sold over the counter, two loaves may be 6oz. short, while the piece of makeweight may not reach an ounce. The provision as to selling by weight does not apply to fancy bread and rolls. No exact definition of "fancy bread" has ever been laid down, and it must be largely a question of fact in each particular case. All bakers or sellers of bread must use avoirdupois weight, and must provide, in a conspicuous place in the shop, beams, scales and weights, in order that all bread there sold may from time to time be weighed in the presence of the purchaser. The penalty for using any other weight than avoirdupois is a sum not exceeding £5 nor less than 40 shillings, and for failing to provide beams and scales a sum not exceeding £5. The acts also define precisely what ingredients may be employed in the manufacture of bread, and impose a penalty not exceeding £10 nor less than £5 for the adulteration of bread. (*See* further under ADULTERATION.)

Although the Act of 1836 extends to the whole of Great Britain (Ireland excepted) out of the city of London and beyond 10mi. of the Royal Exchange, yet in many Scottish burghs this act is replaced by local acts on the sale of bread. These are in all cases of a much more stringent nature, requiring all batch or household bread to be stamped with the reputed weight. Any deficiency within a certain time from the withdrawal of the bread from the oven is an offence.

It may be noted that the Acts of 1822 and 1836 define precisely what may and may not be sold as bread. It is laid down in section 2 that "it shall and may be lawful . . . to make and sell . . . bread made of flour or meal of wheat, barley, rye, oats, buckwheat, Indian corn, peas, beans, rice or potatoes, or any of them, and with any (common) salt, pure water, eggs, milk, barm, leaven, potato or other yeast, and mixed in such proportions as they shall think fit, and with no other ingredients or matter whatsoever."

Sanitation of Bakehouses.—The sanitary arrangements of bakehouses in England were first specially regulated by the Bakehouse Regulation Act, 1863, which was repealed and replaced by the Factory and Workshop Act, 1878; this act, with various amending acts, was in turn repealed and replaced by the Factory and Workshop Act, 1901. By the Act of 1901 a bakehouse is defined as a place in which are baked bread, biscuits, or confectionery from the baking or selling of which a profit is derived. The duty of enforcing the Act of 1863 was placed on the local authorities; since then there have been sundry vicissitudes in the respective jurisdictions of the factory inspectors and of the local authorities in the matter of sanitary supervision of bakehouses, but the position now reached is that the local authority administer the general sanitary provisions in the Factory Acts so far as regards bakehouses which are "workshops" (*i.e.*, where no mechanical power is used in aid of the manufacturing process) and also, as regards all bakehouses, certain special provisions which apply to bakehouses only.

Mention may also be made of a welfare order made by the secretary of State in 1927 and enforceable by the factory inspectors, which requires (*inter alia*) suitable washing facilities and drinking water to be provided.

In the United States the sale of bread and bakery products and the sanitation of bakery plants are governed by State laws and municipal ordinances, usually enforced by public health and other local authorities.

Bread and bakery products shipped in interstate commerce are, however, subject to the provisions of the Federal Food, Drug and Cosmetic Act of 1938 and the regulations promulgated under its authority. This law is concerned mainly with adulteration and misbranding.

BREAD: HOME-MADE

The making of home-made bread demands ingredients of flour, fat, liquid and the correct amount of sugar, salt, yeast, the maintenance of an even temperature during the rising process, skilful kneading and proper baking. Different kinds of wheat flour vary in bread-making value according to the gluten that can be developed in them. Gluten makes the bread dough elastic so that it can expand and holds the bubbles of gas formed by the yeast. Yeast, which serves as the leavening agent, may be used in the commercially prepared dry or compressed form or as it is made in the home in the liquid form. Liquids used in bread-making are milk, water and potato water. Shortening, consisting of animal or vegetable fat or oil, is used in bread-making to produce a soft crumb.

Oven Conditions.—If using a coal range, make a good fire and bank it against the side of the oven. Let the heat lessen later. When cooking by gas or electricity heat the oven 15 to 20min. before the loaves are put in. Lessen the heat after the loaves have risen well and are slightly brown. If the oven is too hot the crust will become dark and hard and the inside heavy; if too cool the bread will be pale and dry from too slow cooking. If bread is sodden the dough may have been too moist or the loaves, while hot, put to cool so that the steam could not escape; if the bread rises too much and is full of holes the oven was too cool or the dough rose too fast because it was left in too hot a place. If the yeast is mixed either too hot or too cold the bread will not rise well as the yeast plant is killed by too great heat or by extreme cold. An oven temperature of 350° F is needed at first. Test with an oven thermometer or sprinkle a little flour on the oven sheet; if it turns dark brown in 4–5min. the oven is ready.

These directions are for baking bread in the oven of a domestic coal range, gas or electric cooker. It is not advisable to bake large loaves in small ovens. If a quartern—3½lb. of flour—is used make it into two loaves. If the oven is very small only rolls or 1lb. or ½lb. loaves should be attempted. Whole wheat and other dark breads should always be made into small loaves. They take a little longer to cook than white.

White Bread.—In a bowl or bread-mixer, place 4 tablespoonfuls of granulated sugar, 4 tablespoonfuls of shortening (butter, lard, etc.), 4 teaspoonfuls of salt, and pour over it one quart of hot milk. Let stand until tepid. Add yeast, prepared by dissolving 2 cakes of fresh compressed yeast in one-half cup of warm, or tepid, water. Sift in about 16 cups of bread flour, stir, and mix or knead on a floured board until dough does not adhere to the fingers. Put dough in well greased bowl or mixer, cover it, and let stand at about 80° F. until dough has risen to about three times original size. After the first half-hour, the partly risen dough may be broken or punched up, after which it will continue rising.

When raised sufficiently, knead lightly on a board and shape into three loaves. Place in greased bread pan and let it rise again in a warm place until about double in size. Put in oven heated *to 400° F. for 15min., continue at 350° F. for 30 minutes. When properly baked, bread draws away slightly from sides of pan, and is evenly brown on top.*

Remove from pans and cool quickly on a sieve or rack. Store and slice only when cold.

Whole wheat and rye breads, or mixtures of these made with white flour are prepared in a similar manner. Raisins or chopped nuts may be added for variety.

In rural districts where some of the ingredients are locally produced, home-made bread may be less expensive for large families, but under urban conditions baker's bread is usually cheaper. (J. A. To.)

BREAD MANUFACTURE

In bread-making, the aim of modern development is to make the process both economical and automatic. Nothing is more desirable than that this ideal should be attained, for where handling of the material can be dispensed with it is certain that economy in production must be the result, whilst from a hygienic point of view the benefits are obvious. An authority states that "the doughing machine without doubt gives the greatest ease to the workman, the greatest peace of mind to the owner, and the greatest satisfaction to the consumer," and there is no doubt that even in smaller bakeries economy may be effected by even a partial substitution of hand labour by machines, of which the range is sufficient to meet all needs. The process of bread-making may conveniently be divided into four sections—namely, flour-handling, dough-making, loaf-making and baking; and although detailed attention must be directed to the completely automatic plant, for the most part the machines involved are none the less applicable to bakeries which are only in part automatic.

Flour-handling.—Handling of the flour entails blending, sifting and weighing. The machines used for blending are either continuous in action or work on the batch principle. In the former the hopper of the machine is divided by partitions and the various flours fed into the compartments, at the bottom of which are adjustable feed rollers which can be controlled to deliver the requisite quantity of flour. It is claimed that such blending machines are efficient but it is doubtful whether any blend can be perfect and regular unless made in a batch machine. This type is similar in action to that of the universal kneader and each batch of flours is thoroughly mixed in it before being allowed to pass out to the elevator, which carries the flour from the blender up to large hoppers where the different mixtures are stored. A sifting machine is fitted below the storage hopper which serves the purposes of removing fluff or refuse, breaking up any lumps and thoroughly aerating the flour. The spiral brush sifter is an ideal machine for the purpose. The flour is fed into a chamber in which a spiral brush works against a semicircular sieve. This machine is rapid in action, easily cleaned and noiseless. The sifter delivers the flour into an automatic weigher. This machine is adjusted like the ordinary platform weigher, and as it discharges it automatically cuts off the supply of flour from the sifter. In large plants, where there are two or more storage hoppers, travelling mechanism allows the weigher to be moved to a position underneath any one hopper. An arrangement suitable for smaller bakeries comprises a blending machine, sifter and fixed weigher to serve one kneading machine. From the weigher the flour discharges direct into the kneading machine and is ready to be made into dough

Dough-making.—Pure water at the right temperature for dough-making is secured by using a tempering tank. Such tanks, of which the inside is either tinned, galvanized or of copper, are fitted with hot and cold water supplies, any temperature being thus easily obtained. A thermometer and gauge glass enable the temperature and quantity of the water within the tank to be seen at a glance. In bakeries where the process includes the making of a sponge, a sponge mixer is used. This consists of a dough mixer in which the materials are stirred together by means of blades carried on a revolving spindle, the latter being raised clear of the mixer when mixing is finished, and the sponges are then allowed to rise in troughs. The kneading machine has long been the most familiar mechanical unit in the bakehouse and dates at least to 1760 when a Frenchman, Salignac, devised a model in which harrow-shaped arms, mechanically operated, mix the dough in a trough. The Boland machine, which dates from about the middle of the 18th century, was also of French origin and was probably the first which efficiently replaced the work of human arms. It consisted essentially of a trough in which revolved a pair of blades operating in the manner of alternate screws. This machine was adopted widely in other countries than France and was one of the first to be used in the British isles. Amongst the modern kneading machines which are suitable for making various types of dough is that known as the Universal. The body of the machine is a metal trough in which two blades of special shape revolve side by side on horizontal axes. The base of the trough is so shaped as to follow the path of the two arms so that no particle of dough can escape thorough kneading. The machine can be tilted easily either by hand or by power, without stopping the arms, so that the discharging of the finished dough into the dough truck is simply accomplished. The "Viennara" dough kneader is also widely used. In this the dough is made in a round pan standing on a platform which revolves about a vertical axis. The kneading is effected by an arm, T-shaped at the end, which reaches over and into the pan. The end of the arm sinks into the dough, travels across the pan and then rises again. As the pan is itself revolving, fresh dough is repeatedly brought within reach of the arm. In this way the dough is very gently and continuously stretched and folded. When the kneading is finished the pan is wheeled away for proving, a dough truck in this case being unnecessary, and afterwards returned to the machine for "cutting back." In a second type of this machine the revolving pan is not movable, but has a hinged door through which the dough can readily be discharged when kneading is complete.

Loaf-making.—The loaf-making process is begun by division of the dough into pieces of suitable and uniform size. Until the year 1896 this was invariably done by hand, but at that time the first automatic dough divider was put on the market and this machine marked a very substantial advance in the mechanical equipment of bakeries. The success of these machines depends largely upon the amount of punishment which the dough receives during the operation of dividing, for, if it is treated too severely, the after-effects are serious and will be reflected in the finished loaf. The division is effected by pressing the dough into cylinders, of which there may be one, two, or three, in accordance with the output of the machine, and which are adjustable in size so that the correct weight of dough may be included each time they are filled. In the United States, the number of cylinders is usually rated 2, 4 and 6. The contents of the cylinders are automatically ejected and the pieces of dough fall onto a travelling band and are carried forward. Great importance attaches to the actual method by which the cylinders are filled and this varies in different models. In a widely used type the dough is fed into the hopper and by means of a weighted ram the necessary force is applied to press it into the cylinders. The pressure is adjustable to suit different types of dough and it is said that the punishment inflicted upon the latter by this method is reduced to a minimum. "Handing up," "balling up" or "rounding" in order to restore uniformity to the pieces of dough after treatment in the divider necessarily follows. This was formerly performed by hand, but the process is today carried out successfully by machines of which the "conical" and "flexible" types are well known. The former consists of a revolving cone-shaped table with grooved surface for gripping the dough, around which is a stationary spirally shaped trough supported from above. The pieces of dough are fed into the trough at the base of the cone and the latter in revolving works them up to the top, to be discharged onto a travelling band. As the piece of dough ascends it is forced against the side of the trough and undergoes a screw-like motion which makes it uniform throughout and ensures stretching of the skin in every direction. At the delivery end of the trough the slope is decreased, with the result that the "tail" of the piece of dough is "tucked in" and it rolls off the table practically spherical. The principle underlying the action of the "flexible" moulder is identical with that of the "conical" machine, except that the conical surface is replaced by an inclined moving table composed of metal laths carried on chains and so forming an endless belt. The moulding troughs, which in this case may be two or more in number, are straight and are adjustable in size to suit different weights of dough and varying degrees of working. Handling of the dough after it leaves the handing-up machine has been made unnecessary by the advent of the automatic swinging tray prover. The pieces of dough coming from the hander-up fall onto trays and travel into the proving chamber, which is warmed to the required temperature and supplied with moist vapour to prevent a skin from forming on the loaves. The trays, carried on chains, move through the prover by a circuitous route devised to save floor space and the speed is adjustable to give the correct time of proving. The damp heat within the prover necessitates regular and thorough cleaning and the suspended trays are easily removable for this purpose. The loaves on coming out of the prover are tipped onto a travelling band ready for the final moulding machines. These are similar in operation to the handing-up or preliminary moulding machines, but are fitted with a splitting device for cutting the loaf in two when making cottage bread and with a shaping device for "tin" or "pan" bread. A final proofing for about 1 hr. completes the process and the loaves are ready for the oven.

Bread-baking.—In early times the oven, which was a flat baking space built in brickwork, was heated internally by wood or coke. Externally heated ovens followed, in which the baking chamber was surrounded by flues leading from furnaces fired with coke or coal. A marked step forward was, however, taken when about the middle of the 19th century the Perkins steam pipe oven was introduced. Rows of sealed iron pipes containing water are placed at the crown and sole of the oven. The pipes project outside the oven and the projecting ends are heated. The steam produced in the pipes is much superheated and the temperature of the oven is by this means readily raised to 450–500° F. After the start this mode of heating produces a steady heat, and the oven can be used continuously with the minimum of attention. The old method of charging the oven with the hand peel has been superseded in modern machine bakeries by the draw plate, or the Peel or travelling oven in the United States. The draw plate is mounted on wheels and is drawn out of the oven, charged with loaves, and then returned. Decker ovens in which one baking chamber is built over another are used in some cases. It may be said that the problem of the completely automatic plant for baking pan bread has been solved by the production of the swinging tray travelling oven with which is combined a swinging tray automatic final prover. The loaves leave the final moulder and are deposited on the trays which pass continuously through prover and oven. The empty baking tins move back on the trays over the top of the oven to the feed end of the prover, when they are charged afresh. The bread is not handled even on leaving the oven for it passes next to a swinging tray cooler and is then automatically wrapped in paper for delivery. A development in oven construction is the travelling plate oven heated directly by gas or indirectly by oil or electricity. This oven can be included in the wholly automatic plant and can be used for baking all types of bread. (R. T. C.; J. A. To.)

IN THE UNITED STATES

Commercial baking in the United States is a large and growing industry. It ranks second among the food industries in value of products, first in annual payroll, and seventh among all industries. In 1937 (figures from 1937 U.S. Census of Manufactures) 17,193 baking establishments, employing 239,388 wage-earners, used $727,021,811 worth of materials and manufactured goods worth $1,426,162,859. Of the total production 59% was in the form of bread and other yeast-raised products; 15·8% biscuits, crackers, and buns; ·5% in pretzels; 13·6% cakes; 1·24% cookies; 3·3% doughnuts; 5·3% pies; and 1·3% pastries. In addition 15,037 bakeries accounting for 87% of the total reported using 41,515,936 bbl. of wheat flour and 2,776,828bbl. of rye flour and other flours. The baking industry also used 1,130,639,487lb. of sugar; 672,919,980lb. of butter, lard, and other shortenings; milk and eggs valued at $60,882,853; and millions of dollars worth of yeast, malt, syrups, salt, and other essential bread ingredients.

During the period 1921–28 many wholesale bakeries were consolidated and large organizations now operate chains of plants, in some cases covering the entire country. In the manufacture of biscuits and crackers, which are sold in package form under conditions which protect the products from deterioration, large-scale production and distribution over wide areas is possible The consolidation of bread and cake plants is limited to operating control and the products are still sold within a restricted area. The use of enriching materials such as whole milk and dry milk solids has improved the character of bread and its nutritive value The idea that bread from white flour is innutritious is now recognized as erroneous.

The average American white bread is comprised of about 48% carbohydrates, mostly in the form of starch, 2% fat, 9·5% protein of good biological value, 2% ash, and 38% moisture. Included in the ash are the food-minerals, calcium, phosphorus, and iron. White bread also contains small but appreciable amounts of the vitamins, thiamin, riboflavin and carotin. It is easily digested.

Arrangement of Plant.—Improved bread and cake quality is secured through the improved processes and machinery used in the modern bakery. In the development of the industry the bakery has grown from a single floor to a building several stories high. The flour purchased in car-load quantities is stored on the upper floor where it is matured or aged for several months before it is delivered to the mixing and sieving machines where it is blended *en route* to the automatic weighing devices on the mixing-room floor below. Water of definite temperature is added to the weighed flour in the mixer together with weighed amounts of yeast, sugar, salt and in most cases condensed or dried milk. The dough made from these materials is placed in large troughs each holding 1,000 to 1,200lb. of dough and sent to the dough or fermentation rooms where it undergoes a process of rising or fermenting for several hours. During the development of the yeast the dough is punched or kneaded several times to release some of the gas generated by the growing yeast plant and to develop the gluten of the flour under ideal conditions. The dough is then taken from the troughs and passes through automatic dividers which cut out pieces of uniform size for making 1lb and 1½lb. or other size loaves. The pieces of cut dough are passed on to a machine called the "rounder-up" which produces shape and form. The balled-up dough then slowly passes through a proofing chamber which is kept at a uniform temperature and in which the dough lying in slowly moving trays again expands under the influence of the growing yeast. From this point it passes to moulding machines which roll and shape it to forms to fit the bread pans in which it enters the oven for baking.

Motive Power.—The modern bakery is electrically equipped. Every operation which can be performed by machinery is mechanical and the power is usually supplied by electric motors which are a part of each machine. In the development of electrically driven mixers, special devices have been installed which not only make every operation mechanical but also remove the possibility of injury to the workmen.

Ovens.—The modern bakery demands a type of oven in which the heat can be quickly and uniformly applied and into which the dough can be loaded and the baked bread removed with no loss of time. This need has resulted in the building of travelling ovens in which the hearth moves forward from the loading end to the exit where the baked loaves are delivered in a never-ceasing stream. Other types of travelling ovens convey the pans containing the dough through a uniformly heated chamber, delivering them finally at the initial point where the same workman who loads the travelling trays removes the baked bread.

Fuel.—Coal, coke, gas, oil and electricity are used in firing modern bake-ovens, the type used being determined chiefly by the cost per unit quantity of bread baked. Where electricity is cheap it is the ideal fuel. Travelling ovens are usually gas-fired under systems which give an automatic control over the gas burned and heat obtained. The earlier types of ovens in which wood, coal and coke are used as fuel are rapidly giving way under the development of processes of heating which are automatic, dustless and cheap.

Wrapping and Delivery.—Sanitary legislation and development of more hygienic practices in handling food supplies have compelled the wrapping of bakery products so that they are fully protected against dust, dirt and contamination by handling. As the baked loaves leave the oven they pass to a conveyor which delivers them to travelling racks on which they are cooled to room temperature. When thoroughly cool the loaves are sliced by machinery and then pass to wrapping machines which envelop them in paraffin paper or cellophane and seal them in an air-tight package.

They then go to the shipping room to be packed in wood or metal baskets or in more modern practice in large cardboard cartons for shipment by truck or express. The products intended for local delivery are placed in specially built delivery wagons; the usual practice of distributing bread from the wholesale bakeries is through the retail grocer who purchases bread daily from a number of companies and in turn delivers it still in its original wrapper to the housewife.

Modern Operation.—Every operation in the modern bakery is automatically controlled and mechanically registered. The number of revolutions of the mixer is predetermined; the temperature of the water which makes the dough is thermostatically controlled; the heating of the dough in the process of mixing is held down by chilled air or brine-cooled mixer walls; the temperature and humidity of the dough room is fixed, the speed of the divider, rounder, proofer, moulder, travelling oven, cooler and wrapping machine is so synchronized that lost motion or wasted time in any operation is impossible. Indeed, in a decade baking has become fully mechanized.

Mechanics to run the machines, chemists to buy the ingredients and prepare the formulae, technicians to apply them to actual shop practice, have about taken the place of the craftsman baker who less than a generation ago was indispensable.

(H. E. Ba.; J. A. To.)

BREADFRUIT. This important staple food of the South Pacific, cultivated less commonly in other parts of the tropics, is the fruit of *Artocarpus altilis*, a tree of the family Moraceae.

The tree is extremely handsome. It reaches a height of 40 to 60 ft., and has large, ovate, glossy-green leaves entire toward the base and 3- to 9-lobed toward the apex. Male and female flowers are borne in separate inflorescences on the same tree: the staminate or male ones in dense, club-shaped catkins; the female or pistillate, which are very numerous, are grouped together and form a large prickly head upon a spongy receptacle. The ripe fruit, which is composed of the matured ovaries of these pistillate flowers, is roundish, commonly 4 to 8 in. in diameter, greenish to brownish-green externally, with white and somewhat fibrous pulp. There are two distinct forms of breadfruit: one seedless, the other (sometimes known as breadnut) containing many seeds resembling chestnuts.

BREADFRUIT (ARTOCARPUS ALTILIS), SANTIAGO DE CUBA (ABOUT ONE-FIFTH NATURAL SIZE)

The seedless form is the most valuable and the one usually grown. It has been cultivated in the Malayan archipelago (where the species is held to be indigenous) since remote antiquity. From this region it spread throughout the tropical South Pacific region in prehistoric times. Its introduction into the new world is connected with the memorable voyage of Captain William Bligh in H.M.S. "Bounty," a voyage recommended by Captain James Cook, who had seen the breadfruit in the Pacific islands and considered that it would prove highly useful as a foodstuff for Negro slaves in the West Indies.

After the failure of this voyage, a second was carried out which resulted in the successful establishment of the tree in Jamaica, where, however, it failed to live up to expectations, because the Negroes preferred bananas and plantains.

The breadfruit is not a fruit in the popular sense of the term, but a product containing considerable amounts of starch, not to be eaten uncooked.

Regarding methods of preparing it for the table, W. E. Safford writes (*Useful Plants of Guam*): "It is eaten before it becomes ripe, while the pulp is still mealy, and of a consistency between bread and sweet potatoes. In Guam it was formerly cooked after the manner of most Pacific island aborigines, by means of heated stones in a hole in the earth—layers of stones, breadfruit and green leaves alternating. It is still sometimes cooked in this manner on ranches but the usual way of cooking it is to boil it or bake it in ovens; or it is cut in slices and fried like potatoes. The last method is the one usually preferred by foreigners. The fruit, boiled or baked is rather tasteless by itself, but with salt and butter or gravy it is a palatable as well as nutritious article of diet."

In the West Indies and on the mainland from Mexico to Brazil the breadfruit tree is grown in dooryards and the fruit appears upon the market.

Propagation of the seedless forms is by means of root suckers or root cuttings. Numerous varieties are cultivated in the Pacific islands, but these are not known in tropical America. The tree withstands no frost and has not been successful even in the southernmost parts of Florida.

In the South seas, cloth is made from its fibrous inner bark; the wood is used for canoes and furniture; and a glue and caulking material are obtained from the viscid milky juice which exudes from incisions in the trunk. (W. Po.)

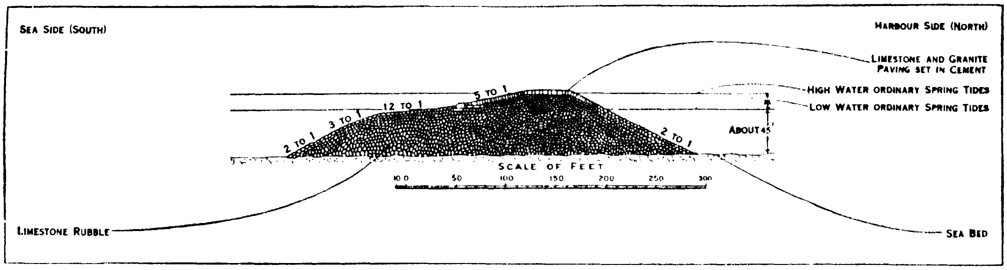
BREAD TICKET. In World War I, the scarcity of cereals in Europe forced nearly all the belligerent powers, and some of the neutrals, to ration bread. This led to the issue of bread tickets or coupons as the obvious means of distributing supplies equitably.

In Germany and Austria, the consumers were supplied with bread tickets as early as 1915; the cards bore detachable coupons, numbered and dated to prevent fraud. Later, France and Italy followed suit, and Scandinavia, Holland and Switzerland found it necessary to issue bread tickets. In the United Kingdom, rationing was adopted only after much argument and delay. Finally, ration books for some foods were issued, and each consumer had to choose and register with a particular retailer, but although the rationing of bread was contemplated it was not put into practice.

(*See* RATIONING.)

BREAKING BULK, a nautical term for the taking out of a portion of the cargo of a ship, or the beginning to unload; and used in a legal sense for taking anything out of a package or parcel, or in any way destroying its entirety. In England it was important in connection with the subject of bailment, involving the curious distinction that where a bailee received possession of goods in a box or package, and then sold them as a whole he was guilty only of a breach of trust, but if he "broke bulk" or caused a separation of the goods, and sold a part or all, he was guilty of felony. This distinction was abolished by the Larceny act (1861), which enacted that whoever, being a bailee of any chattel, money or valuable security, should fraudulently take or convert the same to his own use, or the use of any person other than the owner, although he should not "break bulk" or otherwise determine the bailment, should be guilty of larceny (§ 3).

BREAKWATER, a barrier intended to break the force of water at a particular place. A breakwater provides the artificial protection necessary, when a harbour is formed in an exposed situation, to supplement or complete such natural shelter as may be afforded by the configuration of the coast line or by the presence of outlying islands, reefs, etc. (*see* also the article HARBOURS). Although a harbour pier or jetty may be so placed and built as to serve the double purpose of a berthing place and a breakwater, the term breakwater is generally confined to a struc-



BY COURTESY OF THE CIVIL ENGINEER-IN-CHIEF, ADMIRALTY

FIG. 1.—CROSS SECTION (1927) OF THE PLYMOUTH BREAKWATER. IT IS SUBSTANTIALLY THE SAME AS THE SECTION COMPLETED BY JOHN RENNIE IN 1829

ture used solely for protection; indeed, in some cases breakwaters are isolated, so as to be cut off by water from the shore, as at Plymouth.

Breakwaters must be made sufficiently strong to withstand the impact of the waves during the worst storms to which they are exposed. It is therefore essential, before constructing a breakwater, to investigate carefully the exposure of the site, the distance of any sheltering land in the most stormy direction, the slope of the beach and the depth of the sea in the neighbourhood of the shore, and the protection, if any, afforded by outlying shoals or sandbanks. In a tidal sea, the height required for a breakwater and the extent of it exposed to breaking waves is affected by the difference in level between high and low water. The nature and the extent of any drift of sand or shingle along the shore must be ascertained. A study of the conditions of the currents is also necessary in order to avoid, in planning the works, the placing of the entrance to the sheltered area in such a position as to expose ships making the harbour to inconveniently strong cross-currents. These and other similar problems face the engineer in planning the form and situation of the protective works of a harbour.

Winds.—Observations of the force, prevalence and direction of the winds belong to the science of meteorology (*q.v.*), but such records are valuable to the engineer in indicating from which directions, open to the sea, the worst storms, and consequently the greatest waves, may be expected. Moreover, it is necessary for constructing or repairing a breakwater to know the period of the year when the calmest weather may be safely anticipated. In the parts of the world subject to periodical winds such as the monsoons, the direction and force of the winds vary with remarkable regularity according to the seasons, and even such uncertain occurrences as hurricanes and cyclones generally visit the regions in their track at definite periods of the year, according to the locality.

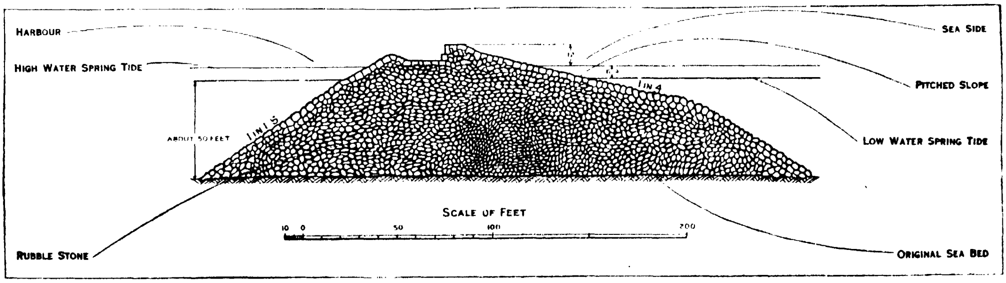


FIG. 2.—CROSS SECTION OF THE OUTER ARM OF PORTLAND OLD BREAKWATER

Waves.—The size of waves depends on the force of the wind and the distance along which it blows continuously, in approximately the same direction, over a large expanse of ocean. The greatest waves are, accordingly, encountered where the maximum distance in a certain direction from the nearest land—or, as it is termed, the "fetch"—coincides with the line travelled by the strongest gales. The dimensions, indeed, of waves in the worst storms depend primarily on the extent of the sea in which they are raised; though in certain seas they are occasionally greatly increased by the exceptional velocities attained by hurricanes and typhoons.

Waves have been found to attain a maximum height (measured from trough to crest) of about 20ft. in the Mediterranean, 25ft. in the Bay of Biscay and 40ft. in the Atlantic ocean; whilst waves of 50 to 60ft. in height are said to have been observed in the south Atlantic ocean off the Cape of Good Hope, where the expanse of sea reaches a maximum. The length of large waves bears no definite relation to their height, and is apparently due, in the long waves often observed in exposed situations, to the combination of several shorter waves in their onward course. Thus waves of over 600ft. in length have been met with during severe gales in the Atlantic ocean; whilst waves from 600 to 1,000ft. long are regarded as of common occurrence in the Pacific ocean during storms.

The rate of transmission of the undulation also varies with the exposure; for the ordinary velocity of the apparent travel of waves in storms has been found to amount to about 22m. an hour in the Atlantic ocean, and to attain about 27m. an hour off Cape Horn. The large waves observed in mid-ocean do not, however, reach the coast, because their progress is checked and their height and length reduced by encountering the shelving sea-bottom on approaching the shore.

The actual waves which have to be arrested by breakwaters therefore depend on the exposure of the site, the existence of continuous deep water close up to the shore and the depth in which the breakwater is situated. On the other hand, the height and consequently the destructive force of waves are increased on running up a funnel-shaped bay by the increasing concentration of the waves in the narrowing width, just as the tidal range of a moderate tidal current is much augmented by its passage up the bay of Fundy, or the Bristol channel into the Severn estuary. This effect is intensified when the bay faces the direction of the strongest winds. Thus at Wick, on the north-east coast of Scotland, a mass of masonry weighing 1,350 tons, placed at the head of the breakwater projecting halfway across the bay and facing the entrance, was moved by the waves during a violent storm. On the same coast, a portion of Peterhead breakwater, weighing 3,300 tons, was shifted 2in in 1898. It has been estimated that the wave stroke necessary to move this mass amounted to 2 tons per sq.ft.

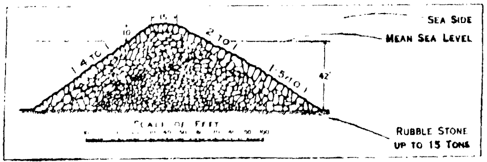


FIG. 3 CROSS SECTION OF THE WEST BREAKWATER AT COLON, PANAMA

on the average over the face of the displaced wall. At Bilbao in Spain, where the bay, like that of Wick, is funnel shaped, a monolithic mass of 1,700 tons weight at the breakwater end was carried 105ft. into the harbour during a severe gale (Dec. 1894).

Where outlying sandbanks stretch in front of a coast, as for instance the sandbanks opposite Yarmouth sheltering Yarmouth roads, large waves cannot approach the land, for they break on the sandbanks outside. Waves indeed always break when, on running up a shoaling beach, they reach a depth approximately equal to their height; and the largest waves which can reach a shore protected by intervening sandbanks are those which are low enough to pass over the banks without breaking. Waves often break in depths of water greater than their own height, and any sudden change in the level of the sea bed over which a wave is travelling may bring about its disruption even in water of considerable depth.

The force of the wind, as transmitted by degrees to the sea, is manifested as a series of progressing undulations without any material displacement of the body of water. So long as the wind continues to act on waves which it has brought into existence it continues to increase their height and length. The waves thus accumulate the energy which they receive from the wind. When a wave reaches a lee shore its energy has either to be dissipated by the breaking of the wave or to be reflected.

On encountering a vertical, or approximately vertical, obstacle to its onward course, each wave, on reflection, deals a blow against the obstacle proportionate to its size and rate of transmission. When a wave reaches shoal water the undulation is transformed into a breaking wave rushing up the sloping shore, till, on its energy being spent, it recoils back into the sea.

A breaking wave concentrates its transmitted force on a portion of the water forming the undulation, which consequently strikes a more powerful blow over a limited area against any structure than the more distributed shock of a simple undulation beating against a vertical wall. Moreover, the recoil or backwash of broken waves produces a greater scour than the simple reflection of an undulation from a vertical wall. The materials forming the covering of the slope and the toe of a breakwater mound must therefore be able to resist this erosive effect. The large concrete blocks often placed pell-mell as protection on the sloping face of a rubble mound breakwater absorb much of the energy of a breaking wave in their interstices and similarly reduce the force of the backwash. On the other hand, when a vertical surface is exposed to a heavy breaking wave a large mass of water is projected upwards and there is a heavy down stroke. Consequently the material at the toe of the wall is liable to displacement by the wash of recoil, unless the depth is sufficient to provide an ample cushion of water below the undulation. There are of course also stages of wave stroke to which a breakwater structure may be exposed which are intermediate between the complete breaker on a sloping beach and the pure reflection of a wave. (*See* also the article TIDES. Students of the subject should consult the works of Sir George Airy, Weber, Scott Russell, T. Stevenson, W. J. M. Rankine and W. H. Wheeler.)

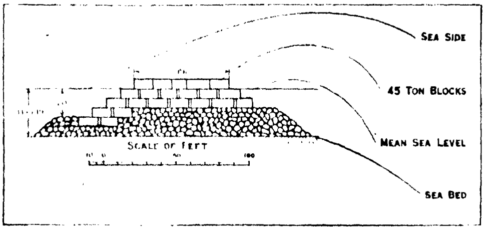


FIG. 4. THE CONCRETE BLOCK BREAKWATER AT CETTE, FRANCE

Protection of Unfinished Work.—The protection of unfinished work during the seasonal periods of stormy weather is a difficult problem which has to be faced by the breakwater builder. Work may have to be entirely suspended for a portion of each year and the scar or unprotected end of the unfinished structure, exposed as it is on three sides out of four, is particularly liable to sea damage. At Bilbao, for instance, during the building of the main breakwater, long lengths at the outer end were destroyed year after year in the winter seasons. Special precautions are usually taken to secure the safety of unfinished work in such circumstances.

Types of Breakwater.—Breakwaters may be classified under four general types: (1) a simple mound of stone rubble or concrete blocks, or a combination of the two materials; (2) a mound raised to near or above water level surmounted by a solid superstructure of masonry or concrete; (3) a mound foundation finished off at a considerable depth below water level and surmounted by an upright wall breakwater of concrete or masonry; and (4) an upright wall breakwater, built up solid from the sea bottom to the top. The second and third types (frequently referred to as composite breakwaters) are, in fact, combinations of the first and fourth types. The classification is in some degree an arbitrary one, and examples can be cited in which one type merges in another. Generally, the choice of type is determined by the materials available at the site, the depth of water, the nature of the sea bed and, in some cases, by the facilities and plant which are available for the execution of the work. The length of time allowable for the construction of a given length of breakwater has also, in some cases, a bearing on the choice of design and method of construction.

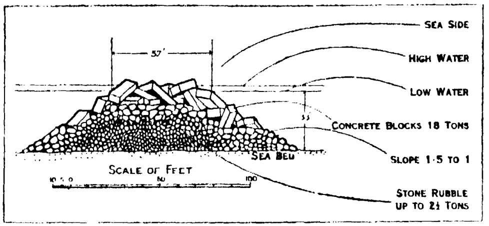


FIG. 5.—CROSS SECTION OF WEST BREAKWATER EXTENSION AT PORT SAID

(1) MOUND BREAKWATERS

A rubble mound consists of a mass of stone, just as it is obtained from a quarry, tipped into the sea along a predetermined line till the mound emerges out of the water. The stone is deposited from barges or is carried to the work in wagons run out from the shore on staging; frequently the two methods are combined. The larger masses of stone are often selected for placing in the more exposed parts of the work and or the faces of the breakwater, and for this purpose the use of cranes may be necessary. The mound thus deposited is gradually consolidated under the action of the sea and the weight of material, and a tolerably stable form is by degrees attained by continued deposits of stone. When the foundation is of soft and compressible material the stone rubble sinks into the sea bed owing to the weight of the superimposed materials. At Alexandria the rubble at the base of the north breakwater extension (1905–8) sank to a level of 20ft. below the original bed, the silt of which was forced upwards at the sides of the mound.

The rubble mound system is wasteful of materials and entails a relatively high expenditure on maintenance. It can only be resorted to where quarries near at hand are able to furnish large supplies of stone at a cheap rate. When the site is an exposed one storm waves carry the stones on the top, if unprotected, forward on to the harbour slope, while the recoil of the wave on the outer face draws down the stones on that side, thus flattening the slope. Frequent replenishing with a fresh deposit of stones is thus necessary. The inclination of the flattened sea slope, which extends from above high water to well below low water, depends on the exposure and the size of the stones on the face.

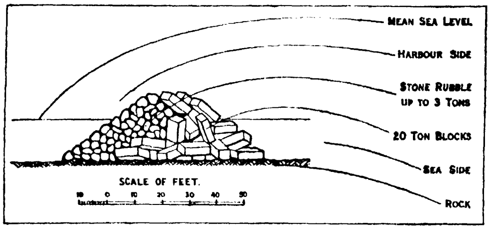


FIG. 6.—OLD NORTH BREAKWATER AT ALEXANDRIA, WESTERN HARBOUR

In order to avoid the injuries to which a rubble mound is subjected by waves various methods have been devised for protecting the top and the sea slope of the mound. For instance, the upper part of Plymouth, England, breakwater (fig. 1) has been covered over by granite and limestone paving set in cement. In other cases the surface stones are selected, roughly masoned and set close together as at Portland, England (fig. 2). The chief point of importance is to cover the outer slope and the top of the mound with the largest stones that can be procured, and when large stones are not readily obtainable concrete blocks furnish a convenient substitute.

Concrete Block Protection.—Where concrete blocks are employed it is usually as the outer covering on the top and sea slope of a rubble mound, as for example in the older breakwaters at Algiers, where the depth reaches 70ft., and at the ports of Cette and Bona (Algeria). The breakwater at Cette (fig. 4) has given trouble owing to the erosion of the sea bed and the unequal settlement of the coursed blocks. A more usual arrangement is to deposit the blocks at random or pell-mell. Other examples of blockwork protection are the north-east breakwater at Colombo harbour, the extension of the west breakwater at Port Said (1912–22) (fig. 5) and the older part of the north breakwater at Alexandria (1870–74). In this case concrete blocks compose the outer half of the mound, sheltering the inner half consisting of small rubble (fig. 6). Occasionally a mound breakwater has been formed entirely with concrete blocks, as for instance the main portion of the western breakwater at Port Said (1864–68) (fig. 7).

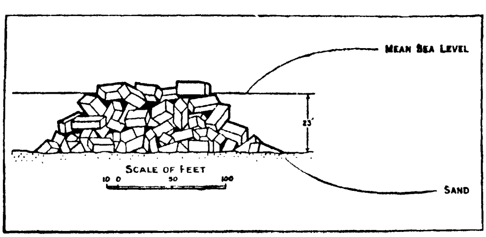
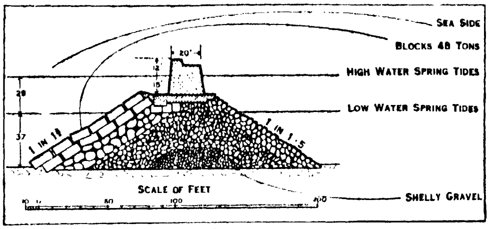


FIG. 7.—OLD INNER PORTION OF WEST BREAKWATER AT PORT SAID

Utility of Concrete Blocks.—Concrete blocks possess the great advantage that they can be made wherever sand and shingle can be procured, and of a size only limited by the appliances which are available for handling them. In fact, in places where stone of any kind is difficult to procure at a reasonable cost, as for instance at Port Said, concrete is indispensable. At Pará (Brazil) blocks made of Portland cement and sand (without any stone or shingle) were used in the construction of the port works. Large artificial blocks, moreover, by enabling a comparatively steep slope to be formed with them on the sea side of a mound breakwater, reduce considerably the amount of materials required; especially at exposed sites, and also for breakwaters extended into deep water. These large concrete blocks are deposited by cranes travelling on staging or on the completed portion of the work, or are tipped into the sea from a sloping platform on barges, or floated out between pontoons, or slung out from floating cranes or derricks. Sometimes when a mound breakwater has been raised out of water, advantage is taken of a calm period of the year and a low tide to form large blocks of concrete within timber framing on the top of the mound so as to afford additional protection.

Advantages and Disadvantages of Mound Breakwaters.—The large mass of a mound breakwater gives it great stability; this type is, moreover, suited to construction on a sandy or silty sea bed. The large quantity of material required for its construction and the continuous maintenance necessary are, however, disadvantages. The type has, since the end of the 19th century, been employed to a limited extent, excepting perhaps in North America, and usually in comparatively sheltered positions of moderate depth. Well known examples of the mound breakwater, in addition to those already mentioned, are at Howth (the first example on a large scale in the British Isles) and Kingstown, both on Dublin bay, at Table bay (Cape Town) and in the outer part of the Nuovo mole at Genoa (1862–68). Instances of more recent construction are at Colon, Panama (fig. 3) and Takoradi, a Gold Coast harbour (1922–28), and the Courtney bay breakwater at St. John, New Brunswick (1912–20).



BY PERMISSION OF M. MICHEL SCHMIDT

FIG. 8.—CROSS SECTION OF THE DIGUE CARNOT AT BOULOGNE

(2) MOUND BREAKWATERS WITH SOLID SUPER-STRUCTURE AT OR NEAR WATER LEVEL

This type is a modification of the first class and possesses most of its advantages and disadvantages. It comprises the majority of breakwaters constructed in the last quarter of the 19th and the early years of the 20th centuries; but with the growing necessity of providing artificial shelter in great depths of water it has become more usual to build breakwaters in such situations with superstructures carried down well below low water, as described later.

The solid superstructure reduces the amount of materials required, according to the depth at which it is founded, and the solid capping also serves to protect the top of the mound from the action of the waves. In the case of a mound breakwater, portions of the highest waves generally pass over the top of the mound, and their force is also to some extent expended in passing through the interstices between the blocks or stones; whereas a superstructure presents a solid face to the impact of the waves. A superstructure, accordingly, must be strongly built in proportion to the exposure and to the size of the waves liable to reach it. Special care, moreover, has to be taken to prevent the superstructure from being undermined, for the waves in storms, dashing up against this nearly vertical, solid obstacle, tend in their recoil down the face to scour and displace the materials of the mound at the outer toe of the superstructure and thereby undermine it. This risk is specially present where the superstructure is founded on the mound near low water level, and there is therefore no

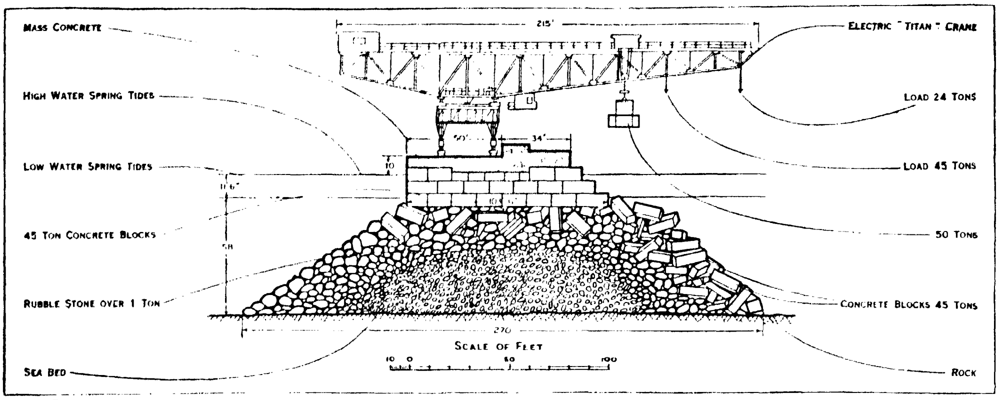


FIG. 9. CROSS SECTION OF OUTER PORTION (1928) OF CASABLANCA BREAKWATER. DIAGRAM SHOWS THE TITAN CRANE USED IN BUILDING THE BREAKWATER. BY PERMISSION OF THE CHIEF ENGINEER, CASABLANCA

adequate cushion of water above the mound to withstand the recoil.

Superstructures.—The forms of superstructure exhibit considerable variations, ranging from a few concrete blocks laid in courses on the top of the mound, or a paving protected by a parapet wall on the sea side, up to a solid structure which is sometimes of considerable height in situations where there is a large tidal variation. The object aimed at in the case of superstructures founded at or near low water level is to lay the foundations on the mound at the lowest level consistent with building a solid structure with stones or concrete blocks set in mortar, out of water in the ordinary manner. The desideratum in the case of superstructure foundations laid at some depth below low water (*see* section [3] which follows) is to stop the raising of the mound at such a depth under water as to secure it from displacement by the waves. It is to the failure to provide adequately for this that the destruction or serious damage of many 19th century breakwaters is to be attributed. (*See* Sir W. Matthews, *Proc. Inst. C.E.*, vol. clxxi. [1908]. Sir Maurice Fitzmaurice has recorded, *Proc.* vol. ccxiv. [1922], that at Peterhead some 50-ton concrete blocks, joggled together and forming part of an apron protecting the rubble mound of breakwater about 45ft. below low water, were displaced 50ft. and overturned during a gale.)

These failures have led harbour engineers to recognize that destructive wave action can take place at depths of about 50ft. in situations of great exposure to the ocean, and down to more than 30ft. in the Mediterranean. In more sheltered positions the depths are proportionately less. Furthermore, the effect of the waves is at its maximum at sea level and the pressure of the wave on a vertical surface is more or less constant over the whole zone corresponding to the height of the wave, but below this zone it decreases rapidly (*see* E. Quellennec, Int. Congress of Navigation 1926, Paper 31). The pressure exerted at sea level by a wave in situations of great exposure may exceed three tons per square foot.

Examples of rubble mound breakwaters surmounted by a superstructure founded at or near low water or sea level are those at Cherbourg, Holyhead and Marseille, the Galliera and Giano moles at Genoa, the San Vincenzo mole at Naples, the east harbour breakwater at Alexandria, the digue Carnot at Boulogne, the north breakwater at Algiers and those at Fishguard, Le Havre, Oran, Civitavecchia and Casablanca, the latter in a much exposed position on the Atlantic coast of Morocco (fig. 9). The very exposed breakwater at Alderney was commenced on this principle about the middle of the 19th century (*see* section [3] which follows).

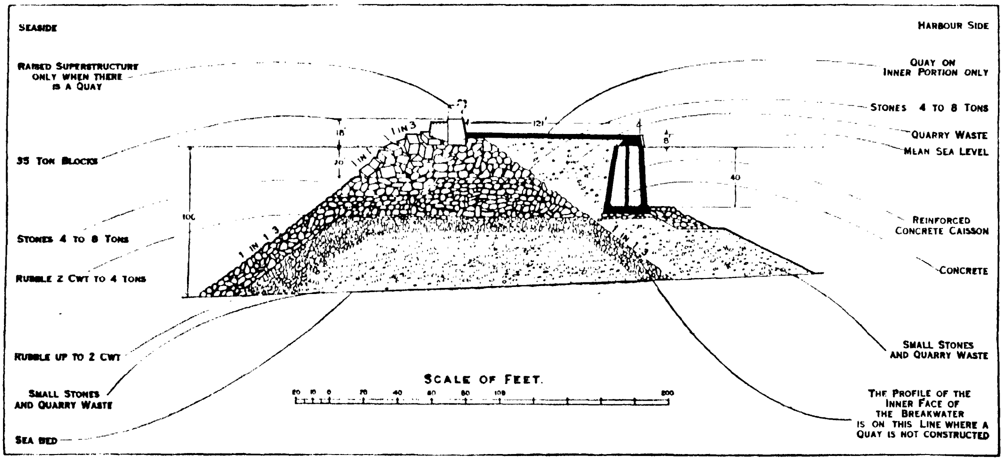

Seaside
Raised Superstructure only when there is a Quay
35 Ton Blocks
Stones 4 to 8 Tons
Rubble 2 Cwt to 4 Tons
Rubble up to 2 Cwt
Small Stones and Quarry Waste
Sea Bed
18'
20
100
1 in 3
1 in 1
1 in 1.3
121'
8'
40
Scale of Feet.
Harbour Side
Quay on Inner Portion only
Stones 4 to 8 Tons
Quarry Waste
Mean Sea Level
Reinforced Concrete Caisson
Concrete
Small Stones and Quarry Waste
The Profile of the Inner Face of the Breakwater is on this Line where a Quay is not constructed

FIG. 10.—CROSS SECTION OF THE MARSEILLE BREAKWATER, SHOWING THE WAVE BREAKER OF LARGE CONCRETE BLOCKS ON THE RUBBLE MOUND

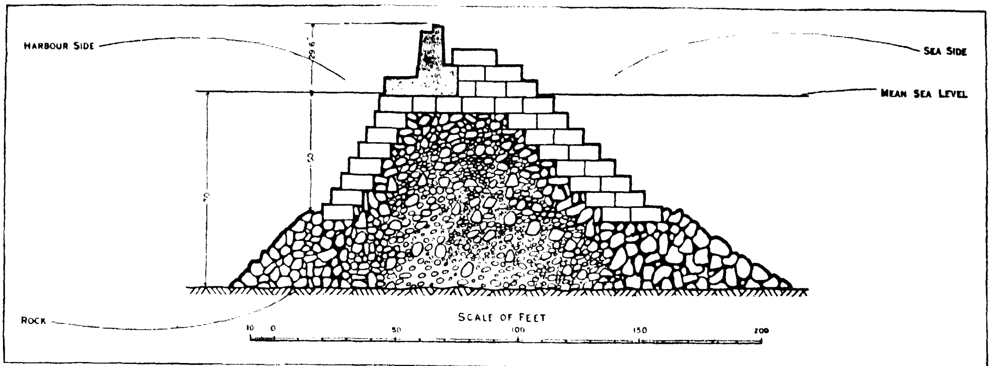


FIG. 11.—THE CIVITAVECCHIA BREAKWATER. RUBBLE MOUND PROTECTED BY COURSED CONCRETE BLOCKS

The outer breakwaters at Leghorn and St. Jean de Luz have superstructures founded at low water level on concrete block mounds.

The breakwaters at Le Havre and Boulogne (fig. 8) are examples of the sorted mound surmounted by superstructure walls which, although founded well above low water, rise to a considerable height on account of the large tidal range at these ports, viz., 24½ft. and 29ft. respectively.

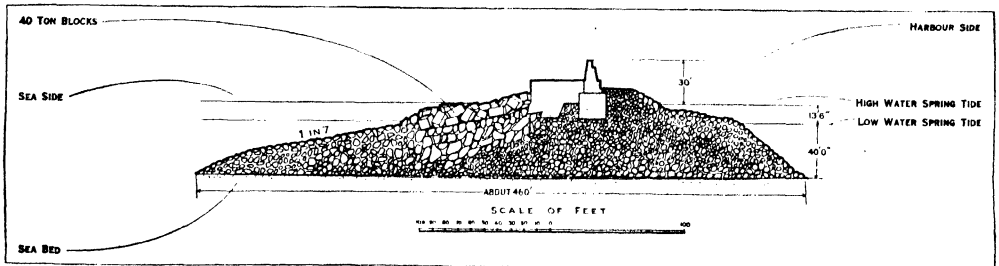
Marseille Breakwater.—The great breakwater at Marseille (*see* HARBOURS) is a successful example of the sorted rubble mound breakwater where a quay has been formed on the inner face, sheltered on the sea side by a narrow superstructure, founded at sea level, and protected on the sea slope of the mound from undermining by a wave breaker of large concrete blocks deposited pell-mell (fig. 10) on the rubble mound and having a flat slope from lowest water level up to the face of the superstructure wall well above highest sea level.

Other Mediterranean Breakwaters.—The outer portions of the San Vincenzo breakwater at Naples and the older parts of the Galliera mole at Genoa extend into depths of about 110ft. and 80ft. respectively, and have been provided with superstructures similar in type to, but more solid than, the superstructure at Marseille. The sorted rubble mounds are protected on the sea slope by stepped courses of concrete blocks from a depth of over 20ft. below sea level. The outer extension of the main breakwater at Civitavecchia is an interesting example of the composite type of breakwater in which the rubble mound has been protected, and greatly reduced in volume and extent in deep water, by stepped courses of concrete blocks carried up from near the bottom of the mound (fig. 11). In all these cases, and in some other examples of similar construction, serious damage has occurred, largely due to the unequal settlement of the horizontally bedded courses of blocks. For this reason the Marseille type of sea face protection is to be preferred and is now generally adopted.

Fishguard Breakwater.—The breakwater at Fishguard, constructed between 1900 and 1918, is an interesting example of a composite breakwater which, in spite of weaknesses inherent in the original design, has been made suitable to the exposed situation in which it has been installed. It was at first designed as a rubble mound carried up to about high water with concrete superstructure and parapet; but the wastage of rubble on its sea face was found to be so serious that in 1913 it was decided to protect the rubble by the deposit of 40-ton concrete blocks placed pell-mell over the whole of the seaward face of the mound above low water springs (fig. 12). Previous to this, the quantity of stone rubble deposited annually for maintenance purposes on the sea face, of about half a mile in length, averaged 85,000 tons for several years.

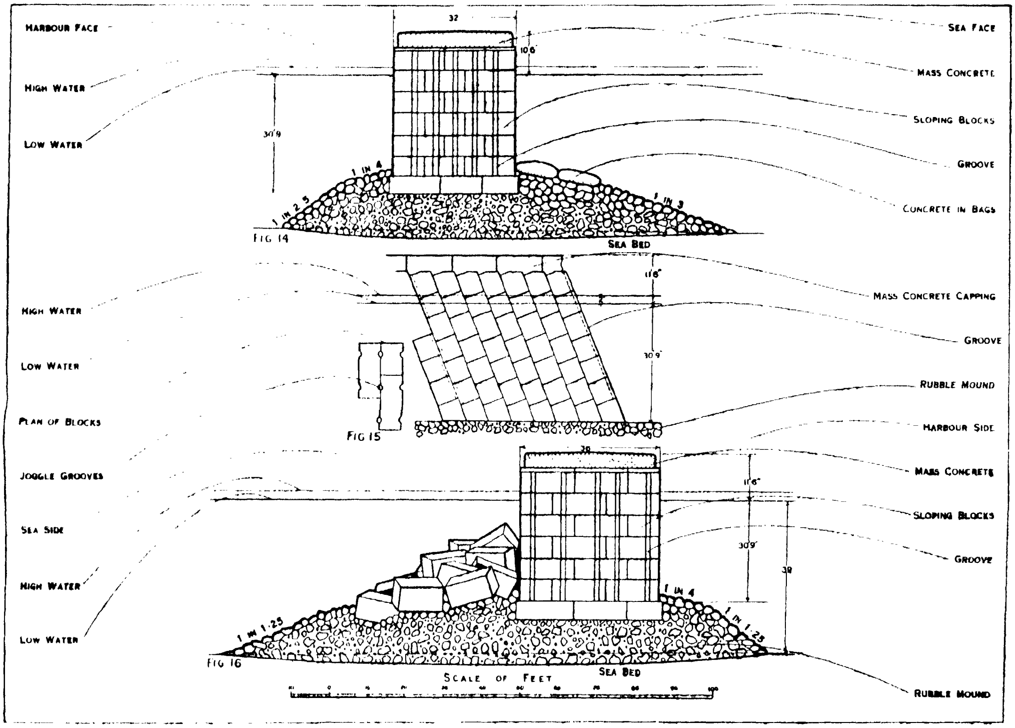
Danger of Non-solid Superstructures.—Formerly, in constructing a large superstructure upon a rubble mound, it was a common practice to build an outer sea wall and an inner harbour wall, the intermediate space being filled, in the interest of economy, with rubble. A parapet wall was also generally erected on the sea side. This system of construction was adopted for the superstructures at Holyhead and Portland (inner arm), and at St. Catherine's, Jersey. Alderney, the Tyne and the Colombo south-west breakwaters were also commenced on this system (*see* section [3] which follows); but experience showed the danger in exposed situations of a small breach in the comparatively weak outer wall, leading to the scouring out of the rubble filling and progressive destruction, and the practice was abandoned. (In certain cases the rubble filling was replaced by solid hearting.)

Another cause of possible damage is due to the action of waves on the air which fills the interstices between the stones or blocks of mound and composite breakwaters. The violent compression of imprisoned air under a solid capping, or deck, exerts a destructive force which may blow up or displace the superstructure if its thickness and weight are not great enough to resist the pressure.



BY COURTESY OF MESSRS. COODE, FITZMAURICE AND WILSON

FIG. 12.—CROSS SECTION OF FISHGUARD BREAKWATER. RUBBLE MOUND WITH SOLID SUPERSTRUCTURE PROTECTED BY 40-TON PELL-MELL CONCRETE BLOCKS



PERMISSION OF MESSRS COODE, FITZMAURICE AND WILSON

FIGS. 14, 15, 16.—CROSS SECTIONS OF THE BREAKWATERS OF COLOMBO
Fig. 14.—North-west breakwater—sloping block work
Fig. 15.—Side elevation of sloping block work
Fig. 16.—Outer arm of south-west breakwater, showing sloping block work with wave breaker of 30-ton concrete blocks on sea face

Breakwaters in North America.—Many breakwaters constructed for forming harbours on the sea coasts of the United States and Canada and in the Great Lakes are of the rubble mound type. The two detached breakwaters sheltering the old Delaware harbour made many years ago were of this type. They were united towards the end of the 19th century by closing the gap between them, the new work being similar in section to that of the breakwater (fig. 13) formed in 1897–1901 for providing a harbour of refuge seaward of the original Delaware harbour. The breakwater, commenced in 1898, in San Pedro bay, Los Angeles, in a depth of 48ft. at low water, is of the same form. A simple mound construction was adopted in 1910 for the Colon breakwater (fig. 3), when the construction of the Panama canal made the port, naturally a bad one, a harbour of importance.

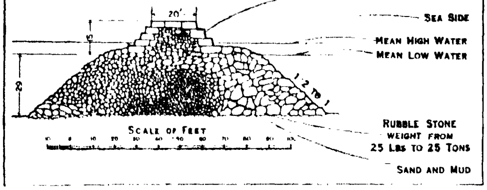


FIG. 13.—CROSS SECTION OF BREAKWATER, DELAWARE BAY HARBOUR OF REFUGE, U.S.A.

(3) MOUND BREAKWATERS WITH SUPERSTRUCTURE BELOW LOW WATER

As the main object of this class of breakwater is to keep the mound below the zone of wave disturbance in severe storms, it is evident that the depth at which the superstructure is founded should vary directly with the exposure and inversely with the size of the materials forming the mound.

Though composite breakwaters are still occasionally constructed with a superstructure founded on a rubble mound at, or above, low water, as described in the preceding section, the practice of placing the foundations at a considerable depth has become more usual. In Italian harbours, for instance, whereas at the close of the 19th century practically all the then existing breakwaters were of the former type, the deep submerged vertical-wall type has been adopted for nearly all breakwater construction in deep water since 1900. French engineers have, however, continued to favour the earlier form of the composite breakwater, the Marseille design being the prototype of most of the deep water breakwaters built by them during the first quarter of the 20th century. They have, nevertheless, departed from this practice in the case of the later work carried out at Algiers, and it is probable that the future extension of the breakwater at Marseille, to form the Bassin du Phare, in a depth exceeding 100ft. will be similar to the Algiers design.

Alderney.—The depth at which wave action may adversely affect a rubble mound has been only very gradually realized. Thus in 1847 the Alderney breakwater, though fully exposed to the Atlantic ocean, was begun with a superstructure founded at low water upon a rubble mound. Within two years the foundations had to be carried 12ft. below low water. This construction was adhered to up to close to the head, though the breakwater, completed in 1864, extended 4,700ft. from the shore into a depth of 130ft. at low tide, the spring rise being 18 feet. The recoil of the waves from the high superstructure wall brought about the degradation of the mound to a depth of 20 feet.

Colombo.—At Colombo, where the range of tide is only 2ft., the south-west breakwater (1875–85), which is exposed to the full force of the south-west monsoon, extends into a depth of 39ft. at low water. The superstructure was founded on a rubble mound 20ft. below low water. It is protected along its sea face by an apron of concrete in bags. The lesser depth of water and the lower superstructure, combined with the concrete bag protection, are factors which saved the breakwater from the failure which overtook that at Alderney where the exposure is similar. Nevertheless, the experience gained of the action of the sea on the south-west breakwater led to the north-west detached breakwater at Colombo, of similar type, and constructed at a later date in a somewhat deeper but less exposed situation, being built with the foundations of the superstructure on the rubble mound placed at a depth of 31ft. below low water (fig. 14). In the building of the outer arm extension of the south-west breakwater (completed 1912) a submerged wave breaker of 30-ton concrete blocks deposited pell-mell was constructed on the sea face of the upright wall (figs. 15 and 16), and this protection was extended along the whole of the sea face of the older part of the breakwater.

Peterhead.—The south breakwater for the harbour of refuge at Peterhead, begun in 1888, extends into a depth of 57ft. at low water (*see* HARBOURS). For 1,000ft. from the shore it was built as an upright wall on a rocky bottom, but the outer portion consists of a superstructure wall of concrete blocks founded on a rubble base originally 30ft. below low water, increased after a storm in 1898 to 43 feet. The outer toe is protected by concrete blocks laid on the rubble mound. The northern breakwater at Peterhead (building 1928) is of the upright wall type on a rock foundation.

Naples.—The Ante-Murale breakwater at Naples (fig. 17) is a rubble mound in a depth which at the outer end exceeds 100 feet. The superstructure of horizontally coursed concrete blocks is founded 31ft. below sea level and is capped by mass concrete. Here the sea bed is firm and comparatively non-yielding and special precautions were taken in building the rubble mound; consequently the structure has not suffered as a result of unequal settlement.

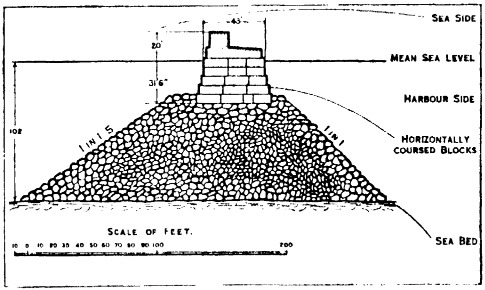


FIG. 17.—CROSS SECTION OF THE ANTE-MURALE BREAKWATER AT NAPLES HARBOUR

Sloping-block System.—A difficulty experienced in building a solid superstructure on the top of a rubble mound arises from the settlement of the mound which takes place when the weight of the wall comes on it. When the superstructure consists of horizontal courses of masonry or concrete blocks, irregular settlement is likely to occur, resulting in dislocation of the joints and sometimes fracture of blocks. The sloping-block (or "sliced-block") system, in which the blocks form a series of sloping sections, laid at an angle to the horizontal usually from 67° to 74°, was devised to meet this difficulty. The blocks are free to settle, slice by slice, on the mound and are usually joggled together on the sliding faces by means of grooves in the blocks, filled by concrete in bags placed in position and rammed by divers, or by a groove and tenon moulded in the block faces (figs. 14 to 16, 18 to 20 and 24).

The settlement of the structure is sometimes accelerated by placing extra blocks temporarily on the top of the permanent blocks, thus increasing the load above the normal. Where a Titan crane is employed for setting the blocks, the weight of this assists settlement. The mass concrete capping on top of the blocks should never be constructed until settlement as far as can be assured has taken place.

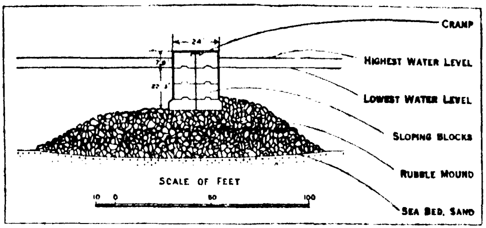


FIG. 18.—CROSS SECTION OF THE ORIGINAL BREAKWATERS AT MADRAS

Karachi.—The first superstructure built on the sloping block system was at Karachi. The blocks were laid at an inclination of 76° in two rows of three superimposed blocks and were entirely unconnected. Consequently the sea, forcing its way in a storm between the two vertical rows, overturned some of the 27-ton top blocks and threw them on to the rubble mound. In effecting the necessary repairs the top blocks were connected by stone dowels.

Madras.—The superstructures of the Madras breakwaters, commenced in 1877 (fig. 18), were of similar construction to that at Karachi; but the blocks in each row were connected by a mortise and tenon joint with the blocks above it. The unconnected vertical joint between the two rows, however, led to the destruction of the greater part of the walls of the outer arms during a cyclone in 1881. In the subsequent reconstruction bond was introduced in the successive tiers of each sloping section and the upper blocks were cramped together. After settlement on the mound had ceased, a thick capping of mass concrete was laid on the top of the structure; and, finally, a mound of pell-mell concrete blocks was deposited on the rubble on the sea face of the wall to break the force of the waves and prevent undermining.

The harbour at Madras is constructed in a position of extreme exposure and the works have suffered severe sea damage on many occasions. The original harbour entrance on the east side between the ends of the two curved breakwaters was closed in 1910, partly on account of the serious range in the harbour, due to the position of the entrance, and also because of the rapid silting which was taking place (*see* HARBOURS). A new entrance was constructed on the north side of the harbour protected by a sheltering arm. This arm, as well as the new portion of the breakwater closing the old entrance, is of sloping block work on a rubble foundation protected by 30-ton wave-breaker blocks on the sea face (fig. 19). The outer portion of the sheltering arm was destroyed during a cyclone in Nov. 1916 and has since been reconstructed.

Marmagão.—The breakwater at Marmagão, a Portuguese harbour on the west coast of India, commenced in 1884, is somewhat similar to the later work carried out at Madras. The mound in this case is formed on a soft clay bed readily compressible (fig. 20).

Colombo.—At Colombo the superstructures of both the south-west and north-west breakwaters were built on the sloping block system in sections 5½ft. thick at an angle of 68° (figs. 14 to 16). The blocks are bonded across each section and grooves are formed in the adjacent faces of the sections. The voids so formed were filled with concrete in bags after settlement on the mound had ceased. The same method of bonding and keying was adopted in the later work at Madras.

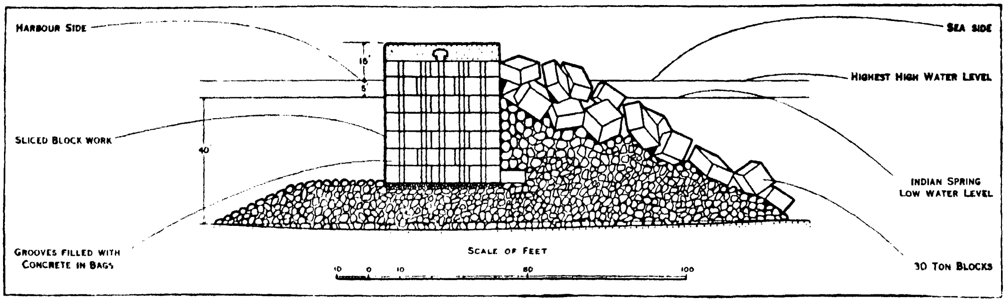


FIG. 19 THE MODERN MADRAS BREAKWATERS: CROSS SECTION OF NORTH SHELTERING ARM AND BREAKWATER CLOSING OLD ENTRANCE

Other Examples of Sloping Block Construction.—The superstructure of the new Valparaiso breakwater extension (*see* below) makes use of sloping block work; and among other breakwaters of this type building in 1928 may be mentioned those at Port Elizabeth and Antofagasta (Chile), and the extension of the Table bay breakwater. In the case of the last named the blocks are, however, laid direct upon the hard clay of the sea bed and not on a rubble mound

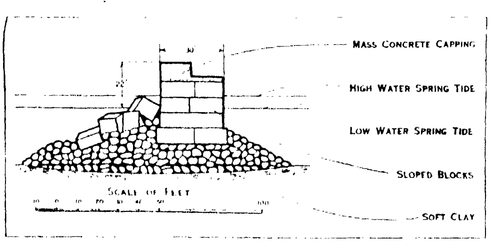


FIG. 20 – CROSS SECTION OF THE BREAKWATER AT MARMAGAO, INDIA

Hollow-block Construction.—In the Granili breakwater at Naples, commenced in 1910, hollow concrete blocks each weighing under 100 tons, but measuring 30ft ×16½ft ×7½ft, were substituted for the smaller solid blocks used in the original work. The cavities in the blocks were filled with concrete deposited under water. The blocks being set one directly above another, five in height and in two rows, form separate piers free to settle independently. The two rows of blocks make up a superstructure 60ft. wide. The capping of solid masonry and concrete work above water level is constructed in separate sections covering only two piers of blocks to enable the masonry to follow the settling movements of the blocks.

The weak point of the hollow block system is the necessity of depositing unset concrete under water, always a difficulty and attended by uncertainty as to the quality of the concrete so treated Apart from this possible source of weakness, the hollow block method of construction gets rid of the fear of displacement of solid concrete blocks set in horizontal bonded courses. It has been largely adopted in Italy, and to some extent in other countries, in situations of moderate exposure or where lengthy periods of calm weather can be looked for. At Genoa the Vittorio Emanuele III. breakwater (fig. 21), built after the construction of the Granili breakwater at Naples, is of similar type; but larger hollow blocks, which weigh up to 230 tons and extend the full width of the wall, were employed.

Cyclopean Concrete Blocks.—Following on their successful work with hollow blocks Italian engineers devised in 1923 a system of construction in which blocks of large dimensions, each extending the full width of the superstructure, are set to form pillars usually of three or four tiers in height. Blocks weighing from 200 tons to over 400 tons have been used in the building of breakwaters of this description, and for their handling floating lifting appliances have been devised which are of far greater capacity than any previously employed. The blocks, known as Cyclopean, are nearly solid, each having small cavities for convenience of lifting, which are ultimately filled with concrete (*see* Albertazzi and Cagli, Int. Congress of Navigation, 1926, Paper 36).

The extension of the eastern jetty at Catania in Sicily is the first example of Cyclopean construction on a large scale, the blocks weighing 300 tons. Blocks of similar weight have been used in the new breakwater at Bari. The extensions of the Vittorio Emanuele III. breakwater and the Galliera mole at Genoa are (1928) being constructed with Cyclopean blocks. In these cases the weight of each block is restricted to 220 tons in order to make use of the existing floating cranes which had handled the earlier cellular blocks at that port. At Bengazi (Cirenaica) solid blocks, weighing 550 tons and constructed in a small dock, were floated into position by means of coupled pontoons between which a block, partly waterborne, was slung.

In the building of the Mustapha breakwater at Algiers, begun in 1927, blocks which weigh up to 418 tons are founded on a rubble mound at a depth of 49ft. (fig. 22), and are lifted and lowered into place by a floating portal crane of 450 tons lifting capacity mounted on two pontoons. The joint faces of the blocks are grooved and tenoned in the vertical planes.

Caisson Walls in Composite Breakwaters.—Caissons constructed of reinforced concrete or steel were employed in the building of the superstructures of composite breakwaters many years before the introduction of the hollow block and Cyclopean systems. The use of caissons is generally satisfactory when they can be founded directly on a firm and unerodible sea bed, but in several instances where this is not the case extensive damage has occurred. In any case it is a difficult matter to float, tow, sink and fill with concrete caissons of large dimensions.

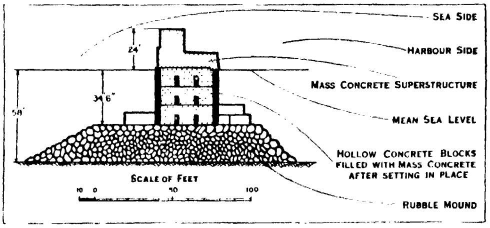
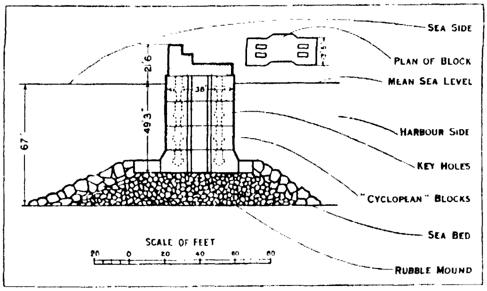

SEA SIDE
HARBOUR SIDE
24'
MASS CONCRETE SUPERSTRUCTURE
34'6"
58'
MEAN SEA LEVEL
HOLLOW CONCRETE BLOCKS FILLED WITH MASS CONCRETE AFTER SETTING IN PLACE
SCALE OF FEET
10 0 50 100
RUBBLE MOUND

FIG. 21.—VITTORIO EMANUELE III. BREAKWATER AT GENOA. NOTE THE HOLLOW BLOCK CONSTRUCTION. BY PERMISSION OF THE CHIEF ENGINEER

Bilbao.—The composite breakwater at Bilbao harbour at the mouth of the River Nervion, begun in 1888, has probably been one of the most difficult to construct on account of its great exposure to the Atlantic waves. The original design consisted of a wide rubble mound up to about 16ft. below low water; a mound of concrete blocks up to low water; and a solid masonry superstructure. The repeated damage to this wall by successive winter storms led (in 1895) to the abandonment of the original design and the construction, on a widened rubble base, of a superstructure protected to some extent by the outlying concrete block mound. The modified superstructure was formed of iron caissons partially filled with concrete which were floated out, sunk in position and filled up with concrete blocks and mass concrete. The caissons, which measured about 43ft. in width across the breakwater, 23ft. in length and 23ft. in height, weigh about 1,400 tons when filled. They form the base of a concrete wall founded at half tide level and carried up to 8ft. above high water. Although some difficulties have been brought about by the settlement of the rubble foundation, these have been overcome and the breakwater has successfully resisted the attacks of the heavy Atlantic rollers (see *Churruca and the Port of Bilbao*, Bilbao, 1910).

Other Examples of Caisson Construction.—The mole of Zeebrugge (1900–09) (fig. 23), is an example of a breakwater, in a much less exposed situation than Bilbao, in the building of which caissons were used with not altogether satisfactory results, the work having suffered damage during construction. The caissons, of steel and reinforced concrete, are founded on a rubble mound at various depths up to 40ft. below low water. The largest caissons are 100ft. long and 38ft. wide (see *Mémoires,* Société des Ingénieurs Civils de France, Dec. 1904). Reinforced concrete caissons have also been used in building (1908–13) the two breakwaters at Bahia (Brazil), where the water is shallow and the position a sheltered one, and at Scheveningen in Holland. Their use in the construction of the Bizerta breakwater, begun in 1899, was attended by failure and ultimately abandoned. The east breakwater extension at Barcelona, finished in 1909, had a superstructure wall formed up to water level by caisson monoliths. Nearly a mile of this wall was destroyed or damaged during a gale in 1920; but the failure was due not directly to the use of caissons but to inadequate width in the wall and the absence of protection of the inner toe of the superstructure. At Kobe, a Japanese port in a comparatively sheltered position, reinforced concrete caissons of large size have been used since 1910 in the construction of breakwaters on a soft and yielding sea bed. The caissons are founded on a rubble mound and protected by coursed block work both on the outer and inner faces.



BY COURTESY OF MESSRS. SCHNEIDER AND COMPANY

FIG. 22.—THE MUSTAPHA BREAKWATER, ALGIERS, OF CYCLOPEAN BLOCK CONSTRUCTION. THE CONCRETE BLOCKS WEIGH OVER 400 TONS

Valparaiso.—One of the most interesting breakwater structures of the 20th century is that at Valparaiso, the first part of which was built in 1912–21 (see *Proc. Inst. C.E.*, vol. ccxiv., 1922). The breakwater is of composite construction; the inner section, 541ft. in length, consisting of horizontal coursed concrete blocks set on a submerged rubble mound at a depth of 20ft. and protected on the sea face by a pell-mell block wave-breaker of the Madras type (*see* above). The superstructure of the outer portion (fig. 24), 405ft. in length, consists of reinforced concrete caisson monoliths, which were floated over and sunk upon a rubble mound at 46ft. below mean level of the ocean. These monoliths are the largest which had been hitherto constructed in such a situation, each measuring 65½ft. long, 52½ft. wide at base and 49ft. in height, and were, after sinking, filled with mass concrete. The monoliths, as well as the blockwork of the inner section, are surmounted by a mass concrete superstructure and parapet wall. The outer portions of the breakwater were founded at a depth of over 150ft., on a comparatively soft sea bed of clay and mud. The depth in which the Valparaiso breakwater has been built is greater than obtains in the case of any other marine structure and it is fully exposed to the northerly gales of the Pacific ocean.

An extension of the breakwater, 2,300ft. in length, in an easterly direction across Valparaiso bay, in depths as much as 180ft. in places, was commenced in 1923 and was still under construction in 1928. For this extension sloping block work was substituted for caisson monoliths in the building of the superstructure, partly on account of the soft character of the sea bed in the silt of which it is estimated that the mound will sink considerably. The sloping blocks are joggled by pre-formed grooves and tenons on the sliding faces, and are surmounted by *in situ* concrete work as in the older structure. The lower part of the mound, up to a level of 66ft. below mean sea level, is of sand dredged by a powerful suction hopper dredger, and deposited on the sea bed, the flat slopes being protected by stone rubble.

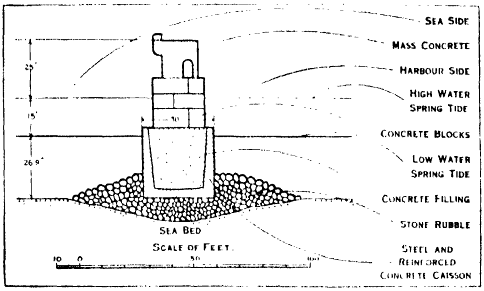


FIG. 23.—CROSS SECTION OF OUTER PART OF MOLE OF THE ZEEBRUGGE BREAKWATER

Timber Cribwork.—The superstructures of composite breakwaters, built by the United States and the Canadian Governments in the Great Lakes, were often composed of timber cribs floated, like caissons, into position and sunk by filling them with rubble stone. The former cheapness of timber in those regions made this simple mode of construction economical in spite of the rapid decay of the timber. In the more modern examples the timber work is usually not carried higher than about 3ft. below water level, the upper parts being of concrete construction.

Suitability of Composite Breakwaters to Deep Water Conditions.—In view of the increased depth at which superstructures are now founded upon rubble mounds, causing the breakwaters to approximate more and more to the upright wall type, it might seem at first sight that the rubble base might be dispensed with and the superstructure founded directly on the sea bed. Two circumstances, however, still render the composite form of breakwater indispensable in certain cases: (1) the great depth into which breakwaters have sometimes to extend, reaching about 60ft. below low water at Peterhead, 117ft. below mean sea level at Naples and even 180ft. at Valparaiso; and (2) the necessity, where the sea bottom is soft or liable to be eroded by scour, of a wide base between it and the upright superstructure.

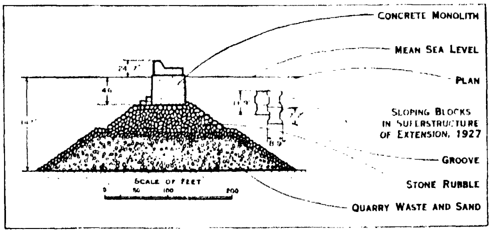
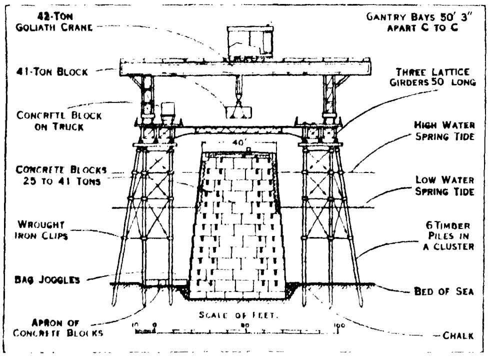


FIG. 24.—CROSS SECTION OF THE VALPARAISO BREAKWATER (1912–21), SHOWING REINFORCED CONCRETE MONOLITH SUPERSTRUCTURE

The sloping blocks used in building the superstructure of the extension (1927) are shown in the small plan on right

The injuries to which composite breakwaters appear to have been specially subject must be attributed primarily to the greater exposure and depth of the sites in which they have been frequently constructed as compared with rubble mounds or upright walls; but *the direct cause of damage and even destruction has in many cases been the insufficient depth at which superstructures have been founded.* Upright walls, indeed, are not well suited for erection in waters of great depth owing to the increased pressure of air under which divers have to work in laying blocks or preparing foundations. In the case of simple rubble mounds, the very large quantity of materials required for a high mound with flat slopes makes that type unsuited to such situations. The ample depth at which superstructures are now commonly founded; the due protection of the outer toe; the adoption of improved systems of block construction, such as the sloping block or the Cyclopean; adequate bonding and keying of the blocks; and the dispensing in many cases with a high sheltering wall, render modern superstructures as stable as upright wall breakwaters of similar height. Nevertheless, the conditions of exposure being equal, superstructures require generally greater base width than upright walls of the same height, because the greater depth of water in which such composite breakwaters are built exposes them to larger waves.



BY COURTESY OF MESSRS. COODE, FITZMAURICE AND WILSON

FIG. 25.—CROSS SECTION OF SOUTH BREAKWATER, DOVER HARBOUR, ILLUSTRATING THE METHOD EMPLOYED IN THE CONSTRUCTION OF THE THREE BREAKWATERS AT DOVER HARBOUR

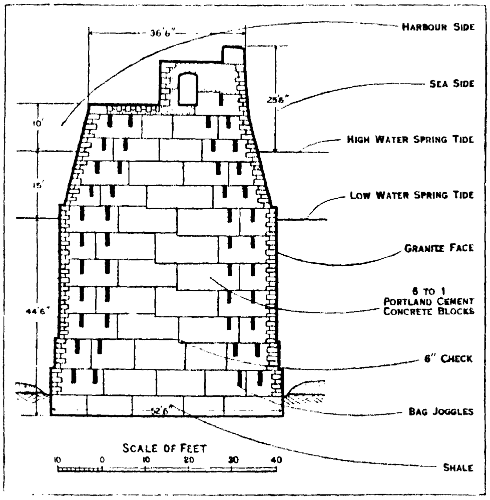
(4) UPRIGHT WALL BREAKWATERS

The fourth type of breakwater is a solid structure founded directly on the sea bottom in the form of an upright, or nearly upright, wall with only a moderate batter or inclination from the perpendicular on each face. This type is limited to sites where the sea bed consists of rock, chalk, boulders or other hard material not subject to erosion by scour, and where the depth at high water does not exceed about 70 feet. When the foundations for an upright wall breakwater have to be levelled by divers, and the blocks laid under water by their help, the extension of such breakwaters into a considerable depth is undesirable on account of the increased pressure imposed upon diving operations. (*See* DIVERS AND DIVING APPARATUS.) In the north breakwater at Peterhead (1928) the coursed concrete blocks were built on a rock foundation in 60 ft. at low water, or about 71 ft. at high water springs.

Dover.—The Admiralty pier at Dover was begun about the middle of the 19th century and is an early and notable example of an upright wall breakwater resting upon a hard chalk bottom. It was subsequently extended in connection with the works for forming a closed naval harbour at Dover, which works included the construction of an eastern breakwater and a detached south breakwater (see *Proc. Inst. C.E.*, vol. ccix., 1921). These are founded on a bottom, carried down to the hard chalk underlying the surface layer, levelled by men in diving-bells. The breakwaters are built of concrete blocks in bonded courses (fig. 25), the outer blocks above low water being faced with granite masonry. The face blocks are joggled together, and above low water the blockwork is set in cement mortar and the vertical joints grouted up. The blocks were laid by Goliath travelling cranes running on temporary staging supported by clusters of timber piles driven into the chalk bottom. Four Goliaths on each staging were used for excavating, preparing foundations with diving-bells and block-setting.

The deepest foundation is 53ft. below low water springs. The rise of tide at springs being 18¾ft., the average depth is thus approximately 66ft. at high tide, necessitating a pressure of about 30 lb. on the square inch, which is near the limit at which divers can work continuously, without injurious effects, in diving bells. The detached southern breakwater has a flush deck, but the Admiralty pier and the eastern breakwater have parapet walls. All the breakwaters are protected from scour along their outer toe by an apron of concrete blocks.

Tyne Piers.—The two breakwaters at the mouth of the River Tyne were originally commenced, about the middle of the 19th century, as composite breakwaters, the foundation level of the superstructure being placed at varying depths from near low water down to about 27ft. below low water in the case of the north pier. Towards the end of the century the north pier was severely damaged and breached as a result of the undermining of the foundation of the superstructure, brought about by the degradation of the rubble mound. The outer portion of this breakwater, about 1,500ft. in length, was reconstructed (1899–1909) on a straight line inside and under the shelter of the damaged curved part of the original breakwater (see *Proc. Inst. C.E.*, vol. clxxx., 1910). The reconstructed work is of the Dover type, the foundations, except near the inner end, being carried down to hard shale. All the exposed blocks are faced with granite and all blocks above low water are set in cement. A novel feature was introduced into the design with the object of preventing the sliding of one course of blocks over the course immediately below it; a check 6in. high, extending practically from end to end of the work, being provided in each course of blocks below low water (fig. 26).

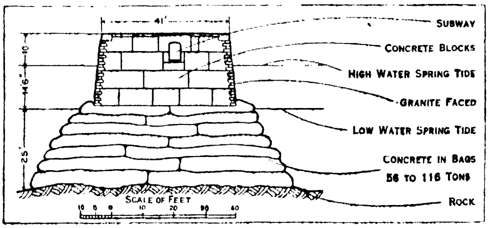


BY COURTESY OF MESSRS. COODE, FITZMAURICE AND WILSON

FIG 26.—CROSS SECTION OF TYNE NORTH PIER AS RECONSTRUCTED, 1899–1908

Granite-faced Blocks.—It may be mentioned here that the use of granite masonry facing for concrete blocks in breakwater construction is unusual in modern work. The improvements which have been effected in concrete construction, its reliability when properly carried out and the impermeability of sound, well made concrete, have resulted in the gradual abandonment of masonry construction in favour of the more economical concrete. In some French ports large blocks are still made of a rough masonry consisting of rubble stone set in a concrete matrix and forming a sort of coarse conglomerate. Where the local conditions as to materials are favourable this form of construction is very economical.

Concrete-bag Foundations.—The levelling of the foundations for an upright wall breakwater is costly and tedious, even in chalk; and the expense and delay are enhanced where the bottom is hard rock. In constructing two breakwaters at the entrance to Aberdeen harbour on a bottom of granite, in 1870–77, bags of freshly mixed concrete were laid on the sea bed; and these bags, by adapting themselves to the rocky irregularities, obviated levelling the bottom. The bags each held 50 tons and were deposited from hopper barges towed out to the site. They were used for the construction of the breakwaters up to low water, mass concrete being employed for those portions above that level. Bags holding 100 tons were used subsequently at Newhaven in constructing a breakwater on a chalk foundation. Still later the two breakwaters sheltering the approach to the River Wear and the Sunderland docks were built, on a sea bed of marl rock, with a foundation mound of concrete in bags holding 56 to 116 tons deposited from hopper barges. The more exposed northern (Roker) breakwater (fig. 27) is devoid of a parapet, the deck being 11ft. above high water. The south breakwater has a parapet wall. Bag work was also used in constructing the superstructure of the eastern breakwater of Bilbao harbour below low water, where the rubble mound is of moderate height; but this application of the system appears less satisfactory, as settlement of the superstructure on the mound would produce cracks in the set concrete of the bags.



BY COURTESY OF THE CHIEF ENGINEER, RIVER WEAR COMMISSION

FIG. 27 —CROSS SECTION OF BREAKWATER NEAR OUTER END OF ROKER PIER, SUNDERLAND

Caisson Monoliths.—Caisson monoliths have also been used in constructing the foundations of upright wall breakwaters, and some of the Heligoland moles, demolished after the World War, were built on this system (see *Proc. Inst. C.E.*, vol. 220, 1926) Caissons, sunk by means of compressed air through the overlying sand and gravel into a foundation of hard chalk, were employed in constructing the lower portions of the vertical walls of the breakwaters at Dieppe where the tidal range is 30ft. at springs.

GENERAL

Block-setting Cranes.—The blocks used in breakwater construction are often laid in place by overhanging, block-setting cranes, called "Titans," which travel along the completed portion of the breakwater and deposit the blocks in advance on the mound levelled by divers. The cantilever superstructure of the Titan crane is supported centrally on a ring of rollers, set on the top of the travelling pedestal or portal, so that it can revolve and pick up blocks from behind the crane and deposit them at the side of the breakwater as well as in advance of the finished work (fig. 9). The large Titan at Peterhead deposits 50-ton blocks at a maximum radius of 100ft.; that used at Fishguard had a radius of 125 feet. Titans are generally preferred for block setting by British engineers and have the important advantage, in exposed situations, that they can be moved back into shelter in stormy weather. The weight of the Titan also contributes to the consolidation of the rubble mound. When a Titan crane has been used in the building of a breakwater it should be retained, on the completion of the work, in some convenient position, as well as permanent rails for its travel along the breakwater. The crane is then available for use if repairs have to be carried out involving the lifting of large blocks. Such maintenance work must always be anticipated in the case of breakwaters of the mound and composite types.

Gantry cranes (called "Goliaths") travelling on temporary staging, are sometimes employed for block setting when the depth of water is not too great. As several cranes can be employed at the same time more rapid progress can be made than with a single Titan crane working at the end of a breakwater; but the expenditure on plant and staging involved by this method of construction is much greater than when a Titan crane is used. At many Mediterranean and other ports, where a continuance of calm seas over considerable periods of time is usual, floating plant is commonly employed for block setting.

Breakwater Heads.—The end of a breakwater is frequently subjected to intense scour which may extend to a considerable depth. The foundations of a superstructure wall at the head of a breakwater are therefore sometimes placed at a lower level than the rest of the work; the base of the superstructure is often made wider; and the rubble mound, if there be one, is extended and the protection by apron blocks increased. Moreover, in solid blockwork construction some special means must be adopted to finish off and protect the concrete blocks where the ordinary section of the work terminates.

Various methods have been adopted for the construction of the heads of breakwaters. In some cases large steel caissons, circular or rectangular in plan, have been sunk on or into the sea bed or mound to form a foundation brought up above water level and afterwards filled with concrete blockwork or mass concrete. The blockwork of the main portion of the breakwater is subsequently built up to, and makes junction with, the caisson head. The head of the Colombo south-west breakwater is an early instance of a steel caisson founded on a rubble mound; and a circular steel caisson sunk to below sea-bed level was used for the head of the north sheltering arm at Madras (see *Proc. Inst. C.E.*, Selected papers, 1926). In other instances reinforced concrete caissons have been employed instead of steel caissons. Where caissons are not used the end of the breakwater is often built of specially constructed and keyed blocks in the form of a roundhead or some other enlargement of the normal section. This plan is commonly adopted in the construction of upright wall breakwaters on firm foundations such as the Dover breakwaters and the north pier at Tynemouth described in the preceding section. It has also been used in the Gibraltar moles (see *Proc. Inst. C.E.*, vol. cxcvii., 1914) completed in 1905.

Some form of lighthouse (*q.v.*) or port light for the guidance of mariners is usually established on a breakwater head.

Parapet Walls.—It has been the general practice to provide a shelter or parapet wall on the sea face of breakwater superstructures. In many cases a tunnel-way or passage is formed in the parapet for access in stormy weather to the light at the head of the breakwater. In several important examples, however, such as the island breakwater at Dover and the Colombo western breakwaters, no parapet wall is provided. Moreover, sheltered access can be provided by a subway under the deck of the breakwater as at Sunderland. In special cases where a breakwater has to serve as a quay, like the Admiralty pier at Dover, a high parapet wall is essential; but in most cases, in order to increase the stability of the structure, it would seem advisable to keep the parapet very low or to dispense with it altogether. This course is particularly expedient in very exposed sites, as a high parapet intensifies the shock of the waves against a breakwater and their erosive recoil.

Small Breakwaters.—The breakwaters and protective piers which are constructed at small harbours such as fishery harbours and ports of secondary importance are frequently built in comparatively shallow water and sheltered positions. In their construction the principles which have been set out in the foregoing paragraphs are applicable, *mutatis mutandis*. Many small upright wall breakwaters have been constructed in a moderate depth of water on a hard bottom of rock, chalk or boulders, by erecting timber framing in suitable lengths, lining it inside with jute cloth and then depositing concrete below low water in closed hopper skips. The portion of the breakwater above low water is then raised by tide work with mass concrete or masonry.

A form of breakwater, frequently adopted in past times for comparatively sheltered positions in no great depth of water where the sea bed consisted of sand or other soft material, is the cribwork pier. This type of structure was commonly formed of two rows of timber piles driven in the sea bed and connected together by ties or bracing, to which were fixed horizontal timber runners with spaces between them. The crib so formed was filled in with large stone rubble.

Cost of Breakwaters.—The expense involved in the construction of breakwaters varies within wide limits. The degree of exposure of the site; the depth of water; the facilities for obtaining materials and labour and their cost, vary so much in different cases as to make comparison fallacious. The following figures of the average cost per lineal foot of typical breakwaters illustrate the wide variation. It should be noted that from 50% to 100% must be added to pre-war cost figures to make them comparable with post-war conditions.

Place.	Type.	Average depth of water at H. W.	Approximate cost per lineal foot.
Breakwaters built before 1914			
		ft.	£.
Plymouth	1	59	290
Holyhead	2	54	163
Alderney	3	80	260
Colombo	3	42	170
Madras	3	43	125
Dover, old Admiralty pier	4	40	360
Dover, harbour breakwaters	4	60	415
Peterhead, south	3	60	300
Tyne north pier (reconstruction)	4	50	300
Marseille	2	90	120
Naples (San Vincenzo)	2	93	180
Algiers	2	52	120
Bilbao	3	63	203
Panama (Colon)	1	40	100
Breakwaters built since 1914			
Valparaiso, 2nd section	3	120	560
Valparaiso, 3rd section	3	170	760
Antofagasta	3	81	470
Marseille	2	100	200
Palermo	3	125	310
Naples (Granili)	3	59	230
Casablanca	2	60	250

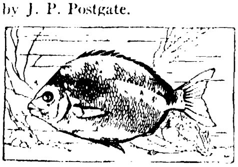
Time Occupied in Building Breakwaters.—The construction of most of the breakwaters described in this article has occupied many years; sometimes twenty and even thirty or forty years. An advance of 150 or 200ft. in the course of a season's work is often regarded as satisfactory. Generally speaking an increase in the rate of building involves a larger expenditure for a given length of structure.

Bibliography.—For general principles of design and descriptions of 19th century construction *see* L. F. Vernon-Harcourt, *Harbours and Docks* (2 vols. Oxford, 1885); T. Stevenson, *The Design and Construction of Harbours* (1886); W. Shield, *Harbour Construction* (1895); Quinette de Rochemont, *Cours de Travaux Maritimes* (3 vols. 1900); C. de Cordemoy, *Les Ports Modernes* (2 vols. 1900); and, particularly for Italian breakwaters, *Ports Maritimes de l'Italie* (Milan, 1905; French and Italian eds.). G. de Joly and C. Laroche, *Travaux Maritimes*, vols. i. and ii. (1921–22), is a good modern work. Brysson Cunningham, *Harbour Engineering* (3rd ed., 1928), also contains references to more recent work. The writings of Smeaton, Telford and Sir John Rennie are of great historical interest in connection with early construction. The *Proceedings* of the International Navigation Congresses include many important papers on breakwater design and construction, especially those of the congresses at Milan (10th, 1905), Philadelphia (12th, 1912) and Cairo (14th, 1926). A good and well illustrated description in English of earlier Italian breakwaters is L. Luiggi's *Recent Breakwaters in Italy* (Int. Maritime Congress, London, 1893). E. Quellennec's *Memoir* (I. N. C., Cairo, 1926) is an excellent résumé of modern Continental practice. Complete bibliographic lists are issued periodically (since 1908) by the International Association of Navigation Congresses, Brussels. *See* also *Proceedings Inst. C.E.* and *Mémoires*, Société des Ingénieurs Civils de France.

(N. G. G.)

BRÉAL, MICHEL JULES ALFRED (1832–1915), French philologist, was born on March 26 1832, at Landau in Rhenish Bavaria, of French parents, and died in Paris on Nov. 25 1915. After studying at Weissenburg, Metz and Paris, he entered the École Normale in 1852. In 1857 he went to Berlin, where he studied Sanskrit under Bopp and Weber. On his return to France Bréal entered the department of oriental mss. at the Bibliothèque Impériale. In 1864 he became professor of comparative grammar at the Collège de France.

His principal works are *L'Étude des origines de la religion Zoroastrienne* (1862); *Hercule et Cacus* (1863), in which he disputes the principles of the symbolic school in the interpretation of myths; *Le Mythe d'Oedipe* (1864); *Les Tables Eugubines* (1875); *Mélanges de mythologie et de linguistique* (2nd ed., 1882); *Dictionnaire étymologique latin* (1885); *Essai de Sémantique* (1897), on the signification of words, translated into English by Mrs. H. Cust, with preface by J. P. Postgate.


A SEA BREAM, MANY SPECIES OF WHICH ARE EXCELLENT FOOD FISHES

BREAM (*Abramis brama*), a carplike fish with a deep, compressed body and a long anal fin. It is found in the rivers of Europe and northern Asia, in lakes and sluggish streams; the record weight for England is 17 lb. A related species, the White Bream (*A. blicca*) is much smaller. The name is also given to the Sea Breams (*Sparidae*) and in the United States to the golden shiner (*A. chrysoleucus*) and others of the carp family.

BREAST, the term properly confined to the external projecting parts of the thorax in females, which contain the mammary glands (for anatomy, and diseases, *see* Mammary Gland); more generally it is used of the external part of the thorax in animals, including man, lying between the neck and the abdomen.

BREASTED, JAMES HENRY (1865–1935), American orientalist and historian, was born at Rockford, Ill., on Aug. 27, 1865. After graduating from North-western college (now North Central college) in 1888 he studied at Chicago theological seminary, Yale university and the University of Berlin. Beginning at the University of Chicago in 1894 as an assistant in Egyptology, he became professor of Egyptology and Oriental history in 1905, and director of the Oriental museum. He then directed an archaeological expedition in Egypt and the Sudan (1905–07). Meantime, by commission of the royal academies of Germany in 1900, he had been appointed on a mission to the museums of Europe to copy and arrange the Egyptian inscriptions in those museums for the first exhaustive Egyptian dictionary. In 1919, with funds supplied by John D. Rockefeller, Jr., he organized the Oriental institute at the University of Chicago as a scientific laboratory, the first of its kind, for investigating the early career of man and studying the history of ancient civilization. As first director of the institute he led an expedition to the Near East in 1919–20, subsequently organizing a series of five expeditions extending from the Black sea to Upper Egypt, with headquarter buildings in Asia Minor (Hittite expedition), Palestine (Armageddon expedition) and Luxor (Epigraphic expedition). He was editor of the institute's publications, appearing in three series. As a result of his representations to John D. Rockefeller, Jr., in 1925, the latter authorized him to offer the Egyptian Government the sum of $10,000,000 for establishing an Egyptian museum and an archaeological research institute in Cairo. Although never declined, the acceptance of this offer was so delayed that it was consequently withdrawn. In 1927 he drew the same donor's attention to similar needs in Palestine and was authorized to offer the Palestine Government the sum of $2,000,000 for a new archaeological museum at Jerusalem. This offer was accepted and the gift was duly made. In 1919 he was elected president of the American Oriental Society, and in 1927 president of the American Historical Association.

He has published, among other works, *De Hymnis in Solemn sub Rege Amenophide IV., Conceptis* (1894); *A New Chapter in the Life of Thutmose III.* (1900); *Ancient Records of Egypt* (1906–07); *A History of Egypt* (1906; also French, German and Russian editions, and editions for the blind); *The Monuments of Sudanese Nubia* (1908); *Development of Religion and Thought in Ancient Egypt* (1912; French and German translations in preparation); *Ancient Times* (1915; also Swedish, Arabic and Malay editions), re-edited as *The Conquest of Civilization* (1926); *Survey of the Ancient World* (1919); *History of Europe, Ancient and Medieval* (with J. H. Robinson, 1920); *The Oriental Institute—A Beginning and a Program* (1923); *Oriental Forerunners of Byzantine Painting* (1924); *The Conquest of Civilization* (1926).

See George Ellery Hale, "The Work of an American Orientalist," *Scribner's Magazine*, vol. lxxiv., p. 392–404 (1923).

BREASTPLATE, in ancient armour, a plate of iron, steel or other metal, so fastened to protect the wearer's chest and front of the body in battle. Breastplates are still worn by the Household Cavalry in full dress, *e.g.*, when on duty at the Horse Guards, London.

BREASTWORK, in military language, artificial cover from enemy fire built up of logs, sandbags, etc., above ground level. In swampy ground or woods it is commonly employed instead of trenches.

BREAUTÉ, FALKES DE (d. 1226), military adventurer, was one of the foreign mercenaries of King John of England, from whom he received in marriage the heiress of the earldom of Devon. On the outbreak of the Barons' War (1215) the king gave him the sheriffdoms of six midland shires and the custody of many castles. In 1217 he helped the royalist party of Henry III. to win a decisive victory at Lincoln, over Louis, the French claimant to the throne. But after the death of William Marshal, earl of Pembroke, Falkes joined the feudal opposition in conspiring against the justiciar, Hubert de Burgh. Deprived in 1223 of most of his honours, he took part in a rebellion in 1223–24. In 1224, he went into exile. He failed to obtain a pardon through the mediation of Pope Honorius III. and died at St. Cyriac in 1226.

BIBLIOGRAPHY.—See *Shirley, Royal Letters*, vol. i.; the *Patent* and *Close Rolls;* Pauli, *Geschichte von England*, vol. i., p. 540–545.

BRECCIA, in petrology, the name given to rocks consisting of angular fragments embedded in a matrix. They may be composed of any kind of material, and the matrix, which usually corresponds to some extent to the fragments it encloses, may be siliceous, calcareous, argillaceous, etc. The distinctive character of the group is the sharp-edged and unworn shapes of the fragments; in conglomerates the pebbles are rounded and water-worn. Breccias may originate in many ways. Some are formed by ordinary processes of atmospheric erosion; frost, rain and gravity break up exposed surfaces of rock and detach pieces of all sizes; in this way screes are formed at the bases of cliffs, and barren mountain-tops are covered with broken débris. If such accumulations are changed into hard rock by pressure cementation they make typical breccias. Caves, coral reefs and volcanic regions are other frequent sources.

Another group of breccias is due to crushing; these are produced in fissures, faults and veins, below the surface, and may be described as "crush-breccias" and "friction-breccias." Very important and well-known examples of this class occur as veinstones, which may be metalliferous or not. A fissure is formed, probably by slight crustal movements, and is subsequently filled with material deposited from solution (quartz, calcite, barytes, etc.). Very often displacement of the walls again takes place, and the infilling or "veinstone" is torn apart and brecciated. It may then be cemented together by a further introduction of mineral matter, which may be the same as that first deposited or quite different. Other crush-breccias occurring on a much larger scale are due to the folding of strata which have unequal plasticities. Great masses of limestone in the Alps, Scottish highlands, and all regions of intense folding are thus converted into breccias. Cherts frequently also show this structure; igneous rocks less commonly do so; but it is perhaps most common where there have been thin-bedded alternations of rocks of different character, such as limestone and dolerite, limestone and quartzite, shale or phyllite and sandstone. Fault-breccias closely resemble vein-breccias

A third group of breccias is due to movement in a partly consolidated igneous rock, and may be called "fluxion-breccias." Lava streams, especially when they consist of rhyolite, dacite and some kinds of andesite, may rapidly solidify, and then become exceedingly brittle. If any part of the mass is still liquid, it may break up the solid crust by pressure from within and the angular fragments are enveloped by the fluid lava. When the whole comes to rest and cools, it forms a typical "volcanic fluxion-breccia."

(J. S. F.)

BRECHIN, royal and small burgh, Angus (Forfarshire), Scotland, on the left bank of the South Esk, 7¾ mi. W. of Montrose, a station on the loop line of the L.M.S.R. from Forfar to Bridge of Dun. Pop. (1938) 6,615. Area, 1 sq.mi. Brechin was the site of a Culdee abbey. The Danes are said to have burned the town in 1012. David I erected it into a bishopric in 1150, and it is still a see of the Episcopal Church of Scotland. In 1452 the earl of Huntly crushed the insurrection led by the earl of Crawford at the battle of Brechin Muir, and in 1645 the town and castle were harried by the marquess of Montrose. James VI. gave a grant for a hospital; this still supplies funds for charity. No trace remains of the old walls and gates. Ancient structures include a very early two-arched stone bridge, Holy Trinity cathedral (13th century) much altered, and near by a round tower built about A.D. 1000. It is 86¾ft. high, has at the base a circumference of 50ft. and a diameter of 16ft., and is capped with a hexagonal spire of 18ft., which was added in the 15th century. This type of structure is common in Ireland, but the only Scottish examples are those at Brechin, Abernethy in Perthshire, and Egilshay in the Orkneys. Brechin castle played a prominent part in the Scottish War of Independence. In 1303 it withstood for 20 days siege in force by the English under Edward I., surrendering only when its governor, Sir Thomas Maule, had been slain. From the Maule family it descended to the Dalhousies. Its library contains Burns' correspondence with George Thomson and several cartularies, including those of St. Andrews and Brechin. In the Vennel (alley or small street) are ruins of the *maison dieu* or *hospitium*, founded in 1250 by William of Brechin. The industries include linen manufactures and flax-spinning, bleaching, rope-making, distilling, iron-founding and paper-making. Brechin unites with Arbroath, Forfar, Bervie and Montrose to return one member to parliament.

BRECKENRIDGE, a city of northeastern Texas, U.S.A., 110 mi. W. of Fort Worth; the county seat of Stephens county. It is on federal highway 80 (alternate) and is served by the Cisco and Northeastern and the Wichita Falls and Southern railways. The population in 1920 was 1,846; in 1930, 7,569; in 1940, 5,826 by federal census. It has large manufactories related to the petroleum industry. The city was settled in 1876 and incorporated in 1919.

BRECKINRIDGE, JOHN CABELL (1821–1875), American soldier and political leader, was born near Lexington, Ky., on Jan. 21, 1821. He was a member of a family prominent in the public life of Kentucky and the nation. His grandfather, John Breckinridge (1760–1806), was a United States senator from Kentucky in 1801–05 and attorney-general in President Jefferson's cabinet in 1805–06.

John Cabell Breckinridge graduated in 1838 at Centre college, Danville, Ky., continued his studies at Princeton, and then studied law at Transylvania university, Lexington, Kentucky. He practised law in Frankfort, Ky., in 1840–41 and in Burlington, Ia., from 1841 to 1843, and then returned to Kentucky and followed his profession at Lexington. In 1847 he went to Mexico as major in a volunteer regiment. In 1849 he was elected a Democratic member of the Kentucky legislature; in 1851–55 he served in the national House of Representatives. In 1856 he was chosen vice-president of the United States on the Buchanan ticket, and although a strong pro-slavery and states rights man, he presided over the Senate with conspicuous fairness and impartiality during the trying years before the Civil War. In 1860 he was nominated for the presidency by the pro-slavery seceders from the Democratic national convention, and received a total of 72 electoral votes. As vice-president and presiding officer of the Senate, it was his duty to make the official announcement of the election of his opponent, Lincoln. He succeeded John J. Crittenden as United States senator from Kentucky in March 1861, but having subsequently entered the Confederate service he was expelled from the Senate in Dec. 1861. As brigadier-general he commanded the Confederate reserve at Shiloh, and in Aug. 1862 he became major-general. On Aug 5 he was repulsed in his attack on Baton Rouge, but he won distinction at Stone River (Dec. 31, 1862–Jan. 2, 1863). He took part in the battle of Chickamauga, defeated Gen Franz Sigel at Newmarket, Va , on May 15, 1864, and then joined Lee and took part in the battles of Cold Harbor June 1 and 3. In the autumn he operated in the Shenandoah Valley, and with Early was defeated by Sheridan at Winchester on Sept. 19 In Jan. 1865 he became secretary of war for the Confederate States At the close of the war he escaped to Cuba, and thence to Europe. In 1868 he returned to the United States and resumed the practice of law at Lexington, Ky , where he died on May 17, 1875

BRECON or **BRECKNOCK (ABERHONDDU),** cathedral town, municipal borough and capital of Breconshire, Wales. Pop. (est. 1938) 5,136. Area, 4.48 sq.mi. It is at the confluence of the Honddu with the Usk near the centre of the county Its site commands routes from Builth in the north, Llandovery in the west, Merthyr and Crickhowell in the south, and Knighton and Hay in the east. About 3 mi. W. of the town is the Roman station known as "Y Gaer" and as is often the case, Brecon has continued the importance of the nodal site selected by the Romans. From the ruins of the Roman fort, it is said, Bernard de Newmarch built the original Norman castle in 1092. Its history was a stormy one as was the case with all castles that were outposts near the Welsh hills. Bernard subsequently founded, near the castle, the Benedictine priory of St. John, which he endowed and constituted a cell of Battle abbey. Nothing remains of the original church except portions of the nave walls, but the rebuildings of the first half of the 13th century and of the 14th century gave beautiful Early English and decorated additions and made the edifice one of the finest churches in Wales. In 1923 it was made the cathedral of the newly constituted diocese of Swansea and Brecon.

Around the original castle and priory a small mediaeval town grew up, and its inhabitants received a series of charters from the de Bohuns, into which family the castle and lordship passed, the earliest recorded charter being granted by Humphrey, 3rd earl of Hereford. A Dominican friary was established southwest of the town and was refounded by Henry VIII in 1542 as a collegiate church and school; it is now known as Christ's college and is one of the two public schools in Wales, the other being Llandovery. The nodal site of the town offered special facilities during Tudor economic developments for establishment of trade guilds as well as a Guild hall. There were formerly five guilds, the chief industries being cloth and leather manufacture. The town became one of the chief centres of trade in South Wales. There are now a monthly fair and further fairs monthly from May to December. There are five ancient fairs for stock, and formerly each of them was preceded by a leather fair. Further charters were granted by Mary in 1536 and again by Elizabeth. Brecon destroyed its castle to preserve its neutrality during the Civil Wars. The subsequent centuries were periods of social life and bustle for the now important capital of the county. The borough came under the Municipal Corporations act in 1835. A college for the training of Congregational ministers was established in 1869.

By a statute of 1535 Brecon elected a member to represent it in parliament, a right it retained until it was merged in the county representation in 1885. It is now (since 1918) merged in the representation of the joint counties of Brecon and Radnor.

BRECONSHIRE or **BRECKNOCKSHIRE,** an inland county in south Wales, and fourth largest in all Wales, bounded on the northwest by Cardigan, on the north and northeast by Radnor, on the east and southeast by Monmouth, on the south by Glamorgan, and on the west by Carmarthen. Area, 733.3 sq.mi.

Physical Conformation.—With the exception of the Vale of Usk at Crickhowell the county is almost encircled by mountains. To the north a range of barren hills, known as Mynydd Eppynt, stretches right across the county in a north-easterly direction towards Builth, beginning with Mynydd Bwlch y Groes (1,450ft.) near Llandovery. These hills are composed of the oldest rocks in the county, the Llandeilo shales, with their volcanic outflows (often containing mineral springs, as at Llanwrtyd and Builth) as well as the Bala beds, which, with the succeeding lower and upper Llandovery shales, sandstones, and conglomerates, form the sparsely populated sheep walks of the north part of the county. To the south-east of this region a narrow outcrop of Llandovery, Wenlock, and Ludlow sandstones and mudstones follows. The remainder and greater part of the county is occupied by the gently inclined old red sandstone, largely hill country, the highest point of which, north of the Usk, is Pen y Gader (2,624ft.) between Talgarth and Llanthony, where the lower marls and cornstones of the old red sandstone form the much dissected plateau of the Black mountains. The ring of hills is continued south of the Usk by the Brecon Beacons, composed mainly of the conglomeratic upper beds of the old red sandstone, weathered into many escarpments and plateaux. The highest point is Pen y Fan or Cadair Arthur (Arthur's Chair) (2,910ft.). In the extreme south-west of the county the ring of hills is completed by the Carmarthen Van, the highest point of which, Van Brycheiniog (2,632ft.), is in the county. The extreme southern boundary is formed by the scarps and moorlands of the carboniferous limestone and millstone grit, while the lowest beds of the coal measures (much folded) are reached in the upper Tawe and Neath valleys and near Brynmawr.

Drainage System.—The most distinctive feature of the drainage system is the valley of the Usk. The river rises in the Carmarthen Van in the west and flows nearly due east, dividing the county into two nearly equal portions. It also collects numerous streams from the Beacons on the south and the Eppynt in the north. The most important tributary streams are the Tarell and the Honddu. The confluence of the latter with the Usk marks the site of Brecon—the county town. Another river of the eastward drainage is the Wye, which forms the northern boundary of the county from Rhayader to Hay. A portion of the upper Towy, flowing north-east to south-west, following the line of the Eppynt, forms the county boundary on the north-west. The southern section has the upper reaches of the Taff, Neath, and Tawe, all of which ultimately flow southwards to the Bristol channel as part of the general south and south-westerly drainage system of Wales. There is evidence that the region was heavily glaciated, and much boulder clay is found in the lower valley lands and striated pebbles and boulders occur at a great height on the Black mountains. The porous rocks of Breconshire constitute one of the best water-producing areas in Wales, and many industrial centres are supplied from reservoirs in this county.

History.—As usual the earliest remains of man are on the high ground. Later the Usk and Wye valleys became especially important as ways through the mountains from the English border. On the spurs of the moorland overlooking the valleys are many hill-top camps. An interesting site is the artificial island in Llangorse lake (Llyn Safaddan) in the east of the county at the foot of the Black mountains, where traces of lake dwellings were discovered in 1869. The conquest of the district by the Romans was effected about A.D. 75–80. Their main purpose was to keep open valley lines of communication through their fortified nodal sites, such as the one three miles out of the present town of Brecon excavated in 1925–26 by the officers of the National Museum of Wales (see *Y Cymmrodor,* vol. xxxvii., 1926). Smaller forts were established on roads leading from this fort towards Neath and Crickhowell. On the departure of the Romans, the hill tribes and other raiders seem to have regained possession of the Usk valley under Brychan, who became the ancestor of one of the three chief tribes of hereditary Welsh saints. His territory (named after him Brycheiniog, whence Brecknock) lay wholly east of the Eppynt range, for the lordship of Buallt, corresponding to the modern hundred of Builth, to the west, remained independent, probably till the Norman invasion. Most of the older churches of central Brecknockshire were founded by or dedicated to members of Brychan's family.

From the middle of the 8th century to the 10th, Brycheiniog proper, with its valley-ways open to the English plain, often bore the brunt of Mercian attacks, and many of the castles on its eastern border had their origin in that period. Subsequently, when Bernard de Newmarch and his Norman followers obtained possession of the country in the last quarter of the 11th century, these were converted into regular fortresses. Bernard himself built a castle at Talgarth on the Upper Wye, but in 1091 he moved southwards and, having defeated Bleddyn Ab Maenarch, he established himself at Brecon, which he made his *caput baroniae*. Brycheiniog was then converted into a lordship marcher and passed to the FitzWalter, the de Braose, the Bohun, and the Stafford families in succession, remaining unaffected by the statute of Rhuddlan (1282), as it formed part of the marches, and not of the principality of Wales.

The Irfon valley, near Builth, was, however, the scene of the last struggle between the English and Llewelyn, who in 1282 fell in a petty skirmish in that district. Raids from the hills were frequent and Glyndwr (Glendower *q.v.*), at the head of a band of tribesmen, marched to Brecon in 1403.

Upon the attainder of Edward, duke of Buckingham, in 1521, the lordship of Brecon with its dependencies became vested in the Crown. In 1536 it was grouped with a whole series of petty lordships marcher and the lordship of Builth to form the county of Brecknock with Brecon as the county town, and the place for holding the county court. The most important mediaeval monastic house was the priory of St. John the Baptist, founded by Bernard de Newmarch at Brecon in the 11th century.

This county became famous for its wool in the later middle ages and attracted large numbers of continental weavers at different times, some of whom were refugees forming part of an intellectual *élite*. John Penry (1559–93), born at Llangammarch in the north-west of the county, was typical of the spirit of Puritanism that characterized this region, which developed strong points of view in religion, as is shown by the early importance of the Quakers and later of the Baptists. Later Howell Harris (1714–73), one of the most fiery leaders of the Methodist revival, was a native of the county.

Industries.—The county's one-time agricultural prosperity is indicated by an agricultural society dating from 1755, the oldest in Wales. Agriculture is still the chief occupation, and the county is chiefly pastoral. The breeding of cobs and ponies, as in Cardiganshire, is also important. The upper reaches of the Swansea and Neath valleys are important areas on the anthracite coalfield, while bituminous coal is mined in the south-east corner near Brynmawr. There are also limestone, fire clay, and cement works on the outcrop of the carboniferous limestone.

Railways and Communications.—The L.M.S.R. from Craven Arms to Swansea and from Hereford to Swansea runs through the county, effecting junctions with the G.W.R. at Builth (old Cambrian line), Three Cocks (mid-Wales line), Talyllyn (Merthyr and Newport line), and at Colbren (Neath and Brecon line). Brynmawr in the south-east is connected by L.M.S.R. with Abergavenny and with Pontypool and G.W.R. with Newport. Brecon is also connected with Newport by the Brecknock and Abergavenny canal (35m.), which was completed in 1801. The Swansea canal and that of the Vale of Neath have also their northern terminals in the county, at Ystradgynlais and Abernant respectively. The main roads are probably the best in south Wales, and nodal sites such as Brecon and Builth are coming into prominence in this respect. There were 1,160 mi. of roads in 1942.

Area and Administration.—The area of the administrative county is 733.3 sq.mi. with a population (est. 1938) of 53,060. Wartime movements caused an increase of 10% between Sept. 1939 and Feb. 1941. The only municipal borough is Brecon, which is the county town, pop. (est. 1938) 5,136. The other urban districts are Brynmawr (6,622), Builth Wells (1,508), Hay (1,362) and Llanwrtyd (662). The county forms part of the south Wales circuit and the assizes are held at Brecon. It has one court of quarter sessions and is divided into ten petty sessional divisions. There are 89 civil parishes, while of the ecclesiastical parishes or districts wholly or in part within the county all but three were until 1923 in the diocese of St. David's but are now in the newly constituted diocese of Swansea and Brecon, the remaining three being in the diocese of Llandaff. Brecon is the site of the new cathedral. The county is not divided for parliamentary purposes and until 1918 returned one member to parliament; since that date its representation is merged with that of the county of Radnor.

BREDA, town, province of North Brabant, Holland, at the confluence of the canalized rivers Merk and Aa. Pop. (1940) 50,793. Breda was in the 11th century a direct fief of the Holy Roman empire, its earliest known lord being Henry I. (1098–1125), in whose family it continued, until Alix, heiress of Philip (d. 1323), sold it to Brabant. It passed ultimately to William I. (1533–84), the first stadtholder of the Netherlands. Breda obtained municipal rights in 1252, but was first surrounded with walls in 1534 by Count Henry of Nassau, who also restored the old castle, originally built by John of Polanen in 1350. It remained until the 19th century the most important of the line of fortresses along the Meuse. Captured by the Spaniards in 1581, in 1590 it fell again into the hands of Maurice of Nassau. Its surrender to the Spaniards (1625) after a siege, is the subject of the famous picture by Velasquez in the Museo del Prado in Madrid. In 1637 Breda was recaptured by Frederick Henry of Orange, and in 1648 it was finally ceded to Holland by the treaty of Westphalia. It was the residence, during his exile, of Charles II. of England. In 1696 William, prince of Orange and king of England, built the new castle. During the French Revolution, it was taken by Dumouriez in 1793, evacuated soon after and retaken by Pichegru in 1795. In 1813, the citizens of Breda again made themselves masters of the town. In 1575 a conference was held here between the ambassadors of Spain and those of the United Provinces; in 1667 a peace was signed by England, Holland, France and Denmark; and by the same Powers in 1746–47. The town has a fine quay, town hall and park. The principal Protestant church is a Gothic building (13th century), with a fine tower, and a choir (1410). Breda was heavily bombed when the Germans invaded Holland in May 1940.

BREDAEL, JAN FRANS VAN (1683–1750), Flemish painter, son of Alexander van Bredael (d. 1720), also an artist, was born in Antwerp. He imitated the style of Wouwerman and Breughel with much dexterity. He visited England, where he was well employed. There were several other van Bredaels, who won honour as artists—notably PIETER (1622–1719), Alexander's father, and JOZEF (1688–1739). They were formerly known as "Breda," but this apparently is incorrect, though it occurs as a signature on a picture by Jan Frans in the Amsterdam gallery.

BREDERODE, HENRY, VISCOUNT OF (1531–1568), a descendant of the ancient counts of Holland, was born at Brussels in Dec. 1531, and died at Recklinghausen on Feb. 15, 1568. In 1566 he was one of the founders of the confederacy of nobles who bound themselves to maintain the rights and liberties of the Netherlands and to resist the expected introduction of the Inquisition by signing a document known as "the compromise." This document is believed to have been the work of Sante-Aldegonde, with the assistance of Louis of Nassau and Brederode. Brederode was gay and popular, reckless and generous, and one of the principal leaders of the movement. On April 5 of that year 250 confederates assembled at the Hôtel Culemburg and marched to the palace, led by Louis and Brederode, to present to the regent, Margaret of Parma, a petition setting forth their grievances, called "the request." Refusing, in the following August, to take an oath of loyalty demanded by Margaret of Parma, Brederode made unsuccessful attempts to raise an army at Antwerp and Amsterdam; in April 1567 he fled to Emden, where, on hearing of the appointment of the Duke of Alva, he signed a second compromise with seven other exiles. After his death in 1568, Alva passed a sentence of banishment and confiscation on him.

See M. C. Van den Hall, *Heinrich von Brederode* (1845).

BREDOW, a shipbuilding district in the Prussian province of Pomerania, lying immediately north of Stettin (*q.v.*), with which it is incorporated.

BREECH, a covering for the lower part of the body and legs The word in its proper meaning is used in the plural, and is confined to a garment reaching to the knees only. The meaning of "the hinder part of the body" is later than, and derived from, its first meaning; this sense appears in the "breech" of a gun. The word is also found in "breeches buoy," a sling life-saving apparatus, consisting of a support of canvas breeches. The "Breeches Bible," a name for the Geneva Bible of 1560, is so called because "breeches" is used for the aprons of fig-leaves made by Adam and Eve On the stage the phrase a "breeches" part is used when a woman plays in male costume. "Breeching" is a strap passed round the breech of a harnessed horse and joined to the shafts to allow a vehicle to be backed. In military science the word is used to denote the hinder part of a firearm, containing the projectile and propellent. Up till the middle of the 19th century these had to be inserted from the muzzle of the weapon; loading by the breech is universal to-day for guns and all other firearms.

BREEDS AND BREEDING. A breed of domestic animals or cultivated plants is a group of individuals which have been separated from other members of the same species in their recent ancestry and which exhibit a certain combination of hereditary characters considered to be typical of that breed. Individual departures from breed type are usually small enough or few enough that, if all the characteristics of an individual are considered, its breed can be recognized. "Variety" is often used instead of "breed" in plant breeding. Where breed and variety have different meanings, as in poultry breeding, breed is the broader term.

Although the existence of local races has been recognized from the remotest times, formal organization of breeds began in Britain late in the 18th century The first published herdbook, *The General Stud Book for Thoroughbred Horses*, appeared in 1791. A breed begins when men notice that the animals of one herd or one community seem different from others and superior for some purposes. A pedigree barrier of some sort is then raised between these animals and the rest of the species, so that their special characteristics will not be diluted or scattered by crossing them with other stock. This is usually done by a breed association which defines the breed ideal and supervises registration The pedigree barrier is not always absolute. In some breeds individuals with a little outside ancestry can be admitted. Registration of individual pedigrees is customary in pure breeds of the larger farm animals although in some cases, such as sheep in Britain or Australia, registration may be by flocks. Individual pedigrees of poultry, "pet and fancy stock," and plants are rarely recorded except in the private records of the breeder.

Breeds can become different in the following ways: (1) the foundation animals included when the breeds were first organized may already be different; (2) subsequent selection is often directed toward different goals, since each breed can serve more than one purpose and the importance of those purposes varies in different types of farming; or (3) the chance variations which Mendelian inheritance permits may cause a gene to become abundant in one breed and rare in another.

The improvement of breeds was usually accelerated when conditions of management and environment were improved, as after the enclosure of the common lands in Britain or after the pioneering phases of settlement in the United States were completed. Improvement in the environment does not (as far as is known) create any genuinely new heredity, but does permit hereditary differences to manifest themselves more clearly and be selected more accurately. The incentive to improved breeding is considerably increased at such times, since low inherent ability is then likely to be the main obstacle to increased economic returns from animal breeding.

Aesthetic desires pride in possessing something unique, and the sporting thrill of achieving a difficult goal, are the main motives governing the breeders of many breeds of "pet and fancy stock," such as dogs, cats, pigeons, canaries, guinea pigs, mice, flowers, ornamentals, etc. Breeders of pigs, cattle, chickens, cereal grains, potatoes, etc., generally try to keep fancy points from influencing their choices, lest this decrease the selection which could otherwise be practised for utility characteristics.

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BREEZE. (1) A current of air less than a "wind," which in turn is less than a "gale." (*See* BEAUFORT SCALE.) The term is qualified in many different ways, *e.g.*, glacial-breeze—a cold breeze blowing down the course of a glacier; lake-breeze—light wind blowing on to the coast of a lake in sunny weather during the middle of the day; mountain breeze—a mass of air flowing down into the valley during the night; valley breeze—a day breeze blowing up the valleys. The unqualified term is usually applied to the light wind blowing landwards by day, sea-breeze, and the counter wind blowing offshore at night, land-breeze.

(2) In industry breeze is a name given to small cinders and fine coal used in burning bricks. The term is also applied to small clinker and clinker dust. Used as a matrix with Portland cement, breeze is now widely employed to make lintels for building, fixing-bricks, and blocks for building cheap partitions. A breeze for such a purpose should be carefully washed and rendered free from sulphur to prevent disintegration after moulding. The coke-breeze fixing-brick is a very useful product, as it saves much labour in fixing door-frames, skirtings, picture-mouldings, etc. The breeze block will hold nails, and its use therefore makes it unnecessary to plug walls where joinery has to be fixed.

BREGENZ, the capital of the Austrian province of Vorarlberg, is situated at the south-east corner of Lake Constance It has an important nodal position commanding routes from southern Germany to the Upper Rhine valley and the Arlberg as well as communications by water with the other towns on the lake shores. The value of the location is proved by its long and disturbed history, admirably recorded in the collections of the Vorarlberger Landesmuseum. The old town, the *Brigantium* of the Romans, lies on a castle-crowned hill overlooking the modern site. Here, in 1408, the Appenzellers were defeated, while in 1647 during the Thirty Years' War the town was sacked by the Swedes. The rejuvenation of modern times is in great measure due to its possibilities as a port. The principal exports are cattle and the cotton goods manufactured in Vorarlberg, but an important trade in grain and foodstuffs is also carried on. The town grew rapidly in the 20th century Pop. (1939) 18,788.

BREGUET, LOUIS CHARLES (1880–), French engineer, a descendant of the famous watchmaker, Abraham Louis Breguet, was born Jan. 2 1880, in Paris. He received his education at the Lycées Condorcet and Carnot, and graduated in science. He was from the outset of his career a prominent member of the engineering firm that bears his family name, and eventually became head engineer of its electric service. The Maison Breguet, which came to the front in French aeronautical construction, provided him with ample ground for research; he published a quantity of reports on aerodynamics, on the energy converted by propellers in motion and on the rise of aircraft from the ground. He studied and equipped in 1909 the first helicopter which was able to rise perpendicularly carrying a passenger.

BREHON LAWS, more properly called *Feinechus*, were the ancient laws of Ireland. Brehon (*Breitheamh*) is the Irish word for judge. Regular courts and judges existed in Ireland from prehistoric times.

The extant remains of these laws are ms. transcripts from earlier copies made on vellum from the 8th to the 13th century, now preserved with other Gaelic mss. in Trinity college and the Royal Irish Academy, Dublin, the British Museum, Oxford university, some private collections and several libraries on the continent of Europe. The largest and most important of these documents is the *Senchus Mór*, or "Great Old Law Book." No copy of it now existing is complete. What remains of it occupies the first, second and a portion of the third of the volumes produced by the Brehon Law Commission appointed in 1852.

In the *Annals of the Four Masters* it is said "The age of Christ 438, the tenth year of King Laeghaire (Lairy), the *Senchus Mór* and *Feinechus* of Ireland were purified and written." This entry has some historical corroboration.

The text and earlier commentaries are in the *Bearla Feini*—the most archaic form of the Gaelic language. Many words, phrases and idioms are now obsolete, and so difficult to translate that the official translations are to some extent confessedly conjectural. Frequently only the opening words of the original text remain. Wherever the text is whole, it is curt, elliptical and yet rhythmical. The rigorously authentic character of these laws, relating to, and dealing with, the actual realities of life, and with institutions and a state of society nowhere else revealed to the same extent, the extreme antiquity both of the provisions and of the language, and the meagreness of continental material illustrative of the same things, endow them with exceptional archaic, archaeological and philological interest. No man was allowed to act as judge until he had studied the full law course, which occupied 20 years, and had passed a rigorous public examination. The course of study for judge and law-agent, respectively, is carefully laid down. The Brehon was an arbitrator, umpire and expounder of the law, rather than a judge in the modern acceptation. It appears, without being expressly stated, that the facts of a case were investigated and ascertained by laymen before submission to a Brehon for legal decision. The complainant could select any Brehon he pleased, if there were more than one in his district. Every king or chief of sufficient territory retained an official Brehon, who was provided with free land for his maintenance and acted as registrar or assessor in the king's court. In ordinary cases the Brehon's fee was said to have been one-twelfth of the amount at stake.

Assemblies, national, provincial and local, were a marked characteristic of ancient Irish life. They all, without exception, discharged legal, legislative or administrative functions. Most of the assemblies were annual, some triennial, some lasted only a day or two, others a week and occasionally longer. All originated in pagan funeral or commemorative rites and continued to be held, even in Christian times, in very ancient cemeteries. They were called by different names—*Feis*, *Aenach*, *Dál*, etc. At one assembly held at Uisneach about a century before Christ a uniform law of distraint for the whole of Ireland was adopted. Each provincial kingdom and each *tuath* had assemblies of its own. Very careful provision is made for the preparation of the sites of great assemblies, and the preservation of peace and order at them is sanctioned by the severest penalties of the law.

The Clan System.—*Tuath*, *Cinel* and *Clann* were synonyms meaning a small tribe or nation descended from a common ancestor. A king and clan being able, subject to certain limitations, to adopt new members or families, or amalgamate with another clan, the theory of common origin was not rigidly adhered to. Kinship with the clan was an essential qualification for holding any office or property. The rules of kinship largely determined status with its correlative rights and obligations, supplied the place of contract and of laws affecting the ownership, disposition and devolution of property, constituting the clan an organic, self-contained entity, a political, social and mutual insurance co-partnership. The solidarity of the clan was its most important and all-pervading characteristic. According to the traditional view the entire territory occupied by a clan was the common and absolute property of that clan, a portion being set apart for the maintenance of the king. Warriors, statesmen, Brehons, Ollamhs, physicians, poets and even eminent workers in the more important arts, were also rewarded with free lands. Rank, with the accompanying privileges, jurisdiction and responsibility, was based upon a qualification of kinship and of property, held by a family for a specified number of generations, together with certain concurrent conditions; and it could be lost by loss of property, crime, cowardice or other disgraceful conduct. A portion of land called the *Cumhal Senorba* was devoted to the support of widows, orphans and old childless people. According to the later and now very generally accepted view of Prof. Eoin MacNeill there was no communal holding of land by the clan. Clan itself meant little more than a princely family, like, say, the Hohenzollerns in Germany. There was no land, blood or personal name common to the people subject to such a family. Anything in the nature of common holding or redistribution of land was confined to the joint families next to be described.

Fine (*finé*), originally meaning family, came in course of time to be applied to a group of kindred families or a joint family group of four generations. Even those who adhere to the traditional view of the clan will admit that in course of time a large and increasing proportion of the good land became limited private property. The area of arable land available for the common use of the clansmen was gradually diminished by these encroachments. The land belonging to the joint family (*finé*) was at intervals liable to redistribution when the joint family broke up. In this distribution men might or might not receive again their former portions. In the latter case compensation was made for unexhausted improvements. This land could not be sold, nor even let except for a season in case of domestic necessity. The holders had no landlord and no rent to pay for this land, and could not be deprived of it except for a crime. They were subject only to public tributes and the ordinary obligations of free men. The unfenced and unappropriated common lands—waste, bog, forest and mountain—all clansmen were free to use promiscuously at will.

Tenure of Land.—There was hardly any selling and little letting of land in ancient times. Nobles and other persons holding large areas let to clansmen, not the land, but the grazing of a number of cattle specified by agreement. They also let cattle to a clansman who had none or not enough, and this was the most prevalent practice. There were two distinct methods of letting and hiring—*saer* (=free) and *daer* (=unfree), the conditions being fundamentally different. The conditions of *saer*-tenure were largely settled by the law, were comparatively easy, did not require any security to be given, left the clansman free within the limits of justice to end the connection, left him competent in case of dispute to give evidence against that of the noble, and did not impose any liability on the joint family of the clansmen. By continued use of the same land for some years and discharge of the public obligations in respect of it in addition to the *ciss* or payment as tenant, a clansman became a sub-owner or permanent tenant and could not be evicted. There is no provision in these laws for evicting any one. For the hire of cattle a usual payment was one beast in seven per annum for seven years; after which the cattle that remained became the property of the hirer. *Daer*-tenure, whether of cattle or of the right to graze cattle upon land, was subject to a *ciss-ninsciss* (=wearisome tribute), for the payment of which security had to be given. A man not in the enjoyment of full civil rights, if able to find security could become an unfree clansman. A free clansman by becoming an unfree-clansman lowered his own status and that of his joint family, became incompetent to give evidence against that of a noble, and could not end the connection until the end of the term except by a large payment. The members of his joint family were liable, in the degree of their relationship, to make good out of their own property any default in the payments. Hence this tenure could not be legally entered into by a free clansman without the permission of his joint family. Unfree clansmen were also exposed to casual burdens, like that of lodging and feeding soldiers when in their district. All payments were made in kind. When the particular kind was not specified by the law or by agreement, the payments were made according to convenience in horses, cattle, sheep, pigs, wool, butter, bacon, corn, vegetables, yarn, dye-plants, leather, cloth, articles of use or ornament, etc.

People who did not belong to the clan and were not citizens were in a base condition and incompetent to appear in court in suit or defence except through a freeman. The *Bothach* (=cottier) and the *Sen-cléithe* (=old dependant) were people who, though living for successive generations attached to the families of nobles, did not belong to the clan and had no rights of citizenship. *Fuidhirs*, or manual labourers without property, were the lowest section of the population. Some were born in this condition, some clansmen were depressed into it by crime, consequences of war or other misfortune; and strangers of a low class coming into the territory found their level in it. The *fuidhirs* also were divided into free and unfree; the former being free by industry and thrift to acquire some property, after which five of them could club together to acquire rights corresponding to those of one freeman. The unfree *fuidhirs* were tramps, fugitives, captives, etc.

Fosterage, the custom of sending children to be reared and educated in the families of fellow-clansmen, was prevalent among the wealthy classes. A child in fosterage was reared and educated suitably for the position it was destined to fill in life. There was fosterage for affection, for payment and for a literary education. Fosterage began when the child was a year old and ended when the marriageable age was reached, unless previously terminated by death or crime. Every fostered person was under an obligation to provide, if necessary, for the old age of foster parents. The affection arising from this relationship was usually greater, and was regarded as more sacred than that of blood relationship.

Law of Contract.—The solidarity of clan and joint family in their respective spheres, the provisions of the system, the simple rural life, and the prevalence of barter and payments in kind, left comparatively little occasion for contracts between individuals. Consequently the rules relating to contract are not very numerous. They are, however, sufficiently solemn. No contract affecting land was valid unless made with the consent of the joint family. Contracts relating to other kinds of property are more numerous. When important or involving a considerable amount, they had to be made in the presence of a noble or magistrate. The parties to a contract should be free citizens, of full age, sound mind, free to contract and under no legal disability. "The world would be in a state of confusion if express contracts were not binding." From the repeated correlative dicta that "nothing is due without deserving," and that a thing done "for God's sake," *i.e.*, gratis, imposed little obligation, it is clear that the importance of valuable consideration was fully recognized. So also was the importance of time. "To be asleep avails no one"; "Sloth takes away a man's welfare." Contracts made by the following persons were invalid: (1) a servant without his master's authority; (2) a monk without authority from his abbot or manager of temporalities; (3) a son subject to his father without the father's authority; (4) an infant, lunatic, or "one who had not the full vigilance of reason"; (5) a wife in relation to her husband's property without his authority. She was free to hold and deal with property of her own and bind it by contract. If a son living with his father entered into a contract with his father's knowledge, the father was held to have ratified the contract unless he promptly repudiated it. "One is held to adopt what he does not repudiate after knowledge, having the power." Contract of sale or barter with warranty could be dissolved for fraud, provided action was taken within a limited time after the fraud had become known. Treaties and occasional very important contracts were made "blood covenants" and inviolable by drawing a drop of blood from the little finger of each of the contracting parties, blending this with water, and both drinking the mixture out of the same cup. The forms of legal evidence were pledges, documents, witnesses and oaths. In cases of special importance the pledges were human beings, "hostage sureties." These were treated as in their own homes according to the rank to which they belonged, and were discharged on the performance of the contract. If the contract was broken they became prisoners and might be fettered or made to work as slaves until the obligation was satisfied. Authentic documents were considered good evidence. A witness was in all cases important, and in some essential to the validity of a contract. His status affected the force of the contract as well as the value of his evidence; and the laws appear to imply that by becoming a witness, a man incurred liabilities as a surety. The pre-Christian oath might be by one or more of the elements, powers or phenomena of nature, as the sun, moon, water, night, day, sea, land. The Christian oath might be on a copy of the Gospels, a saint's crozier, relic or other holy thing.

Criminal Laws.—These laws recognized crime, but in the same calm and deliberate way in which they recognized contract and other things seriously affecting the people. Although we find in the poems of Dubhthach, written in the 5th century and prefixed to the *Senchus Mór*, the sentences "Let every one die who kills a human being," and "Every living person that inflicts death shall suffer death," capital punishment did not prevail in Ireland before or after. The laws uniformly discountenanced revenge, retaliation, the punishment of one crime by another, and permitted capital punishment only in the last resort, and in ultimate default of every other form of redress. They contain elaborate provision for dealing with crime, but the standpoint from which it is regarded and treated is essentially different from ours. The State, for all its elaborate structure, did not assume jurisdiction in relation to any crimes except political ones, such as treason or the disturbance of a large assembly. For these it inflicted the severest penalties known to the law—banishment, confiscation of property, death or putting out of eyes. A crime against the person, character or property of an individual or family was regarded as a thing for which reparation should be made, but the individual or family had to seek the reparation by a personal action. This differed from a civil action only in the terms employed and the elements used in calculating the amount of the reparation. The function of a judge in a criminal as in a civil action was to see that the facts, with modifying circumstances, were fully and truly submitted to him, and then by applying the law to these facts to ascertain and declare the amount of compensation that would make a legal adjustment. For this amount the guilty person and in his default his kindred, became legally debtor, and the injured person or family became entitled to recover the amount like a civil debt by distraint. There were no police, sheriffs or public prisons. The decisions of the law were executed by the persons concerned, supported by a highly organized and disciplined public opinion springing from honour and interest and inherent in the solidarity of the clan. Prof. MacNeill, however, contends that the State took a far more active part in enforcing Brehon decisions than that herein described, the king in general acting as judge, subject to professional advice. There is good reason to believe that the system was as effectual in the prevention and punishment of crime and in the redress of wrongs as any other human contrivance has ever been.

In calculating the amount of compensation the most characteristic and important element was *Enechlann* (=honour-price, honour-value), a value attaching to every free person, varying in amount from one cow to 30 cows according to rank. It was the assessed value of *status* or *caput.* It was frequently of consequence in relation to contracts and other clan affairs; but it emerges most clearly in connection with crime. By the commission of crime, breach of contract, or other disgraceful or injurious conduct, Enechlann was diminished or destroyed, a *capitis diminutio* occurred, apart from any other punishment. Though existing apart from fine, Enechlann was the first element in almost every fine. *Dire* was the commonest word for fine, whether great or small. *Eric* (=reparation, redemption) was the fine for "separating body from soul"; but the term was used in lighter cases also. In capital cases the word sometimes meant Enechlann, sometimes *coirp-dire* (=body-fine), but most correctly the sum of these two. It may be taken that, subject to modifying circumstances, a person guilty of homicide had to pay (1) *coirp-dire* for the destruction of life, irrespective of rank; (2) the honour-value of the victim; (3) his own honour-value if the deed was unintentional; and (4) double his own honour-value if committed with malice aforethought. The sum of these was in all cases heavy; heaviest when the parties were wealthy. The amount was recoverable as a debt from the criminal to the extent of his property, and in his default from the members of his joint family in sums determined by the degree of relationship; and it was distributable among the members of the joint family of a murdered person in the same proportions, like a distribution among the next of kin. The joint family of a murderer could free themselves from liability by giving up the murderer and his goods, or if he escaped, by giving up any goods he had left, depriving him of clanship and lodging a pledge against his future misdeeds. In these circumstances the law held the criminal's life forfeit, and he might be slain or taken as a prisoner or slave. He could escape only by becoming an unfree labourer in some distant territory. When the effect of a crime did not go beyond an individual, if that individual's joint family did not make good their claim while the criminal lived, it lapsed on his death. "The crime dies with the criminal." If an unknown stranger or person without property caught red-handed in the commission of a crime refused to submit to arrest, it was lawful to maim or slay him according to the magnitude of the attempted crime. "A person who came to inflict a wound on the body may be safely killed when unknown and without a name, and when there is no power to arrest him at the time of committing the trespass." For crimes against property the usual penalty, as in breach of contract, was generic restitution, the quantity, subject to modifying circumstances, being twice the amount taken or destroyed.

Law of Distress.—Distress or seizure of property being the universal mode of obtaining satisfaction, whether for crime, breach of contract, non-payment of debt, or any other cause, the law of distress came into operation as the solvent of almost every dispute. Hence it is the most extensive and important branch, if not more than a branch, of these ancient laws. There was no sale, because sale for money was little known. The property in the thing seized, to the amount of the debt and expenses, became legally transferred from the debtor to the creditor, not all at once but in stages fixed by law. A creditor was not at liberty to seize household goods, farming utensils, or any goods the loss of which would prevent the debtor recovering from embarrassment, so long as there was other property which could be seized. A seizure could be made only between sunrise and sunset. "If a man who is sued evades justice, knowing the debt to be due of him, double the debt is payable by him and a fine of five *seds*." When a large debt was clearly due, and there was no property to seize, the debtor himself could be seized and compelled to work as a prisoner or slave until the debt was paid.

When a defendant was of rank superior to that of the plaintiff, distress had to be preceded by *troscad* (=fasting). This is a legal process unknown elsewhere except in parts of India. The plaintiff having made his demand and waited a certain time without result, went and sat without food before the door of the defendant. To refuse to submit to fasting was considered indelibly disgraceful, and was one of the things which legally degraded a man by reducing or destroying his honour-value. The law said, "he who does not give a pledge to fasting is an evader of all; he who disregards all things shall not be paid by God or man." If a plaintiff having duly fasted did not receive within a certain time the satisfaction of his claim, he was entitled to distrain as in the case of an ordinary defendant, and to seize double the amount that would have satisfied him in the first instance. If a person fasting in accordance with law died during or in consequence of the fast, the person fasted upon was held guilty of murder. Fasting could be stopped by paying the debt, giving a pledge, or submitting to the decision of a Brehon. A creditor fasting after a reasonable offer of settlement had been made to him forfeited his claim. "He who fasts notwithstanding the offer of what should be accorded to him, forfeits his legal right."

BIBLIOGRAPHY.—Pending the work of a second Brehon Law Commission, the Laws are best studied in the six imperfect volumes (*Ancient Laws of Ireland*, 1865–1901) produced by the first Commission (ignoring their long and worthless introductions), together with Dr. Whitley Stokes's *Criticism* (1903) of Atkinson's *Glossary* (1901). The following are important references (kindly supplied by Dr. Whitley Stokes) for detailed research:—R. Dareste, *Études d'histoire de droit*, pp. 356–381 (1889); Arbois de Jubainville and Paul Collinet, *Études sur le droit celtique* (2 vols., 1895); Joyce, *Social History of Ancient Ireland*, vol. i. pp. 168–214 (2 vols., 1903); *Zeitschrift für celtische Philologie*, iv. 221 (*see* also vol. 14, p. 1 and vol. 15); the Copenhagen fragments of the Laws (Halle, 1903); important letters in *The Academy*, Nos. 699, 700, 701, 702, 703, 704, 706, 707 (substantially covered by Stokes's *Criticism*); *Revue Celtique*, xxv. 344; *Eriu* i. 209–315 (collation by Kuno Meyer of the Law tract Crith Gablach). Maine's *Early Hist. of Institutions* (1875) and *Early Law and Custom*, pp. 162, 180 (1883); Hearn's *Aryan Household* (1879) and Maclennan's *Studies in Ancient History*, pp. 453–507 (1876), contain interesting general reference, but the writers were not themselves original students of the laws. L. Ginnell's *Brehon Laws* (1894) may also be consulted. *See* also A. Ua Clerigh, *History of Ireland to the Coming of Henry II.*, chaps. 14 and 15 (1908); E. MacNeill, *Phases of Irish History*, chaps. 10 and 12 (1919); S. Bryant, *Liberty, Order and Law under Native Irish Rule* (1923); R. Thurneysen, *Cóic Conara Fugill* (*Die fünf Wege zum Urteil*) (1926).

(M. J. R., A. E. C.)

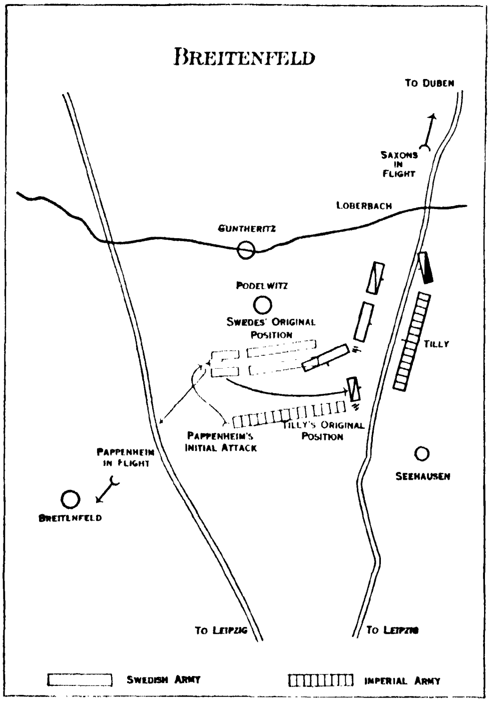
BREISACH, a town of Germany, in the *Land* of Baden, standing on a basalt rock 250ft. above the Rhine, 10m. W. of Freiburg. Pop. (1933), 3,368. Breisach (*Brisiacum*), formerly an imperial city and until the 18th century one of the chief fortresses of the empire, is of great antiquity. A stronghold of the Sequani, it was captured in the time of Julius Caesar by Ariovistus and became known as the *Mons Brisiacus*. Fortified by the emperor Valentinian in 369 to defend the Rhine against the Germans, it remained throughout the middle ages one of the chief bulwarks of Germany and was called the "cushion and key (*Kissen und Schlüssel*) of the German empire." It gave its name to the district Breisgau. In 939 it was taken by the emperor Otto I., and remained the exclusive possession of the emperors for two centuries. In 1254 and 1262 the bishops of Basle obtained full control over it, but in 1275 it was made an imperial city by King Rudolph I., and the Habsburgs possessed it from the 14th century. In the Thirty Years' War Breisach successfully resisted the Swedes, but it was forced to capitulate to the Protestants after a memorable siege in 1638. The French held it from 1648, and it was several times besieged by them after its restoration to Austria in 1697. By the peace of Pressburg (1805) it was finally incorporated with Baden, and the fortifications were razed. Two mediaeval gates, however, remain. It has a fine minster, partly Romanesque, partly Gothic, dating from the 10th to the 15th centuries; one western tower is 13th century Gothic, the other Romanesque. The interior is remarkable for the woodcarving of the high altar, and for tombs and pictures. There is little industry, but a considerable trade is done in wines and other agricultural produce. On the opposite bank of the Rhine, here crossed by a railway bridge, lies the little town of Neubreisach, built as a fortress by Louis XIV.

BREISGAU, a district of Germany, in the *Land* of Baden. It extends along the right bank of the Rhine from Basle to Kehl, and includes the principal peaks of the southern Black Forest and the Freiburg valley. The Breisgau, at one time a district or *gau* (Lat. *pagus*) of the Frankish empire, was ruled during the middle ages by hereditary counts. Of these the earliest recorded is Birtilo (962–995), ancestor of the counts and dukes of Zähringen. On the death of Berchthold V. of Zähringen in 1218, his co-heiresses brought parts of the Breisgau to the counts of Urach and Kyburg, while part went to the margraves of Baden. The male Urach line becoming extinct in 1457, an heiress carried to the house of Baden what had not been alienated to the Habsburgs. In the struggle between France and Austria from the 17th century onwards the Breisgau frequently changed masters. In 1801 Austria was forced to cede it to Ercole III., duke of Modena, in compensation for the duchy of which Napoleon had deprived him. His successor Ferdinand took the title of duke of Modena-Breisgau, but on his death in 1805 the Breisgau was divided between Baden and Württemberg. The latter ceded its portion to Baden in 1810.

See Stokvis, *Manuel d'histoire, etc.* (Leyden, 1890–93).

BREISLAK, SCIPIONE (1748–1826), Italian geologist of German parentage, was born at Rome, where he was a professor in the college of Ragusa, and then in the Collegio Nazareno. The king of Naples invited him to inspect the mines and similar works in that kingdom, and appointed him professor of mineralogy to the royal artillery. The vast works for the refining of sulphur in the volcanic district of Solfatara were erected under his direction. His *Topografia fisica della Campania* (1798) contains the results of much accurate observation. He was an exile in Paris from 1799 until 1802, when he was appointed inspector of the saltpetre and powder manufactories near Milan. The mineral Breislakite was named after him.

BREITENFELD, a village in Saxony, 5½m. N.N.W. of Leipzig, noted in military history. The first battle of Breitenfeld was fought on Sept. 17, 1631, between the allied Swedish and Saxon armies under Gustavus Adolphus and the imperial forces under Count Tilly (*see* THIRTY YEARS' WAR). The latter's invasion of Saxony had driven the Elector to abandon his long-sustained neutrality, and his urgent appeal for aid had brought Gustavus from the Elbe. On the plain between, but in advance of the villages of Seehausen and Breitenfeld, on the crest of a gentle slope, Tilly drew up his army in order of battle, covering a front of about two and a half miles. Controversy has raged on many of the details, not least Tilly's original dispositions, although it would seem most probable that it was originally formed in two, with a reserve in the rear, rather to the right centre behind the guns and on a slight elevation. When, however, the rout of the Saxons gave him the opportunity to move his infantry to the right to attack the exposed flank of the Swedes, he probably pushed the "battalia" of his second line forward into the intervals of the first line for the purpose of this oblique move and attack. The infantry formed 13 or 17 solid squares of from 1,500 to 2,000 men apiece. Tilly's cavalry were on the two wings, as was customary, Pappenheim on the left, Fürstenberg and Isolani on the right, a total of about 10,000, making altogether an army of about 35,000—rather less than the combined forces of the Swedes and Saxons, but, after the early rout of the latter, far superior to the Swedes alone. Only in guns had Tilly a marked inferiority.



PLAN OF THE BATTLE OF BREITENFELD, 1631, SHOWING THE SUCCESSIVE DISPOSITIONS OF THE ALLIED SWEDISH AND SAXON TROOPS AND THE IMPERIAL FORCES

When the Saxons were forced to retire, Tilly moved his infantry (imperial forces) to a position to attack the exposed Swedish left flank. A brilliant counter manoeuvre was executed by Gustavus, cutting Tilly off from his communications at Leipzig and separating him from his artillery. The result was the complete defeat of the imperial army

Early in the morning of Sept. 17, 1631, the allied armies, in two columns, Swedes on the right and Saxons on the left, crossed the Loberbach, a marshy stream running across their front. The formality of the time is well shown by the failure to fall on Gustavus during this crossing. Only Pappenheim with some 2,000 cavalry went forward to hinder the advance, but the Scots of the vanguard, supported by dragoons, drove him back. Gustavus formed his army in two lines and a reserve. On his left was drawn up the Saxon army. By noon the armies were in position and the battle opened with an artillery duel, in which Torstensson's guns fired three shots to the imperialists' one. This continued for over two hours, when the fiery Pappenheim, without awaiting orders, moved his cavalry to the left to outflank the Swedish right, and then swinging round struck at the Swedish flank. The manoeuvring power and flexible formation of the Swedes enabled Gustavus to wheel up his second line cavalry at right angles to the first and so form a defensive flank, which, strengthened by musketeers, proved a rampart on which Pappenheim's cuirassiers broke themselves to pieces.

After seven vain assaults the imperial cavalry fell back discouraged, and, followed up sharply by the Swedes, were driven in flight from the field. Meanwhile critical events had been taking place on the other wing. The imperial cavalry, under Fürstenberg, had fallen on the Saxons, and in a short half hour almost the whole army, infantry and cavalry alike, were in disorderly flight—thus laying bare the flank of the Swedes.

Inspired by the rout of the Saxons, Tilly now ordered his centre to move to the right and follow in the wake of Fürstenburg, and by an oblique march brought his heavy infantry "battles" into line on the flank of the Swedes. It was a manoeuvre in which we can perhaps find the germ of Frederick the Great's famous "oblique order" of attack. But he was meeting an alert, not a supine enemy, and one, moreover, whose flexible formations enabled him to manoeuvre more quickly than Tilly's unwieldy squares. Horn, commanding the Swedish cavalry on this wing, swung back his first line and wheeled up his second to oppose a new front to this attack in flank, while Gustavus hurried infantry from his second line to reinforce him and prolong the line. With the issue still uncertain, there came a decisive stroke; with his right wing now secure, since Pappenheim's flight, Gustavus himself, taking a large part of his right wing cavalry, swept round and over Tilly's original position, where his guns remained, cutting him off from Leipzig. The captured guns were turned to enfilade Tilly's new left flank, while Torstensson with the Swedish artillery pounded his front, and Gustavus made a general wheel with his centre and right to attack the imperial left. Assailed in front and partly in flank, with their close-packed ranks torn by a double weight of artillery fire, the rigid and immobile imperial squares could but offer a hopeless resistance. The end was inevitable, and though their stand was magnificent, nightfall saw the scattered remnants in headlong flight. The long invincible imperial army, under whose iron heel all Germany had lain prone in ruin or terror, was not merely defeated but destroyed for all practical purposes of resistance. Apart from an actual loss of about 12,000, the fugitives were so dispersed that Tilly on his retreat could rally but 600 and Pappenheim only another 1,400.

The victory struck terror into the hearts of the empire—Vienna was said to be "dumb with fright," Bohemian forests were laid low to block the road, the walls of cities hundreds of miles from the battlefield were kept manned. For the moment the emperor could raise no effective forces to oppose Gustavus's advance. At a council of war the Elector of Saxony and Count Horn, besides many other officers, advocated an immediate advance on the imperial capital. More notable still, Oxenstierna the prudent, though not present at Breitenfeld, was strongly in favour of this plan. But Gustavus decided otherwise—to move into south-west Germany, giving as his reasons that he did not wish to lose sight of Tilly, and that he wished to make use of the resources of the Catholic dioceses there for the maintenance of his army, so allowing the Protestants of North Germany a chance to recuperate.

Whether his decision was guided by the highest wisdom is a moot point. Those who support it point to the value of consolidating his position, of rallying new friends to his standard, and simultaneously gaining a grip on the territories of the Catholic League—thus he could organize a fresh centre of Protestant power before attempting greater schemes. On the other hand, we need to remember that this move on the Rhine earned him the distrust of France, his ally, and that never again did the imperial power appear so shaken, or its seat so defenceless, as on the morrow of Breitenfeld.

The village of Breitenfeld also gives its name to another great battle in the Thirty Years' War (Nov. 2, 1642), in which the Swedes under Torstensson defeated the imperialists under the archduke Leopold and Prince Piccolomini, who were seeking to relieve Leipzig The Swedish cavalry delivered the decisive stroke of the day on this occasion also. (B. H. L H.)

BREITNER, GEORGE HENDRIK (1857–1923), Dutch painter, was born Sept. 12 1857, at Rotterdam. He began to study painting at The Hague, and was a pupil of William Maris. His early work showed the influence of Rochussen, who was the first to discover Breitner's great talent. In later years he was strongly influenced by Jacob Maris's colouring, but afterwards became an independent impressionist. The subjects of his pictures were chosen from old parts of Amsterdam, from popular life in the town or from the vigorous movements of manoeuvring cavalry and artillery. He died at Amsterdam June 5 1923.

BREMEN, one of the German *Lander*. A constitution was adopted on May 15, 1920. Area, 99 sq.mi.; pop. (1939) 400,104. It falls into three distinct parts: (1) the largest portion, with the city of Bremen, lying chiefly on the right bank of the lower Weser, surrounded by the Prussian province of Hanover and the *Land* of Oldenburg, and consisting in the main of lowland country intersected by canals and dikes; (2) the town and district of Vegesack, lying immediately north of the main portion, on the right bank of the river; (3) the port of Bremerhaven, 46m. down the Weser, at its mouth. Of the whole territory about one-half is meadow and grazing land, one-quarter under tillage, and the remainder woodland, sandy wastes, river surface or urban agglomerations. Market gardening, the rearing of cattle, for which the district is widely famed, and fishing form the chief rural occupations. About 87% of the inhabitants are Protestants, and 7% Roman Catholics. The highest power in the state resided until 1933 in the house of burgesses, which consisted of 120 representatives, chosen by all citizens of the state. The senate, an executive body of 14 members, was elected by the Bürgerschaft. Two *Bürgermeister* presided over its deliberations. Bremen was formerly a free port, but from Oct. 1888, the state, with the exception of two small free districts in Bremen and Bremerhaven, joined the German customs union. The state has two Amtsgerichte (courts of first instance) at Bremen and Bremerhaven respectively, and a superior court (Landgericht) at Bremen, whence appeals lie to the Oberlandesgericht for the Hanseatic towns at Hamburg. The 31 mi. of railway are owned and worked by the state.

BREMEN, city and seaport of Germany, capital city of the *Land* of Bremen, and one of the Hanseatic towns, occupying a sandy plain on both banks of the Weser, 46 mi. from the North sea. Pop. (1939) 342,113. The city consists of four quarters: the old town (Altstadt) and its suburban extensions (Vorstadt) being on the right bank of the river, and the new town (Neustadt) with its southern suburb (Südervorstadt) on the left bank. The river is crossed by three bridges, the old, the new (1872–1875), and the railway bridge. The former ramparts are promenades. Two new communes and parts of two others were added in 1921.

The romantic old town, with its winding streets flanked by massive gabled houses, dates from Hanseatic days. The fine town hall (Rathaus) on the market square dates from the 15th century and has a handsome Renaissance façade. Before it stands a statue of Roland, the emblem of civic power. The Rathaus, as well as the cathedral and bourse, was damaged in the Spartacist disturbances of 1919. Within, there is a handsome gallery of paintings, and in an upper hall a model of an old Hanseatic frigate, with the device *Navigare necesse est, vivere non est necesse,* hangs from the ceiling. The cathedral of St. Peter (12th century) on the site of Charlemagne's wooden church, has a famous lead roof. The churches of St. Ansgarius, of Our Lady and of St. Stephen date from the 12th and 13th centuries. Other interesting buildings are the Schütting, or merchants' hall, originally built in 1619 for the cloth-traders' gild, and the Stadthaus, the former archbishop's palace. There are numerous handsome modern buildings. A beautiful park occupies the Burgerweide (meadows) to the north-east of the city. Bremen, with its predominance of one-family houses, contrasts with most German towns where the flat system is widespread.

The industries are those typical of a modern port and include shipbuilding, milling of oils and grains, jute-spinning, rope-making and the production of tobacco, chemicals, sugar and rice; there are extensive shipbuilding yards. Ships of 25 ft draught are able to reach the port, and the waterway is kept open in winter by ice-breakers Total harbour area (1939) 6,041.5 ac. Trade is predominantly transit; excellent railway communications are maintained with the chief industrial districts of Germany. Electric tramways and local steamboats serve the immediate neighbourhood.

The chief imports are coal, grain, cotton, wood, iron ore, rice, oil-seeds, mineral oils, wool, tobacco, cottonseed, meal, asphalt, rice offal, copper, coffee, jute, wine, herrings, etc. The exports include woollen goods, glass, iron and iron wares, machinery, wire, cement and mineral salts. Bremen is specially important as the importer of raw products from America and inter-tropical lands; vast quantities of tobacco and rice are handled For international trade it ranks as the chief port of Germany, after Hamburg: 5,717 vessels entered in 1937, with aggregate tonnage of 5,386,000.

HISTORY

In 787 Bremen was chosen by St. Willehad, whom Charlemagne had established as bishop in the *pagi* of the lower Weser, as his see. In 848 the destruction of Hamburg by the Normans led to the transference of the archiepiscopal see of Hamburg to Bremen. In 965 the Emperor Otto I granted to Archbishop Adaldag "in the place called Bremun" the right to establish a market, and the full administrative, fiscal and judicial powers of a count, no one but the bishop or his *advocatus* being allowed to exercise authority in the city—a privilege frequently confirmed by subsequent emperors. There is no direct evidence of the existence of any communal organization during this period, but it is clear from the vigorous part taken by the burghers in the struggle of the Emperor Frederick with Henry the Lion of Saxony that some such organization very early existed. In the 13th century, however, Bremen was still strictly subordinate to the archbishop and his *Vogt;* the council could issue regulations only with the consent of the former, while in the judicial work of the latter, save in small questions of commercial dishonesty, its sole function was advisory. By the middle of the 14th century this situation was reversed; the elected town council was the supreme legislative power in all criminal and civil causes, and in the court of the *advocatus* two *Ratsmänner* sat as assessors. The victory had been won over the archbishop; but a fresh peril had developed in the course of the 13th century in the growth of a patrician class, which, as in so many other cities, threatened to absorb all power into the hands of an oligarchy. In 1304 the commonalty rose against the patricians and drove them from the city, and in the following year gained a victory over the exiles which was long celebrated by an annual service of thanksgiving. After a century of trouble, in 1433 the old aristocratic constitution was definitively restored. But though in Bremen the efforts of the craftsmen's "arts" to secure a share of power had been held in check, the city government did not, as at Cologne and elsewhere, develop into a close patrician oligarchy. No artificial restraint was placed upon individual enterprise, and the question of the government having been settled, Bremen rapidly developed in wealth and influence.

The Reformation was introduced into Bremen in 1522 by Heinrich von Zütphen. Archbishop Christopher of Brunswick-Wolfenbüttel (1487–1558), a brutal libertine, hated for his lusts and avarice, looked on the reforming movement as a revolt against himself. He succeeded in getting the reformer burned; but found himself involved in a life and death struggle with the city. Archbishop Christopher was succeeded in 1558 by his brother Georg, bishop of Minden (d. 1566), who is reckoned as the last Roman Catholic archbishop of Bremen. His successor Henry III. (1550–85), was a Lutheran and married. Protestantism was not, however, definitively proclaimed as the state religion in Bremen until 1618. The last archbishop, Frederick II. (of Denmark), was deposed by the Swedes in 1644. In 1646 Bremen received the privileges of a free imperial city from the Emperor Ferdinand III. The Swedes, during their occupation of Bremen, refused to consent to this: but in 1720, when the elector of Hanover (George I. of Great Britain) acquired the archbishopric, he recognized Bremen as a free city. In 1806 it was taken by the French, and subsequently annexed by Napoleon to his empire. Restored to independence by the congress of Vienna in 1815, it subsequently became a member of the German Confederation, and in 1867 joined the North German Confederation, with which, in 1871, it was merged in the German empire.

During the political and social upheaval in Germany at the conclusion of World War I, a Workers' and Soldiers' council was set up in Bremen and, on Nov. 15, 1918, the red flag was hoisted at the Rathaus.

After many days of unrest, order was not completely restored until Feb. 9, 1919, when the town and its outskirts were occupied by government troops. Because of its equipment of submarines and other ships and its great commercial importance, Bremen was heavily bombed many times by the allies in World War II and suffered great damage.

See Buchenau, *Die freie Hansestadt Bremen* (3rd ed., Bremen, 1900); *Bremisches Urkundenbuch*, edited by R. Ehmck and W. von Bippen (1864, fol.); W. von Bippen, *Geschichte der Stadt Bremen* (Bremen, 1892–98); F. Donandt, *Versuch einer Geschichte des bremischen Stadt-rechts* (Bremen, 1830); *Bremisches Jahrbuch* (1864–1900); and Karl Hegel, *Stadte und Gilden*, vol. ii. p. 401 (Leipzig, 1891); Wilhelm Breves, *Bremen in der deutschen Revolution* (Bremen, 1919).

BREMER, FREDRIKA (1801–1865), Swedish novelist, was born at Tuorla, Finland, on Aug. 17, 1801. Her father, a wealthy iron master and merchant, purchased an estate at Årsta, about 20m. from Stockholm. During a tour in central Europe in 1820–21, Miss Bremer became acquainted with Schiller's works, which made a deep impression on her. She had begun to write verses from the age of eight, and in 1828 she published the first volume of her *Teckningar ur hvardagslifvet* (1828). The second volume (1831), containing one of her best tales, *Familjen H.*, gave decisive evidence that a real novelist had been found in Sweden. She increased her reputation by *Presidentens döttrar* (1834), *Grannarne* (1837) and others. After her father's death in 1830 she lived for some time in Norway, and in the autumn of 1849 went to America, returning through England. The admirable translations (1846, etc.) of her works by Mary Howitt secured for her a warm and kindly reception. In her later novels *Hertha* (1856) and *Far och dotter* (1858) Fredrika Bremer expounded her views on the emancipation of women. In 1856 she again travelled, and spent five years on the Continent and in Palestine. On her return she settled at Årsta, where she died on Dec. 31, 1865.

See *Life, Letters and Posthumous Works of F. Bremer*, by her sister, Charlotte Bremer, translated by F. Milow (1868). A selection of her works in 6 vols. appeared at Örebro, 1868–72.

BREMERHAVEN, a seaport of Germany, within the *Land* of Bremen, on the right bank and estuary of the Weser, at the confluence of the Geeste, 38m. N. of the city of Bremen. Pop. (1939) 25,816. It is built on a tract of territory ceded to Bremen by Hanover in 1826, and further increased by treaty with Prussia in 1869. It forms practically a single town with Geestemünde (Prussia), which lies across the Geeste and with which it is connected by a drawbridge. The port was opened in 1830, and its rapid development is due to the enterprise of Johann Smidt (1773–1859), burgomaster of Bremen. Besides an excellent harbour, there are large wet docks, including the Kaiserhafen. This, together with the north portion of the Neuerhafen, constitutes the free harbour. Here are the workshops and dry docks of the North German Lloyd steamship company. The entrance to the port is ice-free nearly all the year round. Shipbuilding and kindred industries are carried on; and there is a fishing industry, with fish-salting and smoking. The chief imports are cotton, tobacco, frozen meat, phosphates, copper and bananas. The exports are of a general character. Vessels that cannot reach Bremen lighten or discharge at Bremerhaven. In 1938, almost 1,000 vessels, with a net tonnage that totalled more than 2,900,000, entered the port.

During World War II the British royal air force bombed the docks and shipyards frequently and heavily, and set fire to the fast luxury liner "Bremen" at her pier.

BREMERTON, a city of Kitsap county, Wash., U.S.A., on Puget Sound, 15 mi. west-southwest of Seattle. It is on state highways 14 and 21 and is served by eight modern ferries. The population in 1930 was 10,170 and in 1940 it was 15,134. The Puget sound navy yard employs 12,600 men and has the largest dry docks in the United States.

BRENDAN, BRANDON or BRANDAN (*c.* 484–578), Irish saint and hero of a legendary voyage in the Atlantic, is said to have been born at Tralee in Kerry in A.D. 484. Mediaeval historians usually call him Brendan of Clonfert, or Brendan son of Finnloga, to distinguish him from his contemporary, St. Brendan of Birr (573). Little is known of the historical Brendan, who died in 578 as abbot of a Benedictine monastery which he had founded twenty years previously at Clonfert in eastern Galway. The story of his voyage across the Atlantic to the "Promised Land of the Saints," afterwards designated "St. Brendan's Island," ranks among the most celebrated of the mediaeval sagas of western Europe. Its traditional date is 565–573. The legend is found, in prose or verse and with many variations, in Latin, French, English, Saxon, Flemish, Irish, Welsh, Breton and Scottish Gaelic. Although it does not occur in the writings of any Arabian geographer, several of its incidents—such as the landing on a whale in mistake for an island—belong also to Arabic folk-literature. Many of Brendan's fabulous adventures seem to be borrowed from the Irish saga of Maelduin or Maeldune, and others belong also to Scandinavian mythology. The oldest extant version of the legend is the 11th century *Navigatio Brendani.*

Only in 1759 was the apparition of St. Brendan's island explained as an effect of mirage.

See C. Wahlund, *Die altfranzösische Prosaübersetzung von Brendans Meerfahrt* (Uppsala, 1900); F. Novati, *La "Navigatio Sancti Brendani" in antico Veneziano* (Bergamo, 1892); G. Schirmer, *Zur Brendanus-Legende*, etc. (Leipzig, 1888); F. Michel, *Les Voyages merveilleux de St. Brendan*, etc. (Paris, 1878); and P. F. Moran, *Acta Sancti Brendani . . . . Original Latin Documents connected with the Life of St. Brendan* (Dublin, 1872).

BRENHAM, a city in S.E. Texas, U.S.A., 68m. N.W. of Houston; the county seat of Washington county. It is served by the Santa Fe and the Southern Pacific railways. The population in 1930 was 5,974; and it was 6,435 in 1940. It is a shipping point for cotton, grain, poultry, dressed turkeys, and livestock. Its factories include a cotton mill, a cotton compress, a cottonseed oil mill, a broom factory, marble and granite works, and a large hatchery. It was settled about 1844, incorporated in 1858, and chartered as a city in 1873. A commission-manager form of government was adopted in 1920.

BRENNER PASS, the lowest (4,495 ft.) and one of the most frequented passes across the Alps in all ages, though the name used in the middle ages was "the route through the valley of Trent." It is the great gate of Italy, and by it most Teutonic invaders reached Italy. Many side passes join this great thoroughfare. It was crossed no fewer than 66 times by various emperors, between 793 and 1402. A carriage road was constructed over it in 1772 and the railway over it in 1864–67. From Innsbruck to the summit of the pass (by rail) is 25 mi. The line then descends through the Eisack valley past Bressanone (54 mi.) to Bolzano (24 mi.). Thence it follows the valley of the Adige to Trent (35 mi.) and on to Verona (56½ mi.)—in all 174½ mi. by rail from Innsbruck to Verona.

BRENNUS, I. A leader of the Gauls who invaded Italy in 390 B.C. It should be observed that his name first appears in Livy and is not found in Polybius or Diodorus. It is difficult to disentangle the facts of this invasion from the legends; it seems clear that Brennus crossed the Apennines, advanced on Rome down the *Via Salaria,* and defeated the Roman army at the Allia, some 12m. from Rome. He then appears to have delayed a day or two on the field, giving time to fortify the Capitol; to have sacked Rome, besieged the Capitol for six months, accepted the offer of the defenders to ransom themselves, and then, probably, departed safely with his booty. Of the rest of the picturesque story, the massacre of the Patricians in their chairs; the night attack on the Capitol, the sacred geese and the exploits of Manlius; the false weights at the paying of the ransom, and the hurling by Brennus of his sword into the scales, with the famous words, "*Vae Victis,*" we may believe as much as we please. But the Livian "happy ending," wherein Camillus arrives from the blue at the moment of payment, and wipes out Brennus and his forces together, is really too good to be true.

BIBLIOGRAPHY.—Diod. XIV.: Polyb. II.: Liv. V.

II. Over a hundred years later (279), another Brennus at the head of a band of Gauls invaded Greece. Earlier raiding expeditions from Pannonia had been successful at the expense of Ptolemy Ceraunus in Macedonia. Brennus now advanced through Macedonia towards Greece proper, and was first held up at Thermopylae, and beaten off with great loss. Later, as had happened to Leonidas, the mountain pass was betrayed, but the Greek army was taken off by the Athenian fleet. Brennus, with the advance guard that had gone over the upper pass, pushed on for Delphi with its vast treasure. About 4,000 was the strength of the defending force on the rock, but they had an immensely strong position, and when Brennus collapsed under his wounds the invaders broke and fled, pursued by the Greeks all the way to Thermopylae. Brennus disdained to recover after his defeat, and put an end to his life by draughts of strong wine. Justin says that he was "unable to endure the pain of his wounds," and the humiliation of defeat.

BIBLIOGRAPHY.—Paus. X.: Justin, XXIV.

BRENTANO, KLEMENS (1778–1842), German poet and novelist, was born at Ehrenbreitstein on Sept. 8, 1778. His sister was the well known Bettina von Arnim, the correspondent of Goethe. He studied at Halle and Jena, where he made the acquaintance of the Schlegels, Hardenberg and Tieck, and afterwards resided at Heidelberg, Vienna and Berlin. In 1818, weary of his somewhat restless and unsettled life, he joined the Roman Catholic Church and withdrew to the monastery of Dülmen, where he lived for some years in strict seclusion. The latter part of his life he spent in Regensburg, Frankfurt and Munich, actively engaged in Catholic propaganda. He died at Aschaffenburg on July 28, 1842. Brentano, whose early writings were published under the pseudonym Maria, belonged to the Heidelberg group of German romantic writers, and his works are marked by excess of fantastic imagery and by abrupt, bizarre modes of expression. But although he possessed no great poetic genius, he occupies an important position in the history of German literature. It was with the publication of *Des Knaben Wunderhorn* (1805–08), of which he was joint editor, that the new character of the Romantic movement showed itself. Instead of the vague profundity typical of the first Romantics, we find here the simplicity of the volkslied, a form of lyric which Brentano could imitate most skilfully. A satirical vein was another feature of his work, and appeared in some of his prose writings. Among his first publications were *Satiren und poetische Spiele* (1800), and a romance *Godwi* (1801–02); of his dramas the best are *Ponce de Léon* (1804), *Victoria* (1817) and *Die Gründung Prags* (1815). On the whole his finest work is the collection of *Romanzen vom Rosenkranz* (published posthumously in 1852); his short stories, and more especially the charming *Geschichte vom braven Kasperl und dem schönen Annerl* (1838), which has been translated into English, are still popular.

Brentano's collected works, edited by his brother Christian, appeared at Frankfurt in 9 vols. (1851–55). The best modern issue is the collected works edited by Carl Schüddekopf (Munich and Leipzig, 1909, etc.). Selections have been edited by J. B. Diel (1873), M. Koch (1892), and J. Dohmke (1893). *See* J. B. Diel and W. Kreiten, *Klemens Brentano* (1877–78), the introduction to Koch's edition and R. Steig, *A. von Arnim und K. Brentano* (1894).

BRENTANO, LUDWIG JOSEPH (called LUJO) (1844–1931), German economist, was born at Aschaffenburg on Dec. 18, 1844. He received some of his academical education in Dublin, and was professor of political theory in Breslau (1872), and later in Strasbourg, Vienna, Leipzig and Munich. He retired in 1914. He advocated free trade, and in industrial questions, combated the wages fund theory. In 1868 he made a thorough study of trade unionism in England, which resulted in his principal work, *Die Arbeitergilden der Gegenwart* (Leipzig, 1871–72; Eng. trans. by L. T. Smith). The book was assailed by Bamberger and other economists, but is important not only as an authority on modern associations of workmen, but for having given an impetus to the study of the gilds of the middle ages, and the examination of the great stores of neglected information bearing upon the condition of the people in earlier days. Brentano, who received the Nobel Peace prize in 1927, was a leading pacifist in Germany, and a familiar figure at international peace gatherings.

His other works include *Das Arbeitsverhältnis gemass dem heutigen Recht* (1877); *Die christlich-soziale Bewegung in England* (1883); *Über das Verhältnis von Arbeitslohn und Arbeitszeit zur Arbeitsleitung* (1893); *Agrarpolitik* (1897); *Die Schrecken des überwiegenden Industriestaats* (1901); *Die Wirtschaftlichen Lehren des christlichen Altertums* (1902); *Die Entwickelung der Wertlehre* (1908); *Die deutschen Getreidezölle* (1911); and also a book on *Malthusianism* (1909). *See* Neiffer and Palyi, *Lujo Brentano* (1925).

BRENTFORD AND CHISWICK, a municipal borough of Middlesex, England, about 9 mi. W of London It is served by the S. Ry. and the London Passenger Transport board, and is at the confluence of the Brent and the Thames. In 1927 Brentford was united with Chiswick and in 1932 the combined urban district was incorporated under the name Brentford and Chiswick. Pop. (est 1938) 61,470. Area, 3.83 sq.mi. The borough comprises a parliamentary division and returns one member.

In 1016 Edmund Ironside defeated the Danes at Brentford (Braynford). A toll was granted by Edward I, who gave the town a market, for the construction of a bridge across the river, and in the reign of Henry VI a hospital of the Nine Orders of Angels was founded near its western side. In 1642 a battle was fought here in which the royalists defeated the parliamentary forces. During the 16th and 17th centuries Brentford was a favourite resort of London citizens; and its inn of the Three Pigeons is frequently alluded to by the dramatists of the period. References in literature point, in most cases, to the town's reputation for excessive dirt.

The church of St. Nicholas in Chiswick has ancient portions. In the churchyard is the tomb of William Hogarth. Chiswick hall, no longer extant, was formerly associated with Westminster school. There in 1811 the Chiswick press was founded by Charles Whittingham.

The united borough includes Turnham Green and Grove Park. Although the district, as a western suburb of London, is largely residential, there are breweries and riverside works, while soapmaking, sawmilling and market gardening are carried on. In 1928 Chiswick house and grounds (66 ac.) were acquired, and the united borough by 1943 had over 300 ac. of open spaces, excluding Gunnersbury park. The Grand Junction canal joins the Brent there.

Toward Isleworth is Sion house, a mansion founded by the Lord Protector Somerset in 1547 and enlarged by Inigo Jones and Robert Adam. The site was previously occupied by a convent of Bridgittine nuns established at Twickenham in 1415 and removed there in 1431.

BRENTON, SIR JAHLEEL (1770–1844), British admiral, was born in Rhode Island, U.S.A., on Aug. 22, 1770, the son of Rear Admiral Jahleel Brenton (1729–1802). He served with great zeal in the peace before the beginning of the war in 1793, but seeing no chance of employment went to serve in the Swedish navy against the Russians. In 1790 he received his commission in the English navy, and until 1799 he served under Earl St. Vincent. As commander of the "Speedy" brig he won much distinction in actions with Spanish gunboats in the Straits of Gibraltar. In 1800 he reached the rank of post captain, and served as flag captain to Sir James (afterwards Lord) Saumarez in the action at Algeciras, and in the straits in 1801. In 1803 he was wrecked on the coast of France, and imprisoned till 1806. His most brilliant action was fought with a flotilla of Franco-Neapolitan vessels outside of Naples in May 1810. He was made a baronet in 1812 and K.C.B. in 1815. Later he became commissioner of the dockyard at Port Mahon, and then at the Cape, and was afterwards lieutenant-governor of Greenwich hospital till 1840. His brother, CAPTAIN E. P. BRENTON (1774–1839), is best remembered by his writings on naval and military history—*Naval History of Great Britain from the Year 1783 to 1822* (1823) and *The Life and Correspondence of John, Earl of St. Vincent* (1838). A *Memoir of the Life and Services of Vice-Admiral Sir Jahleel Brenton,* based on his own papers, was published in 1846 by the Rev. Henry Raikes, and reissued by the admiral's son, Sir L. C. L. Brenton, in 1855.

BRENTWOOD, urban district, Essex, England; 18 mi. N.E. of London by the L.N.E. railway (Brentwood and Warley station). Pop. (est. 1938) 27,420. Area 28.4 sq.mi. The neighbouring country is undulating and well wooded. Brentwood was formerly an important posting station on the main road to the eastern counties, which follows the line of the railway to Colchester. The name (*Burntwood*) is supposed to record an original settlement made in a clearing of the forest. The district is largely residential. The old assize house, an Elizabethan structure, remains. A free grammar school was founded in 1557. The county asylum is in the vicinity. There are breweries and brick works. To the south lies Warley Common, with large barracks.

BRENZ, JOHANN (1499–1570), Lutheran divine, eldest son of Martin Brenz, was born at Weil, Württemberg, on June 24, 1499. Ordained priest in 1520, he ceased to celebrate mass in 1523. Protected by his patron Duke Ulrich of Württemberg, he was appointed (Jan. 1553) provost of the collegiate church of Stuttgart. He was a strong advocate of Lutheran doctrine, and author of *Syngramma Suevicum* (Oct. 21, 1525), which set forth Luther's doctrine of the Eucharist. He opposed applying the death penalty to anabaptists or other heretics in the *De Haereticis, an sint persequendi* (1554), issued by Sebastian Castellio under the pseudonym of Martinus Bellius. An incomplete edition of his works (largely expository) appeared at Tübingen, 1570–1590. A volume of *Anecdota Brentiana* was edited by Pressel in 1868. He died on Sept. 11, 1570.

See Hartmann and Jäger, *Johann Brenz* (1840-42); Bossert, in Herzog's *Realencyklop.* (1897).

BRÉQUIGNY, LOUIS GEORGES OUDARD FEUDRIX DE (1714–1795), French scholar, was born at Gainneville near Havre, on Feb. 22, 1714, and died at Paris on July 3, 1795. After the close of the Seven Years' War he was sent to search in the archives of England for documents bearing upon the history of France, more particularly upon that of the French Provinces which once belonged to England. From this mission (1764–66) Bréquigny brought back copies of about 7,000 documents, which are now in the Bibliothèque Nationale. A useful selection of these documents was published by Jean Jacques Champollion-Figeac, in the collection of *Documents inédits relatifs à l'histoire de France* (2 vols., 1839, 1847). Bréquigny himself drew the material for important studies from the rich mine which he had thus exploited. These were included in the collection of the Académie des Inscriptions. The Revolution interrupted him in his collection of *Mémoires concernant l'histoire, les sciences, les lettres, et les arts des Chinois*, begun in 1776 at the instance of the minister Bertin, when 15 volumes had appeared.

See Champollion-Figeac's preface to the *Lettres des rois et reines;* the *Comité des travaux historiques*, by X. Charmes, vol. i. *passim;* and the *Catalogue des manuscrits des collections Duchesne et Bréquigny* (in the Bibliothèque Nationale), by René Poupardin (1905).

BRESCIA (anc. *Brixia*), episcopal see, Lombardy, Italy, capital of the province of Brescia, at the foot of the Alps, 52 mi. E. of Milan and 40 mi. W. of Verona by rail. Pop. (1936) 92,583 (town), (1938) 131,509 (commune). The plan is rectangular, with streets at right angles, a Roman peculiarity, though the Roman town occupied only the eastern portion of the later one. The Piazza del Museo marks the site of the forum, and the museum on its north side is in a Corinthian temple with three *cellae*, probably the Capitolium of the city, erected by Vespasian in A.D. 73. It contains a famous bronze statue of Victory, found in 1826. Near it are the remains of the ancient theatre. The castle, at the northeast angle, commands a fine view. The old cathedral (11th–12th century) is a round domed building over a 9th century church, and the Broletto, adjoining the new cathedral (a building of 1604) on the north, is a massive building of the 12th and 13th centuries (the original town hall, now the prefecture and law courts), with a lofty tower. The convent of S. Salvatore, founded by Desiderius, king of Lombardy, has three churches, two of which now contain the fine mediaeval museum. The church of S. Francesco has a Gothic façade and cloisters. The Palazzo del Comune, begun in 1492 and completed by Jacopo Sansovino in 1554–1574, is a magnificent structure, with fine ornamentation. The church of S. Maria dei Miracoli (1488–1523) has rich details, especially of the reliefs on the façade. Many other churches, and the picture gallery (Gallerio Martinengo), contain fine works of the painters of the Brescian school, Alessandro Bonvicino (generally known as Moretto), Girolamo Romanino and Moretto's pupil, Giovanni Battista Moroni. The city has no less than 72 public fountains. Brescia makes iron ware, particularly fire-arms and weapons (one of the government small-arms factories is here), also machinery, woollens, linens and silks, matches, candles, etc. It is the chief centre of the stocking factories of Italy. Mazzano, 8m. E. of Brescia, has stone quarries. Brescia is on the main railway line between Milan and Verona, and has several branch railways and steam tramways.

The ancient Celtic Brixia of the Cenomani submitted to Rome in 225 B.C. Augustus founded a civil colony here in 27 B.C. In 452 it was plundered by Attila, but was the seat of a duchy in the Lombard period. From 1167 it was one of the most active members of the Lombard League. In 1258 it fell into the hands of Eccelino of Verona, and belonged to the Scaligers (della Scala) until 1421, when it came under the Visconti of Milan, and in 1426 under Venice. Early in the 16th century it was one of the wealthiest cities of Lombardy, but has never recovered from its sack by the French under Gaston de Foix in 1512. It belonged to Venice until 1797, then to Austria; it revolted in 1848, and in 1849 was the only Lombard town to rally to Charles Albert, but it was taken after ten days' obstinate street fighting by the Austrians, to be lost in 1859.

See A. Agoletti, *Brescia* (Bergamo, Arti Grafiche, 1909), well illustrated.

BRESLAU, a city of Germany, capital of the Prussian province of Lower Silesia, and an episcopal see, situated in a wide and fertile plain on both banks of the navigable Oder, 350 mi. from its mouth, and 202 mi. from Berlin on the railway to Vienna. Pop. (1939) 615,006. It was the eighth city of the reich. The Oder, which here breaks into several arms, divides the city into two unequal halves, crossed by numerous bridges. The larger portion, on the left bank, includes the old or inner town, surrounded by beautiful promenades on the site of the ramparts dismantled after 1813. Outside the ramparts, and across the Oder, lies the new town, with extensive suburbs, containing many handsome streets and spacious squares. In the ancient inner town, with its narrow streets, are several mediaeval buildings of great interest. The cathedral, dedicated to St. John the Baptist, was begun in 1148, completed in the 15th century, and enlarged and restored later. One of its chief treasures is the high altar of beaten silver. The Kreuzkirche (church of the Holy Cross), dating from the 13th and 14th centuries, is an interesting brick building, remarkable for its stained glass and its historical monuments. The Sandkirche, dedicated to Our Lady of the Sand, dates from the 14th century. The Dorotheen, or Minoritenkirche, remarkable for its high-pitched roof, was founded by the emperor Charles IV. in 1351. Of the Evangelical churches the most important is St. Elizabeth (*c.* 1250), rebuilt in the 14th and 15th centuries, and restored in 1857. The church possesses a celebrated organ, fine stained glass, a magnificent stone pyx (1455) over 52ft. high, and portraits of Luther and Melanchthon by Lucas Cranach. The reformation in Silesia was first proclaimed in 1523, in the Gothic church of St. Mary Magdalen (14th century).

The business streets of the city converge upon the Ring, the market square, in which is the 14th–16th century town-hall, a fine Gothic building, containing the Fürstensaal, in which the diets of Silesia were formerly held, while beneath is the famous Schweidnitzer Keller, used since 1355 as a beer and wine house. The university (founded in 1702), a striking Gothic building facing the Oder, was built (1728–1736) as a college by the Jesuits, on the site of the former imperial castle presented to them by the emperor Leopold I., and contains a magnificent hall (Aula Leopoldina), richly ornamented with frescoes. It was greatly augmented by the incorporation of the university of Frankfurt-am-Oder in 1811. The library is specially rich in oriental literature. In 1938 the university had 2,500 students. The faculty of theology is here mixed (both Protestant and Roman Catholic) as at Bonn, Münster and Tübingen. Breslau has also a famous technical high school, with 450 students in 1938. Other public buildings are the Stadthaus (civic hall), the royal palace, the Government offices (a handsome pile erected in 1887), the provincial House of Assembly, the municipal archives, the courts of law, the Silesian museum of arts and crafts and antiquities, the museum of fine arts and the exchange. Statues and fountains are numerous. It is, however, as a commercial and industrial city that Breslau is most widely known. It is the chief industrial centre of eastern Germany, with iron-founding and manufactures of machinery, linen, clothes, railway-carriages, paper and furniture. Important fairs are held in spring and autumn. Trade is greatly facilitated by its situation close to the extensive coal and iron fields of Upper Silesia, in proximity to the Austrian and Polish frontiers, at the centre of a network of railways and on a deep waterway connecting with the Elbe and the Vistula. Between 1912 and 1917 a new canal, the Breitenbachfahrt, for the use of barges from Upper' Silesia, was constructed, linking the Oder with the Alte Oder.

History.—Breslau (Lat. *Vratislavia*) is first mentioned by the chronicler Thietmar, bishop of Merseburg, in A.D. 1000, and was made the seat of a bishop in the 11th century. It formed part of Poland until 1163, when it became the capital of an independent duchy. Destroyed by the Mongols in 1241, it soon recovered its former prosperity and received a large influx of German colonists. The bishop obtained the title of a prince of the empire in 1290. When Henry VI., the last duke of Breslau, died in 1335, the city came by purchase to John, king of Bohemia, whose successors retained it until about 1460, giving the growing town many privileges. Disliking the Hussites, Breslau placed itself under the protection of Pope Pius II. in 1463, and a few years afterwards came under the rule of the Hungarian king, Matthias Corvinus. After his death in 1490 it again became subject to Bohemia, passing with the rest of Silesia to the Habsburgs when in 1526 Ferdinand, afterwards emperor, was chosen king of Bohemia. It passed to Prussia in 1741, though held for a short time by the Austrians in 1757, and by the French in 1807 and 1813. The sites of the fortifications, dismantled by the French in 1807 were given to the civic authorities by King Frederick William III., and converted into promenades.

BRESSANONE (formerly Brixen), an urban district, province of Bolzano, Italy. Pop. (1936) 6,520 (town); 9,503 (commune); at the confluence of the Isarco and Rienza, with a station on the Brenner railway, 34m. S.E. of that pass, and 24m. N.E. of Bolzano. The aspect of the city is picturesque and very ecclesiastical; it is still the see of a bishop, and contains an 18th-century cathedral, an episcopal palace and seminary, 12 churches and five monasteries. The see was founded at the end of the 8th century (possibly 6th century) at Sabiona on the rocky heights above the town of Chiusa (some way south), but in 992 was transferred to Bressanone which, perhaps a Roman station, had become a royal estate, under the name of *Prichsna,* and in 901 had been given by Louis the Child to the bishop. In 1027 the bishop received from the emperor Conrad II. very extensive temporal powers, which he lost to Austria only in 1803. The town was surrounded in 1030 by walls. In 1525 it was the scene of the first outbreak of the great peasants' revolt. About 5½m. north of it is the great fortress of Franzensfeste, now called Fortezza, built 1833–38, to guard the route over the Brenner and the way eastward up the Val Pusteria.

BRESSE, natural region, eastern France, embracing portions of the departments of Ain, Saône-et-Loire and Jura, extending 60 mi. from the Dombes on the south to the river Doubs on the north, and 20 mi. from the Saône east to the Jura. Varying from 600 to 800 ft. above sea level, it slopes slightly west. Heaths and coppice alternate with pastures and arable land; pools and marshes are numerous, especially in the north. Its chief rivers are the Veyle, the Reyssouze and the Seille, tributaries of the Saône. The soil is gravelly clay, moderately fertile, and cattle-raising is carried on. The region is especially celebrated for its table poultry. The district belonged in the middle ages to the lords of Bâgé, from whom it passed in 1272 to the house of Savoy. The province, as such, with Bourg as its capital, was founded in the 15th century. In 1601 it was ceded to France by the Treaty of Lyons, and formed (with the province of Bugey) first a separate government and later part of the government of Burgundy.

BRESSUIRE, a town in western France, department of Deux-Sèvres, 48m. N. of Niort. Pop. (1936) 5,704. The town overlooks the Dolo, a tributary of the Argenton. Its history is a series of pillages and burnings, notably in 1214, 1370, 1598 and 1794. The church of Notre-Dame (12th and 15th centuries) has an imposing Renaissance tower, and the castle (built by the lords of Beaumont, vassals of the viscount of Thouars) is in ruins; part of the site is occupied by a modern château. It is an agricultural market-centre and makes woollen goods. Bressuire has a sub-prefect and a tribunal of first instance.

BREST, west France, capital of an arrondissement in the department of Finistère, 155m. W.N.W. of Rennes by rail. Pop. (1936) 79,342. It lies north of a magnificent land-locked bay, and occupies the slopes of two hills divided by the river Penfeld, the left bank being regarded as Brest proper, the right as Recouvrance. There are also extensive suburbs to the east. Some hill-sides are so steep that the ascent is made by flights of steps. This is characteristic of many old fishing settlements. Brest was ceded about 1240 by a count of Léon to John I., duke of Brittany. From 1342 to 1397 it was in English hands and the saying was current that "He is not duke of Brittany who is not lord of Brest." By the marriage of Francis I. with Claude, daughter of Anne of Brittany, Brest with Brittany passed to the crown. Richelieu, in 1631, constructed a harbour with wooden wharves, which soon became a station of the French navy. Colbert changed the wooden wharves for masonry and otherwise improved the port, and Vauban's fortifications followed in 1680–88. Fortifications and naval importance have continued to develop. Running round the shore to the south of the town is the Cours d'Ajot promenade. The castle with its donjon and seven towers (12th to 16th century) commands the entrance to the river.

The roadstead consists of a deep indentation formed by coastal subsidence, about 14m. long and averaging 4m. wide, barred by the peninsula of Quélern, leaving the Goulet passage, from 1 to 2m. broad. The outline of the bay is broken by numerous submerged tributary valleys. The naval port, in great part excavated in the rock, extends along both banks of the Penfeld. There are also large naval barracks. The commercial port, separated from the town by the Cours d'Ajot, comprises a tidal port with docks and an outer harbour. The chief imports are wheat, wine, coal, timber, petrol, iron and steel, fertilizers and paper-pulp. Exports: fruit, potatoes, pyrites and pit-props. Besides its sardine and mackerel fisheries, the town has flour-mills, breweries and engineering works, and manufactures of candles, chemicals (from seaweed), boots, shoes and linen. Brest communicates by submarine cable with America and French West Africa.

During World War I Brest became the port of disembarkation for the American army fighting in France. Troops and material were landed there, and new docks were rapidly constructed and many older ones deepened. After 1918 Brest became more and more important as a calling port for trans-Atlantic liners and a leading naval centre. Brest is the seat of a sub-prefect and has tribunals of first instance and of commerce, a chamber of commerce, a board of trade-arbitrators, two naval tribunals and a tribunal of maritime commerce.

BREST-LITOVSK (Polish *Brześć rad Bugiem*), capital of the Polish province of Polesie in 52° 5′ N. and 23° 39′ E., at the junction of the river Muchawiec with the Bug, and of railways from Warsaw, Kiev, Moscow and East Prussia. Pop. (1867), 22,493; (1931) 50,733, of whom more than one half were Jews. Brest has suffered many calamities in its history. Ravaged by the Mongols in 1241, by the Teutonic knights in the 14th and the Crimean Tatars in the 15th centuries, its population decreased by more than 24,000 during the wars of 1914–18 and 1920. In 1596 the famous council met there which established the United Catholic Church. From 1795 to 1921 it belonged to Russia. During World War II it was occupied by the U.S.S.R. from Sept. 1939 to June 1941, when it was conquered by the Germans.

BREST-LITOVSK, BATTLES OF. Under this heading are related the fortunes of Mackensen's third forward bound in the great offensive of the Central Powers against Russia in 1915. The period covered is from the middle of July to the middle of September. The aim of Mackensen's group of armies, directed between the Bug and Vistula rivers toward Brest-Litovsk—the same direction as that of the first Austrian offensive of the World War—was to force the retirement of the Russians from the Polish salient and, if possible, to cut their line of retreat. His attack was combined with one from the north by Gallwitz's XII. Army against the Narew line. In the upshot, though both attacks were successful, Russian resistance slowed them down sufficiently to enable the forces in the Polish salient to escape.

Mackensen's two previous attacks had carried him from the Dunajec to the San, then, after a pause, to Lemberg (Lwow), which was captured on June 22, and north-east toward the Chelm (Kholm)-Lublin line. Again a short pause was necessary to reorganize his forces and prepare a fresh advance.

The Armies Employed.—In the middle of July, when Mackensen resumed his advance, the position of the opposing forces was roughly as follows: The Russian IV. (Ewarth), III. (Lesh) and XIII. (Gorbatovski) Armies faced south-west, from the Pilica river near its junction with the Vistula to about Sokal on the Bug (north-east of Lemberg). On the right of this group the II. Army still held the Bzura-Rawa-Ruska positions west of Warsaw; on the left, the VIII., XI. and IX. Armies stretched south along the Upper Bug to Zloczów and thence to the Rumanian border. The Russian losses had been extremely heavy; in the III. Army, for example, five corps mustered between them only 25 000 bayonets. Their morale had naturally suffered.

Mackensen's group comprised, in that order from north-west to south-east, the Austrian IV. Army, the German XI. Army, the new German Army of the Bug (Linsingen), and the Austrian I. Army (Puhallo). The first three were to carry out the main attack between the Bug and the Vistula, while the I. Army was to cover the right and advance towards Wlodimierz Wolynski. Farther south, the Austrian II. Army and German Southern Army were to cover the offensive counter-attack from the east, the same task that the Austrian II. and III. Armies had failed to perform at the beginning of the war. On the extreme right, the VII. Army (Pflanzer-Baltin) was to push forward and clear the southern portion of East Galicia. West of the Vistula Woyrsch's corps of Landwehr was to advance in conjunction with Mackensen's left and if possible cross the river below Dęblin.

The Fighting Begins.—Mackensen's attack began on July 15. From the first, progress was slow. The Russians withdrew a few miles, but in no part of the line was any decisive success achieved. On the 18th, for the first time in history, the Prussian Guard met the Russian Guard on the field of battle; honours appear to have been even between them Meanwhile Woyrsch had overcome the right wing of the Russian IV. Army and reached the Vistula; he crossed on July 28, some 20 m. north of Dęblin. Mackensen attacked again on the 29th and broke through the Russian front half way between Lublin and Chelm; the former place was evacuated on July 31 and the latter on Aug. 1. It had taken Mackensen 17 days to make good the 25 m. to these places.

Gallwitz in the north had also been unable to gain a rapid success and was advancing only slowly. But before the triple threat of the forces of Mackensen, Woyrsch and Gallwitz, the Russians were compelled to evacuate Warsaw and Dęblin, the former on Aug. 4, and the latter on Aug. 5. The Russian left wing (IV., III., XIII. Armies) in front of Mackensen was now executing a wheel to the east, to conform with the retreat of the centre from the salient. Positions had been entrenched in anticipation of this movement. Mackensen made a last effort to break through and intercept the Russian centre between Warsaw and Brest-Litovsk. But his attacks at Lubartow between Aug 5 and 8 only gained ground slowly, and by Aug. 9 it was obvious that the Russians had escaped from the noose which it had been proposed to draw round their centre. The main portion of Mackensen's group moved north-east towards Brest-Litovsk, exercising a purely frontal pressure on the retreating Russians. The only outflanking movement now possible in this part of the field was east of the Bug, directed against the rear of Brest-Litovsk. This was attempted by the Austrian I. Army and the Army of the Bug. The former now advanced on Kowel, while the Bug army, which had crossed the river at Wlodawa, advanced through the Pinsk Marshes (Polyesie) to cut the Brest-Litovsk-Kobryn-Pinsk railway line.

The Final Stages.—The remainder of the story can be quickly told. Under increasing pressure from the Austrian IV. Army and the German XI. Army, the Russians evacuated Brest-Litovsk on Aug. 26. But they held off the Bug army from Kobryń sufficiently long to allow of the safe withdrawal of their forces from Brest-Litovsk. The Austrian I. Army after reaching Kowel sent a cavalry corps across the Pinsk Marshes to join the Bug army, and itself became involved in battle against the south-western group of Russian armies towards Luck (Lutsk) and Równe.

At the end of August Mackensen's force was reduced. The Austrian IV. Army was transferred to the right group, south of the marshes; portions of the XI. Army had already been withdrawn for the Serbian campaign, to which Mackensen himself was now called. What remained of his forces was placed under Linsingen and pursued the Russians as far as Pinsk, where a line was taken up which remained unaltered to the end of the war.

The poverty of the communications had much hampered Mackensen. In his previous drives from the Dunajec and from the San he had depended principally on the effect of his heavy artillery. The lack of roads and railways south of Lublin and Chelm made it difficult to advance his guns and to keep them supplied with ammunition. The Russians, too, had shown all their traditional stubbornness in retreat. In this part of the theatre the Pinsk marshes made a wide enveloping movement impossible, and the direction of Mackensen's advance was inevitable. Ludendorff had foreseen the slowness of advance on this line and had persistently counselled that the main blow should be directed by Kovno and Wilno (Vilna) on Minsk.

(*See* also Dunajec-San, Battles of the; Lemberg, Battles of; Narew, Battles of the.)

Bibliography.—E. von Falkenhayn, *General Headquarters, 1914–16, and Its Critical Decisions* (1919); Sir A. Knox, *With the Russian Army 1914–17* (1921). *See* also World War, *Bibliography*.

(A. P. W.)

BREST-LITOVSK, TREATIES OF. Two treaties were signed at Brest-Litovsk early in 1918: on Feb. 9 between the Central Powers and the Ukrainian Republic, and on March 3 between the Central Powers and the Soviet Government of Russia.

On Nov. 20, 1917, following on a resolution passed by the Congress of Russian Soviets in favour of immediate peace, the new Bolshevik Government informed the Central Powers of its readiness to come to terms; on Dec. 1 fighting ceased on the eastern front; and on Dec. 5, as the result of negotiations at Brest-Litovsk, an armistice was arranged for 10 days (extended on Dec. 15 for 30 days more) with a view to negotiating peace.

The first meeting of the peace delegations was held on Dec. 22 in the fortress of Brest-Litovsk, the headquarters of the German Eastern Army. The principal German delegate was Herr v. Kühlmann, the principal Austro-Hungarian Count Czernin; Turkey and Bulgaria were also represented. The chief representative of the Soviet Government, until the arrival of Trotsky on Jan. 7, was Dr. Joffe. The Ukrainian Republic, which claimed independence of Russia, sent a separate delegation, composed wholly of youthful idealists. Its chief spokesmen were Sevryuk, a literary man, and M. Holubowicz; among its members was Prof. Valdemaras, afterward prime minister of Lithuania.

The Russians at once laid down as a *sine qua non* the principle of "peace without annexations and indemnities, and the recognition of the right of self-determination for all peoples." This was accepted by the Central Powers, but only on condition that it should be agreed to by all the belligerent powers as the basis of a general peace. In the event of their refusing, the Central Powers reserved a free hand in dealing with Russia alone. On Dec. 28 at the close of the preliminary discussions, the Russians were allowed 10 days in which to secure the adhesion of the Entente Powers.

When the conference reopened on Jan. 7 the situation had changed for the worse. The Entente Powers having refused the Russian proposal, it was now a question of concluding a separate peace. The Russians and Ukrainians were now at open war; the latter insisted on negotiating a separate peace and demanded the recognition of their independence—which was conceded by the Central Powers on Jan. 9. On this same day the negotiations with the Russians on territorial questions reached a deadlock. The Germans insisted that Poland, Courland, Lithuania, and parts of Livonia and Esthonia had already determined to attach themselves to the Central Powers; the Russians demanded that a plebiscite should be taken after the withdrawal of the German troops. All efforts at compromise failed, and on Jan. 18 Trotsky left for Petrograd (Leningrad).

The threatened breakdown of the negotiations was less alarming to Germany than to Austria-Hungary, whose internal condition was now desperate. To relieve this situation a separate peace with the Ukraine was proposed, and to this Germany readily assented since the sacrifices involved would be made by Austria-Hungary alone, while Germany would profit by the opening up of the corn supplies of southern Russia. The conditions demanded by the Ukrainians were severe and humiliating, and in order to avoid them Austria-Hungary renewed her efforts to make peace with Russia. But Trotsky, who returned on the 30th, was in no mood for compromise. He could sign a peace, he said, in which Russia would be frankly coerced, but could not declare in Art. I. that there were no annexations and then in Art. II. agree to such annexations. Russia would bow to facts, but would not give "a certificate of morality" to the victors. Thus, after eight days of futile debate, the deadlock continued.

Treaty with the Ukraine.—In these circumstances, and in spite of Trotsky's protests, the treaty between the Central Powers and the Ukrainian *Rada* was signed on Feb. 9. Austria-Hungary ceded the district of Cholm to the Ukrainians, undertook to erect the Ruthenian parts of Galicia and the Bukovina into an autonomous crown land, and conceded full rights to the Ruthenian language and culture elsewhere in the monarchy, all of which was a deadly offence to the Poles. In return the Ukrainians undertook to supply the Central Powers with a million tons of breadstuffs annually. If this latter condition were not fulfilled, the whole treaty was to be null and void.

Breach with Russia.—Although Trotsky had announced that the treaty with the Ukraine was an unfriendly act which would make peace with Russia impossible, he consented to continue negotiations on a new basis; all "theoretical questions" were to be excluded from the debates, and the territorial settlements were to be made "without qualification." This broke down on the attitude of the German military men, who complained of Bolshevik propaganda in the German army (which Trotsky justified), and rightly suspected Trotsky of playing for time in expectation of the outbreak of revolution everywhere. On the evening of Feb. 10 Trotsky, pressed to explain himself, rose and left the hall, after announcing briefly that Russia would cease hostilities but would not conclude a treaty of peace.

The military, who had throughout hampered the work of Kühlmann and Czernin, were now definitely in the ascendant. On Feb. 18 Germany denounced the armistice and invaded Estonia, her troops reaching the shores of Lake Peipus. On Feb. 19, Petrograd being immediately threatened, Lenin and Trotsky sued for peace, accepting the conditions laid down at Brest-Litovsk. The Germans, however, now delivered an ultimatum embodying fresh demands, including the German occupation of Estonia and Livonia, to which the Russians agreed on Feb. 24. On Feb. 26 the Russian delegation once more appeared at Brest-Litovsk, with Sokolnikov as its chief spokesman.

The proceedings of the conference, which met on March 1, were short. Sokolnikov announced that Russia accepted all the conditions "dictated to her by Germany sword in hand." In vain the Central Powers protested that the ultimatum had contained the results of weeks of discussion. Sokolnikov declared that there could be no question of discussing the treaties "in this atmosphere of force," and that they would sign the drafts submitted to them "under the eyes of the workmen, soldiers and peasants of all the world, who would judge these treaties." Without further debate the treaty with Russia was signed on March 3.

The Peace Treaty with Russia.—This was threefold. The main treaty embodied the territorial cessions mentioned above and, in addition, the cession to Turkey of Kars, Ardahan and Batum. Four annexes regulated the economic relations between the four powers and Russia, on the general basis of reciprocity. Additional treaties regulated the juridical relations between them. Lip-service was done to the principle of "no indemnities," but Russia had to promise to pay 300,000,000 gold roubles as "compensation" for damage done. The treaty was annulled by Germany under the terms of the Armistice of Nov. 11, 1918, and by the Soviet Government two days later. The treaty with the Ukrainian *Rada* was from the first a "scrap of paper." The breadstuffs for which Austria-Hungary had been willing to pay so great a price only materialized in miserably inadequate quantities, under pressure of German arms, and the *Rada* itself was dissolved when the Germans occupied the Ukraine.

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BRETEUIL, LOUIS CHARLES AUGUSTE LE TONNELIER, Baron de (1730–1807), French diplomatist, was born at the château of Azay-le-Féron (Indre) on March 17, 1730. He served on embassies to Cologne, St. Petersburg (Leningrad), Stockholm, Vienna, Naples, and again Vienna, until he was recalled in 1783 to become minister of the king's household. A close friend of Marie Antoinette, he presently came into collision with Calonne, who demanded his dismissal in 1787. His influence with the king and queen, especially with the latter, remained unshaken, and on Necker's dismissal on July 11, 1789, Breteuil succeeded him as chief minister. The fall of the Bastille three days later put an end to the new ministry, and Breteuil made his way to Switzerland with the first party of *émigrés*. At Soleure, in Nov. 1790, he received from Louis XVI. exclusive powers to negotiate with the European courts, and soon brought himself into opposition with his old rival Calonne, who held a chief place in their councils. After the failure of the flight to Varennes Breteuil received instructions from Louis XVI., designed to restore amicable relations with the princes. Foreign sovereigns looked on the comte de Provence as the natural representative of his brother and found a pretext for non-interference on Louis's behalf in the contradictory statements of the negotiators. After the execution of Marie Antoinette he retired into private life near Hamburg, returning to France in 1802. He died in Paris on Nov. 2, 1807.

See the memoirs of Bertrand de Molleville (1816) and of the marquis de Bouillé (1884); and E. Daudet, *Coblentz, 1789–1793* (1889), forming part of his *Hist. de l'émigration*.

BRETHREN IN CHRIST. After the Reformation there arose in Europe a group known as pietists. A large number of these pietists settled in Lancaster county, Pennsylvania. From this group in Lancaster county a number of permanent church organizations arose—one of them, the Brethren in Christ. At first the Brethren in Christ chose no name, though its members were designated by others as River Brethren as they lived near the Susquehanna river. It was in 1862 that the community chose the name, Brethren in Christ. No honour is given to any one person for the starting of this organization. The Church stands for equality of all communicants. In doctrine it stands for justification by faith, holiness and empowerment, Divine healing, trine immersion, washing the saints' feet, holy kiss, non-resistance, scriptural veiling and the general resurrection of the dead. The officers of the Church are bishops, ministers and deacons. The Church is controlled by a general conference held annually. One delegate is allowed for every 50 members. The members are scattered throughout the United States and Canada. Foreign missionary activities are being carried on in Africa and India;

through city and rural mission stations, through tabernacle meetings and by the placing of young men in neglected sections the Church ministers to about 25,000 people. In 1928 there were about 6,000 communicant members (A. W. C.)

BRETHREN, THE CHURCH OF THE: *see* GERMAN BAPTIST BRETHREN.

BRÉTIGNY, French hamlet (dept. Eure-et-Loir, arrondissement and canton of Chartres, commune of Sours), which gave its name of a treaty concluded there on May 8, 1360, between Edward III. of England and John II. of France. Edward III. obtained, besides Guienne and Gascony, Poitou, Saintonge and Aunis, Agenais, Périgord, Limousin, Quercy, Bigorre, the countship of *Gaure, Angoumois, Rouergue, Montreuil-sur-mer,* Ponthieu, Calais, Sangatte, Ham and the countship of Guines, John II. had, moreover, to pay 3,000,000 gold crowns for his ransom. On his side the king of England gave up the duchies of Normandy and Touraine, the countships of Anjou and Maine, and the suzerainty of Brittany and of Flanders. The treaty should more properly be called the treaty of Calais, since it was ratified there on Oct. 24, when an important clause in the treaty of Brétigny was omitted.

BRETON, JULES ADOLPHE AIMÉ LOUIS (1827–1906), French painter, was born on May 1, 1827, at Courrières, Pas de Calais, France, and died on July 4, 1906. He was sent in 1843 to Ghent, to study under de Vigne, and in 1846 to Baron Wappers at Antwerp. Finally he worked in Paris under Drolling. His first efforts were in historical subjects, "Saint Piat preaching in Gaul"; then, under the influence of the revolution of 1848, he painted "Misery and Despair." In 1853 he exhibited the "Return of the Harvesters" at the Paris Salon, and the "Little Gleaner" at Brussels. Thenceforward he was essentially a painter of rustic life, especially in the province of Artois.

See Jules Breton, *Vie d'un artiste, art et nature* (autobiographical) (Paris, 1891); Marius Vachon, *Jules Breton* (1899).

BRETON, BRITTON or **BRITTAINE, NICHOLAS** (1545?–1626), English poet, was born in the parish of St. Giles-without-Cripplegate. There is no official record of his residence at the university, but the diary of the Rev. Richard Madox tells us that he was at Antwerp in 1583 and was "once of Oriel College." He is supposed to have died shortly after the publication of his last work, *Fantastickes* (1626). Breton found a patron in Mary, countess of Pembroke, and wrote much in her honour until 1601, when she seems to have withdrawn her favour.

His best work is to be found in his pastoral poetry. His *Passionate Shepheard* (1604) is full of sunshine and fresh air, and of unaffected gaiety. The third pastoral in this book—"Who can live in heart so glad As the merrie country lad"—is well known, with some other of Breton's daintiest poems, among them the lullaby, "Come little babe, come silly soule," it is incorporated in A. H. Bullen's *Lyrics from Elizabethan Romances* (1890). His keen observation of country life appears also in his prose idyll, *Wits Trenchmour,* "a conference betwixt a scholler and an angler," and in his *Fantastickes*, a series of short prose pictures of the months, the Christian festivals, and the hours, which throw much light on the customs of the times. Most of Breton's books are very rare and have great bibliographical value. His numerous works, with the exception of some belonging to private owners, were collected by Dr. A. B. Grosart in the *Chertsey Worthies Library* in 1879.

BRETÓN DE LOS HERREROS, MANUEL (1796–1873), Spanish dramatist, was born at Quel (Logroño) and was educated at Madrid. Enlisting in 1812, he served against the French in Valencia and Catalonia, and retired with the rank of corporal in 1822. His first piece, *Á la vejez viruelas,* was produced in 1824, and proved the writer to be the legitimate successor of the younger Moratin. During the next four years he composed 30 plays, six of them original, the rest being translations or recasts of classic masterpieces. His plays were a long series of successes. He wrote some 360 original plays, 23 of which are in prose. No Spanish dramatist of the 19th century approaches him in comic power, while his metrical dexterity is unique *Marcela o a cual los trés?* (1831), *Muérete; y verás!* (1837), and *La Escuela del matrimonio* (1852), are perhaps his best plays.

See Marqués de Molíns, *Bretón de los Herreros, recuerdos de su vida y de sus obras* (1883); *Obras de Bretón de Herreros* (1883); E. Piñeyro, *El Romanticismo en España* (Paris, 1904).

BRETON LANGUAGES: *see* INDO-EUROPEANS; CELTIC LANGUAGES.

BRETON LITERATURE. It is usual to divide Breton literature into three periods corresponding to the language—old, middle and modern. The written remains in the first period (8th to 11th centuries) consist entirely of glosses and names in ancient documents. The chief collections of glosses are (1) the Oxford glosses on Eutychius; (2) the Luxemburg glosses; (3) the Bern glosses on Virgil; (4) the Cambridge glosses on Amalarius; (5) five *Collationes Canonum*, the chief mss. being at Paris and Orleans. All the glosses have been published by Loth (*Vocabulaire Vieux-Breton,* 1884). Breton names occur in Latin lives of saints, in the Charter of Redon written in the 11th century but dating largely from the 9th, and in the Charter of Landevennec (11th century). Lists of these names occur in Loth's *Chrestomathie Bretonne.*

The Middle Breton period extends from the 11th to the 17th centuries, but down to the 15th century only proper names are found, in such official documents as the Charter of Quimperle (12th and 13th centuries), with the exception of a few scraps of verse discovered in a 14th century ms. in Paris (*Revue Celtique*, xxxiv. 241). These scraps constitute the earliest known connected text in Breton. But it is at the end of the 15th century that Breton literature can really be said to begin. To this period belong a Breton-Latin-French dictionary called the *Catholicon* of Lagadeuc, dated 1464 and printed in 1499 (the first printed Breton book) and the dictionary and conversations (French-Breton) of Quiquer de Roscoff, printed in 1626. A collection entitled *Cantiques bretons* was published in 1642 in which the names of several Breton airs are given. All the remaining works of the period are religious. Two are in prose—the *Life of St. Catherine* (1576) and the *Mirror of Confession* (1621). The former is a translation of the version found in the *Golden Legend,* and the latter a translation from French. The other works are in verse. *The Life of St. Nonn* (end of the 15th century) is a paraphrase in the form of a drama of the Latin life, with some attempts to localize a few events in Brittany. *Le Grand Mystère de Jésus* (1530) follows the French play of Arnoul Gresban and Jean Michel. This drama falls into three parts, the Passion, the Resurrection, Dialogues. *Le Mystère de Sainte Barbe* (1557) is also derived from a French play. Three long poems on the *Passing of Mary,* the *Fifteen Joys of Mary* and the *Life of Man* belong to the same period as the *Grand Mystère de Jésus,* all three probably being based on French versions. A Breton metrical version of the Creed occurs in a French mystery play dated 1456 (*Revue Celtique,* xx. 184). *Le Mirouer de la Mort* is a somewhat lugubrious poem of 3,602 lines composed in 1519 by "Maestre Jehan an Archer Coz" and printed in 1575. It is based ultimately upon a Latin work (in prose mixed with verse) of which versions exist in French. It is a description of the four destinies of man—death (lines 59–582), the last judgment (lines 583–1954), hell (lines 1955–2702), heaven (2703–3566), the remaining lines being introductory and conclusion. *Doctrin an christenien,* a translation from French, was published in 1622. The metrical *Devout Meditations* of Cadec appeared in 1651, and in the previous year a collection of carols (*An Nouelou ancien*). To the 16th century belong a Book of Hours in verse, a prose extract from the Léon missal, and also a prose catechism. The lack of originality in the Breton published works of this period is obvious. None of them can be said to reflect in any way the real Breton culture of the period. French influences are particularly evident in the enormous number of French words that appear. French was the language of the upper classes, and the predominance of religious subjects among the literary remains of the period together with the complete absence of what was truly Breton in spirit argues strongly in favour of the assumption that the indigenous culture of the country was entirely neglected by the learned classes. In view of what was to occur later in Breton literature the most significant thing among the products of the middle period is the existence of the three mystery plays already mentioned.

The Modern Period.—Modern Breton is considered to begin with the appearance in 1659 of Julien Maunoir's grammar, *Le Sacré Collège de Jésus*, in which he substituted for the traditional orthography a more phonetic system. This orthographical division has however practically no significance from the literary standpoint, for the same types of works continued to appear up to the 19th century. Numerous collections of religious poems and manuals of devotion in prose and verse were published. But the bulk of Breton literature in this period consisted of mysteries and miracle plays. The subjects of these plays fall into four classes: (1) Old Testament subjects; (2) New Testament subjects; (3) lives of the saints; (4) chivalry. Generally the plays are derived from French sources, and in the case of the third class from Latin lives of the saints. The treatment is invariably of the traditional style, even when the saint is Breton. Of course there is occasionally some local colouring, as could be expected, but broadly speaking the plays evince little originality. To the first class belong *Creation ar bed, Buc Jacob, Vie de Moise, Vie de David;* to the second *Bue santes Anna Saint Jean-Baptiste, La Passion, Vie de lantecrist* (which treats of the Last Judgment, and in which occurs the well-known Debate of the Body and the Soul). It is but natural to find in Brittany several plays of the third class—*St. Gwennolé, St. David, St. Garan, St. Patrick,* etc. In the fourth class are found *Vie des quatre fils, Aymon* and *Huon de Bordeaux.* The following may also be noted: *Vie de Louis Eunius* (into which the legend of St. Patrick's purgatory enters), *Robert le Diable*, and the three farces *Ar Farvel goapaër* (*Le bouffon moqueur*), *Ian Mêlargé* (*Mardi-Gras*), and *La Vie de Mallargé, de Tristemine sa femme, et de ses enfants.* The actors in these plays were always peasants, and the whole movement incurred the displeasure of the clergy, with the result that the Breton stage was well-nigh killed about the middle of the 19th century. But a revival set in towards the end of the century, largely due to the inspiration of the Abbé le Bayon, founder of the Breton theatre of Ste. Anne d'Auray, and author of Breton dramas. Loth has described the 18th century as the "century of dictionaries," and little of literary importance appeared in that century. But the 19th century saw a revival of interest in Breton, largely due to the work of Le Gonidec. A real endeavour was made to create a national literature, particularly after the attention of the whole world of letters was attracted to Brittany by the publication of *Barzas Breiz.* The most prominent of the pioneers of this movement were Auguste Brizeux, F. M. Luzel and Prosper Proux. Brizeux (1803–58), better known as a French poet, wrote a collection of lyrics entitled *Telen Arvor* (1884). Luzel published original compositions under the title *Bepred Breizad, Toujours Breton* (1864). Proux published *Canaouenno grét gant eur C'hernewod* (1838) and *Ar Bombard Kerne* (*The Hautboy of Cornouailles,* 1866). The themes tended to be conventional, and the works of these writers are somewhat monotonous. An anthology of poems connected with the movement appeared in 1862 under the title *Bleuniou Breiz, Poésies anciennes et modernes de la Basse-Bretagne.* P. D. de Goesbriand published in 1836 a Breton version of several of La Fontaine's fables, and a collection of metrical fables appeared in 1867 entitled *Marvaillou Grac'h Koz* by G. Milin. A book of Georgics, *Levr al labourer,* in the Vannes dialect, was published by the Abbé Guillome in 1849. A translation of the Scripture prepared by Le Gonidec and revised by Troude and Milin was published in 1868.

Ballad Literature.—But it is the legends, folk-tales and ballads that constitute the glory of the literature of Brittany. The famous collection of ballads entitled *Barzas Breiz* was issued in 1839 by Hersart de la Villemarqué (1815–95) and immediately aroused interest and attention. Folk-poetry was the fashion at the time and de la Villemarqué set about collecting the popular poetry of his country. The material was, however, severely edited by him and several collaborators who transformed at will, expunging the crude and gross. He himself believed that the folk-songs went back to the early days of the Breton people and so were similar to the traditional Welsh poetry associated with Llywarch Hen and Taliesin. He further thought that it was possible to make them appear in their primitive dress. But criticism of his work has been unsparing, and has shown that no trace of anything earlier than the 16th century occurs in these songs. It has made clear that songs were touched up in order to contain historical reminiscences of early times. *Barzas Breiz* (or *Barzaz Breiz* from the 2nd ed. of 1867 on) therefore is no anthology of Breton popular poetry. Its contents may be divided into three classes: (1) Poems rearranged by the editor or others and consisting of love-songs and ballads. (2) Modern poems transferred to mediaeval times. (3) Spurious poems dealing with such personages as Nominoe and Merlin. Its appearance caused a controversy almost as famous as that caused by Macpherson's forgeries and reminds one of the recent commotion in Wales consequent upon the exposure of Iolo Morganwg's methods. F. M. Luzel was the first scholar to publish the genuine ballad literature of Brittany. His collection appeared in two volumes bearing the title *Gwerziou Breiz-Izel, Chants populaires de la Basse-Bretagne* (1868 and 1874), and contains the original of several of the poems in *Barzaz Breiz.* The *gwerziou* (*complaintes*) deal with local history (particularly crimes of various sorts), religious legends and superstitions, folk-lore. They are dramatic in composition, simple and concise in style. They display greater originality than the other type of popular poetry called *soniou,* consisting of love-songs, satires, carols and marriage-lays. French influence is often found in the *soniou.* They were first published by F. M. Luzel with the collaboration of Le Braz in two volumes with the title *Soniou Breiz-Izel, chansons populaires de la Basse-Bretagne* (1890). Luzel also collected folk-tales and legends, and published a large number of them in Breton as well as in French translations His published collections are, *Contes bretons recueillis et traduits par F. M. Luzel* (1870), *Les Légendes chrétiennes de la Basse-Bretagne* (1881) and *Veillées bretonnes, moeurs, chants, contes et récits populaires des Bretons-Armoricains* (1879). Another collector of Breton legends was Anatole le Braz. He was commissioned to investigate the stories current with reference to *An Ankou* (death), and his results are found in his *La Légende de la mort* (1912–13). Other collections are *Ar marvailler brezounek* (1870) by Troude, *Pipi Gonto* (2 vols., 1902, 1908) by A. le Moal, and *Marvailhou ar Vretoned* (1907) by C. M. le Prat.

Growth of National Feeling.—A new movement started in the '90s of last century which was remarkably prolific. Reference has already been made to the revival of drama; many of the dramatic works were crude, and largely propagandist. On the other hand the poetry produced was distinctly better than that of the earlier part of the century. The leading figure of the period was Jaffrennou (*Taldir*), author of two striking volumes of lyrics —*An Hirvoudou* ("Sighs," 1899), *An Delen Dir* ("The Harp of Steel," 1900)—and *Barzaz Taldir* (3 vols.). A greater artist is Erwan Berthou. C. M. de Prat, J. Cuillandre and N. Quellien may also be mentioned. An anthology of lyrics appeared in 1902 under the title of *Bleuniou Breiz-Izel, Dibab Barzoniezou.* The literature of the period is clear evidence of the growth of national feeling in Brittany. This feeling is becoming more pronounced, and with the profounder awakening of national consciousness Breton literature grows richer. One of the outstanding figures in recent Breton literature was Jean-Pierre Calloc'h, who was killed in action in 1917, a grave loss to Breton letters. His works were published (with a French version) in 1921 under the title *A Genoux.* He wrote in the Vannes dialect, and his works display his profound love of country and his mystic qualities. Another sign of awakening is the attempt to enrich the vocabulary in order to extend the use of the language by the creation of new terms. This is very much in evidence in the "archaeological" romance entitled *Sketla Segobrani.* On the other hand we find the attempt to restore earlier Breton words with the necessary changes deduced by so-called phonetic "laws" and similarly to "bretonize" Welsh words. This is seen in J. le Roux's Breton version of the mediaeval Welsh romance of *Peredur fab Efrawg;* the translator has also attempted to fashion an orthography which will make the work easily legible to speakers of all the Breton dialects (*Le roman de Pérédur, texte gallois traduit en breton,* par J. le Roux, Rennes, 1923). Several collections of tales have been recently published, chiefly collected from the various periodicals. It is interesting to note that, in addition to the translation of *Peredur,* other works are being turned into Breton, such as Synge's *Riders to the Sea* (*War varc'h d'ar mor*) and the Irish story *Oidhe Chloinne Tuireann* (*Tonkadur Bugale Tuireann*). The present awakening in Breton literature owes much to the incessant work of François Vallée and the scholarly work of Prof. Émile Ernault.

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BRETONNEAU, PIERRE (1778–1862), French physician of Tours, was born on April 3, 1778, at Saint Georges-sur-Cher and died on Feb. 18, 1862. His fame rests on the first performance (1825) of the operation of tracheotomy for croup; on the clinical distinction of diphtheria, so-named by him in his *Des inflammations spéciales du tissu muqueux et en particulier de la diphthérite* (1826); and on his work on typhoid, which, he foresaw, would be differentiated from typhus. In 1814 he passed the examination for doctor of medicine in Paris and in 1815 became *médecin in chef* of the hospital at Tours. Here he studied epidemic typhoid. He has been described as one of the greatest epidemiologists of his time. His contribution to the knowledge of typhoid is only second in historical importance to that of his work on diphtheria. The doctrine of specificity was his third most important contribution to medicine. By this doctrine he foreshadowed the germ theory of disease.

See P. Triaire, *Bretonneau et ses correspondants* (1892); *Proceedings* of the Royal Society of Medicine, 1924, vol. 18, page 1.

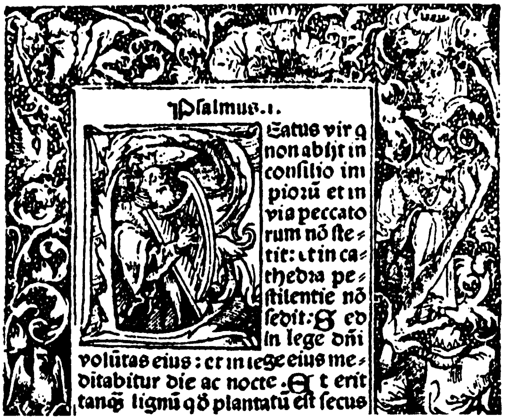
BRETSCHNEIDER, KARL GOTTLIEB (1776–1848), German theologian, was born at Gersdorf (Saxony), on Feb. 11, 1776. He lectured on philosophy and theology at Wittenberg (1804–06); was pastor of Schneeberg, Saxony (1806–08); superintendent at Annaberg, Saxony (1808–16); and then removed to Gotha, where he was general superintendent until his death (Jan. 22, 1848). The best part of his life's work was done at Gotha. In 1820 appeared his treatise on the Gospel of St. John, *Probabilia de Evangelii et Epistolarum Joannis Apostoli indole et origine,* which discussed with moderation the arguments against Johannine authorship. Bretschneider announced in the preface to the second edition of his *Dogmatik* in 1822, that he had never doubted the authenticity of the gospel, and had published his *Probabilia* only to draw attention to the subject, and to call forth a more complete defense of its genuineness. His greatest contribution to exegesis was his *Lexicon Manuale Graeco-Latinum in libros Novi Testamenti* (1824), valuable for its use of the Greek of the Septuagint, of the Old and New Testament Apocrypha, of Josephus, and of the apostolic fathers, in illustration of the language of the New Testament. In 1826 he published *Apologie der neuern Theologie des evangelischen Deutschlands.* An English translation of his *Manual of the Religion and History of the Christian Church* appeared in 1857. His dogmatic position seems to be intermediate between the extreme school of naturalists, such as Heinrich Paulus, J. F. Röhr and Julius Wegscheider on the one hand, and D. F. Strauss and F. C. Baur on the other. Recognizing a supernatural element in the Bible, he nevertheless allowed a full critical exercise of reason in the interpretation of its dogmas (*cf.* O. Pfleiderer, *Development of Theology*).

BRETWALDA, a title meaning "Ruler of Britain," applied by the *Anglo-Saxon Chronicle* to Egbert, king of the West Saxons, when he became overlord of all the English peoples south of Humber. The chronicler states that seven other kings, from Aella of Sussex in the 5th century to Oswiu of Northumbria in the 7th, had held this title before Egbert. It was a poetical expression, not a formal style, and is therefore not found in Latin documents of an earlier time.

BREVE, in music, the note of greatest time-value (the equivalent of two semibreves) in our existing Western notation, represented by the sign ||o|| or |=|. It is, however, now seldom used, the semibreve having taken its place for practical purposes, although it is not quite obsolete, Brahms for instance having employed it in his *German Requiem.* Formerly there were other notes longer still, namely, the large or maxima and the long or longa; in contrast with which the breve (brevis, brief) received its name, but these disappeared many centuries ago. (*See* MUSICAL NOTATION; HARMONY).

BREVET (a diminutive of the Fr. *bref*), a short writing, originally an official writing or letter, with the particular meaning of a papal indulgence. The use of the word is mainly confined to a commission, or official document, giving to an officer in the army a permanent, as opposed to a local and temporary, rank in the service higher than he holds substantively in his corps. In the British army "brevet rank" exists only above the rank of captain, but in the United States army it is possible to obtain a brevet as first lieutenant. In France the term *breveté* is particularly used with respect to the general staff, to express the equivalent of the English "passed staff college" (p.s.c.).

BREVIARY, the book which contains the daily service for the canonical hours in the Roman Catholic Church (Lat. *breviarium,* abridgment, epitome). It includes psalms, lessons, antiphons, etc., for every day in the year; but excludes the Eucharistic office (contained in the Missal) and the rites of baptism, marriage, ordination, etc. (which are found in the Ritual or the Pontifical). In the early days of Christian worship the Bible furnished all that was required, containing as it did the books from which the lessons were read and the psalms recited. The first step in the evolution of the Breviary was probably the separation of the Psalter into a choir book. The monastic practice of daily reciting the 150 psalms took so much time that the monks began to spread it over a week, dividing each day into hours, with its allotted psalms for each hour. St. Benedict in the 6th century drew up such an arrangement, and the Roman division, which remained practically unchanged until 1912, is perhaps even older. To the Psalter were added, in course of time, other service books, containing prayers, antiphons, etc. Jean Beleth, a 12th-century liturgical author, gives a long list of books needful, besides the Psalter and Old and New Testaments, for right conduct of the canonical office:—Antiphonary, Passionary, Collectar, etc. The inconvenience of using such a library naturally led to the substitution of one compendious volume. Attempts in this direction were made as early as the 8th century by Alcuin, and a little later by Prudentius, bishop of Troyes; Gregory VII (pope 1073–85) simplified the liturgy used at the Roman court, and gave his abridgment the name of Breviary. But the earliest extant ms. containing the whole canonical office is of the year 1099 (from Monte Cassino, now in the Mazarin library). A few 12th century Breviaries are extant, all Benedictine; but under Innocent III (pope 1198–1216) their use began to be more general. The



Pſalmus.i.

Eatus vir q
non abijt in
conſilio im
pioꝛū et in
via peccato
rum nō ſte⸗
tit: et in ca⸗
thedꝛa pe⸗
ſtilentie nō
ſedit: S ed
in lege dñi
volūtas eius: et in lege eius me⸗
ditabitur die ac nocte. E t erit
tanꝗ lignū qđ plantatū eſt ſecus

BY COURTESY THE BETTMAN ARCHIVE

SECTION OF PAGE FROM BREVIARY OF CONSTANCE (1516)

Breviary of the Roman court was adopted (with some modifications, *e.g.*, the substitution of the "Gallican" for the "Roman" version of the psalms) by the newly founded order of Franciscan friars, with the authorization of Gregory IX. (1227–41); and through their wide-ranging activity it became known all over Europe, and supplanted the older partial books. Nicholas III. (1277–80) introduced the Franciscan Breviary for the Roman churches, and thus made its position secure. It did not, however, supersede the various local diocesan Breviaries until 1568, when Pius V. issued it in a revised form, and made it obligatory in every diocese where the local use could not show at least 200 years of existence; and since then it has gradually become universal except in the Benedictine, Dominican and some other religious orders, in the diocese of Milan (where the Ambrosian use persists), and in the cathedrals of Toledo and Salamanca (where the Mozarabic use, once universal throughout Spain, is still followed). Of the many revisions of the Roman Breviary the most remarkable is that by Cardinal Francis Quiñones (1535), which, undertaken by order of Clement VII., passed through many editions before its suppression in 1568, and was largely used by the compilers of the English Prayer Book of 1549. The Pian Breviary was altered by Clement VIII. in 1602 (through Baronius and Bellarmine), especially as concerns the rubrics; and by Urban VIII. (1623–44), a purist who unfortunately tampered with the text of the hymns, injuring both their literary charm and their historic worth.

In the 17th and 18th centuries a movement of revision, largely under Gallican and Jansenist influences, but also in the interests of sound critical scholarship, took place in France, and succeeded in modifying about half the Breviaries of that country. These reformed French Breviaries—*e.g.* the Paris Breviary of 1680 by Archbishop François de Harlay (1625–95) and that of 1736 by Archbishop Charles Gaspard Guillaume de Vintimille (1655–1746) —show a deep knowledge of Holy Scripture, and much careful adaptation of different texts; but during the pontificate of Pius IX. a strong Ultramontane movement arose against them. This was inaugurated by Montalembert, but its literary advocates were chiefly Dom Guéranger, a learned Benedictine monk, abbot of Solesmes, and Louis Veuillot (1813–83) of the *Univers;* and it succeeded in suppressing them everywhere, the last diocese to surrender being Orleans in 1875. The Jansenist and Gallican influence was also strongly felt in Italy and in Germany, where Breviaries based on the French models were published at Cologne, Münster, Mainz and other towns. Meanwhile, under the direction of Benedict XIV. (pope 1740–58), a special congregation collected many materials for an official revision, but nothing was published. In 1902, under Leo XIII., a commission under the presidency of Monsignor Louis Duchesne was appointed to consider the Breviary, the Missal, the Pontifical and the Ritual. The findings of this commission have not been published; but Pius X., by the Apostolical Constitution "Divino Afflatu" (Nov. 1, 1911), ordained (as from Jan. 1, 1913) the use of a newly-arranged Psalter, as well as the observance of certain new regulations in the manner and order of reciting the office—the main object of the changes being to restore the weekly recitation of the entire Psalter.

The beauty and value of many of the Latin Breviaries were brought to the notice of English churchmen by one of the numbers of the Oxford *Tracts for the Times*, since which time they have been much more studied, both for their own sake and for the light they throw upon the English Prayer Book.

From a bibliographical point of view some of the early printed Breviaries are among the rarest of literary curiosities. Being merely local, the copies were not spread far, and were soon worn out by daily use. Doubtless many editions have perished without leaving a trace of their existence, while others are known by unique copies. In Scotland the only one which has survived the convulsions of the 16th century is that of Aberdeen, a Scottish form of the Sarum Office, revised by William Elphinstone (bishop 1483–1514), and printed at Edinburgh in 1509–10 (the Sarum Rite was much favoured in Scotland as a kind of protest against the jurisdiction claimed by the church of York). Four copies have been preserved, and it was reprinted in 1854 for the Bannatyne Club. It is particularly valuable for the notices of early Scottish history embedded in the lives of the national saints. Though enjoined by royal mandate in 1501 for general use within the realm of Scotland, it was probably never widely adopted. The new Scottish *Proprium* sanctioned for the Roman Catholic province of St. Andrews in 1903 contains many of the old Aberdeen collects and antiphons.

The Sarum Breviary itself, originally compiled by St. Osmund (bishop of Salisbury 1078–99) was very widely used. Many editions were printed in the 15th and 16th centuries. Other English uses are those of York (observed in the northern province) and Hereford.

Contents of the Roman Breviary.—The Breviary is sometimes found in one volume, sometimes in two; but usually it is in four volumes, for the winter, spring, summer and autumn portions of the ecclesiastical year (which begins with the first Sunday in Advent). After the calendar, tables for finding Easter, general rubrics and other prefatory matter, each volume contains (1) Psalter; (2) *Proprium de Tempore;* (3) *Proprium Sanctorum;* (4) *Commune Sanctorum;* (5) Extra Services.

1. *Psalter.*—The psalms arranged in sections, with prayers, hymns, antiphons, etc., for the several hours throughout the week. In the new Breviary the psalms are arranged so that the whole psalter may be recited each week, and (by dividing some of the longer psalms) that the portion allotted to each day's office may be of approximately the same length (*e.g.*, the quota for Matins is nine psalms of 15 verses each). Psalms cxlviii.–cl. are always used at Lauds, and give that office its name. The text of the psalms is that commonly known as the Gallican, *i.e.* St. Jerome's second revision of the Old Latin version. This was adopted at Rome in the 13th century (having long been accepted elsewhere) instead of his first revision, the so-called Roman version, which is still used in St. Peter's.

2. *Proprium de Tempore.*—The lessons, little chapters, and special antiphons, etc., for every Sunday and week-day throughout the ecclesiastical season.

3. *Proprium Sanctorum.*—The like for saints' days and other festivals determined by the day of the month. The lessons consist largely of summaries of the saints' lives, and this part of the Breviary, though revised from time to time, is often criticized adversely as containing historical inaccuracies. As about 90% of the days in the year have, during the course of centuries, been allotted to some saint or other, it is easy to see how this section of the Breviary has encroached upon the *Proprium de Tempore.* This has long been one of the chief problems involved in a revision of the Breviary; it is dealt with to some extent in the reformed Psalter of Pius X.

4. *Commune Sanctorum.*—Offices for feasts of various groups or classes of saints (apostles, evangelists, martyrs, etc.), for the dedication of a church, and for feasts of the Blessed Virgin Mary. These offices are of very ancient date.

5. *Extra Services.*—These include the Little Office of the Blessed Virgin Mary, the Office of the Dead and offices peculiar to each diocese.

It has already been indicated, by reference to Matins, Lauds, etc., that not only each day, but each part of the day, has its own office, the day being divided into liturgical "hours." A detailed account of these will be found in the article HOURS, CANONICAL. Each of the hours of the office is composed of the same elements, viz. psalms (including canticles), antiphons, responsories, hymns, lessons, little chapters, versicles and collects.

The *psalms* have already been dealt with.

The Psalter of the Breviary also includes seven Old Testament canticles for use of Lauds, viz. the Song of the Three Children (Dan. iii. 57–88, on Sunday), Song of Isaiah (Is. xii., Monday), Song of Hezekiah (Is. xxxviii. 10–20, Tuesday), Song of Hannah (1 Sam. ii. 1–10, Wednesday), Song of Moses (Exod. xv. 1–19, Thursday), Song of Habakkuk (Hab. iii., Friday), Song of Moses (Deut. xxxii. 1–43, Saturday), and three from St. Luke, viz. the Benedictus (i. 68–79) at Lauds, Magnificat (i. 46–55) at Vespers, and Nunc Dimittis (ii. 29–32) at Compline.

The *antiphons* are short liturgical forms, of biblical or patristic origin, used before and after a psalm. The term originally signified a chant by alternate choirs, but has quite lost this meaning in the Breviary.

The *responsories* and *versicles* are similar in form to the antiphons, and are used with them before and after psalms, also after the lessons and little chapters, and sometimes after prayers.

The *hymns* are short poems going back in part to Prudentius and Ambrose. Together they make a fine collection, despite Urban VIII.'s misguided attempts to improve them.

The *lessons* are drawn from the Bible, the Acts of the Saints, *and patristic homilies. In the lessons, as in the psalms, the order for special days breaks in upon* the normal order of ferial offices and dislocates the scheme for consecutive reading. The lessons are read at Matins (which on Sundays and feast-days is subdivided into three nocturns).

The *little chapters* are very short lessons read at the other "hours."

The *collects* come towards the close of the office and are short prayers summing up the supplications of the congregation. They are largely drawn from the Gelasian and other Sacramentaries.

Clerics in major orders and members of most religious orders must each day publicly join in or privately read aloud the whole divine office. Few laymen read the breviary; but the custom of reading it, at least in part, constantly grows under encouragement.

Translations of the Roman breviary exist in French, German and English, the last-named done by the Marquess of Bute (1879; new ed. 1908), containing skilful renderings of the ancient hymns by J. H. Newman, J. M. Neale, and others. A pocket-sized version, edited by Charles Francis Brown, appeared in 1936–38 (London).

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BREVIARY OF ALARIC (*Breviarium Alaricanum*), a collection of Roman law, compiled by order of Alaric II., king of the Visigoths, in the year 506. It comprises 16 books of the Theodosian code; the *Novels* of Theodosius II., Valentinian III., Marcian, Majorianus and Severus; the *Institutes* of Gaius; five books of the *Sententiae Receptae* of Julius Paulus; 13 titles of the Gregorian code; two titles of the Hermogenian code; and a fragment of the first book of the *Responsa Papiniani*. From the circumstance that the *Breviarium* has prefixed to it a royal rescript (*commonitorium*) directing that copies of it, certified under the hand of Anianus, should be received exclusively as law throughout the kingdom of the Visigoths, the compilation of the code has been attributed to Anianus by many writers, and it is frequently designated the Breviary of Anianus (*Breviarium Aniani*). The code, however, appears to have been known amongst the Visigoths by the title of "*Lex Romana*," or "*Lex Theodosii*," and it was not until the 16th century that the title of "*Breviarium*" was introduced to distinguish it from a recast of the code, which was introduced into northern Italy in the 9th century for the use of the Romans in Lombardy. This recast of the Visigothic code has been preserved in a ms. known as the Codex Utinensis, which was formerly kept in the archives of the cathedral of Udine, but is now lost; and it was published in the 18th century for the first time by P. Canciani in his collection of ancient laws entitled *Barbarorum Leges Antiquae*. Another ms. of this Lombard recast of the Visigothic code was discovered by Hänel in the library of St. Gall. The chief value of the Visigothic code consists in the fact that it is the only collection of Roman Law in which the five first books of the Theodosian code and five books of the *Sententiae Receptae* of Julius Paulus have been preserved, and until the discovery of a ms. in the chapter library in Verona, which contained the greater part of the *Institutes* of Gaius, it was the only work in which any portion of the institutional writings of that great jurist had come down to us. *See* GERMANIC LAWS, EARLY.

The most complete edition of the *Breviarium* will be found in the collection of Roman law published under the title of *Jus Civile Ante-Justinianum* (Berlin, 1815). *See* also G. Hänel's *Lex Romana Visigothorum* (Berlin, 1847–49).

BREVIER, a printing type ("8 point"), smaller than bourgeois and larger than minion, which derives its name from its original use in breviaries. The following passage is set in brevier type:

> William Caxton, the first English printer, was born in the Weald of Kent, perhaps at Tenterden. The name, which was apparently pronounced Cauxton, is identical with Causton, the name of a manor in the parish of Hadlow.

In France, brevier type is called *petit texte*. (*See* PRINTING TYPE.)

BREWER, JOHN SHERREN (1810–1879), English historian, was born at Norwich, the son of a Baptist schoolmaster. He was educated at Queen's college, Oxford, was ordained in the Church of England in 1837, and held various preferments and lectureships. The introductions to his *Letters and Papers of the Reign of King Henry VIII.*, which were published separately, under the title *The Reign of Henry VIII.*, in 1884, form a scholarly and authoritative history of Henry VIII.'s reign. He died at Toppesfield, Essex.

BREWER, a city of Penobscot county, Maine, U.S.A., on the east bank of the Penobscot river, opposite Bangor, with which it is connected by ferry and buses. The population in 1940 was 6,510. At one time it had eight shipbuilding yards, and formed with Bangor the chief lumber-shipping port of the U.S. Its present industries include a large pulp and paper mill, brickworks with an annual output of 2,000,000 to 5,000,000, a tool mill and shoe and moccasin manufacturing plants.

Brewer was settled in the 18th century, separated from the town of Orrington and incorporated as a town in 1812, and received a city charter in 1889. It was named after its first postmaster, Col. John Brewer.

BREWING, in its most commonly accepted meaning, denotes the preparation of the alcoholic beverage beer from malted cereals, chiefly barley malt, hops and water, with or without the addition of other carbohydrate material. The art of brewing, which until about the 12th century was practised mainly as a household task performed chiefly by women, has its origin in the earliest beginnings of civilization. Thus some of the oldest records extant on the civilizations of ancient Egypt and Babylonia, dating back some 5,000–6,000 years, contain descriptions of brewing and reveal the fact that the preparation of beer, of which several types were then already known, was an important industry even at that early period. Brewing practices differed with each period and with each region, but they may be said to have originally involved the following general steps: grinding between stones of the germinated barley or whatever cereal was used, adding of water to the crushed cereal to make a dough that could be shaped into loaves, baking of the loaves at low heat, breaking up of the loaves and macerating them with water, fermenting of the resultant infusion by exposure to warmth, and finally, separating of the beverage from the bran of the grain by passing through a woven filter. It will be seen that the initial steps of early brewing were identical with those of baking and, in fact, the two crafts were usually practised together. The materials used for brewing varied, of course, in accordance with the available grains, but they consisted most generally of barley, wheat, oats or spelt and occasionally maize, with admixtures of honey, herbs or spices to enhance the taste of the beverage.

In early mediaeval Europe brewing slowly changed from a household task into a craft and trade which, by the 14th and 15th centuries, had already given rise to powerful guilds in the cities of Germany and England. This transformation was greatly aided by the mediaeval monasteries which brewed their beer in larger quantities to supply not only their inmates but also the inhabitants of the nearby districts. All early beer was of the top-fermented type and it was not until the 15th century that bottom-fermentation was introduced in Bavaria from whence it spread throughout Europe. Some distinction between top-fermented ale and beer was made in England where the former beverage was made without the use of hops. Brewing was early recognized as a profitable source of revenue by the feudal lords who set up a system of licensing under which an annual fee was extracted from anyone engaged in the trade. Taxation of beer itself or of the materials used in its preparation made its first appearance about the middle of the 17th century. Until about the middle of the 19th century the making of beer was confined chiefly to small private and public breweries. The small private breweries slowly passed out of existence and many of the public breweries merged or were absorbed by more prosperous competitors until beer was produced chiefly in large plants, many of which have truly phenomenal production capacities. In the United States, for example, there were in 1873 some 4,131 breweries producing a total of 9,633,323 barrels (1 beer bbl. = 31 gal.). By 1943 this number had declined to about 475 brewing plants with a production in excess of 75,000,000 bbl.

The term beer, commonly applied to fermented malt beverages in general, embraces a wide variety of cereal beverages. A main distinction is usually made between bottom-fermented lager beers and top-fermented ales which differ in their properties and the mode of their production as will be shown below (*see* also BEER). Among the lager beers, the most prominent types are the popular Pilsener and Dortmunder types which possess a pale colour, a medium hop flavour, a rather pronounced carbonation and a low alcohol content (3.0–3.8% by weight); the Vienna type beers which are characterized by an amber colour and a very mild hop taste; and the Munich type beers with their dark-brown colour, fully developed malt flavour and light hop taste. The top-fermented beers include the ales which are pale-coloured, hoppy beverages with an alcohol content slightly higher than that of beer; the porters which possess a dark-brown colour, a full-bodied malty flavour and a relatively mild hop taste; and the stouts which are very dark in colour, have a pronounced malty flavour and a strongly bitter hop taste. As a rule, top-fermented beers possess higher alcoholic contents, ranging from 4 to 6.5% by weight, than do bottom-fermented beers. In addition to the above types of beer, there are others which enjoy only local importance. Among these may be mentioned the top-fermented Weissbier of the Berlin region of Germany in whose production wheat malt is used extensively in addition to barley malt, and the Faro and Lambic beers of Belgium which are subjected to a protracted fermentation by wild yeasts. In Japan, rice forms the traditional brewing cereal in the production of the beer-like Saké (*see* SAKÉ).

BREWING MATERIALS

Malt.—Of the various materials employed in brewing, malt made from barley has the most decisive influence upon the general character and quality of the beer so that the selection of suitable barley varieties and the precise control of malting operations are of great importance. The production of malt in the United States is largely carried out by a separate industry, although there are breweries which operate their own malting plants. The malting qualities of a barley are determined chiefly by the variety of the barley, the locality in which it is grown and the climatic conditions that prevail during its growth, and, to a lesser degree, by the size and shape of the individual barley kernels, thickness of husk, freedom from damaged, diseased or foreign kernels, protein content, mealy endosperm, moisture content and other factors (*see* MALT). The common varieties of malting barleys used in the United States are Oderbrucker, Wisconsin Barbless and Velvet, all six-rowed varieties grown extensively in the mid-western region, and Atlas, also a six-rowed variety, and Hannchen, a two-rowed variety, both cultivated on the Pacific coast. In Europe two-rowed varieties are grown exclusively. The higher protein and enzyme contents of American brewing barleys, as compared with European varieties, have led to important modifications in American brewing procedures, differentiating them from the practices followed in other countries. The complex chemical, physical and biological reactions that occur during the transformation of barley to malt are described in detail in the article on MALT. It will suffice to point out here that during the steeping, germinating, withering and final kilning or drying operations of malting, there occur (1) the development or activation of amylolytic (diastatic) enzymes, (2) the development of proteolytic enzymes, (3) the partial conversion of the starch into dextrins and maltose, (4) the partial modification of the complex, high-molecular protein molecules in the barley, and (5) the partial disintegration of cell walls leading to a mellowing of the grain, often referred to as "modification." The ultimate quality of the malt will depend upon the extent to which these developments are permitted to proceed, improper control leading to "over-modified" or "under-modified" malts of inferior quality.

Depending upon the method of malting employed, various types of malt, such as Pilsener, Dortmund, Vienna and Munich types, are produced. These malts differ in colour, degree of modification, enzyme content and other properties and are used in the brewing of characteristic types of beer. The first two types yield beers of a very pale colour, the Vienna type produces a beer with a light amber or golden colour, while the Munich malts are used in the production of dark beers. American malts in general are intermediary between Pilsener, Dortmund and Vienna types, the so-called extra-pale malts approaching the Pilsener, while the high-dried malts resemble the Munich type somewhat and are used for the production of dark and bock beers.

Adjuncts.—The higher protein, enzyme and husk contents of American barley malts, as compared with European malts, led early to the adoption in America of malt adjuncts prepared from unmalted cereals. Thus early colonial beers were frequently brewed with additions of corn, potato starch, squashes, pumpkins and artichokes. It was not, however, until the 1880s that the use of cereal adjuncts was fully investigated and placed upon a thoroughly rational basis by the pioneer American brewing scientist, Dr. J. E. Siebel. Adjuncts are employed in amounts equivalent to about 20–40% of the total material by weight. They represent an economical source of extract which they furnish in the form of starch, dextrins and sugars, contribute little or no protein and only a negligible amount of mineral substances. They possess no enzymatic power, depending for their conversion into sugars on the excess amylolytic power of the malt. Adjuncts made from corn (maize) lead both in quantity produced and in economic importance. In their production white flint or dent corn is subjected to dry-milling, in the course of which it is freed from its husk, bran and germ, yielding the starchy endosperm in the form of grits, meals or flours of various degrees of fineness. Yellow corn is wet-milled into a practically pure corn starch known as refined grits. The products of both milling methods are so-called "raw adjuncts" in which the starch has not been gelatinized and which require cooking prior to their use in brewing. They may, however, upon further treatment with steam and the application of high pressures and temperatures be converted into gelatinized flakes, in which form they are added to the brewery mash.

Brewers' rice is a by-product of rice milling and is in demand as an adjunct for the production of pale bottle beers. Other cereal adjuncts, generally used only when the normal materials are not available, include unmalted barley, malted and unmalted wheat and oats, tapioca starch and milo corn. Thus, in the war year of 1943, when corn became exceedingly scarce for other than feeding purposes, raw barley was used to a considerable extent by American brewers as a substitute.

Brewing sugars and syrups are produced mainly from corn starch. In their manufacture, the purified starch is converted into dextrins and sugars under the influence of high temperatures and pressures, with small amounts of a mineral acid acting as a catalyst. Depending upon the degree of refining, the sugars and syrups range in colour from white to brown. Since they are free of starch and therefore require no further conversion, they are added directly to the kettle in the course of brewing. In addition to these corn products, malt extracts or malt syrups, which represent highly concentrated malt worts, are used to some extent.

Hops.—The use of hops in beer brewing became permanently established more than 1,000 years ago, while records of their previous use date back to the period of the Second Babylonian empire. Hops (*see* HOP) are perennials belonging to the group of nettles. The female plants bear cones consisting of small leaflet-like flowers provided with glands which secrete a golden-coloured resinous mass called lupulin. Fertilization of the flowers with pollen from male plants results in the formation of seeds. These are undesirable because of the unpleasantly bitter taste which they impart to the beer. As a rule, therefore, male plants are eradicated as completely as possible from hop gardens. Hops are grown in the U.S chiefly in the Pacific coast region of Oregon, Washington and California, where their cultivation was introduced in 1857, and to a limited extent in the state of New York. They are mostly derived from the English varieties, Fuggles and Clusters, and from Saaz (Bohemia) varieties. Great strides in their improvement have been made and their quality compares favourably with the best varieties imported from the famous European hop districts of Saaz, Hallertau, Styria and others.

Used originally to impart a bitter flavour to beer, hops have a manifold effect upon the beverage. They contribute to beer a variety of substances, including small increments of minerals, tannins which aid in effecting the protein precipitation during wort boiling, low-molecular proteins which serve as yeast food, the all-important bitter acids, humulon and lupulon, and their corresponding resins which occur in the lupulin and which impart the pleasant bitter taste to beer, and the essential hop oils, also found in the lupulin, which are responsible for the fine delicate aroma in ales and Pilsener beers Hops improve the biological stability of the beer and have favourable effects on fermentation, foam formation and retention of the finished beer, etc. The amount of hops used varies from 0.4 to 0.8 lb. per barrel for lager wort to as high as 1.5 lb. in ale and porter worts. Special hop extracts, prepared from fresh hops and containing the hop constituents in a concentrated form, are also used.

Water.—Beer on an average contains some 91% water. It is therefore not surprising that the character of the beer is to a large degree determined by the nature of the water used in its production. In fact, for many centuries in the past certain localities in Europe, such as Burton on Trent, Pilsen, Munich, Dortmund and others have enjoyed the reputation of producing excellent ales and beers of distinctive character which could not be duplicated elsewhere. The secret, unrecognized for a long time, lay in the peculiar composition of their waters. Natural waters in different localities vary considerably in their mineral contents and in the type of minerals present. Thus waters may be hard or soft, and their hardness may be of a temporary or permanent nature Temporary hardness in water is caused by the presence of bicarbonates of calcium, magnesium or iron and is so called because application of heat such as in boiling, will convert the soluble bicarbonates into insoluble carbonates which precipitate out and are removed by filtration, the water thus being softened Permanent hardness in water results from the presence of calcium, magnesium and iron salts other than the bicarbonates, such as calcium and magnesium sulphate and chloride. The salts, which occur in water in their dissociated ionic state, react not only with the mineral substances of malt, but exert far-reaching effects upon many of the fundamental reactions that occur throughout the various stages of brewing, such as enzyme activity, solubilization of hop constituents, yeast growth and fermentative action, conditions of active acidity (pH), colour production, and others. Thus it may be seen that the nature of the salts, and the extent to which they are present in water, is of considerable importance to the ultimate character and quality of the beer.

To be suitable for brewing, the water must be potable and of high biological purity, *i.e.*, it must be free of all odours, taints, and bacterial and organic contaminants; it must not contain iron in any form, and, for the production of the typical American pale beers, it should possess a medium degree of permanent, or sulphate, hardness. Since natural waters seldom meet all of these stringent requisites, the majority of them require treatment of some sort, such as filtration, chlorination or adjustment of their mineral contents by the addition of corrective salts. In general. waters high in permanent hardness are used in the production of pale, strongly hopped ales and beers of the Burton and Dortmund type, waters of medium permanent hardness are best suited for brewing the typical American beers, while waters having a medium temporary hardness are used for dark Munich type beers.

Enzymes.—Although enzymes can hardly be considered a brewing material, their importance in malting and brewing is such that a brief consideration of the nature and functions of the more significant enzymes encountered in these processes may be found useful at this point. Enzymes, in general, are organic catalysts of a protein nature elaborated in living cells only. They are normally encountered in extremely small concentrations, a fact which makes their isolation and purification difficult, but they possess tremendous capacities for catalyzing biochemical syntheses or cleavages. They are characterized by a high specificity in their action, *i.e.*, an enzyme will catalyze one specific synthesis or act upon one specific substrate only, a property which led Emil Fischer to state that an enzyme fits the substrate as the key fits the lock. The rate at which an enzyme will function is dependent upon several environmental conditions. Usually, enzyme activity is increased by a rise in temperature up to a certain point, after which the heat inactivates and finally destroys the enzyme; the hydrogen ion concentration (pH) exerts an important influence, each enzyme possessing a certain optimum pH range; the presence of activators or inhibitors, the concentration of the substrate and its physical state are other factors determining the rate of enzyme activity.

An elaborate system of enzyme classification has been set up which cannot be outlined here, but which divides the enzymes into two main groups according to their action: the hydrolases which catalyze hydrolytic cleavages in which water is taken up, and the desmolases which catalyze more drastic energy-yielding cleavages. Each of these main groups contains numerous divisions and sub-groups. Some of the more important hydrolytic enzymes active in brewing are: the phosphatases, as exemplified by amylophosphatase which splits off the phosphoric acid bound to the carbohydrate in starch; the carbohydrases which act upon carbohydrates as substrates and include (*a*) the hexosidases, such as invertase which hydrolyzes sucrose to glucose and fructose, and maltase which splits maltose into its two glucose molecules; and (*b*) the polyases which include the amylases, or diastase, the starch converting enzymes, and the cytases which attack the hemicelluloses of the cell walls; the proteases which catalyze the breakdown of proteins and include the proteinases which initiate the cleavage of larger proteins into smaller colloidal particles, and the peptidases which produce peptides and amino acids; and finally, the lipases which act on fats and oils, breaking them down into fatty acids and glycerine. The desmolases, whose activities enter intimately into the complex biochemical reactions that occur in fermentation and respiration, are largely oxidizing enzymes which catalyze a dehydrogenation, *i.e.*, they split off hydrogen. They include the oxidases and catalases. Their study is difficult and only fragmentary knowledge is available concerning their complex functions.

BREWING PROCESSES

Grinding of Malt.—The initial step in brewing is the proper reduction of the malt to a grist of suitable fineness. This is accomplished by special malt mills which subject the malt to a crushing, rather than a grinding action. The malt grinding operation has a three-fold object. It first aims at a clean separation of the husk from the endosperm of the malt kernel. It tries, secondly, to reduce the endosperm to a rather coarse meal with as little of fine flour as possible since the latter may interfere with subsequent mashing operations. It attempts, thirdly, to preserve the husk without too much disintegration to prevent impairment of its ability to serve as a filtering medium at the end of the mashing process. Malt from storage bins is first transferred by means of conveyors, elevators or pneumatic systems to a cleaning-reel where it is freed from last traces of malt sprouts, dust and foreign seeds. It then passes through either a simple malt mill possessing only one pair of steel rolls, or a multi-roller mill having up to six pairs of rolls. Modern mills are of the multi-roller type and are usually provided with separating screens which give them great flexibility for the purpose of by-passing or regrinding of selected mill streams. Additional equipment in the brewery mill room includes automatic scales and scale-hoppers for the accurate weighing of the malt and malt adjuncts.

Mashing.—The purpose of mashing is (1) to bring into solution those substances in the malt and adjuncts which are directly soluble in water; (2) to render insoluble substances soluble through enzyme action; and (3) to bring about enzymatic modification or conversion of starch, proteins, gums, etc., in such a manner and to such an extent that a wort of proper composition and acidity is produced. This three-fold purpose is accomplished by permitting physical, chemical and enzymatic processes to operate under closely controlled conditions of time and temperature. The physical processes involve bringing into solution such soluble malt components as sugars, dextrins, pentosans, protein, pectins, mineral salts, etc.; the swelling and gelatinization of starch granules at medium and high temperatures; and the coagulation of high-molecular proteins at the higher temperatures. The chemical processes result chiefly in the proper acidification of the mash and the formation of buffer substances and involve the interaction of the phosphates of the malt with the carbonates and sulphates of the brewing water. The enzymatic processes modify and bring into solution otherwise insoluble starches and proteins and determine the final composition and character of the wort. They are therefore of the utmost importance from a qualitative and quantitative standpoint. The amylases act upon the starches which are first liquefied and then converted into fermentable maltose sugar by beta-amylase and unfermentable dextrins by alpha-amylase. The proteolytic enzyme proteinase brings insoluble proteins into solution by breaking up the larger complex proteins into simpler ones known as albumoses, peptones and polypeptides. Some of these, in turn, are further reduced by the enzyme peptidase to peptides and amino acids, the basic units of proteins and important for yeast nutrition during subsequent fermentation. Since each enzyme involved is highly specific in its action and attains its optimum activity over rather limited temperature and pH ranges, the mashing process must be so conducted that the activity of each enzyme is properly controlled. The mashing operation is initiated in the mash-tub—a large metal vessel equipped with steam and hot water inlets, with agitators of the rake, paddle or propeller type, and with an array of temperature indicating and controlling instruments. Here are combined the malt and water, with the gelatinized adjuncts added at a later stage, in the proportion of 1 bbl. of water for each 100 lb. of brewing materials of which malt represents 60–80%, and adjuncts the balance. If raw adjuncts are used, they are first gelatinized in the cooker, a steam-heated vessel provided with stirrers. This cooker may be of either the open type or the pressure type. The so-called cooker-mash is prepared by doughing-in the grits, rice, etc., with 25–30% of their weight of malt at 100° F. The temperature is then progressively raised at definite time intervals until boiling is finally attained. This is continued until the adjuncts are completely gelatinized. The mashing procedure described in the following lines may be regarded as fairly typical, though many modifications are encountered in individual brewing plants. For the main-mash the remainder of the crushed malt is doughed-in at 95° F. and this temperature is maintained for 30 minutes or longer for the lactic acid rest, during which acidification of the mash occurs. The temperature is then raised to 113° F. for the protein rest, lasting 30 to 60 min., depending upon the character of the malt. At this temperature level the enzyme proteinase is very active, leading to the formation of low-molecular protein compounds. Further acidification of the mash also occurs and buffer substances are formed. This level is frequently used for the doughing-in of the malt when outside acidifying agents are used and the lactic acid rest is omitted. The next stage is the sugar rest at 133–140° F., lasting from 5 to 20 min. The enzyme beta-amylase has its optimum activity at this level, producing the fermentable maltose sugar from starch. Proteinase is also very active, producing chiefly peptone type compounds. The alcohol content of the final beer is determined at this stage, strong beers or ales being obtained when maltose production is prolonged for more than 10 min., while beers of low alcohol content result when this stage is passed over quickly or omitted entirely and the temperature raised directly to 153–160° F. At this dextrin-forming stage, which is held from 15 to 45 min., alpha-amylase, the enzyme which produces unfermentable dextrins, attains its maximum activity. It is during these last two stages that the cooker-mash is added to the main-mash. When flakes, *i.e.*, pre-gelatinized adjuncts are employed, the cooker-mash is omitted and the flakes added directly to the mash, usually at the dextrinizing temperature. Mashing is terminated when samples of the wort no longer give a colour reaction with a dilute iodine solution, thereby indicating that starch conversion is complete. The final mashing-off temperature of 167–173° F. inactivates all enzymes in a few minutes and the mash is ready for lautering and sparging.

Mashing Systems.—Several variations of the mashing process find practical application in different countries, the modifications being in part based on tradition and in part governed by the character of the available brewing materials and the type of beer produced. They are conveniently classified as infusion methods in which there is a gradual upward adjustment of the temperature, such as in the American mashing procedure just described, or, as is characteristic of British practice, in which a relatively constant temperature is maintained throughout, and as decoction methods in which boiling temperatures are attained and which are widely used in breweries of continental Europe. Variants of the decoction methods include (1) the three-mash system, used chiefly in the production of dark beers, in which three one-third portions of the main-mash are successively withdrawn, brought to a boil and returned, resulting in a step-wise increase in the temperature of the main-mash from 122° F. to 167° F.; (2) the two-mash system, used primarily in brewing pale beers, in which only two portions of the mash are withdrawn for boiling; (3) the one-mash system in which about 5% of the total mash is withdrawn, the remaining mash heated in stages to boiling, cooled by means of attemperators and then re-united with the previously withdrawn portion, the enzymes in the unboiled portion serving as conversion agents for the entire mash; and finally, (4) the high-quick-mash system in which mashing-in takes place at about 143° F., a part of the mash is brought to a rapid boil, returned, and a second portion is subjected to boiling which, on its return, brings the total mash to its mashing-off temperature of 172° F. This rapid system requires only two hours from its doughing-in stage to the lautering stage, as compared with five to six hours required by the more conventional systems used in Europe.

Lautering and Sparging.—Lautering, or filtration, may be carried out either in a combination mash-lauter tub, found chiefly in smaller brewery plants, or in a separate lauter tub. Both are provided with a perforated false bottom and with a number of outlets in their real bottom leading to the "pfaff" or tapping device. They are further equipped with rakes and so-called "sparge arms" or hot water pipes with perforations, centred over the tub and so designed that they will give an even, gentle spray of water when revolving slowly about their central axis. Upon termination of the mashing process, the mash is given a rest of about 30 min. to permit the insoluble residue, chiefly in the form of husks or "spent grains," to settle out and form a filter bed about 18 in. deep on the false bottom. The faucets of the pfaff are then slowly opened and the wort run into a closed, cylindrical wort receiver called the "grant." The initial turbid run is pumped back until it becomes clear and the first wort is then allowed to flow into the brew kettle. When the wort surface reaches the top of the spent grains, sparging with water at 167–178° F. is started, its purpose being to wash out all the extractives from the grains. The rakes and vertical lautering knives and the sparge arms revolve slowly, the first preventing channelling of the layers of spent grains, the latter assuring an even distribution of the sparge water. Sparging is continued until the wort shows an extract content of about 1%, in contrast to the 15–25% contained in the first wort.

Specially constructed mash filters which give a more efficient and rapid separation of the extractives from the spent grains with the use of lesser quantities of sparge water also find increasing use in brewery plants both in the U.S. and in Europe.

Boiling and Hopping of Wort.—The first wort and the sparges combine in the brew kettle to yield a greatly diluted "ketthe wort" which is then subjected to vigorous boiling of 2 to 2½ hours' duration. The kettle is a large copper vessel, frequently pear-shaped, provided with steam jackets, heating coils or percolators designed to withstand steam pressures of 30–60 lb. A large *brightly polished dome, from which rises a fairly wide vapour-venting pipe to the roof of the* brewhouse, covers the kettle and prevents the turbulent wort from spilling over. Kettles are available in a wide variety of designs and may attain capacities up to 600 bbl In the United States steam is the exclusive source of heat employed for boiling, while many European breweries still rely upon direct heating by fire. The objects of boiling are (1) the concentration of the diluted wort by the removal of excess water in the form of vapour, an evaporation rate of approximately 8–10% per hour being occasionally attained, (2) the complete inactivation of any enzymes that may have survived the mashing-off temperature so that further enzymatic changes in the composition of the wort are prevented, (3) the coagulation and subsequent precipitation in the form of flocculent masses known as the "kettle break" of the remaining higher-molecular proteins which are undesirable from the viewpoint of beer stability, (4) the extraction and emulsification of the bittering, preservative and aromatic substances from the hops, and (5) the sterilization of the wort. Many complex physical and chemical reactions occur during boiling which are not as yet fully understood but which exert important influences upon the final character of the beer. *The hops may be added at one time* or, as is done more frequently, at different stages of the boiling process, at the rate of 0.4 to 0 75 lb per barrel for lager beer, 0.6 to 1 lb. for American ale and up to 2.25 lb. for strong British ale and stout. The usual practice is to add about one-fifth of the total weight of the hops about one hour after boiling has started. By this time some wort protein coagulation and flocculation has occurred and given rise to the so-called first "hot break." The initial hop addition brings about the further coagulation and separation of high-molecular proteins in the form of tannin- and phlobaphene-protein compounds, thus clarifying the wort still further. After some 30 min. of additional boiling, the second hop addition, consisting of about two-fifths of the total hops, is made. The purpose of this hopping is to impart to the wort the bitter taste by bringing into solution the bitter acids and resins of the hops. Just before boiling is terminated, the remaining portion of the hops is added to extract the volatile essential oils responsible for the delicate hop aroma. The wort is then discharged, or knocked out, by opening the bottom outlet of the kettle. Many variations of the hopping process have been adopted. Some brewers, in order to preserve the elusive hop aroma and prevent the evaporation of the hop oil, allow the hot wort to run over part of the fresh hops, others add hops to the beer in the storage tanks, while still others may add pure hop oil to the beer. Whatever the method, skill and good judgment are required to impart to beer a distinctive and pleasing hop character.

Straining and Cooling of Wort.—After completion of boiling, the wort is passed through a hop strainer or "hop jack," which is a large vessel fitted with basket-shaped screens. Here the spent hops and the sludge comprising the kettle-break are filtered out. The hop jack is equipped with a sparge which permits nearly complete extraction of the wort from the spent hops.

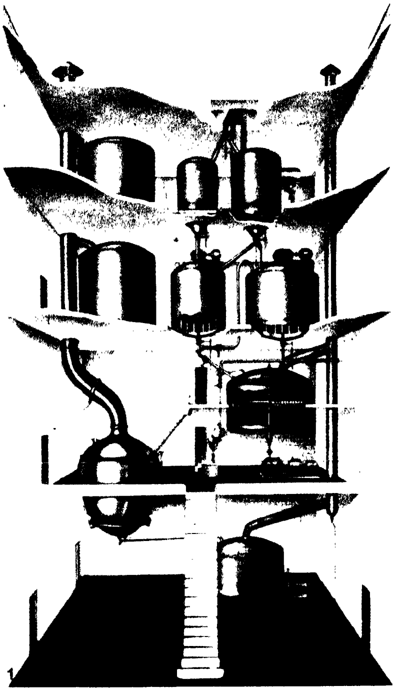
The wort is then passed into the cooling room where its temperature is lowered to 47° F. in lager brewing and to 58° F. in ale brewing. The wort cooler may be one of several types. Originally, the wort was allowed to cool in surface coolers which are large shallow vessels of sufficient capacity to hold the entire kettle charge, the wort standing not more than about six inches deep. These coolers were formerly constructed of wood, but are now made of copper, stainless steel or some other non-rusting metal. Despite strictly sanitary measures, bacterial contamination of the wort was formerly difficult to avoid. This led to the introduction of the enclosed double-pipe cooler and plate-type heat exchanger, and of the vertical Baudelot cooler which consists of a series of horizontal tubes through which the cooling medium circulates and over which the wort flows in thin sheets. The advantages of this last type of cooler are that cooling proceeds at a rapid rate and that the wort still receives adequate aeration thought necessary for the subsequent yeast fermentation. Many breweries have retained the surface cooler, permitting the wort to cool by evaporation to about 160° F., and then running it over the Baudelot cooler. As the wort cools, there occurs a precipitation of protein-, tannin- and hop resin-compounds in the form of coarse and fine flocs. This "cold break," which is of considerable importance to subsequent fermentation and ultimate beer character, brings about a far-reaching clarification of the wort. Modern air conditioning practices and strictest sanitary control measures have largely eliminated the dangers of infection at the critical temperature stages during cooling, and wort spoilage, formerly the bane of nearly every brewery, is now rare.

FERMENTATION

Yeast.—Probably the most decisive phase in the entire brewing process is the fermentation of the wort, a process which changes this bitter-sweet, harsh-tasting solution into an effervescent beverage of a mildly bitter taste and a delicately aromatic flavour. This remarkable transformation is brought about by the action of a uni-cellular fungus, the yeast (*q.v.*). Each yeast cell represents an independent organism performing all the necessary functions of life. The shape of the cell may vary from a spherical to an oval form, depending upon type, age, conditions of growth, etc. Similarly, the size of the cell may vary from 1 to 5 *microns in width and 1 to 10 microns in length*. Despite its minute size, the yeast cell represents a highly complex organism from a cytological and physiological viewpoint. It is composed of living protoplasm, a grayish, granulated, semi-fluid mass in appearance, enclosed in a transparent permeable wall. Embedded in the protoplasm is the nucleus, a round, rather dense body, which is vitally concerned with the hereditary characteristics of the cell and which also plays an important rôle in the metabolic activities of the cell. Yeast reproduces vegetatively by budding in which the cell produces a small protuberance or bud which gradually increases in size and finally separates from the original mother cell, forming a new independent organism capable of undergoing the same process. The enzymes found in the yeast cell represent to a large degree the key to its behaviour. Among the more important hydrolytic yeast enzymes are the carbohydrases which act upon a variety of carbohydrate substrates and reduce them to simple sugars, mainly dextrose; the proteolytic enzymes which degrade proteins and peptides; the esterases which attack nucleic acid and hexoses; the amidases which act on asparagine; and the lipases which convert fats into fatty acids and glycerine. Among the desmolases of yeast, the most important one is the zymase system which is a complex consisting of the enzymes hexokinase, oxido-reductase, enolase, carboxylase and others, and which is directly involved in the transformation of the wort sugar into carbon dioxide and alcohol. In a number of cases, there exists a close relationship between the active portion of enzymes, the so-called "co-enzymes," and the vitamins and hormones. Although fermentation is mainly a process of alcohol and carbon dioxide formation, it is accompanied by many highly complex and as yet little understood side-reactions leading to the formation of esters, acids, aldehydes, glycerine and other products, all of which have a decisive influence on the final aroma and flavour of the beer. In the course of fermentation the pH of the wort drops from about 5.2 to about 4.5, the yeast grows and multiplies rapidly at first, more slowly toward the end, increasing some four to five times in quantity, heat is liberated at the rate of about 260 B.T.U. per each pound of sugar fermented, about equal amounts of CO_2 and alcohol are formed, and further amounts of proteins and tannins are precipitated out.

Brewery yeasts, all of which belong to the species *Saccharomyces cerevisiae*, are generally divided into two major groups, the top-fermenting yeasts and the bottom-fermenting yeasts. In addition to other distinguishing characteristics, such as differences in shape, in rates of fermentation and respiration, in ability to hydrolyze and ferment certain carbohydrates, etc., their main distinction lies in the fact that the top yeasts tend to be uniformly distributed in the fermenting wort and, producing abun-

BREWING



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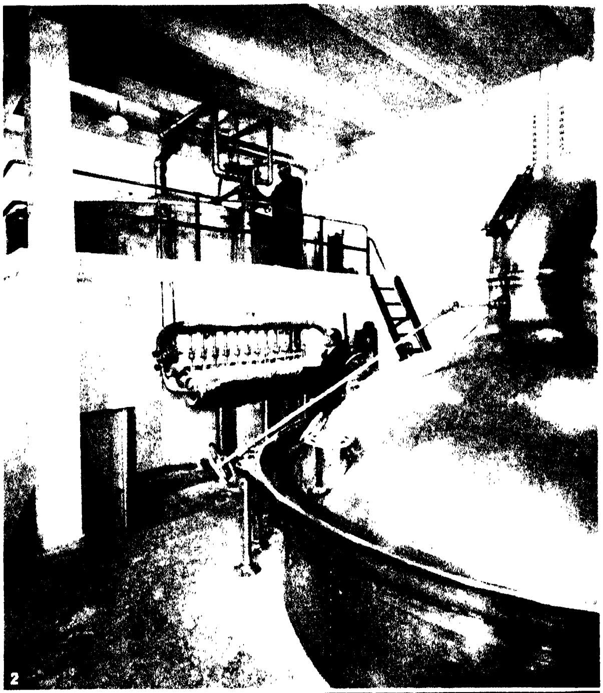

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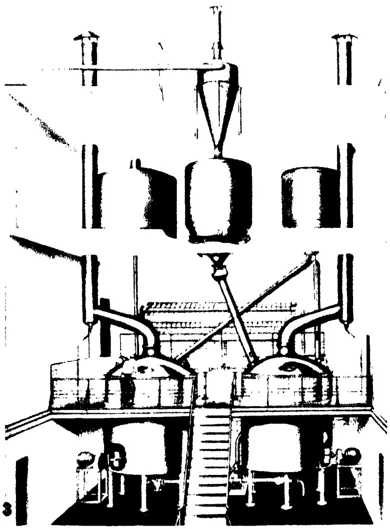

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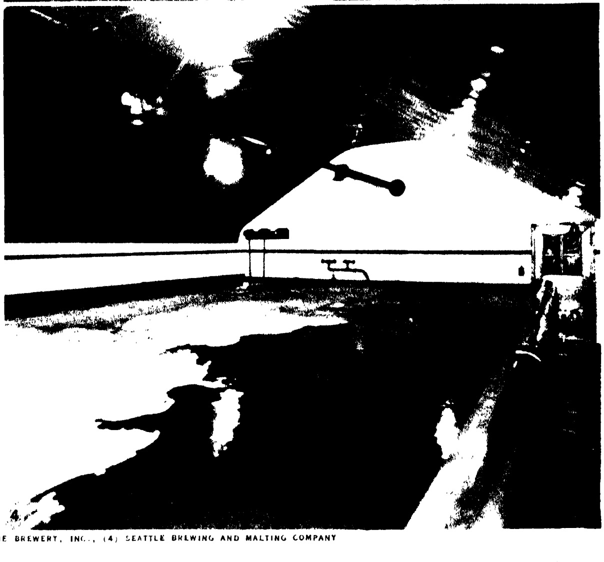

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BY COURTESY OF (1, 3) SIEBEL INSTITUTE OF TECHNOLOGY, (2) THE SPOKANE BREWERY, INC., (4) SEATTLE BREWING AND MALTING COMPANY

1. Diagrammatic scheme of a conventional brewhouse showing water tank, adjuncts and malt hoppers on top floor, water tank, adjunct cooker and mash tub on next floor, lauter tub and brew kettle on second floor and hop jack on bottom floor

2. View of brewhouse interior showing mash tub on upper floor level in background, the "pfaff" and grant underneath, and the brew kettle in the immediate foreground

3. Diagrammatic scheme of the Siebel modernized brewhouse showing water tank, adjuncts and malt hoppers on top floor and two digesters on upper level of first floor with mash filter in background. The two digesters function interchangeably as adjunct cooker, mash tub and brew kettle

4. Example of a surface cooler or "Kuehlschiff" where the boiled wort is allowed to cool slightly and to deposit the insoluble sludge or "trub"

BREWING

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BY COURTESY OF (1) PITTSBURGH BREWING COMPANY (2) SEATTLE BREWING AND MALTING COMPANY (3) THE SPOKANE BREWERY, INC., (4) CENTLIVRE BREWING CORPORATION, FORT WAYNE, IND.

1. Installation showing vertical or "Baudelot" cooler where the wort, by flowing in thin sheets over the pipes through which circulate cold water, chilled brine or ammonia refrigerant, is cooled to the proper temperature for "pitching" with yeast
2. A fermentation cellar where the wort is fermented, in this particular instance, in wooden tanks of the open type. The contents of the tanks represent wort in different stages of "Kraeusen" of bottom fermentation or lager beer production
3. View of a section of a storage cellar showing large closed tanks in which the beer matures for several weeks. Manholes near bottom of tanks allow access of workers for cleaning of tank interiors
4. Partial view of bottling line showing bottles on conveyor coming from bottle washer (left) and being fed to filler (centre) and crowner (right), the bottles eventually passing to the pasteurizer

dant carbon dioxide gas early in the fermentation, are carried to the surface where they form a thick layer, while bottom yeasts, at the beginning, tend to settle rapidly to the bottom of the fermenting tank. The former are used exclusively in the brewing of ales, the latter in the brewing of lager beers.

One of the major advances in the science of brewing came when Pasteur, in 1860, showed that the chemical act of fermentation is essentially a life function of the yeast cell. This discovery brought into the foreground of scientific attention the vital importance of the type of yeast to beer quality and led to far-reaching investigations on yeast. In 1883, the Danish scientist Emil Christian Hansen developed a pure culture method which permits the isolation of a single yeast cell and its subsequent cultivation into a pure strain. This method, adopted by many breweries throughout Europe and America, makes possible the uninterrupted propagation of a single pure strain of yeast from year to year, thus assuring uniform fermentation characteristics for each succeeding brew. Under practical conditions, sufficient yeast from a preceding brew is retained to start the next brew. Yeast, however, may tend to degenerate after being passed through repeated fermentation cycles, becoming contaminated with various types of non-pathogenic bacteria, wild yeasts and organic substances, such as resins, gums, proteins, etc., and losing its fermentative power. It is under such exigencies that the pure culture method safeguards the maintenance of the strain.

Bottom Fermentation.—This type of fermentation is used for the production of the typical American lager beers. First introduced in southern Germany in the middle of the 15th century as a measure to produce a more stable beer, its use spread throughout Europe until by the middle of the 19th century it had been almost universally adopted, except in England where top-fermentation continued almost exclusively. The method was introduced in the United States by German brewers in the 1860s and practically superseded top-fermentation.

In bottom fermentation, the wort, cooled to a temperature of 47° F. is run into a so-called starting tank or settling tub and "pitched" with yeast at the rate of about ¾–1 lb. per barrel of wort. It is a common practice first to prepare the yeast with wort into a thin-flowing slurry and to aerate it in order to promote its vigorous growth. Fermentation of the wort soon sets in after pitching with yeast, a feathery white foam appearing around the edges of the starting tank. After some 15 to 24 hours, the fermenting wort is pumped into clean fermenting tanks, carrying along the vigorous and healthy yeast and leaving behind dead or weak cells and the coarse protein-tannin compounds which have settled out. This results in a purer fermentation, a cleaner yeast crop and an improved beer flavour. Fermentation now becomes highly active and the wort surface becomes covered with a dense white foam called "kraeusen." This foam increases in height and density until the stage of "high kraeusen" is reached on about the third to fourth day. During this period of vigorous fermentation up to 1.5% of extract is fermented daily and the temperature rises to 55–60° F., a further increase being prevented by cooling with attemperators with which the fermenting tanks are equipped. After the fifth day, the rate of fermentation recedes slowly, the stage of "falling kraeusen" is reached, *i.e.*, the foam collapses gradually, leaving a thin brownish scum of intensely bitter taste which must be skimmed off, the yeast settles to the bottom of the tank to form a dense layer, and the temperature begins to decrease. Fermentation ceases entirely after 8 to 10 days and the "green" beer is now pumped into the "Ruh" cellar or storage cellar after being cooled to a temperature of about 36° F. The bottom of the fermenting tank is covered by three successive yeast layers totalling about two inches in thickness. The bottom layer represents weak cells which settled out first, the thick, pale-coloured middle layer consists of healthy and vigorous yeast cells, while the upper layer generally contains objectionable yeast cells. This layer is removed and discarded. The second layer of healthy yeast cells is carefully collected, passed through screens to remove various impurities and washed with sterile water. It is then used for pitching subsequent brews. The bottom layer is usually flushed out into the sewer.

In American practice some of the wort from the starting tank is usually diverted into special closed fermenters capable of withstanding pressures up to 25 lb. Here the wort undergoes its most active phase of fermentation, evolving large quantities of carbon dioxide gas. After initial venting of the tanks to expel the air and other aromatic gases produced during the initial stages of fermentation, the carbon dioxide gas is then collected, further purified to reduce impurities to less than 0.2%, compressed and finally stored in special pressure tanks to be used for the subsequent carbonation of the beer. The wort may then either be permitted to complete its fermentation in the closed fermenters or be transferred into open tanks.

In European lager breweries where carbonation is not practised extensively, fermentation is interrupted while the wort still contains about 1% of fermentable extract. The fermented wort is then pumped into closed pressure tanks in the storage cellar, where a slow secondary fermentation at a temperature of 39–43° F. occurs, the carbon dioxide gas being formed at this stage impregnating the beer and thus producing the desired degree of carbonation.

Top Fermentation.—This type of fermentation, used in the production of ales, differs from bottom fermentation in several important aspects. The yeast employed is of a special kind that rises to the top of the fermenting wort and is active at rather higher temperatures than lager yeast. Its rate of growth and fermentation is also greater so that slightly lower pitching rates, ranging from one-third to one-half lb. per barrel, are required The pitching temperature is held at 54–59° F. in American practice, slightly higher (58–60° F.) in England. During fermentation the temperature is permitted to rise to 68–70° F. The combination of special yeasts and higher fermentation temperatures is responsible for the greater production of aromatic substances which impart to the finished ale its characteristic flavour and aroma. Fermentation lasts usually from six to seven days. The surface of the wort is first covered by a white foam, which is replaced by so-called "rocky heads," *i.e.*, a rather heavy dense foam carrying dark masses of resins and protein particles from the wort. These are skimmed off to prevent their redispersal in the wort. Next follows a rather loose foam which may attain a depth ranging from 2 to 6 ft., depending upon the depth of the wort and the rate of fermentation. At this period the maximum temperature is also generally attained. This foam then begins to collapse and the yeast rises to the top, forming a dense layer which is collected either by skimming or by being permitted to work over the rim of the tank into special chutes or troughs A yeast cover, about 1 in. thick, is left on top of the wort surface to protect it from air-borne infection. A number of different top-fermentation systems have been developed, including (1) the skimming system which is essentially as described above, (2) the dropping system in which the fermenting wort is transferred from the fermenting tank to a cleansing tank when it has reached the stage of high foam formation, (3) the Burton Union system in which the wort is first fermented for about 36 hours in small fermenters of about 50 bbl. capacity and then transferred into special "union" casks in which it clarifies in about five days, and (4) the Yorkshire Stone Square system in which covered slate vessels are used and the fermenting wort is subjected to periodic and frequent pumping. All these systems, excepting the first, are limited in their practical application to England where they are used to produce special types of ale enjoying local favour. Because of their high labour requirements and other factors they are being slowly replaced by the more conventional skimming system which is now practised in nearly all larger plants.

Cellar Processing.—The young fermented beer is allowed to mature or age for a period ranging from one to three months or longer at temperatures close to the freezing point of water, *i.e.*, 32–34° F. The tanks used for this purpose are of the closed type, generally of large capacity, and may be constructed of wood, steel, stainless steel, aluminum or concrete and are coated on the inside with non-soluble, tasteless and odourless lacquers, pitches, synthetic resins, glass enamel, etc. Several different methods of treating the beer in the cellars are in use, all of which, however, aim at the same objectives, namely, to bring about a clarification, mellowing, stabilization and carbonation of the beer. One traditional method, no longer used extensively, is to first store the green beer in the so-called Ruh cellar for a period of three to six weeks under a slight carbon dioxide pressure. During this resting stage many of the insoluble hop resins, protein particles and yeast cells settle out, the enzyme-induced formation of esters and other aromatic and flavouring substances, important to the final character of the beer, occurs, and the beer in general becomes bright. Subsequently the aged beer is transferred into closed tanks in the chip cellar, and kraeusen added. This may be either in the form of wort kraeusen, *i.e.*, fermenting wort in the high kraeusen stage, or sugar kraeusen which is a mixture of boiled sugar solution with added yeast. As a rule, about 15–25% of kraeusen is added to draught beer and 5–15% to beer intended for bottling. The ensuing slow after-fermentation produces carbon dioxide gas which dissolves in the beer and thus carbonates it. Pressure is controlled at about five-eighths lb. per sq.in. by a so-called bunging apparatus which connects with the storage tanks. The secondary fermentation having ceased, the beer is allowed to age some more in the finishing cellar. Formerly, clarification of the beer was promoted by placing beechwood strips, called chips, in the tanks, and by the addition of fining material, or isinglass. This practice, however, is followed in only a very few brewing plants. In fact, the entire process of kraeusening has been largely superseded by direct carbonation. In this method, the aged beer is transferred from the Ruh cellar directly to pressure tanks in the finishing cellar where it is subjected to carbonation which is a process in which the beer is impregnated with pure carbon dioxide gas until it contains some 0.45–0.55% of gas by weight. Carbonation is attained by various means such as by absorption in so-called saturators, by injection in special carbonating arms or pumps, or by diffusion of the gas through porous stone in the tanks themselves. In each case, close control of the operation is essential to assure that correct gas volumes are added to the beer. An innovation in modern American brewing practice is to filter the fermented green beer prior to its storage with the aid of diatomaceous earth. By removing completely all yeast cells, and other insoluble matter, this filtration prevents the undesirable autolysis products of yeast from passing into the beer. In European practice, as was indicated above, the beer is allowed to undergo a natural slow after-fermentation in the storage cellar to attain the desired degree of carbonation.

In ale brewing, the beer is matured at the higher temperatures of 40–46° F. which assist in developing the typical ale character. The hop flavour of ale is usually further accentuated at this stage by "dry-hopping" at the rate of one-fifth to two-thirds lb. per barrel. In American practice, the further treatment of ale in the cellar is practically the same as that of beer. In England and some other sections of Europe some types of ale are subjected to a secondary fermentation after having been filled into the barrels in which they are sold. This fermentation is induced by the addition of primings consisting usually of sugar solutions of a certain specific gravity. It accelerates the conditioning of the beverage and determines its flavour characteristics.

Prior to filling into trade packages the beer undergoes final polishing by being passed through a pulp filter which imparts to the beer that sparkling brilliance demanded by the consuming public. It is also customary to blend several brews to attain uniformity of beer character. The beer is further treated with minute quantities of special enzyme preparations (chill-proofing agents) which convert the larger partially soluble proteins of the beer into completely soluble, non-precipitable proteins so that the beer remains brilliant even upon exposure to freezing temperatures. For taxing purposes, bottle beer receives its final storage in so-called government cellars which contain accurately calibrated storage tanks or beer meters. Here federal tax officers supervise the filling and withdrawing of the beer.

Racking.—In this operation beer is transferred from the tanks of the finishing cellar into barrels which are shipped to the trade. Barrels contain standard volumes ranging from 31 U.S. gallons for the full barrel to slightly less than four gallons for eighths. They are usually made of oak wood and are lined with special pitch to prevent contact of the beer with the wood. In recent years barrels made of laminated wood, steel, stainless steel and aluminum have made their appearance and found a favourable reception. Prior to filling with beer, the barrels are thoroughly washed with hot water and sterilizing solutions on automatic washing machines, or re-pitched, the old pitch lining being first removed, generally by heat, occasionally through the use of solvents. Since beer is a perishable product, strict sanitary control of barrel interiors is of vital importance. The barrels are filled by semi-automatic rackers which operate on the counter-pressure principle, *i.e.*, a gas pressure equal to that in the racker is first established in the barrel to prevent the rapid evolution of carbon dioxide from the beer which would otherwise occur. Upon filling, the barrels are sealed with bungs and tax stamps are affixed in such a position that when the barrel is tapped by the beer dispenser the stamp is destroyed. Draught beer in barrels and in quart and half-gallon bottles must be stored at low temperatures to prevent possible deterioration.

Bottling and Pasteurization.—After the re-introduction of beer in 1933, there was a marked increase in the popularity of so-called packaged beer, *i.e.*, beer filled in bottles and cans, its sales rising in the United States from approximately 25% of the total beer production in 1933 to nearly 61% in 1943. One of the main factors to which this increase may be attributed is the more widespread consumption of beer in the American home.

Because considerable time may elapse before bottle beer is consumed, and because such beer is frequently exposed to drastic temperature changes, particular care is exercised in its production. Beer, to be suitable for bottling, must be brilliant and free from sediment, chill-proof, *i.e.*, capable of withstanding drastic temperature fluctuations without developing a haze, biologically stable, and must possess a clean aromatic odour, a pleasing taste and good foaming qualities when poured into a glass.

A variety of standardized forms and sizes of bottles are in use, including the so-called Stubby, Steinie, Packie, Export and Single Trip bottles which have capacities ranging from 7 to 64 fluid ounces. The glass colour may be white, brown or green. Empty bottles returned from the trade are first inspected for gross contamination and are then passed through an automatic bottle washer. Here they are submerged in soaking tanks containing sterilizing caustic solutions at elevated temperatures; subsequently their interiors are further cleansed with brushes or hot water jets, and the entire bottle, in the final stages of washing, is subjected to a series of hot and cold fresh water rinses The bottles, emerging from the washer in a sparklingly clean and sterile condition, next pass an inspection light and are conveyed to the automatic rotary beer fillers. These units, by means of ingenious valve mechanisms, dispense the beer from tanks into the bottles at rates reaching 250 bottles per minute. The more modern fillers first establish a carbon dioxide counter-pressure in the bottles to avoid excessive foaming and to expel the air which may have a detrimental effect upon beer quality. From the filler the bottles pass on to the crowner, further precautions being taken during the short passage to eliminate the final traces of air in the neck space of the bottle by foaming which may be induced by injecting small amounts of beer or by slight jarring of the bottles by means of a knocker. The crowning machine seals the bottles with crowns which are thin, tin-coated metal shells lined with cork tabs that fit tightly over the lip of the bottle. Cans with conical tops are filled and sealed in a manner similar to that of bottles. For flat top cans a special can filling and sealing unit is required.

Beer, like milk, is a highly perishable food product and, as in the case of milk, its biological stability is greatly improved by pasteurization. Therefore all packaged beer, excepting that dispensed in the larger half-gallon bottles, is normally pasteurized. The bottles, coming from the crowner, next pass into huge pasteurizers of either the submersion or spray type. Based on practical experience, a pasteurization procedure has developed in the United States which provides for maintaining the beer at a temperature of 135–140° F. for 15 to 20 min. The necessity for gradual heating and cooling of the bottles to avoid excessive breakage results in a typical pasteurization cycle requiring approximately 55–60 min. for bottles and 40 min. for cans. Following pasteurization, the bottles pass through automatic labellers where they are provided with labels, neck bands and, in some instances, neck foils. They are finally placed in cartons or wooden boxes by semi-automatic packaging and sealing machines and are then ready for shipment.

By-Products of Brewing.—The main by-products of the brewing process are the spent grains, the spent hops and the surplus brewers' yeast. The spent grains represent a valuable feed supplement that is rich in protein and fat. They have been utilized for many years as an addition to the regular rations for farm animals. Spent grains are used either in their original wet state containing some 75% of water, or are dried in large drum dryers to contain no more than 7% of moisture. Because drying improves their biological stability, facilitates their storage and reduces shipping costs, an increasing proportion of the available spent grains is being dried, especially in breweries located at some distance from agricultural districts. For the year ending June 30, 1943, some 228,000 tons of dried spent grains were produced in the United States, an increase of more than 60% over the preceding year. No really satisfactory use has as yet (1944) been found for spent hops, although they find some application as a feed supplement, fertilizer and in industrial manufacture.

Although the nutritional and medicinal values of brewers' yeast have been recognized since antiquity, few rational efforts to utilize its full potentialities were made until about 1910 when the first yeast dryers were developed. Great progress in yeast utilization in the United States has been made since 1933 and particularly under the impetus of World War II. Dried brewers' yeast contains about 50% of protein of good quality, 2% of fat, 30–40% of carbohydrates, and 2–10% of ash or minerals. On a per pound basis, dried brewers' yeast contains an average of 31.2 mg. of thiamin, 20.27 mg. of riboflavin, 216.7

mg. of nicotinic acid (niacin), 59.6 mg. of pantothenic acid. It is thus one of the most potent natural sources of the vitamins of the B-complex. When irradiated, it is further a rich source of vitamin D. For use as a feed supplement, brewers' yeast is washed and then dried in spray or drum dryers. When used for food or pharmaceutical purposes, it is also debittered by repeated washings in weak alkaline solutions and fresh water. The greater portion of dried yeast goes into the production of animal feeds, food products for human consumption, pharmaceuticals and vitamin concentrates. Other uses are in the manufacture of fertilizers, rosins, glues, polishes, plastics, etc. The potential output of dried yeast in the United States is estimated at 41,000,000 lb.

Science and Technology of Brewing.—Until the 1860s, when the great French scientist, Louis Pasteur, first published his epochal studies on yeast fermentation and, shortly thereafter, on the bacterial causes of beer spoilage, brewing was based largely upon empirical knowledge. Pasteur's discoveries were soon followed by Hansen's studies of the yeast cell and by his development of the pure culture yeast method. Then came in rapid succession the scientific investigations of the processes underlying brewing and fermentation by such investigators as Windisch, Delbrück, Lintner, Balling, Siebel, Schwarz, Henius and others. Their researches exerted a tremendous influence not only upon the scientific aspects of brewing alone, but also upon the general advancements in such fields as biology, biochemistry, bacteriology and medicine, since many of the facts discovered by these scientists constituted universal principles of greatest significance to the biological sciences in general. The same period saw the introduction of mechanical refrigeration and of the improved pulp and diatomaceous filter-aid filters, two developments which found their first practical applications in breweries and which, in turn, had a profound effect upon brewing technology. As new technological innovations made their appearance they were rapidly adopted by the brewing industry until many of the phases of brewing were under the control of scientific precision instruments. Outstanding mile-stones in the development of brewing technology, particularly as they apply to American practices, were the introduction of processed cereal adjuncts; improvements in the mashing process leading to more efficient operations; the modernization of brewhouse equipment and procedures; wort cooling under sterile conditions by means of mechanical refrigeration; the Natural Pure Culture Yeast system based upon a rational procedure of fermentation and yeast recovery; carbonation of beer with pure carbon dioxide gas; the enzymatic stabilization of beer colloids resulting in chill-proof beers; the application of mechanical refrigeration to brewery cellars; the wide-spread use of air-conditioning; the phenomenal improvements in bottling and pasteurizing equipment and methods; and the introduction of the beer can. These advances were pioneered by such scientists as Hantke, Henius, Siebel, Schwarz, Wallerstein, Wahl and others. Nearly all breweries avail themselves of the services offered by independent scientific research laboratories and stations specializing in fermentation technology to assist in maintaining constant technical supervision over all phases of beer production. Some breweries also maintain their own control laboratories.

Economic Importance of the Brewing Industry.—With the signing of the Cullen-Harrison bill in the U.S. on March 22, 1933, by President Franklin D. Roosevelt, legalizing 3.2% beer, an industry of great economic importance was resurrected after 13 years of prohibition. The magnitude of the U.S. brewing industry's contributions to the economy of the nation is revealed by the following partial statistics for the fiscal year ending June 30, 1943. In that year U.S. breweries produced 68,910,219 barrels of beer and ale. To attain this volume, the industry used approximately 72,250,000 bu. of malt, 41,000,000 lb. of hops, 21,200,000 bu. of corn and 245,500,000 lb. of rice. Some 50,000 brewery workers received an estimated total of $97,500,000 in wages and salaries. Total federal tax payments by the industry amounted to $455,872,516. Other taxes, including state, local and miscellaneous levies, totalled an estimated $150,000,000, bringing the aggregate sum paid out by the brewing industry in that year to an estimated $605,634,000. Expenditures for such necessities as plant equipment, barrels, bottles, closures, boxes and cartons, transportation, construction, real estate, power and fuel, advertising, etc., amounted to many additional hundred millions of dollars. The distribution and sale of beer is a sizable industry in itself which provides employment to some 980,000 wholesale and retail establishment proprietors and employees whose aggregate payrolls are estimated to exceed $1,000,000,000 annually.

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BREWSTER, SIR DAVID (1781–1868), Scottish physicist, and one of the founders of the British Association, was born at Jedburgh on Dec. 11, 1781, and died on Feb. 10, 1868, at Allerby, Melrose. He made his name by a series of investigations on the diffraction of light, the results of which he contributed from time to time to *Philosophical Transactions* and other scientific journals.

The most important subjects of his enquiries are enumerated by J. D. Forbes, in his preliminary dissertation to the 8th ed. of the *Encyclopædia Britannica*, under the following five heads: (1) The laws of polarization by reflection and refraction, and other quantitative laws of phenomena; (2) the discovery of the polarizing structure induced by heat and pressure; (3) the discovery of crystals with two axes of double refraction, and many of the laws of their phenomena, including the connection of optical structure and crystalline forms; (4) the laws of metallic reflection; (5) experiments on the absorption of light. In this investigation the prime importance belongs to the discovery (1) of the connection between the refractive index and the polarizing angle, (2) of biaxial crystals, and (3) of the production of double refraction by irregular heating.

Brewster was elected F.R.S. in 1815, and was awarded the Rumford gold and silver medal for his discoveries in connection with the polarization of light in 1818. He did not invent the kaleidoscope, but he may be said to have rediscovered it. He improved the stereoscope by suggesting the use of lenses to combine the dissimilar binocular pictures. More important was his work in persuading the British authorities to adopt the dioptric apparatus, perfected by Fresnel, in their lighthouses. He suggested its use for this purpose as early as 1820. Brewster was one of the group of scientific men who assembled in the archiepiscopal palace at York and developed the idea of a British Association for the Advancement of Science, realized in 1831. In 1838 Brewster became principal of the united colleges of St. Salvator and St. Leonard, St. Andrews, Scotland, and from 1859 till a short time before his death was principal of Edinburgh university.

In 1849 he had the honour of succeeding J. J. Berzelius as one of the eight "foreign associates" of the Institute of France.

In spite of his activity in research and, in his later days, in university life, Brewster accomplished a mass of literary work. He edited the *Edinburgh Encyclopaedia* (1808–30), was one of the leading contributors to the 7th and 8th editions of the *Encyclopædia Britannica*, joint editor (1819–24) of the *Edinburgh Philosophic Journal*, and then (1824–32) editor of the *Edinburgh Journal of Science*. Among his many separate publications may be mentioned his *Treatise on Optics* (1831) and his *Memoirs of the Life, Writings and Discoveries of Sir Isaac Newton* (1855).

See *Home Life of Brewster* (1869) by his daughter, Mrs. Gordon; Ostwald's *Klassiker der exacten Wissenschiften*, No. 168 (Leipzig, 1908).

BREWSTER, WILLIAM (*c.* 1566–1644), American colonist, one of the leaders of the "Pilgrims," was born at Scrooby, Notts, England, *c.* 1566. After studying for a time at Cambridge, he was from 1564 to 1587 in the service of William Davison (?1541–1608), who in 1585 went to the Low Countries to negotiate an alliance with the States General and in 1586 became assistant to Walsingham, Queen Elizabeth's secretary of State. Upon the disgrace of Davison, Brewster removed to Scrooby, where from 1590 until Sept. 1607 he held the position of "Post," or postmaster responsible for the relays of horses on the post road. About 1602 his neighbours began to assemble for worship at his home, the Scrooby manor house, and in 1606 he joined them in organizing the Separatist Church of Scrooby. After an unsuccessful attempt in 1607 (for which he was imprisoned for a short time), he, with other Separatists, removed to Holland in 1608 to obtain greater freedom of worship. At Leiden in 1609 he was chosen ruling elder of the Congregation. In Holland he supported himself first by teaching English and afterwards in 1616–19, as the partner of one Thomas Brewer, by secretly printing, for sale in England, books proscribed by the English Government, thus, says Bradford, having "imploymente inough." In 1619 their types were seized and Brewer was arrested by the authorities of the University of Leiden, acting on the instance of the British ambassador, Sir Dudley Carleton. Brewster, however, escaped, and in the same year, with Robert Cushman (*c.* 1580–1625), obtained in London, on behalf of his associates, a land patent from the Virginia company. In 1620 he emigrated to America on the "Mayflower," and was one of the founders of the Plymouth Colony. Here besides continuing until his death to act as ruling elder, he was also—regularly until the arrival of the first pastor, Ralph Smith (d. 1661), in 1629 and irregularly afterward—a "teacher," preaching "both powerfully and profitably to ye great contentment of ye hearers and their comfortable edification." By many he is regarded as pre-eminently the leader of the "Pilgrims." He died, probably on April 10, 1644.

See Ashbel Steele, *Chief of the Pilgrims; or the Life and Time of William Brewster* (Philadelphia, 1857); and a sketch in William Bradford's *History of the Plimouth Plantation* (new ed., Boston, 1898). Also Justin Windsor, *Elder William Brewster of the "Mayflower"* (1887); George W. Chamberlain, "William Brewster, the Pilgrim Printer," *Magazine of History*, vol. xv., p. 63–66 (1912); and Edward B. Pollard, "Elder Brewster, Lay Preacher of the Pilgrims," *Homiletic Review*, vol. lxxx., p. 264–268 (1920).

BRÉZÉ, the name of an Angevin noble family, the most famous member of which was PIERRE DE BRÉZÉ (? 1410–1465), one of the trusted soldiers and statesmen of Charles VII. He had made his name as a soldier in the English wars, and during the Praguerie he supported the royal cause against the dauphin Louis and the revolted nobles, a service which was remembered against him after Louis's accession to the throne. He fought against the English in Normandy in 1440–41, and in Guienne in 1442. He became chamberlain to Charles VII., and gained the chief power in the State through the influence of Agnes Sorel. The six years (1444–50) of his ascendancy were the most prosperous period of the reign of Charles VII. The dauphin Louis in 1448 brought against him accusations which led to a formal trial, resulting in a complete exoneration of Brézé and his restoration to favour. He fought in Normandy in 1450–51, and became seneschal of the province after the death of Agnes Sorel and the consequent decline of his influence at court. He made an ineffective descent on the English coast at Sandwich in 1457, and was preparing an expedition in favour of Margaret of Anjou when the accession of Louis XI. brought him disgrace and a short imprisonment. In 1462 he accompanied Margaret to Scotland with a force of 2,000 men, and after the battle of Hexham he brought her back to Flanders. He was reappointed seneschal of Normandy, and fell in the battle of Montlhéry, July 16, 1465. He was succeeded as seneschal by his eldest son Jacques de Brézé (*c.* 1440–90), count of Maulevrier; and by his grandson, husband of the famous Diane de Poitiers, Louis de Brézé (d. 1531).

The lordship of Brézé passed eventually to Claire Clémence de Maillé, princess of Condé, by whom it was sold to Thomas Dreux, who took the name of Dreux Brézé, when it was erected into a marquisate. HENRI EVRARD (1762–1829), marquis de Dreux-Brézé, succeeded his father as master of the ceremonies to Louis XVI. in 1781. On the meeting of the states-general in 1789 it fell to him to regulate the questions of etiquette and precedence between the three estates. Brézé did not formally intimate to President Bailly the proclamation of the royal séance until June 20, when the carpenters were about to enter the hall to prepare for the event, thus provoking the session in the tennis court. After the royal séance Brézé was sent to reiterate Louis's orders that the estates should meet separately, when Mirabeau replied that the hall could not be cleared except by force. After the fall of the Tuileries Brézé emigrated for a short time. At the restoration he was made a peer of France, and resumed his functions as guardian of an antiquated ceremonial. He died on Jan. 27, 1829, when he was succeeded in the peerage and at court by his son Scipion (1793–1845).

The best contemporary account of Pierre de Brézé is given in the *Chroniques* of the Burgundian chronicler, Georges Chastellain, who had been his secretary. Chastellain addressed a *Déprécation* to Louis XI. on his behalf at the time of his disgrace.

BŘEZINA, OTTOKAR: *see* JEBAVY, VÁCLAV.

BRIALMONT, HENRI ALEXIS (1821–1903), Belgian general and military engineer, son of General Laurent Mathieu Brialmont (d. 1885), was born at Venlo, Limburg, on May 25 1821. Educated at the Brussels military school, he entered the army as sub-lieutenant of engineers in 1843, and became lieutenant in 1847. From 1847 to 1850 he was private secretary to the war minister, General Baron Chazal. In 1855 he entered the staff corps, and became major-general in 1874. He was then made director of fortifications in the Antwerp district and in 1875 he became inspector-general of fortifications and of the corps of engineers. In 1883 he went to Rumania to advise on fortifications and at the request of the Hellenic Government prepared a scheme for the defence of Greece. He retired in 1886, but continued to supervise the Rumanian defences. He died on Sept. 21, 1903.

At first Brialmont's plans followed with but slight modification the ideas of Vauban, and his original scheme for fortifying Antwerp provided for both enceinte and forts being on a bastioned trace. But in 1859, when the great entrenched camp at Antwerp was finally taken in hand, he had already gone over to the school of polygonal fortification and the ideas of Montalembert. About 20 years later Brialmont's own types and plans began to stand out amidst the general confusion of ideas on fortification which naturally resulted from the introduction of long-range guns and from the events of 1870–71. The extreme detached forts of the Antwerp region and the fortifications on the Meuse at Liége and Namur were constructed in accordance with Brialmont's final principles, viz., the lavish use of armour to protect the artillery inside the forts, the suppression of all artillery positions open to overhead fire, and the multiplication of intermediate batteries (*see* FORTIFICATION AND SIEGECRAFT). In his capacity of inspector-general Brialmont drafted and carried out the whole scheme for the defences of Belgium.

His most important publications were *La Fortification du temps présent* (1885); *Influence du tir plongeant et des obus-torpilles sur la fortification* (1888); *Les Régions fortifiées* (1890); *La Défense des états et la fortification à la fin du XIXe siècle* (1895); *Progrès de la défense des états et de la fortification permanente depuis Vauban* (1898).

BRIAN (926–1014), king of Ireland, known as BRIAN BORU, BOROMA, or BOROIMHE (from *boroma*, an Irish word for tribute), was a son of a certain Cenneide, a chieftain of Munster. He passed his youth in fighting against the Danes, who were constantly ravaging Munster. In 976 his brother, Mathgamhain, who had become king of Thomond about 951 and afterwards king of Munster, was murdered; Brian avenged this deed, himself becoming king of Munster in 978. He forced the tribes of Munster and then those of Leinster to own his sovereignty, defeated the Danes, who were established around Dublin, in Wicklow, marched into Dublin, and after several reverses compelled Maelsechlainn, the chief king of Ireland, who ruled in Meath, to bow before him in 1002. Connaught was his next objective. Here and also in Ulster he was successful, everywhere he received hostages and tribute, and he was generally recognized as the *ardri*, or chief king of Ireland. In 1013 Brian was again at war with the Danes of Dublin, and on April 23, 1014, his forces gained a great victory over them at Clontarf. After this battle, however, the old king was slain in his tent, and was buried at Armagh. One of his charters is still preserved in Trinity college, Dublin.

See E. A. D'Alton, *History of Ireland* (1903), vol. i.

BRIANÇON, a strongly fortified town and climatic resort in the department of Hautes-Alpes, south-east France, near the Italian frontier. Pop. (1936) 5,803.

The old town, composed of steep narrow streets, lies on a plateau over 4,000ft. high, above the upper Durance, at the foot of the descent from the Mont Genèvre pass, 51 mi. by rail from Gap. Briançon, the *Brigantium* of the Romans, formed part of the kingdom of King Cottius. About 1040 it fell to the counts of Albon (later dauphins of the Viennois) and thenceforth shared the fate of the Dauphiné. The Briançonnais included the upper valley of the Durance and tributaries, and the valleys of the Dora Riparia and the Chisone on the eastern side of the Alps. By the Treaty of Utrecht (1713) these valleys were handed to Savoy in exchange for that of Barcelonnette, on the west slope of the Alps. In 1815 Briançon withstood a siege of three months at the hands of the allies, a feat commemorated by an inscription on one of its gates, *Le passé répond de l'avenir*. The modern town extends in the plain south-west of the plateau and forms the suburb of Ste. Catherine, with the railway station and an important silk-weaving factory. The conspicuous parish church dates from the 18th century. In summer Briançon is a busy tourist centre.

BRIAND, ARISTIDE (1862–1932), French statesman, was born at Nantes March 28, 1862. As a law student he became associated with advanced movements in politics, writing articles for *Le Peuple*, and directing the *Lanterne* for some time. From this he passed to the *Petite République*, leaving it to found with Jean Jaurès, *L'Humanité*. At the congress of working men at Nantes in 1894 he secured the adoption of the general strike idea against the adherents of Jules Guesde. From that time, Briand became one of the leaders of the French Socialist party. In 1902, after several unsuccessful attempts, he was elected deputy. From the beginning of his career in the chamber of deputies, Briand was occupied with the question of the separation of Church and State. He was appointed *rapporteur* of the commission charged with the preparation of the law and succeeded in carrying his project through with but slight modifications, and without dividing the parties upon whose support he relied. He accepted the portfolio of public instruction and worship in the Sarrien ministry (1906) so that he might apply the law for which he was largely responsible. So far as the chamber was concerned his success was complete. But the acceptance of a portfolio in a bourgeois ministry led to his exclusion from the Unified Socialist party (March 1906). As opposed to Jaurès, he contended that the Socialists should co-operate actively with the Radicals in all matters of reform, and not stand aloof to await the complete fulfilment of their ideals. In Oct. 1906 Clemenceau formed his first government, and in it Briand remained minister of public instruction and worship. There were certain difficulties in the application of the Separation Law due to the hostility of the Vatican. It was then that Briand gave proof of his essential liberalism. Though he held fast to the principle of the new legislation, he made possible the carrying on of the rites of the Roman Catholic Church under the laws as to associations and public gatherings. On the death of Guyot-Dessaigne in Jan. 1908 he was appointed to the ministry of justice.

When the Government of Clemenceau fell in July 1909 Briand formed his first cabinet, himself taking the portfolio of interior and worship. He announced that he would adopt a policy of national understanding and tranquillity. In Oct. 1910 there was a threat of a general strike on the railways. Briand mobilized all the railwaymen who were still subject to military service, dismissed those who disobeyed and had the members of the strike committee arrested. A majority in the chamber approved his action, but in spite of this the Government resigned on Nov. 2, 1910, as a result of the withdrawal of Viviani, the minister of labour, who disagreed with his colleagues on the question of the right to strike.

Briand immediately formed a new cabinet, of a more radical tendency than its predecessor. This alteration, which offended the moderate Republicans without conciliating the Radicals, weakened the position of the ministry. The parliamentary difficulties about the Franco-German agreement with regard to concessions in the Congo, which was one of the causes, or rather pretexts, of the Agadir crisis of the following July, was among the principal reasons for the resignation, some weeks later, of this Government, although this was not stated at the time. A parliamentary incident gave Briand an excuse for an unobtrusive withdrawal. In Feb. 1911, when he was accused by the Radicals of failing in the strict application of the law with regard to religious houses, his majority fell to six and he resigned.

After some months out of office, he became minister of justice in Poincaré's first cabinet on Jan. 13, 1912. When Poincaré was elected president of the republic in Jan. 1913, Briand succeeded him as premier. The life of this Government was brief. Its most important work was to ask parliament to lengthen the period of military service from two to three years as a rejoinder to the increase in German armaments. On March 18, 1913, on the question of electoral reform, the ministry was overthrown by the senate, which defeated a proposal already passed by the chamber to introduce proportional representation.

Briand remained more or less in retirement until the outbreak of the World War. On Aug. 26, 1914, Viviani felt himself obliged to broaden the base of his Government, and offered Briand the portfolio of justice. On the fall of the Viviani cabinet, Briand on Oct. 29, 1915, formed a government in which he himself took over the direction of foreign affairs. He made its character as a national coalition clear by including as ministers, without portfolio, the Socialist Guesde, the Catholic Conservative Cochin and the three former premiers, de Freycinet, Combes and Bourgeois. However, in the beginning of the summer of 1916, he was accused in certain political circles of a lack of vigour in the prosecution of the war.

By the end of autumn, the Rumanian disaster, and especially the situation in Greece, made him the object of further attacks The question of the higher command was also causing much anxiety. At this time Joffre, who had been made a marshal, was replaced by Nivelle. Briand thought it advisable for all these reasons to reform his cabinet. He appointed Lyautey minister for war, and called in experts who were not in parliament to take charge of the more technical offices. On March 14, 1917, a difference of opinion between the chamber and Lyautey brought about the latter's resignation. After a vain attempt to reform his government, Briand decided to resign.

For three years Briand took scarcely any part in public affairs. It must, however, be noted that in Sept. 1917 von der Lancken, the civil commissioner of Germany in Brussels, renewing an attempt which he had already made in the spring, proposed to Briand, through a Belgian intermediary, a meeting in Switzerland to discuss the possibility of peace. Briand was inclined to accept the offer, but Ribot, the minister of foreign affairs, counselled him to avoid it as a snare.

During the years which immediately followed the war, Briand still remained in retirement. He showed, however, by one or two speeches in the chamber, that he was inclined to move to the Left. In Jan. 1921, on the fall of the Leygues ministry, he was called upon to form a government, and himself took charge of foreign affairs. He interested himself particularly in the application of the Treaty of Versailles, especially with regard to reparations. In the autumn he went to Washington as the French representative at the conference on naval disarmament. From that moment he was fiercely attacked by those who accused him of having failed to safeguard the interests of his own country. This campaign reached its height when, early in 1922, the Inter-Allied conference met at Cannes, and Briand discussed with Lloyd George the question of an Anglo-French defensive pact. A telegram which he received from Millerand, then president of the Republic, decided Briand to return to Paris and confront his enemies. When he arrived he realized that his position had become untenable. He announced his resignation to the chamber on Jan. 12, 1922.

In April 1925 he was offered the portfolio of foreign affairs in Painlevé's cabinet, and he remained in the same office in the second Government formed by this leader in October. The Locarno agreement in Oct. 1925 enormously increased the influence of Briand, who had played an important part in the negotiations. When Painlevé resigned on Nov. 22, Briand became the new head of the Government.

On March 6, 1926, Briand's ministry fell, the chamber having thrown out a financial measure which he considered necessary. Briand, however, accepted office again, but the situation became more and more difficult because of the financial crisis and the continued depreciation of the franc. Raoul Péret, finance minister, suddenly resigned and the Government fell on June 15. But, once again, Briand reconstructed the ministry and brought in Caillaux as finance minister. A month later, on July 17, the ministry was defeated, the chamber refusing to grant the special powers demanded for dealing with the financial problem. Herriot's ministry, which succeeded it, lasted only a few days and fell on July 21. Poincaré then formed a coalition Government in which Briand again became minister for foreign affairs. In this position he continued to direct the foreign policy of France on the basis of European consolidation and reconstruction. He received the Nobel peace prize, at the same time as the two other principal signatories of the Locarno pact, Chamberlain and Stresemann.

A great parliamentarian, although he broke with the extreme Left in 1906, he retained his connection with many of the more advanced political thinkers. His genuinely liberal ideas, and his constant endeavours toward national unity, gained him the sympathy of the moderate parties. His ease and animation as a speaker, his parliamentary experience and his well-known ability in the conduct of foreign affairs, all contributed to that great influence which made him, up to that time, premier more often than any other politician in France. (*See* Outlawry of War.)

Briand's works include: *La Séparation des Églises et de l'État*, discussion of the new system (1909); *Paroles de Paix* (1927).

From July 27 to Oct. 22, 1929, he again served as premier. Briand died March 6, 1932. (P. B.)

BRIANZA, a district of Lombardy, Italy, in the southern part of the province of Como, between the two southern arms of Lake Como. It is fertile, thickly peopled and visited in summer by Milanese who have built fine villas. There are silk, cotton-spinning, yarn and hat factories as well as a furniture industry.

See U. Nebbia, *La Brianza* (Arti Grafiche, Bergamo, 1912), well illustrated.

BRIAREUS or **AEGAEON,** in Greek mythology, one of the three hundred-armed, fifty-headed *Hecatoncheires* (Gr. *ἕκατον*, hundred, *χεῖρες*, hands, arms), the sons of *Ouranos* and *Gaia* (Heaven and Earth). According to one legend, Briareus and his brothers were called by Zeus to his assistance, when Olympus was attacked by the Titans. The latter were defeated and thrown into Tartarus, the three brothers being set to guard them. Other accounts make Briareus an opponent of Zeus and one of the assailants of Olympus, who, after his defeat, was buried under Mount Aetna. Another tradition makes him a giant of the sea, an enemy of Poseidon and the inventor of warships. The *Hecatoncheires* may represent the gigantic forces of nature which appear in earthquakes and other convulsions, or the multitudinous motion of the sea waves, while Roscher sees in them a reference to the polypus, which often attained a great size.

BRIBERY. The offence of bribery may be defined as the offering, giving or accepting of consideration in some shape or form that it may be a motive in the performance of functions for which the proper motive ought to be a conscientious sense of duty. The offence may be divided into two great classes—the one where a person invested with power is induced by payment to use it unjustly; the other, where power is obtained by purchasing the suffrages of those who can impart it.

In England judicial corruption has been a crime of remarkable rarity. Indeed, with the exception of a statute of 1384 (repealed by the Statute Law Revision Act, 1881), there has been no legislation relating to judicial bribery. The first judicial scandal was that of 1289 when several of the judges were tried and convicted of corruption and other offences. The second was that of 1350 when Sir William Thorpe was fined and removed from office for accepting bribes. Other celebrated cases were those of Michael de la Pole, chancellor of England, in 1387; Lord Chancellor Bacon in 1621; Lionel Cranfield, earl of Middlesex, in 1624; and Sir Thomas Parker, first earl of Macclesfield, in 1725. In Scotland for some years after the Revolution the bench was not without a suspicion of interested partiality; but since the beginning of the 19th century, at least, there has been in all parts of the empire a perfect reliance on its purity. The same may be said of the higher class of ministerial officers. There is no doubt that in the period from the Revolution to the end of Queen Anne's reign, when a speaker of the House of Commons was expelled for bribery, and the great Marlborough could not clear his character from pecuniary dishonesty, there was much corruption in the highest official quarters. The level of the offence of official bribery has gradually descended, until it has become an extremely rare thing for even the humbler officers to be charged with it.

In English law bribery of a privy councillor or a juryman (*see* Embracery) is punishable as a misdemeanour at common law, as is the giving or taking of a bribe by any judicial or ministerial officer. The buying and selling of public offices is also at common law and by statute the offence of bribery. By the Customs Consolidation Act, 1876, any officer in the customs service is liable to instant dismissal and a penalty of £500 for taking a bribe, and any person offering or promising a bribe or reward to an officer to neglect his duty or conceal or connive at any act by which the customs may be evaded shall forfeit the sum of £200. Under the Inland Revenue Regulations Act, 1890, the bribery of commissioners, collectors, officers or other persons employed in relation to the Inland Revenue involves a fine of £500. The Merchant Shipping Act, 1894, ss. 112 and 398, makes provision for certain offences in the nature of bribery. Bribery is, by the Extradition Act, 1906, an extraditable offence. Administrative corruption was dealt with in the Public Bodies' Corrupt Practices Act, 1889. The public bodies concerned are county councils, town or borough councils' boards, commissioners, select vestries and other bodies having local government, public health or poor law powers, and having for those purposes to administer rates raised under public general acts. The giving or receiving, promising, offering, soliciting or agreeing to receive any gift, fee, loan or advantage by any person as an inducement for any act or forbearance by a member, officer or servant of a public body in regard to the affairs of that body is made a misdemeanour in England and a crime and offence in Scotland. Prosecution under the act requires the consent of the attorney- or solicitor-general in England and of the lord advocate in Scotland. Conviction renders liable to imprisonment with or without hard labour for a term not exceeding two years, and to a fine not exceeding £500, in addition to or in lieu of imprisonment. The offender may also be ordered to pay to the public body concerned any bribe received by him; he may be adjudged incapable for seven years of holding public office, *i.e.*, the position of member, officer or servant of a public body; and if already an officer or servant, besides forfeiting his place, he is liable at the discretion of the court to forfeit his right to compensation or pension. On a second conviction he may be adjudged for ever incapable of holding public office, and for seven years incapable of being registered or of voting as a parliamentary elector, or as an elector of members of a public body. An offence under the act may be prosecuted and punished under any other act applicable thereto, or at common law; but no person is to be punished twice for the same offence. In certain cases penal servitude can be inflicted (*see* Prevention of Corruption Act, 1916, *infra*). Bribery at political elections was at common law punishable by indictment or information, but numerous statutes have been passed dealing with it as a "corrupt practice." In this sense the word is elastic in meaning and may embrace any method of corruptly influencing another for the purpose of securing his vote (*see* Corrupt Practices). Bribery at elections of fellows, scholars, officers and other persons in colleges, cathedral and collegiate churches, hospitals and other societies was prohibited in 1588–89 by statute (31 Eliz. c. 6). Bribery and corruption of and by agents and others is dealt with by the Prevention of Corruption Acts, 1906 and 1916. By the act of 1906 the giving or accepting of a bribe is made a misdemeanour punishable on indictment by imprisonment not exceeding two years and—or—a fine not exceeding £500, on summary conviction the maximum penalties being four months and £50 respectively. A person serving under the Crown, or under a corporation or municipal or local council or board of guardians is an agent within the act, and the consent of a law officer is necessary for a prosecution. By the act of 1916 a person convicted on indictment under the Public Bodies' Corrupt Practices Act, 1889, or under the act of 1906, where the transaction had relation to a contract with the crown or public body, is liable to penal servitude not exceeding seven years, and in like circumstances the gift or receipt of money or other consideration is deemed to have been corrupt unless the contrary is proved. Local and public authorities of all descriptions are included in the expression "public body." By the Honours (Prevention of Abuses) Act, 1925, it was made a misdemeanour, punishable on indictment or summarily, to give or accept or agree or attempt to give or accept any gift as an inducement for procuring or assisting to procure the grant of a dignity or title of honour. And on conviction the gift is forfeited to the Crown.

(W. de B. H.)

United States.—Bribery or corruption in American law is the offering to or receiving by any person charged with a public duty any money, favour or other thing of value to perform or refrain from performing such public duty. It is a crime, originally a misdemeanour, now a felony in practically all jurisdictions.

In order to consummate the crime it is not necessary that the person to whom the bribe is tendered should actually accept it or that his official action should actually be influenced by it. It is not even necessary that the money be tendered or produced. It is enough if it is offered. But a gift, not intended to influence official action, is not a bribe. It is no defence that the official accepting the bribe or the person offering the bribe was entrapped by the other party in an endeavour to get evidence and that such other party had no intent to influence official action. It is no defence that the bribe offered was worthless or that action or conduct desired by the briber was in itself proper. An officer is guilty who accepts a bribe to do his duty.

The official action sought to be influenced may be that of a judicial officer, or of other regularly appointed or elected officials, or it may be of juror, referee or appraiser, whose official duties and sphere of action are confined to a specific case. (The latter is called embracery, *q.v.*) Or the official action sought to be influenced may be the exercise of the elective franchise (*see* CORRUPT PRACTICES). Offences against the elective franchise are now generally covered in separate statutes and generally contain among their penalties on the one side the loss of the office voted for and on the other the loss of the right to vote for some fixed period.

The bribery statutes have in many instances been extended to cover attempts to influence the action of labour representatives, as to cause or prevent the calling of a strike, although such labour representative is not in strictness a public official or performing a public duty. (B. Re.)

BRIBRI, an Indian tribe dwelling in the mountains of southern Costa Rica. They speak a Chibchan dialect, and belong to a group of related tribes collectively known as Talamancan. Although greatly reduced in numbers and under missionary influence in past centuries, the Bribri maintain primitive cultural features suggesting South American origins.

See Alanson Skinner, "Notes on the Bribri," ***Indian Notes and Monographs,*** Museum of the American Indian, Heye Foundation, vol. vi., No. 3 (1920).

BRICK. Though a common structural material, brick is the most remarkable one in use in the building industry. It is remarkable historically, technically, and artistically, and, it might almost be added, socially. Its history goes back to the earliest times in the civilization of man, and it bears on its surface written records of early ages that are most valuable. Excavations at Ur of the Chaldees, the city of Abraham, have yielded brick tablets inscribed imperishably with information about the life of a people living 6,000 years ago. The Sumerian palace at Kish, in Mesopotamia, built 3,500 years B.C., is another example of the ancient use of brick. It was discovered in 1925–6, and was found to be built of small sized unburned bricks, set with mud joints. The paving was executed in burned brick. A peculiarity of these bricks is that they are plano-convex or cushion shaped, the curved face being laid upwards.

By some it is averred that brick was manufactured 12,000 years ago, and undoubtedly the tower of Babel was constructed of brick, if Old Testament records are to be believed. The walls of Babylon were built of bricks, burned and unburned. The former were 13in. square and 3in. thick, and from the ruins of the great city, burned bricks were removed and used for building more modern cities. Egypt has yielded numerous examples of brick, manufactured in the earliest and subsequent dynasties, and usually the bricks were large and unbaked. The step pyramid of Sakkara is one of the most ancient tombs in that region, and one of the most recently explored. The exterior of it was faced with stone or marble, long since removed, so that the brick structure stands revealed, and has endured through the ages. In Egypt, bricks were frequently impressed with the cartouches of kings for whom they were made, and by these their age can be known. Compared with these earliest examples, the bricks made by the Romans at the beginning of the Christian era, and by the Chinese, to build their great wall, at about the same period, seem almost modern, and yet the art which was developed in those days to a high pitch of usefulness was lost in Europe when the Roman empire fell.

Beautiful examples of brick have been found in the 20th century in India. The Paharpur temple in eastern Bengal was built in the 8th and 9th century, of small bricks laid in mud mortar, and was decorated with rows of terra cotta plaques of considerable artistic merit. This interesting discovery shows that the art was not lost throughout the world while Europe passed through the dark ages.

The excellence of the Roman manufactures is to be seen in England and other countries in which the Romans made bricks. They even developed the art of coating them with beautiful coloured glazes, of which many examples exist. About the time they introduced the art into England, they seem to have lost it in their home country, and none were made in Europe between the end of the 4th and middle of the 13th centuries. In England the Romans made bricks towards the end of the 4th century, and the manufacture ceased when the Roman occupation ended, until the Flemish came over to East Anglia in the 14th century.

Revival After the Dark Ages.—In Europe, the art began to be revived from the 12th or 13th century onward in Holland, Flanders, Germany, Italy, and England. From those days till the 19th century much beautiful brick and terra cotta architecture was executed, and has come down to the present day in monuments testifying to the artistic ability of their creators. Brick was used in Tudor, Jacobean, and Queen Anne architecture with an effect suited to and typical of the countryside and the climate of England, that has influenced the domestic architecture of the 20th century.

Introduction of Machinery.—About the middle of the 19th century brick manufacturers began the development of mechanical production. This progress was inevitable; increased population, increased industries, increased charters of liberty, all helped to cause an enormous expansion of a trade which henceforth was to be the prime factor in the housing of the people. Progress in making bricks was greater in England than in any other country because forests became denuded and stone was scarce in great areas of the land where cities and towns grew.

Brick manufacture was commenced in America about the middle of the 17th century, but it was not until the latter half of the 19th that the industry began to develop in that continent, when English machine-makers went over to seek a market. In Holland, Belgium, and France no real technical progress was made in the manufacture of bricks, until after the World War, although clay-working in other artistic branches reached a high state of perfection in France before the end of the 19th century.

The Nature of Brick.—A brick is essentially a small unit, for use in the construction of walls, piers, buttresses, and arches. By the massing of bricks in quantity with mortar joints of lime or cement, greatly varied forms of construction are erected, having massive or delicate proportions, but always capable of taking their place as the supporting framework, for the carrying of floors, roofs, bridges, viaducts, and commercial structures involving the erection of machinery. Tall chimneys, too, are built with these small units of baked clay, and withstand the strain of storms and the ravages of climate. Brick is made of clay, a product of the breaking down by weather and other destructive agencies of ancient rocks of all kinds. Granite becomes clay, and man in the 20th century moulds this clay and bakes it until it becomes in some instances almost as hard as the granite from which it originated. Some clays again are made into bricks of far less strength than the parent rock, but yet are capable of withstanding destructive agencies such as water, frost, and fire. These agencies have destroyed the rock but leave the brick unscathed.

Resistance to Fire.—Some of the oldest clays found in conjunction with coal in deposits of the carboniferous age, those found as dry shale owing to the enormous pressure to which they have been subjected through countless centuries, form, when made into bricks, a material capable of resisting intense heat. The rocks, from which such shale was originally derived, would have perished and broken up, if subjected to such temperatures as are found in furnaces of many kinds used in industry. The rock could not be heated once in such furnaces without disintegration, but the firebrick may be heated and cooled again and again, and still retain its form and properties. Stone used in building perishes gradually in the acid atmosphere of cities, but well burned brick, made even by the primitive methods of the early manufacturers, remains unharmed, and even improves in hardness by exposure. Brick, then, is *a material of unchallenged durability* and of unsurpassed usefulness in buildings and in industry.

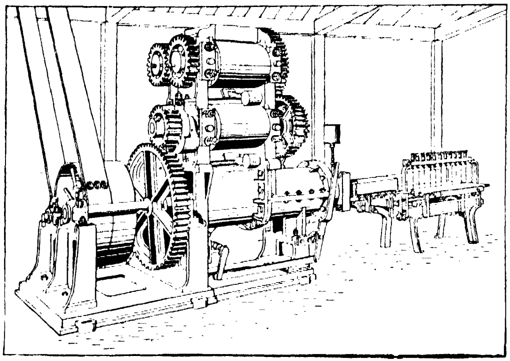
Seasonal Brickmaking.—In the early times spoken of above, when brickmaking entered upon the period of progress, culminating in the highly technical processes of the present time, the manufacture was primitive and tedious.

Andrea Palladio, writing on architecture in 1570, says that drying bricks under shelter "can't be accomplished in less than two years." Up to the time when machinery was introduced, it was always necessary to dig the clay in early autumn, so that weathering under winter conditions rendered it fit for forming, by hand moulding, into brick shape. In smaller works this seasonal treatment still obtains in some parts of England, where surface clays of recent geological age are dug. Hand moulding of bricks, too, still persists in spite of the advent of the machine.

In the early days, the clay, weathered in heaps through the autumn and winter, was dug down from the heaps spread on the ground, watered and then "tempered" by being trodden by men's feet, till a suitable consistency was reached. This method of preparing the clay for moulding has been superseded for a century by the pugmill, a machine first driven by a horse and later by a steam engine, and in this the ground and tempered clay is ready for the moulder in far less time than by the old method. The pugmill of this class consists of a large wooden tub, without heads, set upright on the ground, and furnished with an iron spindle at the axis, carrying knives, which cut and compress the clay as it falls by gravity towards ground level. A rectangular hole, cut in the tub at ground level, allows the ground clay to extrude, so that it can be cut away with a spade and conveyed to the moulder.

The First Brick Machine.—One cannot discover who was the genius that realized the mechanical potentialities of this early clay-preparing machine. He saw that the extruded clay resembled in section the hole in the tub. He saw that a spade cut away a lump of ground clay of quasi symmetrical form, which might be considered to resemble a large brick. He, therefore, conceived the idea of placing the barrel on an iron platform, fitting the knife-carrying spindle with gearing, and applying steam power to drive it. He reduced the orifice in the tub to the size of a brick, and arranged rollers under the mouth, on which the clay could run without deformation of its rectangular shape. He used then a wire to cut off pieces of the clay column of the requisite thickness, and so a wirecut brick was made by a machine. Engineers soon perfected the machine thus conceived, and so the vertical pugmill brickmaking machine was produced from the old horse-driven mill of earlier days. Other brains came into play and decided that the tub might lie on its side and the clay issue from the end of it, through a mouthpiece of suitable shape to make the clay column. This constituted the horizontal pugmill brickmaking machine, resembling a sausage machine in design and action. Instead of one wire to cut off one brick at a time, a "cutting table" was designed by which 10 bricks at once could be cut off by 10 wires carried by a frame. In due time the cutting table was also fitted with a power drive.

The Use of Hard Marls and Shales.—In the early part of the growth of the industry surface clays only were used for brickmaking, but when the horizontal pugmill was evolved other types of clay of earlier geological age could be worked. In order to break down these drier and harder clays, and bring them to the necessary plastic condition, heavy cast-iron rollers were introduced and mounted above the hopper of the pugmill. These rollers took various forms to suit different types of clay. After grinding through the rollers it was found expedient to chop the clay in the presence of water. To do this, horizontal trough mixers were designed with one or two long shafts fixed lengthwise, and carrying small knives along the whole length. A typical train of machinery for making wirecut bricks, then, came to be composed of two pairs of rollers for a preliminary breaking up of hard clays, then a double shaft mixer in which water is added to the clay, then two more pairs of rollers for finer grinding, and finally the horizontal pugmill with rectangular brick sized mouthpiece or die. Accessory to this train is the cutting table for cutting off the bricks to the required thickness.



BY COURTESY OF THE BRIGHTSIDE FOUNDRY & ENGINEERING CO.

HORIZONTAL PUGMILL, SHOWING THE OLDER MACHINES USED IN ENGLAND FOR WIRECUT BRICK MANUFACTURE

It comprises two pairs of grinding rollers, mounted over a horizontal "auger" machine, provided with pugging knives and an expelling worm. At the end of the barrel a water lubricator "die" forms a rectangular clay column, which is cut off in long lengths, and slid forward on to the "side delivery" cutting-table, which cuts it up into (usually) ten bricks

For this plastic wirecut process, in which the clay must contain upwards of 25% of uncombined but thoroughly incorporated water, one other type of grinding machine has been largely adopted in the 20th century. It is called the wet pan and consists of a large flat-bottomed cast-iron dish, some 7ft. to 9ft. in diameter, with sections of the bottom perforated with holes or slots. A heavy vertical shaft in the centre carries heavy cast-iron rollers on the two ends of a horizontal cross shaft. These two heavy rollers, sometimes called edge-runners, are carried rapidly round and round the pan, and crush the clay thrown into it, forcing it gradually through the perforations in the pan bottom.

The Need for Careful Clay Preparation.—By whatever mechanical means it is done, the essential of modern practice is the complete and thorough preparation of clay before it is formed into brick shape. An approved practice is to interrupt the series of operations above described, just before the clay enters the pugmill, for the purpose of resting it for one or two days. The chemical or physical effect of this resting is not understood. But the "resting period" of mechanically treated clay is in some cases essential, and in all desirable, if the best results are to be obtained.

The Semi-Dry Method of Manufacture.—Towards the end of the 19th century a new method of making a brick from hard, almost dry, marls was devised. It consisted in grinding the clay, without added water, in a dry pan of construction similar to the wet pan above described. It differs only in that the pan revolves, and the horizontal shaft carrying the two heavy grinding rollers is stationary. An inner width of the pan bottom, on which the rollers revolve, is not perforated, but the outer half, annular in shape, is provided with fine holes. The dry clay is ground on the solid part of the pan bottom, and pushed by scrapers on to the perforated part. The finely ground particles fall through the holes, and the larger are pushed back under the rollers for further grinding. The powdered clay is again screened and the finest portion passed to the hopper of a powerful press. From the hopper an automatically measured portion is fed into a strong iron or steel mould with moveable plungers top and bottom. The top plunger descends, actuated either by cam, lever or toggle motion or in some cases by hydraulic power, and presses the clay particles together till they coalesce into brick form and size. The bottom plunger then pushes the pressed brick upwards out of the mould, and the "green" brick is ready to be burned in the kiln.

The brickmakers of Nottingham were persuaded that the bricks made by this process, from their hard marl, would supersede the plastic wirecut brick, and large quantities of semi-dry made bricks were produced and used in the town. But disaster overtook these manufacturers, for the bricks crumbled. Great pressure, then not attainable, is necessary to make a good brick by this semi-dry treatment. It is now known that for this type of clay from 75 to 125 tons pressure is needed on the brick. Although unsuccessful at Nottingham, the semi-dry method was adopted at Accrington in Lancashire with highly satisfactory results and practised for many years. Even here a third method called stiff plastic has been found more satisfactory.

The Fletton Brick.—The semi-dry method, however, found a home towards the end of the 19th century in a district where the Oxford claybeds are found in purest quality. In the Peterborough area of Northamptonshire some 10ft. of surface clay had long been worked by plastic process, turning out a brick of relatively poor quality. Beneath this surface, however, exists the Oxford clay, called in the district "Peterborough knotts" to depths varying from 30ft. to 60ft. or more. This material is a dry shale, not of such great geological age as the shale of the carboniferous period, but of similar appearance. It is characterized by the presence in it of a small proportion of mineral oil, and from 5% to 8% of carbon. This shale was found to respond readily to the semi-dry process of brick manufacture, and the bricks produced by it were square and hard, light in weight and colour, but cheap to make, because, firstly, they required no drying, and secondly, the carbon present in the clay proved to be almost sufficient fuel to burn them. A large industry gradually arose there. In 1927 the quantity of fletton bricks produced from the Oxford clay was well over 1,000 millions, or sufficient to build 50,000 modern workmen's houses. Works arose in Bedfordshire, Buckinghamshire and Lincolnshire, in which the same clay was found, all of which adopted the same method of manufacture. The fletton brick is the staple building brick of London, and is produced at such low cost that it can compete with plastic made bricks far from the Peterborough centre.

Road Paving Bricks.—Since the World War the semi-dry process of brick-making has found application to other clays both in England and on the Continent. By its means the hardest and strongest brick ever produced is now made, designed primarily for the paving of roads. For this brick a plastic clay is used, being first dried in order that it may be in a condition suitable for the grinding and pressing process above described.

Stiff Plastic System.—The stiff plastic process of brickmaking is intermediate in character between the plastic wirecut and the semi-dry. It is much used for working marls and shales in the north of England, and many plants are to be found in Lancashire, Yorkshire, Northumberland and elsewhere making building bricks, smooth faced facing bricks, firebricks and hard engineering bricks. In this process the marl or shale is ground in a dry pan and then moistened in a horizontal mixer till it contains upwards of 12% of uncombined water, as compared with 20% to 25% in plastic bricks and 6% to 8% in semi-dry bricks. The press is similar in type to that used for semi-dry making, but, instead of dust, damp grains of clay are fed to a very short vertical pugmill, which forces the completed material into a mould in order to form an immature clot. On emerging from this mould, the clot drops into a finishing mould in which it is pressed into final form, ready for setting in the kiln. Large numbers of firebricks are now made by this method, although the old process of hand moulding is still considered to hold the field for the highest class firebricks.

Hand-Moulded Facing Brick.—The account given above of the development of mechanical manufacture, applied to the production of bricks of various classes, has perforce left out the original hand-moulding method of brickmaking, and has not dealt with the machinery used so largely in America, and to some extent in England, to imitate hand-moulding of the sand-faced variety. As stated above, hand-moulding is still favoured by the best class manufacturers of firebricks, and the production of this variety is of immense importance to the manufacturing trades of all countries in which high temperature furnaces are employed. The hand-moulding process of plastic manufacture produces the sand-faced red-facing brick, with all its modern variety of colour, a brick which for artistic effect in domestic architecture is as yet unsurpassed. The richness of texture and the gradations of colour cannot be equalled by mechanical means, and it is, and always has been, the characteristic facing brick of Great Britain, produced in no other part of the world. The surface clays and Bagshot and Reading beds which serve for the best of this type are found chiefly in the south-eastern fields. The clays are either weathered or mechanically prepared, and pugged in horizontal or vertical pugmills, already mentioned, ready for the hand-moulder. In its mouldable form the clay is very soft, so that when a lump of it is rolled in sand and thrown into a sanded mould, it readily flows into all parts of it, and when turned out on to a suitable pallet, is of good shape with richly sanded surfaces all round. It is then dried and burned in suitable kilns.

The London Stock Brick.—Another type of brick is made by hand-moulding called the stock brick or alternatively the London stock. The chief centres of its manufacture are Sittingbourne in Kent, Shoeburyness in Essex and Slough in Buckinghamshire, but many small yards are dotted about the south-eastern area which use the same process. In most, but not all, of these, the clay is mixed with washed chalk, which has the effect of changing the red colour obtained in burning to a yellow or brindle tone. In a few smaller yards chalk is not added, and the brick is dark brown in general tone. These bricks are moulded by hand, with sand used in the same way as for red-facing bricks. Very large quantities have been produced and delivered to London. The bricks are somewhat rough in texture, light in weight with porous body, this last due to the admixture with the clay of the fuel by which they are burned. Mechanical moulding of both sand-faced red-facing and stock bricks is now adopted by some manufacturers in England. The method is not so much an economizer of labour as it is a substitute for skilled men, who are scarce and difficult to train. In America enormous quantities of sand-faced common bricks are made mechanically, the type of machine being denominated the soft mud moulder. This machine is in the form of a pugmill of varied design, which presses the soft clay into a series of sanded moulds, three, five, six, or even nine side by side in one frame. The mould is filled with clay under the machine and then pushed out to a man in attendance, who strikes off superfluous clay, knocks the two ends of the mould frame to loosen the bricks, and passes the frame to a second hand. The mould frame is now placed face downwards on a long pallet and the bricks allowed to fall out of the moulds ready for removal for drying.

In France and Belgium one other system of moulding a brick has existed for many years and is still practised. It has not found favour in other countries. In the summer season only the surface clay found in great abundance in the north of France and in Belgium is dug, and without any further preparation fed to hand or mechanically operated presses, which press the damp clay into brick form. In some ways this method bears a resemblance to the stiff plastic, but it is very primitive in character.

The Drying of Bricks.—The drying of bricks before burning is, in modern days, a process of great technical difficulty. The old way, still existing in many seasonal works, apart from the earliest method of laying the bricks out in single layer on the ground, was by means of sun and air, no artificial heat being employed. Large space is required for this method, an acre to a million annual production, and it has been almost entirely superseded by artificial dryers, except in small works and the large stock brick fields. The newly moulded bricks are set on edge in long single rows, and when one row is completed a second row is placed on it, and so on till the hack is eight or ten bricks high. The hacks, each with two rows of bricks, are arranged on flat open ground with space for barrows between and the bricks are protected from rain and wind by pent shaped covers and side boards. The bricks require from three to six weeks to become dry according to weather. The labour cost, loss by storms, and damage by handling render this system more costly than it would seem.

In large works in the Midlands and North of England recourse was early had to spacious shedding with floors, on which the bricks are laid, heated by exhaust steam from the power plant, and live steam from the boilers at night. This was found less costly than outdoor drying, and could be and is practised throughout the year in the majority of works making wirecut bricks.

Tunnel Dryers.—At the end of the 19th century, tunnel dryers were proposed and put on the market in Europe and America. In these a series of rail tracks of small gauge are laid in chambers upwards of 100ft. long and 6ft. high. Cars carrying wet bricks are closely loaded with spacing sufficient to allow the passage of hot air. The cars are pushed at regular intervals from one end to the other, while hot air is blown into the chambers in the reverse direction, drying the bricks on the cars progressively in their passage. At first this invention appeared to be technically correct in principle and economical in working. Experience, however, showed that, except for some types of clay which will withstand rapid drying without cracking or warping, this type of plant was much more costly than steam floors. The tunnel dryer is only economical if the bricks can be dried in 24 to 48 hours. Comparatively few clays will admit of such rapid treatment, and if longer time is occupied the capital charges and working costs become too great in proportion to output.

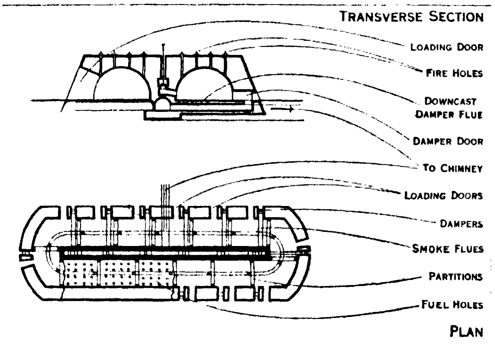
The Humidity Dryer.—The most recent advance in the difficult technical problem of rapid drying of bricks in the mass, is the adoption of a new principle termed humidity drying. It has been found that if a brick is heated in the wet state in an atmosphere saturated with moisture, until it attains a temperature of 120° to 150° it loses no moisture. It may then, however, be subjected to dry currents of air at the relatively high temperature of about 200° and will dry rapidly and completely in a very short time, without cracking or warping. Modern chamber dryers adopting this principle, combined with efficient apparatus for handling the bricks, are highly satisfactory for drying on a large scale and are far less costly than tunnel dryers.

The Burning of Bricks.—For the burning of bricks, in the early days of civilization, in Roman times, and in the period of revival in the 13th to the 18th century, small brick-built kilns or ovens were used, and the heat necessary was produced by wood burning in furnaces situated below the bricks set over them in open formation. Kilns of this type are still used with coal firing in many small works, and are generally known by the name of Scotch kilns. Much waste by over and under burning results in them, and the fuel consumption is as high as 20% of the weight of the burned goods. The down draught kiln, highly perfected in design, is a modification of this intermittent type of brick kiln. In this type an arched-over chamber is provided with furnaces in the external walls. The heat from them passes into the chamber over bag walls in the interior, and then downwards through the goods, descending finally into underground flues leading to a small chimney. Large numbers of this type of kiln are used in this country, not only for brick burning, but also for tiles, pipes, paving quarries, and other varieties.

In America, until recent years, this type was used almost exclusively for very large outputs. In this kiln the fuel consumption is still high, but the quality of the goods produced is as perfect as can be desired. Two important types of high-class bricks are burned almost exclusively in them, the blue Staffordshire engineering bricks, known all over the world as the iron brick, and glazed bricks of various qualities. While common and facing bricks are usually burned at temperatures from 900° to 1,000° C the blue bricks and glazed bricks require a temperature as high as 1,250° C.

Common salt is made use of in burning certain kinds of bricks in down draught kilns. The silver grey sand-faced facing brick made at Reading is one variety, which is very highly valued by architects for its artistic appearance. Salt is also used in kilns burning blue Staffordshire bricks, in order to create a reducing atmosphere in the later stages of the burning, and to form a thin glaze over the surface of the bricks. Salt glazed bricks made with a fireclay or stoneware clay are glazed by means of salt in a similar manner, and are much used for the plinths of large buildings in towns and cities and internally for lavatories, etc.

Clamp Burning.—A method of burning bricks in what are called clamps in England and county kilns on the Continent, was devised perhaps towards the beginning of the 19th century. No records appear to be available as to its origin. Prior to the World War it was the chief method in use in Belgium and the north of France, but has now been largely superseded by modern kilns. In England the method is still in use to a considerable extent in the stock brickfields described above, and in small works chiefly in the south. Clamps are large heaps of bricks stacked systematically as closely as possible. In England they are built of various sizes holding from 100,000 to 1,000,000 bricks, and generally about 10ft. or 12ft. high. On the Continent they are built much larger and higher, containing upwards of 3,000,000 bricks. The fuel for burning is usually incorporated in the mixture of clay and chalk, with a certain variable amount sprinkled between the layers of bricks. Fires are started in small channels at the bottom, and serve to ignite the fuel in and between the bricks. When once the fire has taken a good hold of the bottom courses no more stoking is needed, and the heat spreads gradually throughout the mass. In England it takes six weeks to burn a large clamp of bricks throughout. In the continental system the firing is more rapid, and two or three weeks suffice for burning the large clamps where erected. The fuel is economically applied in this method but the results are uncertain and dependent on weather conditions. Waste by over and under burning is always considerable.



A PLAN AND CROSS-SECTION OF A HOFFMANN KILN

Continuous Kilns.—At the present time the majority of building bricks are burned in continuous kilns of two kinds. In the Hoffmann kiln, named after its inventor, the bricks to be burned are put in chambers in a massive brick construction. The chambers are contiguous, to the number of 16 to 24 in a kiln. They are disposed in two rows with semi-circular or rectangular ends, forming a complete circuit. The bricks are withdrawn after firing and replaced by unburned goods day by day, and day by day also the fire, which is maintained for the burning of them, travels along from chamber to chamber. The actual firing takes place at a position about four or five chambers distant from the point where unburned bricks are being set and about seven to ten chambers from the point where burned bricks are being withdrawn. Adjacent to the point where bricks are being set, a damper is opened, giving passage for the gases of combustion towards a high chimney, which creates the draught required for combustion. A wall or damper of brown paper, pasted on to the green bricks, prevents external air from having access to the bricks in the last chamber set, so that the air and gases passing to the open damper must perforce be drawn through all the bricks set in the 14 to 20 chambers. The cycle of the burning operation therefore is, that cold air enters the back chamber where burned bricks are being drawn, and passes through a series of, say, seven to ten chambers which have been burned and are cooling. It becomes heated in doing so, recuperating and carrying forward the heat so acquired. It reaches then the zone of, say, two chambers which are being fed with coal, and serves to promote combustion. It then continues through the four or five chambers of green bricks set ready for burning, giving up a large proportion of its heat to them and heating them preparatory to being finally burned in their turn. The pull of the chimney draws the heat forward, causing the fire to travel through the chambers successively and continuously, so that each chamber in turn becomes heated, burned, and cooled ready for withdrawal and sale. This type was invented in Germany in the middle of the 19th century, and revolutionized the burning of bricks on a large scale. It quickly found users in England. It is exceedingly efficient in the use of heat, not requiring more than 6cwt. of fuel for 100cwt. of burned goods, instead of 20% used in intermittent kilns.

The Tunnel Kiln.—The second type of continuous kiln is known as the tunnel kiln, and differs from the first in the facts that the goods travel through the tunnel continuously, and the fire zone remains always at the same position. In other respects the principle is the same as in the Hoffmann type. Substitute the word cars for chambers and the description of the burning cycle is identical. The tunnel kiln is built upwards of 300ft. long, is rectangular in cross section, and at ground level is provided with rails, on which run cars carrying the bricks to be burned. Although actually conceived before the Hoffmann kiln, it is only in the years subsequent to the World War that the tunnel kiln has become a commercial proposition. Though simple in principle, great difficulty was originally encountered in obtaining uniform burning. An average dimension of the cross section of the tunnel kiln is about 6ft. square. The cars, about 6½ft. long and carrying, say, 1,200 bricks each, are pushed through the tunnel by hydraulic or gear-driven rams, a car being introduced every one to two hours and taking from 36 to 72 hours to pass from end to end. Tunnel kilns are fired either by direct burning of coal or mineral oil, or by producer gas generated in efficient gas producers. The amount of fuel consumed is similar to that of the Hoffmann type.

Sand-lime Bricks.—One other method of producing bricks may be briefly mentioned. The sand-lime brick, made largely in Germany, in America, and to a smaller extent in England and France, uses sand and lime as its raw materials instead of clay. About 10% of lime in a hydrated condition is mixed with the sand, and bricks are made by the semi-dry method in powerful presses. The bricks are stacked on cars and introduced into large boilers or autoclaves, which when full are closed. Live steam under pressure is then introduced into the autoclaves for a period of about 24 hours, hardening the bricks and rendering them fit for use in buildings.

Value and Production in Great Britain.—The foregoing relatively brief account of brickmaking cannot adequately convey to the reader the vast amount of technical detail involved in the successful carrying on of manufacture. Clays differ widely in characteristics and behaviour, no two kinds being treated in exactly the same way, or yielding exactly the same products. As the years pass, radical changes are made in the incidence of labour. From being a trade of somewhat degraded character, brickmaking has become highly specialized, producing goods of great variety with wide differences in value. A common building brick, for instance, such as the fletton, may be sold at works for 35s. per 1,000, a facing brick at 100s., an engineering brick at 150s., and a glazed brick at 300s. or more. The total production in England is over 5,000 millions annually. The cost of installation of modern works is in the neighbourhood of £3,000 to £4,000 per million annual production, so that the capital value of the industry, as apart from goodwill, is upwards of £20,000,000, and the turnover annually reaches approximately the same figure.

The Strength of Bricks.—The strength of bricks and brickwork is considered to be of considerable importance, in view of the function of brickwork as the framework of buildings and the support of the superimposed loads. The following table gives the ascertained resistance to thrust or, as it is usually termed, the crushing strength of standard qualities of bricks:

	Tons per sq.ft.
London stock	100–150
Sand-lime brick	160
Hand-made red facing	225
Fletton	250
Red marl brick Leicestershire etc.	350
Red marl brick North Wales	500
Red marl brick Lancashire	650
Staffordshire blue	500–700
Red or brindle engineering	600–1,000
Vitrified paving brick	1,750

The strength of brickwork has been found, by the building research board, to be largely dependent on the strength of the joints made in building, and does not approximate to the crushing strength of the bricks used. A Leicestershire brick, for example, requires 350 tons per sq.ft. to crush it, but brickwork built with it in lime mortar fails at 100 tons, and in cement at 150 tons. A Staffordshire blue, built with cement joints, fails at 200 tons per sq. ft.

See A. E. Brown, *Brick Drying; Hand Brick Making* (1902); and A. B. Searle, *Modern Brick Making* (1920). (A. E. B.)

AMERICAN BRICK

Classes and Standards.—In American practice a brick is a structural unit of burned clayey material, in the form of a rectangular block, with the standard dimensions of 2¼in. by 3¾in. by 8in. Bricks of other sizes, of other materials, and other structure than solid except limited perforations, have qualifying names, as:—fire bricks; paving bricks; sand lime, chrome, magnesite and silica bricks; insulating bricks; hollow bricks; Roman bricks, 1½in. by 4in. by 12in.; Norman brick, 2⅜in. by 4in. by 12in.; Old Virginia bricks, 3in. by 4in. by 9in., etc. The standard size of a fire brick is 2½in. by 4½in. by 9in. and there are standard sizes in key, arch, wedge, split and soap fire bricks.

The following standard sizes for paving bricks were adopted in 1927 by the National Paving Brick Association:

2½in. by 4in. by 8½in., plain wire cut bricks, laid the 2½in. depth.
3in. by 4in. by 8½in., plain wire cut bricks, laid the 3in. depth.
3½in. by 4in. by 8½in., plain wire cut bricks, laid the 3½in. depth.
3½in by 4in. by 8½in., repressed block, laid the 4in. depth.
3in. by 3½in. by 8½in., Dunn wire cut lug block, laid the 3in. depth.

Bond in Bricks.—Bricks are bonded into durable products in the process of burning by the fusion and subsequent hardening of the alkaline minerals and mineral salts, denominated fluxes, present in the clay. As fusion and solution of the refractory grains progress with advancing temperature the ware changes from soft, to light hard, to hard, and finally to a vitrified product. In the latter the fused matrix predominates. The porosities range from as high as 25% in the soft bricks to 10% or less in the hard bricks and to 5% or less in the vitrified bricks.

Processes.—The processes used in America are the *soft mud*, the *stiff mud*, and the *dry press*. The *stiff plastic* process intermediate between the stiff mud and the dry press, used in England is not used in America except to a limited degree and in a modified way in the manufacture of some fire clay products.

The soft mud hand moulding operation has been discontinued in America except in the manufacture of fire bricks and in this product it is gradually being superseded by other processes.

Soft Mud Machines.—Soft mud machine moulded bricks were first made in America in 1833, and next from 1840 to 1844 in Philadelphia, Pa. Within a few years machine moulding became the general practice but it did not entirely displace the hand moulding for nearly 40 years

The maximum output of these machines was about 30,000 bricks per day which was the labour limit in *striking* to remove surplus clay from the moulds and *bumping* the moulds to loosen the bricks for dumping The modern moulding machine is automatic. The mould sanding and feeding, the striking and the bumping, are done mechanically, and the labour required is performed by one man who places the pallets on the dumping frame. In the majority of installations wire rope carriers take the loaded pallets to the drying racks. With hand labour practically eliminated the soft mud machines produce upwards of 100,000 bricks per day.

In the most modern plants the dry bricks are taken from the pallets in units of ten or less as may happen, and set on cars in units of 500 to 1,000 bricks as they will be set in the kilns. A crane equipped with a lifting fork sets these larger units in the proper place in the kiln in a single operation.

Dry Press Machines.—The first dry press of which there is record was put into operation in 1847 and in 1848 many such presses were in use. In 1856 a hydraulic press was built in Cleveland, Ohio, and was subsequently developed and put into operation in St. Louis, Mo.

These presses, which made ten bricks with each revolution of the machine became the basis of a large production which still continues. In 1878 a toggle joint press of American design was put into operation in Chicago, Ill.

About 1880 a number of toggle joint presses were developed and became the basis for a large output of dry pressed bricks throughout the country, though the peak of such production has long since been passed.

Stiff Mud Machines.—In 1853, James W. Penfield of Willoughby, Ohio, designed and put into operation a horse driven, intermittent, horizontal plunger, stiff mud machine which became the basis of an extensive manufacture of plunger stiff mud machines and a large output of stiff mud bricks. In 1862, Cyrus Chambers of Philadelphia, Pa., built and put into operation a stiff mud auger machine so-called the "sausage machine" with an automatic cutter, driven by steam power. This was the beginning of the numerous output of stiff mud bricks which predominate the market. In 1928 were many factories which produced more than 100,000 bricks per day from a single machine, and in the Chicago district, where a crane with lifting fork to set the bricks in the kilns in large units is used, the output from a single machine is about 300,000 bricks per day.

Grinding Machines.—The clay preparing machinery is adapted to the nature of the clay or shale utilized. Granulators, disintegrators and rolls are used for soft clays, and dry pans for hard clays and shales. In the United States the dry pan with a capacity from 75 tons to 150 tons per day, depending upon the hardness of the material and the fineness of the grinding, is being replaced by a machine designated as a *grinder* which, in the heavier types, has the capacity of four or five dry pans, or a ton of ground clay per minute. The grinder differs from the dry pan in that the screening feature of the latter is entirely or largely eliminated in the former, and the rollers have been increased in weight in the heavier machines to upwards of seven tons each.

Equipment.—Where sorting is not required, clays are gathered by various types of scrapers but the machine chiefly used is a steam or electric driven shovel, commonly known as a *steam shovel*. When the material will stand in a vertical bank, a *shale planer* is used. This is a powerful chain elevator of the bucket type, but instead of buckets, cutting chisels are attached to the chains. This equipment cuts the material from top to bottom in a shallow cut, the cuttings dropping through chutes into industrial railway cars. As the cutting proceeds the machine advances automatically along the vertical bank. The dug material is hauled to the factory by small locomotives (*dinkeys*). In the factory the lump hard clay or shale is dumped into a reciprocating feeder which spills it into a jaw, gyratory, or single roll crusher, the latter being the most widely used. The crushed clay is then conveyed to the dry pan or grinder into which it is automatically fed by a reciprocating or disk feeder. The pulverized clay is elevated, screened, and conveyed to the brick machine—stiff mud for example—and fed into the pugmill by a disk feeder. Excess clay from the grinders is dumped into a storage bin to be used as occasion requires. Much heavy labour is thus eliminated.

Dryers.—Open yard drying has largely disappeared and air drying in racks is disappearing. In their place several types of artificial dryers are used, the type depending upon the available heat supply. The most widely used dryer is the tunnel type, in which the bricks on cars in units of 500 to 700 are moved through tunnels on tracks. The combustion gas type, designated as a *radiated heat dryer,* has ducts for the smoke gases under the tunnel tracks; the common form has furnaces at one end of the dryer, connecting with the combustion gas ducts. In some installations the combustion gases from burning kilns are collected by fans and forced through the ducts. The *progressive tunnel dryer* collects the hot air from the cooling kiln, from steam coils heated by exhaust or live steam, from auxiliary furnaces, etc., and thus the heated air is put directly into the drying tunnel and comes in contact with the ware. Most tunnel dryers are distinctively humidity dryers since the ware is moving in one direction and the hot air, with its accumulated vapour and decreasing temperature, is moving in the opposite direction. In the newer forms of humidity dryers the main features are better air circulation among the ware and better control of the humidity. For soft mud bricks the *pipe rack* dryer is widely used. This consists of racks of closely spaced steam pipes upon which pallets of bricks rest Fire bricks, because of the need of repressing after partial drying, are largely dried on steam heated floors, known as *hot floors,* though tunnel dryers are used to an increasing extent where the newer processes of manufacture have been adopted.

Kilns.—Every type of kiln is used. The original common *clamp* kiln, known as the *scove* kiln is used in some of the largest common brick operations. This type of kiln lends itself admirably to operations where the bricks are set by machines. Many factories use the *up-draft* kiln which is identically a clamp kiln except the walls of the kiln are heavy and permanent. The *down-draft* kiln is most widely used, despite its greater fuel consumption because of the excellence of the results due to the effective control that it provides over the kiln atmospheres. This insures the production of every possible colour effect by oxidizing and reducing conditions, and also special colours by the use of minerals or salts in the final stages of the firing, such as zinc to produce a green color, manganese to produce black, common salt for glazing, etc. Among the economizer types of kilns are the tunnel kiln, the compartment continuous kiln and the car tunnel kiln. The tunnel kilns often exceed 24 sections in length and are operated with two or more sets of fires, or in other words are operated as two or more kilns. The largest kiln of this type in America in 1928 was in Bessemer Quarries, Ohio, producing paving bricks. This has 208 sections and when in full operation 10 sets of fires are carried at the same time. The kiln is built in two parallel batteries, connected at the ends, and, if straightened out into a single battery, it would be more than a half mile long.

The *compartment continuous kiln* is an advance over the tunnel type, in that the draft often is distinctively down draft instead of being horizontal draft or serpentine draft as in the tunnel kiln and other solid floor kilns. This is used in many localities but since the advent of the car tunnel kiln but few new compartment kilns are installed. The *car tunnel* kiln, built in lengths of 300ft. to 400ft. and producing from 40,000 to 70,000 standard bricks per kiln per day, was in 1928 rapidly coming into use for the production of bricks and fire bricks.

Bloated Bricks.—Clays containing carbon and sulphur minerals, notably iron pyrite, if burned too rapidly in the early stages of the firing during *oxidation,* bloat when the temperatures are carried up to the finishing point. This condition is commonly termed *black coring* because the core of the ware is black from the unburned carbon and the reduction of the iron. The bloating is due to the entrapped gases which cannot escape as vitrification of the clay takes place. In many instances such bloated ware will float in water. During the World War bloated burned clays were produced for the building of concrete ships, and since are finding use in making light weight concrete and light weight building tile.

Texture Bricks.—From Colonial days to the advent of the dry pressed bricks, the bricks were rough, misshapen and irregular in size. The better grades were selected for line (face) bricks and the poorer grades for inwalls. With the appearance of the dry pressed brick, uniform in size and perfect in form, the distinction between common and face, or pressed, bricks became sharply drawn. The manufacturers of stiff mud bricks met the dry press standard by re-pressing the bricks in a press akin to a dry press. Then followed an era of construction with perfect bricks, uniform in colour and laid with thin mortar joints. The bricks comprised the sole structural feature of the wall. In 1903 in New Lexington, O., the wire-cut texture brick was first produced. Wires were stretched across the die to cut off a thin slice from the surfaces of the stiff mud bricks, leaving a rough serrated surface The artistic value of this surface texture was quickly recognized by architects and the manufacture of wire-cut face bricks spread throughout the country. Numerous other textures have been produced by various scratching devices, to some of which distinctive names have been given, as *tapestry, rug, oak bark, raglan, velvet, astrakhan, etc.* With the advent of the texture brick the mortar joint, formerly merely a structural factor to be hidden, has come to be recognized as a characteristic feature in brick wall construction. Uniform shading has given way to mingled shades including every colour and shade possible in burned bricks. The American wall built of all stretchers with hidden bond, has given way to various bonds—English, Flemish, Dutch and a wide range of diaper work. The production of polychrome glazed colour effects, produced by spraying the stiff mud bricks with glazes, has begun to off-set the increasing use of terra cotta products.

Scum and Efflorescence.—A white coating on bricks from the kiln, known as *scum* or *whitewash,* and white, yellow to green coatings which come to the surfaces of brick walls, known as *efflorescence,* are serious brick making problems.

Rattler Tests.—Paving bricks are tested in a machine known as a *rattler,* adapted from a similar machine used in foundries for cleaning castings. It is approximately a cylinder, 28in. in diameter and 20in. wide. The periphery is made of six inch channel bars bolted to the side frames and slightly spaced to permit the escape of the dust. These are lined with steel staves. The charge consists of about 100 pounds of the bricks, 225lb. of one inch and 75lb. of four inch cast iron balls. In the test the machine is rotated at the rate of 30 revolutions per minute for a period of one hour. The loss in the weight of the bricks by abrasion is termed *rattler loss,* and specifications for paving bricks commonly range between 18% and 24% rattler loss.

Output and Value.—The U.S. Department of Commerce report for 1926 gives the following statistics regarding the industry:

	Number of establishments	*Output in thousands*	*Value*
Common bricks	1,220	7,520,411	$88,249,925
Face bricks	456	2,439,820	44,516,236
Vitrified bricks	131	467,580	10,284,741
Hollow bricks	39	63,359	692,258
(This does not include hollow building tile having a value of $23,560,571.)			
Enameled bricks	9	15,441	$1,275,692
Fire bricks	244	1,016,879	40,992,018
(This does not include 40 establishments making special refractory shapes.)			

The total value of all clay products in the United States in 1926 was $459,049,470.

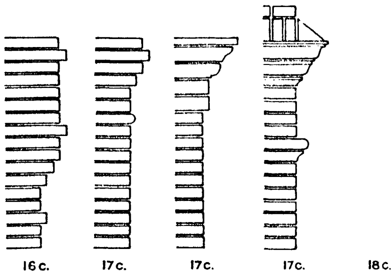
See H. L. Whittemore, "Equalizer Apparatus for Transverse Tests of Bricks," *U.S. Bur. Stand., Tech. Pap.* No. 251 (1924); W. F. Kirk, "Productivity Costs in Common-Brick Industry, *U.S. Bur. Labor Stat.,* Bull. No. 356 (1924); and A. I. Andrews "The Making of Dolomite Brick," *Ohio State Univ. Engr. Serv.,* Bull. No. 31 (Columbus, O., 1925). (E. Lo.)

BRICKFIELDER, a term originally used in New South Wales for a hot scorching dust-laden northerly wind of the sirocco class blowing from the interior, where the sandy wastes, bare of vegetation in summer, are intensely heated by the sun. The name has been extended to similar winds in other parts of Australia. These hot winds blowing strongly, often for several days at a time, defy all attempts to keep the dust down, and parch all vegetation; but being exceedingly dry and hot they also destroy injurious disease germs. The northern brickfielder is almost invariably followed by a strong "southerly buster," cloudy and cool from the ocean. The two winds are dependent on the same cause, viz., a cyclonic system over the Australian Bight. These systems frequently extend inland as a narrow V-shaped depression (the apex northward) bringing the winds from the north on their eastern sides and from the south on their western. Hence as the narrow system passes eastward the wind suddenly changes from north to south, and the thermometer has been known to fall 15 degrees in 20 minutes.

BRICK OVEN. In colonial days in the United States the brick oven, also known as the baker's oven, was used in the home as well as by bakers, to cook by conserved heat. It was built in beside the kitchen fireplace, usually with an arched top. The doors were first of wood, protected on the inside by a sheet of metal. Later iron doors with a draught were used. A hot fire, often of brushwood only, was built in the oven and the iron door closed with the draught open, or the wooden door left slightly open. When the fire had burnt out, the ashes were raked out, the food set in the oven and the door closed without draught. To place and remove the food there was used a slice or peel—a long-handled iron tool with a flat blade to slip under the pot or pan. Many of these ovens were very large, so that many loaves of bread, pies and cakes could be baked at once. The colonial housewife often baked 40 or 50 mince pies in one day, piled them one on the other in a storeroom where they would freeze, and re-heated them when required in the Dutch oven (*q.v.*). These ovens still exist in colonial houses and are sometimes used by lovers of old ways. They are an early form of fireless cooker (*q.v.*).

Brick ovens were also extensively used in England and still are in many country districts.

BRICKWORK. This term is not restricted to simple edifices of bricks, but includes vaulting, tracery, moulding, carving, and gauging for decorative as well as for purely structural purposes.



FROM "A HISTORY OF ENGLISH BRICKWORK"

FIG. 1.—PROFILES OF 16TH, 17TH, AND 18TH CENTURY BRICK CHIMNEY CAPS. THE SAILING COURSES DO NOT PROJECT MORE THAN 1½ INCHES AND THE BRICKS ARE ALL ABOUT 2¼ INCHES THICK

Brickwork may be either of sun-dried or of burnt brick. Both kinds were built at very early periods and are often found together, even in the same wall. Probably the choice between construction of walls of mud (as in Peru and Mexico) or of mud bricks (sun-dried, as in ancient Egypt) depended upon the nature of the clays available.

Antiquity.—The oldest brickwork known is the Sumerian, in the area between the rivers Tigris and Euphrates. Recent investigations at Ur have revealed brickwork earlier than the first dynasty—say before 3200 B.C., and many buildings have been uncovered of date 2100 B.C. Such brickwork has many of the characteristics of modern structures. The bond (*see* p. 120) is carefully kept and stability is secured by headers being carried through into a rubble core behind the brick facing. For important buildings bitumen was used for mortar, for ordinary work the bricks were bedded in mud. Lime mortar does not appear to have been used until the 7th century B.C. Several corbelled arches and vaults were found of date 2100 B.C., and a doorway which had a vaulted arch. This was built of bricks about 10 x 7 x 8 inches. The bricks were not cut as *voussoirs* but had radial (wedge shaped) joints of mud.

The enormous area of ruined brickwork at Babylon is well-known. The Babylonian bricks measured 13x13x3–3½in., with headers 13x6x3–3½ inches. The joints were about 1⅛in. thick and were either of mud or of bitumen. Vast quantities of burnt brick were used. The towers of the Gate of Ishtar (40ft. high) built by King Nebuchadrezzar (605–562 B.C.) originally had 575 representations of animals in relief. (*See* Plate I., fig. 1.) These were the sacred Bull of Ramman, the weather god, and the dragon of Babylon, or Sirrish. Probably the bricks modelled with these bas-reliefs were made in pottery moulds and touched up with some polishing instrument before burning. The portion of the Gate of Ishtar illustrated, was carried out in burnt clay, which, like all the bricks there, is of the same yellowish brown colour as the sand around.

The Greeks used both sun-dried and burnt brickwork and it is recorded of King Agis II. of Sparta that, in 418, he dammed up the River Ophis below the town of Mantinea, through which it flowed, so that the waters sapped the walls of the town, which were built of sun-dried brick. Such brick was preferred by the ancients to burnt brick for defensive works because it was tougher, and for this reason when Mantinea was refortified sun-dried brick was again used but the river was diverted to prevent recurrence of the disaster. The use of these crude bricks for building seems gradually to have given way to brickwork in burnt brick, though instances occur in comparatively modern buildings, as in some old Norfolk cottages, where unburnt bricks are still to be found, usually in inner walls. Sun-dried bricks were used also by the Romans, and Vitruvius (engineer and architect, temp. Julius Caesar and Augustus) gives detailed instructions as to their manufacture. They were made in moulds, whilst the burnt bricks (actually large, thick tiles) were made of plastic clay, beaten flat and trimmed to rectangular shape. In England, as also elsewhere, the art seems to have died out with the fall of the Roman Empire, and until the mediaeval revival such brickwork as was built was of Roman material re-used.

Mediaeval Brickwork.—The mediaeval revival developed the use of brickwork from simple structural to highly decorative purposes. Brick units were cut first in simple forms as in the apse at Torcello, 12th century (*see* Plate I., fig 2), the character of which is not Lombardic but Byzantine. The large zig-zag pattern of the cornice is found also in Constantinople, in Salonika and in Italy at Padua and Murano. The bricks measure 9⅝x4¾x2⅜in. but large flat bricks are cut to fill the spaces under the chevrons. From these simple forms later brick-builders cut and assembled ordinary bricks into an immense variety of decorative features which passed through specially moulded brick units to all the most elaborate designs in terra cotta. In Spain, the three great brickwork districts of Aragon, Andalusia, and Castile abound in interesting examples. At Ternel, in Aragon, the House of the Templars has a cut and moulded cornice of interesting section. Here the bricks are thin (about 1¾in.), of a deep crimson colour, which, set in joints as thick as the bricks themselves, present a rich, glowing effect. At Tarazona is a high tower, built in stages; the arcading, panels, strings, and strapwork of which are formed almost entirely of plain, unmoulded brick; the bricks, which are large and thin, are set with wide joints. The effect close up is coarse, but at a little distance most effective. Lubeck (Schleswig-Holstein), one of the principal Hanse cities, has five Gothic churches and many other important buildings built of brick, while the East end of the church at Prenzlau, Prussia, has rose window, arcading, and tracery all of the same material, forming a remarkable and beautiful achievement in brickwork. Many mediaeval French castles were of brickwork. In these diapers and patterns were often formed, not only by the use of dark headers but with bricks of different colours as long before manipulated in Italy. Plate I., fig. 5 shows a 14th century dovecote at Boos near Rouen, where the brick panels are treated in a diversity of ways by arrangement of bricks in patterns and by the use of bricks of several colourings.

Revival in England.—War and commerce were the two chief factors in the introduction of brick into England in the mediaeval period. English knights who captured and occupied castles in France returned to England and built similar castles for themselves—frequently in brick. Tattershall Castle, Lincolnshire, *c.* 1431–49; Caister Castle, near Yarmouth, built after 1424, and Hurstmonceux Castle, Sussex, 1445–46, are notable instances. Whilst there can be no doubt that these popularized brickwork as a building material, its re-introduction into England was of earlier date and was actually due to commerce. The Hanseatic League, originally an association of merchants, became a federation of great cities of the Baltic and Low Countries; just that area where the scarcity of stone made brickwork universal for buildings. The origin of the Hanse is remote and unknown. Lubeck, the principal Hanse city, was founded 1143. There, at Quedlinburg, and elsewhere in Prussia brickwork of the 12th century is found. Norwich, Lynn, Boston and Hull were amongst the League towns in England, and, of these, Hull was the most important. Wherever the Continental agents of the League settled they seem to have introduced the art of brickmaking and building. Hull was a centre of these activities; by 1303, the corporation had its own brickyards, from which it supplied bricks. War between the League and England hindered development, but when in 1474, its privileges were restored there was a marked impetus given to building with brick in eastern and south-eastern counties,

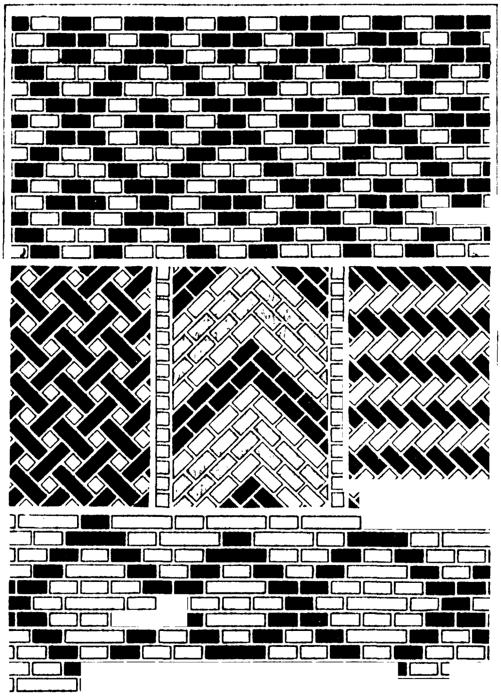


FIG. 2.—EXAMPLES OF EUROPEAN BRICKWORK. AT TOP: DIAPER PATTERNS FROM CHÂTEAU D'AUFFAY, NORMANDY. CENTRE AND BOTTOM: FROM DOVECOTE AT BOOS MANOR, ROUEN

in certain districts of which brickwork almost entirely superseded stone. It must be remembered that this brickwork was not confined to mere building of walls. The most remarkable East Anglican churches, castles and halls, in which the use of brick included every current elaboration, were erected between this date and the Reformation—a period of 50 or 60 years. Of these Oxburgh Hall, Norfolk, 1482; Gifford's Hall, Suffolk, early 16th century; St. Andrew's Church, Sandon, Essex, *c.* 1502; Layer Marney Hall and Church, Essex, *c.* 1520; Hampton Court Palace, *c.* 1520; Sutton Place, Guildford, Surrey, *c.* 1523, and Little Leez Priory, *c.* 1539 (Plate I., fig. 3) are conspicuous instances. The character and appearance of brickwork of this period (early 16th century) are clearly shown in Plate I., fig. 6 of the porch of Pebmarsh church.

Thus example and instruction provided by settlers from the Continent, together with the impulse of fashion set by great and powerful lords, were the primary causes of the re-introduction of brickbuilding in England. It is questionable, however, whether these alone would have been sufficient to establish the art had other necessary factors been wanting, for it is rather owing to its inherent qualities and to convenience that brickwork has so firmly established itself in public favour. Reference has been made to the fact that scarcity of stone in the Low Countries encouraged the use of brick there, and for the same reason it became almost exclusively used in some districts in England. Mention should also be made of the convenience of handling bricks, the dimensions of which, though varying slightly at different periods and in different parts of the country, were such that a bricklayer could pick up a brick with one hand and use the other to spread mortar. A further recommendation of brickwork was its durability. Sound, well-burnt brick, set in good lime mortar, will resist the weather for centuries, even in the English climate; indeed, the limit of its resistance has not yet been reached, for brickwork built over 600 years ago is still sound and likely to stand as much longer, providing no more destructive agency than Nature attacks it.

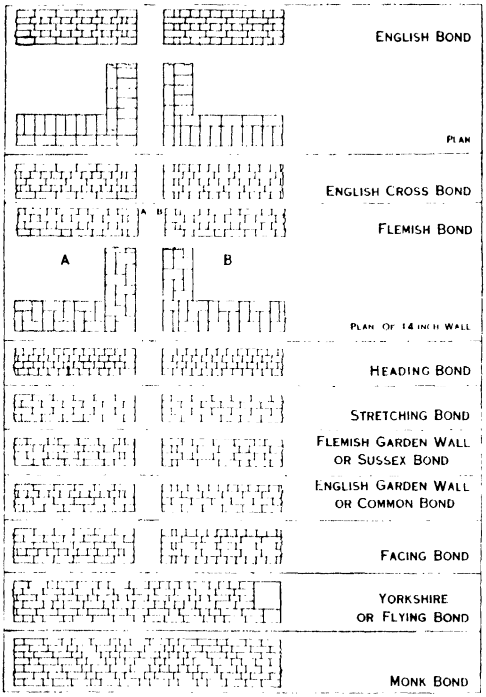
Modern Brickwork.—Although brickwork construction is often found cheaper than building in stone, the widespread belief that it is "common" or inferior to stone is incorrect. It is actually superior to stone in strength and in durability, whilst in form, colour and texture good brickwork is unrivalled. Just as the builders of castles in the 15th century chose brickwork and even introduced the art of brickmaking into the country to obtain it, so Cardinal Wolsey and Henry VIII. employed it in building Hampton Court Palace (upon which they spared no expense) and Sir Christopher Wren used it for his addition there, associated with stone; at Christ's Hospital by itself and at Morden College with painted plaster: all these with a view to securing results which could be obtained in no other way. The Georgian architects continued these themes, until, towards the end of the 18th century, stucco gained favour and brickwork, though still employed, disappeared from view. During the dreary mid-nineteenth century, which the French so happily term "L'Époque du mauvais goût," yellow brick was largely used to build unlovely square houses and more unlovely eccentric ones. This continued up to the third quarter of the 19th century, when a brick revival took place, following the publication of G. E. Street's "Brick and Marble Architecture in Italy," in 1855, the chief effect of which was an eruption of "Venetian" doorways and windows in gauged red brick. Contemporary with and following him, William Butterfield indulged in riots of coloured brick disposed in patterns and in "Gothic" devices, some of which (as the Rugby school buildings) earned the description of "streaky bacon" architecture. Alfred Waterhouse was also tempted by the facility of the material to indulge in remarkable feats of elaboration in brick and terra cotta, as at the Natural History Museum, South Kensington, completed 1880. Such extravagancies were followed by natural re-action, their ultimate effect was to discredit brick as a building material, and imitation of the Butterfield and Waterhouse eccentricities by every suburban villa-builder completed the degradation of brickwork. This was further precipitated by the association of brickwork with the Gothic revival, when architectural fashion turned to the Renaissance manner as the only one suited for buildings adapted to modern requirements. Meantime two architects were producing works which had far-reaching effects upon design, and, incidentally, upon brickwork design. Norman Shaw was the pioneer of the revival of traditional architectural design; Philip Webb of the appreciation of use of materials. It was only necessary that the right ways should be indicated, for to no building material were such attitudes of mind more applicable than to brickwork. War, economy and consequent restrictions have necessitated pruning brickwork of all but essentials, and the tendency is now to depend upon colour and texture—combined with good proportion rather than upon elaboration of detail.

BRICKLAYING

Certain essentials in building good brickwork are:—Accuracy in working to ensure a perfectly horizontal bed and that walls are vertical, or, if the outer face is battered (sloped), that the angle of the batter is maintained. A bricklayer usually first builds up the quoins (angles of building) six or eight courses high, and having got these absolutely true he proceeds to lay courses the whole length of wall between. For the quoins he uses his square, spirit level and plumb to ensure accuracy and then stretches a line the exact height of the next course he has to lay for the whole distance between the quoins. Bricks are laid with the frog (the hollow on one side of the brick) uppermost. It is essential that all joints should be filled with mortar ("well flush up the cross joints"), otherwise the work will be weak. This is so obvious as to appear unnecessary to mention, but bricklayers habitually neglect to flush up and that this must be done has to be impressed frequently upon the foreman. In dry weather bricks must be wetted. Men will not dip them into a bucket of water as they lay the bricks because this makes their hands sore. It is usual, therefore, to pour water over bricks before they are laid or to do so on each course, as laid. Neither method is entirely satisfactory but either is better than perfectly dry bricks, which absorb the moisture from the mortar before it has set, so that it never really unites with them. In wet weather bricks should be protected from excessive rainfall or this will protract the setting of mortar and work will not be ready for succeeding courses when it should be. Brickwork must not be carried up too quickly lest the work should settle and so be out of plumb, for this reason it is usual only to carry up work three or four feet at a time, and to do so evenly all round the building.

Mortar.—Good brickwork implies good mortar, whether of lime or cement. If the sand used is not clean and sharp, or if it is earthy the mortar will not be strong. Lime mortar should be used within ten days of mixing; cement mortar should be mixed in small quantities and used within half an hour. (*See* MORTAR.) The effect of frost upon mortar that has not had time to set hard is to destroy its properties. The exact degree of cold at which bricklaying should be stopped depends upon several factors, but the addition of a proportion of unslaked lime (the amount of which will vary with the degrees of frost registered) will enable work to be continued for some time. Green brickwork may be protected; but the perfunctory protection afforded by laying empty cement bags or a tarpaulin over newly built work is negligible.

Bonding.—Bonds are the arrangements of bricks by which each brick overlaps another by a quarter of its length or 2¼ inches. Bonds are recognised by the arrangements they present on the faces of walls and frequently the substitution of one bond for another may enhance the appearance of brickwork without impairing its strength; although the primary object of bonding is to secure the greatest possible strength to the structure. Only four bonds are *commonly* found in England. They are English, Flemish, Stretching and Flemish Garden Wall bonds. The first three are used for buildings, the last one for single brick (9in.) walls where both sides of the wall are seen. There is no reason, save lack of enterprise, why other bonds should not be employed. In fig. 3 bonds are illustrated, the arrangement on face and return walls being shown in each, together with a short definition to assist in distinguishing one from another. English bond, which consists of alternate courses of headers and stretchers, is regarded as the strongest of all English Cross bond and Dutch bond are merely variations of it: used for an unbroken wall surface, they produce a multitude of little crosses, which form a pleasant variation but too much of which is distressing to the eye Flemish bond consists of alternate headers and stretchers in the same course, and is inferior in every respect to English bond, though preferred by those who strive after "neatness" It was introduced into this country about 1630; not by William III., as often stated, though by the end of the 17th century it had almost entirely supplanted English bond. Heading bond is obviously weak and is only used where strength is not required and for curved walls. Stretching and Facing bonds are used for walls of only half brick (4½in.) thickness. Both are ugly and it is surprising they should be tolerated.



FROM "A HISTORY OF ENGLISH BRICKWORK

Fig. 3—English Bond has alternate courses of headers and stretchers. In English Cross Bond stretchers break joint. Flemish Bond has alternate stretchers and headers. In Heading Bond, all bricks are headers except at the quoin. In Stretching Bond, all bricks are stretchers, except the alternate headers of the quoin. In Flemish Garden Wall, three stretchers, then one header in every course; in English Garden Wall, three stretching courses to each heading course. Monk Bond has two stretchers, then one header

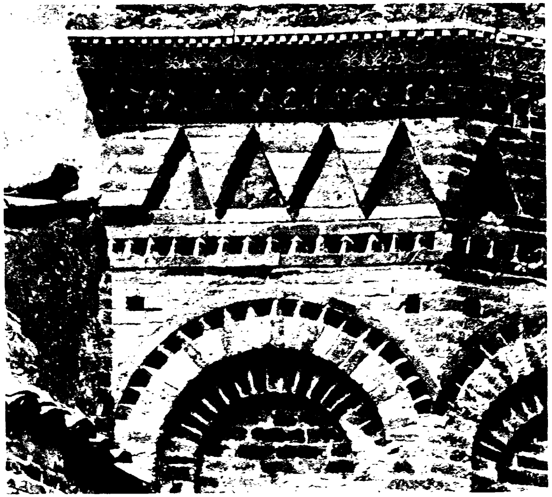
Flemish Garden Wall or Sussex bond consists of three stretchers to one header, repeated in the same course and, as stated above, is used for 9in. walls. The reason is that, owing to the unequal shrinkage of bricks in burning, lengths may vary as much as ⅜in. and some headers in single brick walls built in English or Flemish bonds would project beyond others, producing an unequal and lumpy surface. By using Garden Wall bond fewer headers are needed, and these are picked out to one length before building is begun English Garden Wall bond consists of three courses of stretchers to each course of headers. In the North of England five courses of stretchers go to one course of headers and this is also the practice in the United States, where this bond is called common bond. Like Flemish Garden Wall bond, bricks of even length are picked out for the header courses before the work begins. Either of these Garden Wall bonds may be used instead of Stretching or Facing bonds for half-brick walls (*e.g.*, the outside skin of a cavity wall). The additional cost, if any, is trifling, for the headers will be half bricks (snap headers) in such walls and there are always some broken bricks which can be used up. The improved appearance by comparison with Stretching Bond is remarkable.

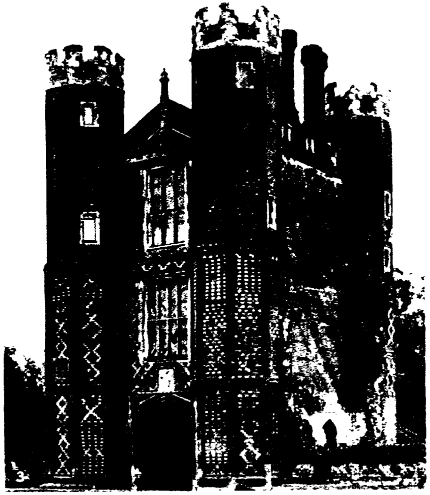
Yorkshire or Flying Bond has no practical value. It was in vogue at a time before bonding was thoroughly understood in England. Monk Bond consists of two stretchers and then a header throughout in the same course. It is the bond used for centuries in Northern Germany and Scandinavia. Over a large wall surface it produces a series of chevrons five courses high—a pleasing variation which is not worrying to the eye. By modifying it, and using headers with burnt ends (grey ends), vertical bonds may be produced, but these will be referred to later.

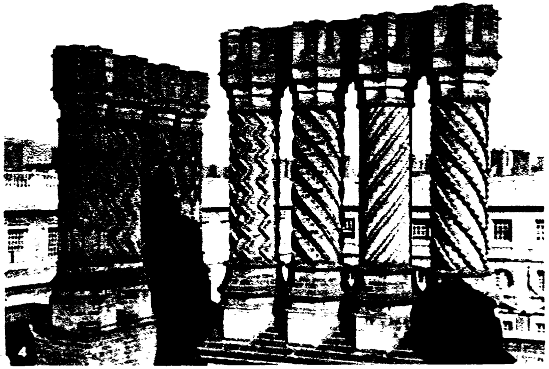
Types of Brickwork.—English brickwork may be divided into three distinct types:—

1. The Tudor, Plate II., fig. 7, in which the bricks are rough in form, are twisted, are irregular in outline and are built with joints from ½ to ¾in. thick. These bricks vary much in colouring and include plum reds, yellow reds, browns and bluish greys. Few modern attempts to produce Tudor brickwork include all these characteristics, yet no brickwork is so generally admired as the old. 2. The 18th century brickwork, Plate II., fig. 5, a type which actually came into fashion in the latter part of the 17th century. The bricks are regular in size and form, with sharp arrises (edges); they are built with joints never exceeding ½in. (often only ¼in.) thick, and the bond is usually Flemish. Bricks vary with the clays of the locality in which they are made, from deep red to the yellow and grey stocks so largely found in London. 3. Gauged brickwork, Plate II., fig. 1. Sometimes whole fronts are built in this manner, but usually piers, panels and dressings. The bricks are rubbed exactly to one size and perfectly smooth on face, with sharp arrises, and they are built with very thin joints (⅛ or 1/16 in.) with lime-putty for mortar. If judiciously employed such brickwork has very high value. Its application may be seen in the portion of a pilaster in Plate II., fig. 5. The earliest gauged work (gauged-measured) in England is about 1630. Plate II., fig. 1, of a window and pilasters at Kew Palace, is dated 1631. The work is gauged but not with that fine accuracy shown in the capital and wall behind in Plate II., fig. 6, which is from an example which represents the highest attainment yet achieved in this kind of brickwork.

Joints and Pointing.—Stronger and better work is obtained by leaving a rough flush joint or by striking a joint with the trowel at the time when bricks are laid than by raking out joints ¾in. and pointing afterwards; though the latter course ensures a more regular and even appearance. For the Tudor type of brickwork, Plate II., fig. 7, the mortar of joints should be left full and squeezed out by pressure when laying the bricks. The superfluous mortar will fall off itself under influence of the weather, leaving a natural surface. If there is any cement in the mortar, or if for any reason a more formal joint is required, the weather-struck joint is best. This is a method which makes the bricks of the upper course throw a slight shadow and water does not lodge on the lower course as when struck the wrong way. Also, when wrongly struck, water penetrates above the joint which frost disintegrates. Old brickwork may have to be re-pointed. When this is necessary, the joints should be raked out much deeper than ¾in., which is usual, 1¼in. is not too much. Objection is sometimes taken to the struck joint for repointing 18th century type of brickwork, where the edges of bricks are worn and broken and where it is desired the wall face should present a neat and formal appearance. In such circumstances tuck pointing is employed, for which the raked-out joints are pointed flush with the wall face in cement or lime mortar and the whole coloured evenly with copperas and coloured pigment, or the whole wall is rubbed over with a piece of soft brick to the colour required. White lime putty or black stopping is then applied to a fine joint which has been raked out in the new mortar and by means of a straight edge and jointer and trimming with a frenchman (a table knife with the point turned up at right angles) a white joint







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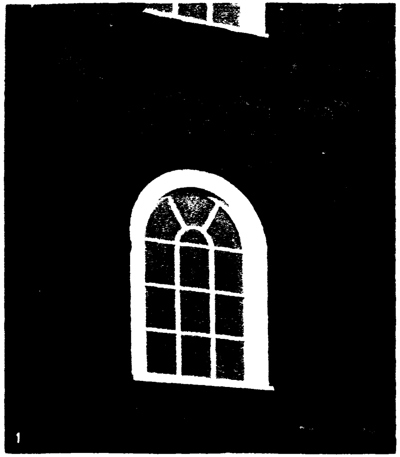
CHARACTERISTIC TYPES OF BRICKWORK FROM THE 5TH CENTURY B.C. TO THE 16TH CENTURY A.D.

1. Gate of Ishtar, Babylon
2. Detail of apse of St. Fosca's church, Torcello, Venetia
3. Inner gatehouse of Little Leighs priory, **Essex**
4. Chimneys of Hampton Court palace, near London
5. Boos manor, near Rouen, France
6. Pebmarsh church, Essex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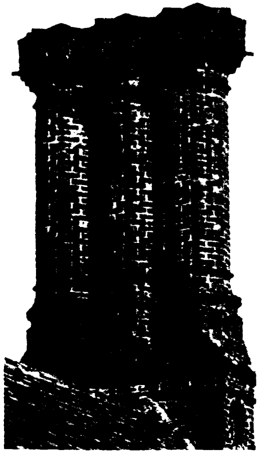

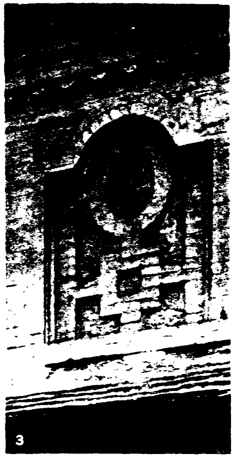
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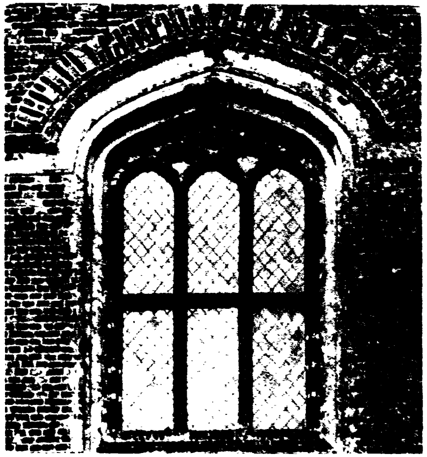

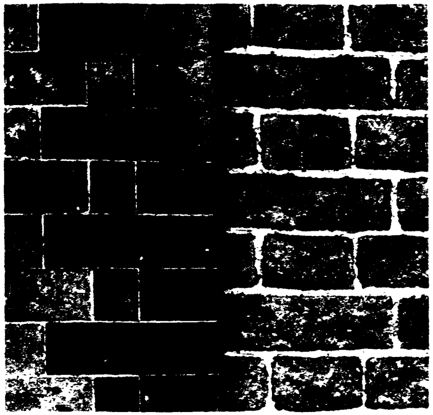

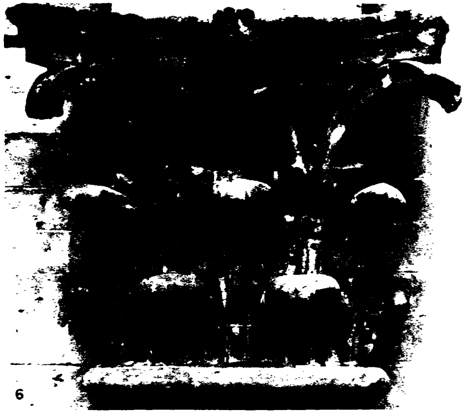
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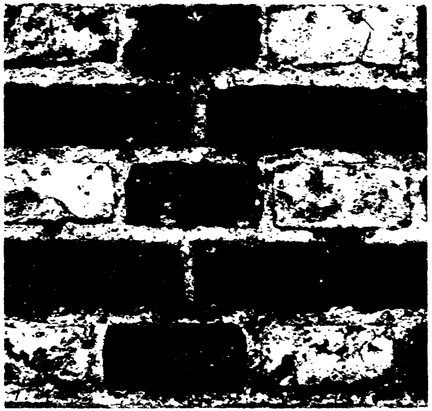


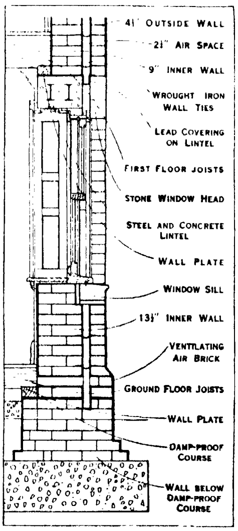
BY COURTESY OF (1, 6) THE DIRECTOR OF THE VICTORIA AND ALBERT MUSEUM, (2, 3, 4, 5, 7) FROM "A HISTORY OF ENGLISH BRICKWORK" NATHANIEL LLOYD

ENGLISH BRICKWORK OF THE SIXTEENTH, SEVENTEENTH AND EIGHTEENTH CENTURIES

1. **Gauged brickwork at Kew palace, London, dated 1631.** Ionic caps and window arch-key of carved brick
2. **Mid-16th century octagonal chimneys of axed brick from a farmhouse in Crundale, Kent**
3. **Mid-17th century work, High street, Godalming, Surrey.** Strapwork in panel, cornices in axed brick
4. **West window of the Layer Marney church, Essex, about 1520, showing brick mullions**
5. Styles of brickwork, early 18th century, from Bradbourne house, Larkfield, Kent. Left, gauged brick pilaster in two colours; right, contemporary walling, bricks fairly regular in size and form
6. Late 17th century finely gauged brickwork, from Enfield, Middlesex, now in Victoria and Albert Museum
7. Detail of Tudor brickwork from Little Leez priory, Essex, about 1538

⅜in. wide and projecting ⅜in. is formed. Recessed, keyed, bastard-tuck, and other joints are seldom used now and are not to be recommended.

Hollow Walls.—Fig. 4 shows a section of a small country house built with hollow external walls, instead of a solid wall. Two 4½in. walls are built 2¼in. apart and are tied together with wrought iron metal ties. The effect is that only the outer wall is exposed to wet, the air in the cavity acts as a non-conductor and consequently the inner wall is warm and dry. Various forms of iron ties are made and some architects prefer glazed brick ties, but the iron ties are most used. At least two are built into every super yard and one to every 12in. height at openings. The section shows the usual practice of brick construction. On the concrete foundation are the stepped footings of brick. Under the floor is a layer of concrete, on which are the sleeper walls, consisting, in this case, of two courses of brick 4½in. wide, between which the damp-proof course of the inner wall is continued across to the wall on the other side of the house. On these sleeper walls the floor joists rest. Moisture passing through the outer wall falls to the bottom of the cavity and is prevented soaking inwards or upwards by the damp-proof course. Openings at the sides of windows are sealed with pieces of slate in cement. Over the windows sheet lead is built into a joint of the outer wall and carried upwards across the cavity into a joint one course higher up in the inner wall. This prevents moisture from the wet brickwork soaking down through the woodwork of the windows. The cavity is ventilated by air inlets passing through the outer wall. It is important that no fragments of mortar should be left which would bridge the cavity, for they would conduct moisture to the inner wall. Such 11in. hollow walls are more stable than 9in. solid walls because they have a broader base but would not be permitted in London as substitute for the latter, so that there a 4½in. outer and a 9in. inner wall would be required. Hollow walls effect economy in expensive facing bricks, as common bricks can be used for the inner wall and only half the number may therefore be required for the half brick outer wall.



BY COURTESY OF THE INTERNATIONAL CORRESPONDENCE SCHOOLS

FIG. 4.—SECTION OF BRICK CAVITY WALL, WHERE BUILDING ACTS REQUIRE WINDOW FRAMES SET BACK TO SHOW 4½-IN. REVEALS

Flat, gauged brick arches and purpose-moulded brick-on-edge sills are seen in brick of brighter red than used for the walls

Arches.—Any arches that are built in stone may be carried out in brick (*see* ARCH), but the forms most used are segmental, semi-circular and straight. The segmental and many semi-circular arches are built of ordinary bricks (not *voussoirs*), the difference between the curves of *extrados* and *intrados* being taken up in the joints, which are wedge-shaped. Other semi-circular arches are carefully gauged. Straight arches (which must be built of gauged *voussoirs*) used over window and door openings are better built with a slight rise. Even a ½in. rise in a 3ft. opening avoids the appearance of a sagging lintel, which is not only unpleasing but may cause fracture of the arch in course of time should the mortar have slightly deteriorated. Even a slight rise increases the strength.

Corbelling and Chimney Caps.—The projection of brick corbelling is limited by (i.) the thickness of the wall—but equal corbels on each side of a wall will balance each other—and by (ii.) the tailing-in (the securing of the wall end of a brick). For excessive projection, as for brick cornices, extra long bricks may be specially made, but skilful men work wonders with bricks of ordinary dimensions, as in the cornices above and below the window in Plate II., fig. 1.

A common form of corbelling is in construction of chimney caps, of which an infinite number of well designed old examples exists. With thin bricks and a large shaft, projections may be as much as or more than 1½in. each course. If the shaft is slight or if the bricks are thick, ¾in. projection may be too great. The old builders seem to have worked less by rules than by trial and experience, and until a cap has been proved satisfactory on a shaft of certain proportions it is wise to proceed in the same way and see at least half a cap built up as a trial. The profiles given in fig. 1 are all of old caps. Plate II., fig. 2, shows a 16th century chimney having detached, octagonal shafts.

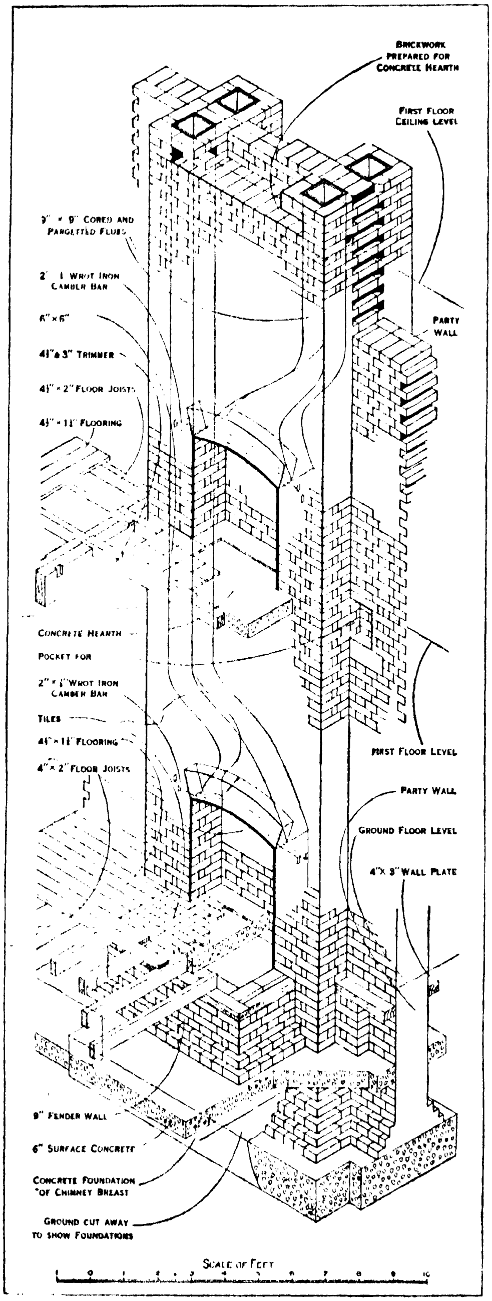
Chimney Breasts and Flues.—The isometric drawing, fig. 5, shows the treatment of these on each side of a 1½ brick party wall between two houses. The descriptive lettering is self explanatory.

Brick fireplaces are more in keeping with the "farmhouse" type of room than in association with highly finished interiors, such as panelled rooms, white-painted woodwork, and dainty wall-papers. It is questionable whether bricks used for fireplaces should be smaller than 7x3½x1¾ inches. The effect of very small bricks and of patterns worked with pieces of plain tile is too finicky and restless to be satisfactory.

Gauging, Moulding, Cutting, and Carving are the higher branches of the bricklayer's art; mastered by few, though many attain some skill in the first three. Allusion has been made already to gauged work, for which bricks are cut with hammer and bolster (a heavy chisel) or with a saw (the blade of which is formed of twisted steel wire stretched in a frame) and finished on a rub stone of coarse, sharp sandstone. Special bricks, called rubbers, are generally used. They contain a large proportion of sand and are easily worked. Much of the moulded work in Tudor times was cut by hand ("axed" was the term, because the brick axe, now obsolete, was the tool employed) and ordinary bricks were picked over to find those which were, not soft, but less hard than the bulk of a making. The method of working varies with the nature of the design. A template (pattern outline) is first made out of card or a thin piece of wood. This is laid upon the brick to be cut and its outline scratched in deeply. The superfluous portions are then cut off (working from outside inwards) with the scutch, which is a light hammer having chisel-shaped heads which can be changed. Some skill is required to get round pieces of stone which have been incorporated in the brick and examination of old moulded bricks shows how the cutter worked. If necessary the work is finished off with a rasp, but a good workman, now, as in Tudor times, will finish his work with the chisel-edged tool. The window in Plate II., fig. 4, has all its moulded bricks cut by hand. The treatment of the intersection of transom and mullions is particularly interesting. Bricks for cutting should not be made with frogs, for often the cutting will expose the cavity. Even a simple mullioned window may require a dozen different templates and as many shaped bricks to be cut. Where there are many windows or where large numbers of each brick are required, it pays to have the bricks "purpose-moulded" in specially made moulds by the brick-makers, but these never have quite the same quality of form and texture as when cut by hand. During the 16th century many chimney shafts were constructed of circular and octagonal sections, embellished with spirals in great variety and with diapers of many patterns, some in purpose-moulded brick but most cut by hand.

Brick Carving.—This is rarely done now, yet it is easy and decorative. The practice is to build up a block of soft (rubber) bricks with very thin joints and to carve the completed block *in situ*. The arms of Henry VIII. are carved over the archway of the gatehouse at East Barsham Manor House, where, however, the brick is in lumps four courses high. Plate II., *fig.* 1 shows carved Ionic capitals and a carved keystone to the window arch, while Plate II., fig. 6, is of a beautiful Corinthian capital of gauged brick carved. Modern work is less ambitious but has taken the form of swags of fruit or flowers, cartouches (bearing a monogram or date), and other enrichments commonly associated with stone.

Tools for carving in brick are simple, consisting of a chisel, a bent screw, and a piece of wire gauze to put over the thumb, with which to rub away the soft brick.



By courtesy of W. R. Jaggard

FIG. 5.—EXAMPLES OF CHIMNEY BREASTS IN PART WALL

Diapers and Patterns.—These were favourite devices of French builders of the 15th century, the patterns in various coloured bricks being derived from the mediaeval Italian work and their influence is seen in contemporary buildings in England, though not equally varied. Fig. 2 shows some French examples. There was a revival of this use of dark headers in 18th century brick buildings in England, usually by picking out the headers which had grey ends and building these so as to produce horizontal or vertical bands. Also by building all headers in Flemish bond, an evenly chequered wall surface was produced. Such restricted methods were often pleasing and more satisfactory than the florid 15th and 16th century treatment. The secret of good results in the use of grey headers is to pick out and use only the soft greys, not the very dark ones. The effect of the latter may be seen in the school buildings at Rugby, which no one would wish to imitate. Strap-work as shown in the panel Plate II., fig. 3, is another excellent form of pattern making.

The nature of bricklayer's work varies from the roughest walling to that requiring great care, but in estimating for any work it has always been necessary to compute what a man should produce. The compilers of old price books based their figures on what a man would average on ordinary house building, taking one kind of work with another but excluding special works such as gauged work, tuck pointing and fancy work. Men were expected to erect their own scaffolding in the time reckoned, and the working day was ten hours.

In 1667, 1,000 bricks daily for one bricklayer and his labourer.
In 1703, 1,000 do. do. do.
1,200/1,500 by exceptional men.
1734 as in 1703.
1740, 1,000 bricks daily for one bricklayer and his labourer. 1,500 if all work was common, rough walling.
1835, 1,000 bricks daily for one bricklayer and his labourer. The modern equivalent, for an eight-hour working day, should be 800 bricks daily.

As many as 809 bricks were laid by one man in an hour at Treeton, York, in 1924, and at Rotherham, in April 1927, William Milnes, a foreman bricklayer, laid 1,121 bricks in one hour—a record not likely to be broken. The work was of the rough kind, which writers quoted above reckoned should be done at the rate of 1,500 daily. Such concentrated effort, assisted by materials being placed by a staff of labourers, bears little relation to daily work but does suggest that, given bricklayers having the will to do more, much might be done to assist output by arranging work and materials conveniently. Detail photographs of the actual operations show the work to have been done from scaffolding and to have been sound and good, as indeed competent eye-witnesses certified it to be; 700 bricks daily is the usual output in the district.

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BRICOLE (a French word of unknown origin), a military engine for casting heavy stones; also a term in tennis for a side-stroke rebounding off the wall of the court (corrupted into "brick-wall" from a supposed reference to the wall), and in billiards for a stroke off the cushion to make a cannon or hazard.

BRIDE, the term used of a woman on her wedding-day. It appears in many combinations, some of them obsolete; *e.g.*, "bride-bell" (wedding-bells), "bride-banquet" (wedding-breakfast). The bride-cake, or wedding-cake, had its origin in the Roman *confarreatio*, a form of marriage, the essential features of which were the eating by the couple of a cake made of salt, water and flour, and the holding by the bride of three wheat-ears, symbolical of plenty.

In the middle ages the wheat-ears were worn or carried by the bride. It became the custom for young girls to assemble outside the church and throw grains of wheat over the bride. In time the wheat-grains were cooked into thin dry biscuits, which were broken over the bride's head. In Elizabeth's reign these biscuits took the form of small rectangular cakes made of eggs, milk, sugar, currants and spices. Every wedding-guest had at least one, and the cakes were thrown at the bride as she crossed the threshold. They were the forerunners of the modern wedding cake which assumed its glories of almond paste and ornaments during Charles II.'s time.

Even to-day in rural parishes, wheat is thrown over the bridal couple with the cry "Bread for life and pudding for ever," expressive of a wish that the newly wed may be always affluent. The throwing of rice, a very ancient custom but later than the wheat, is symbolical of the wish that the bridal may be fruitful. The *bride-cup* was the bowl or loving-cup in which the bridegroom pledged the bride, and she him. The phrase "bride-cup" was also sometimes used of the bowl of spiced wine prepared at night for the bridal couple. *Bride-favours* (or bride-lace) were at first pieces of gold, silk or other lace, used to bind up the sprigs of rosemary worn at weddings. Later these took the form of bunches of ribbons. *Bridegroom-men*, or groomsmen, represented a survival of the primitive days of marriage by capture, when a man called his friends to assist to "lift" the bride. Bridesmaids were usual in Saxon England. The senior of them attended the bride for some days before the wedding. The making of the bridal wreath, the decorations for the wedding-feast, the dressing of the bride, were among her special tasks. The senior groomsman (the best man) was the personal attendant of the husband. The *bride-wain*, the wagon in which the bride was driven to her new home, gave its name to the weddings of any poor couple, who drove a "wain" round the village, collecting small sums of money or articles of furniture towards their housekeeping. These were called *bidding-weddings*, or *bid-ales*. In Wales so general was the custom of "bidding-weddings" even up to the early part of the present century that printers kept the form of invitation in type. The bride's veil is the modern form of the *flammeum* or large yellow veil which completely enveloped the Greek and Roman brides during the ceremony. Such a covering is still in use among the Jews and the Persians.

BIBLIOGRAPHY.—*See* Brand, *Antiquities of Great Britain* (Hazlitt's ed., 1905); Rev. J. Edward Vaux, *Church Folklore* (1894).

BRIDEWELL, a district of London between Fleet Street and the Thames, so called from the well of St. Bride or St. Bridget close by. Until the 16th century it was open ground, sometimes cultivated, sometimes waste, but Henry VIII built on it (1515–*c.* 1523) "a stately and beautiful house," where he entertained the emperor Charles V and his suite in 1525. In 1553 Edward VI made it over to the city as a penitentiary, a house of correction for vagabonds and loose women. Owing to this circumstance, other institutions of this character were frequently known as bridewells in England and sometimes also in the United States. The prison was closed in 1855.

BRIDGE. The origin of the game of Bridge is very doubtful. It is sometimes said to have originated in Russia, but there is no satisfactory proof of that statement. It was first known under the title of "Biritch, or Russian Whist," and this probably gave rise to the idea that it was of Russian origin, although, as a matter of fact, the word "Biritch" is not to be found in any Russian dictionary. Many years ago the Russians played a card game called "Ieralasch," or "Ieralache," which bore a close resemblance to short whist without a trump suit. From this arose the more scientific Russian games of "Siberia" and "Preference," both of which had certain points in common with Bridge.

There is no record of the transformation of any of these Russian games into anything approaching modern bridge. The game was probably of Levantine origin. It was certainly played 50 years ago in Eastern Europe, notably in Constantinople and in Greece, and, if there were any necessity to assign to it a definite nationality, that honour must be awarded to Greece. There has been a good deal of correspondence in the newspapers as to the origin of the name "Bridge," and some very fantastic reasons have been given for it, but the transition from "Biritch" to "Bridge" is such a very natural one that it is surely unnecessary to look any further.

It is an old story how Lord Brougham, who had recently returned from Cairo, went into the card room of the Portland club one afternoon in the autumn of 1894, and sat down to play whist. When it came to his turn to deal he omitted to turn up a trump card, and when his attention was called to it he said, "I am very sorry, but I thought I was playing Bridge." "Bridge," they said, "what is that?" "What a pity you do not know it," he replied, "it is the finest card game ever invented." As soon as the rubber of whist was finished the others asked him to show them this wonderful new game. He did so, and they were so charmed with it that, from that moment onwards, bridge became the standard game at the Portland club, which had always been regarded as the headquarters and the stronghold of whist. From the Portland club the new game soon spread to other clubs, and wherever it was introduced there it stayed and flourished, so that in a very short time it became practically the national card game of Britain. The idea that bridge was unknown in Britain till then is mistaken. It was unknown in London clubland, but it was regularly played, in private circles, many years before.

It has been stated that the game was first introduced into Britain in 1880, but there is no evidence of that. The first authentic mention of it is that, in the year 1886, a small pamphlet was published in London, entitled "Biritch, or Russian Whist." It was quite a small affair, giving a very attenuated description of the game, but what there was of it, the method of scoring, and the laws as to declaring, etc., were almost identical with bridge which came into vogue eight years later. There is a copy in the British Museum (Press mark 7913 aa 51), and another in the Bodleian, and there are said to be one or two in private hands.

For a considerable time after the introduction of bridge in 1894, it remained almost exclusively a club game. Men played it at London clubs, or in their country houses when they were able to get up a rubber, but it was by no means the popular social game which it has since become. It was not until the beginning of the present century, in 1901 or 1902, that ladies discovered what a delightful field of amusement and speculation was open to them. When once they realized the fascination of the game they adopted it as their own, and became even more enthusiastic about it than the men. There are many first-class women players. London is full of mixed bridge clubs, and there are many for women only.

Whist and bridge are somewhat on the same lines. Both are partnership games for four players, and the play of the cards is on similar lines, but there are two outstanding points of difference. First, as to the trump suit. At whist this is arbitrarily determined by the last card dealt, which the dealer turns up on the table. At bridge the trump suit is selected by the dealer or his partner, without consultation, or they can elect to play without a trump (*sans atout*). The other point of difference is that, although there are four players, the dealer's partner is always dummy, and takes no part in the play of that particular hand. Directly the first card is led, dummy's cards are exposed on the table, and the duty of playing the two hands devolves solely on the dealer. The value of both tricks and honours varies with the trump suit. The game consists of 30 points scored by tricks alone. The score has to be kept on paper. For this purpose scoring blocks are provided with two vertical columns divided by a horizontal line. Tricks are scored below the horizontal line and honours above. The score for honours does not count towards winning the game, but as soon as the score of either side amounts to 30 or more, below the line, the game is won. At the end of the rubber the whole score, above and below, is added up, and 100 points are added to the winners of the rubber. A rubber is the best of three games. If the first two are won by the same side the third is not played.

Declarations can be doubled by the adversaries and redoubled by the declarers, but not beyond the point at which each trick is valued at 100. Doubling does not affect the score for honours on penalties. Each trick above six ("the book") counts:—

When spades are trumps, 2 points per trick.
When clubs are trumps, 4 points per trick.
When diamonds are trumps, 6 points per trick.
When hearts are trumps, 8 points per trick.
When there are no trumps, 12 points per trick.

Honours consist of ace, king, queen, knave, ten in a suit declaration, and the four aces when there are no trumps.

If a player and his partner conjointly hold any three suit-honours they score twice the value of the trick; if four honours, four times the value; if five honours, five times the value. If a player holds four or five honours in his own hand, he scores eight or ten times the value of the trick, and if when a player holds four his partner holds the fifth they score nine times the trick value above the line. In a no trump game three aces in the joint hands count 30, four aces count 40, or four in one hand 100 points.

On the completion of the deal, the dealer must either make a declaration or leave it to his partner. A declaration means that the declarer contracts to win at least the odd trick in a specified suit, or at no trumps. When the declaration is left the partner of the dealer is obliged to declare something—he has no alternative. If he has a bad hand, he will naturally declare spades, as that is the cheapest declaration he can make. If he has a good hand, he will declare no trumps. Whatever he declares the dealer will play the two hands; the partner will put his cards down on the table and become dummy. Whichever side wins the odd trick or more scores the value of it below the line. It is quite possible for the adversaries to win the game on a declaration by the dealer.

The declaration at bridge affords an opportunity for the exercise of certain qualities which were never called into use in the game of whist. The same technical skill is required for the management and play of the cards in both games, but at whist the trump suit is fixed before the start, whereas at bridge the result of the game will frequently depend upon the judicious exercise of the right of choosing the trump suit. The most expensive declaration being no trumps, when the value of each trick is 12 points, or more than a third of the game, the first consideration of the dealer should always be whether his hand is strong enough for this call. The game of bridge owed a great part of its popularity to the no trump declaration. There is nothing quite like it. It was, of course, unknown at whist, which, towards the finish, became almost more of a science than of a speculative game, but here you have a strong element of uncertainty and speculation, which appeals strongly to the mind of the average player, and also it is so much more interesting to play the combined hands at no trumps than in a suit declaration.

The game of bridge had a great success in Britain for rather more than ten years, and then, just as suddenly and completely as it had killed whist, it was itself superseded by its own offspring, auction bridge. (*See* Auction Bridge; Contract Bridge.)

(W. Da.; X.)

See also W. Dalton, *Bridge Abridged, or Practical Bridge* (1901); J. B. Elwell, *Advanced Bridge* (1904).

BRIDGEBUILDING BROTHERHOOD, a confraternity (*Fratres Pontifices*) that arose in the south of France during the latter part of the 12th century, and maintained hospices at the chief fords of the principal rivers, besides building bridges and looking after ferries. The brotherhood was recognized by Pope Clement III. in 1189.

BRIDGE-HEAD (Fr. *tête-du-pont*), in fortification, a work designed to cover the passage of a river by means of fortifications on one or both banks. In a wider sense it is used to mean the area occupied on the far side of a river by a protective detachment in order to cover effectively the crossing of the main body. As the process of moving an army over bridges is slow and complicated, it is usually necessary to secure it from hostile interruption, and the position constituting the bridge-head must therefore be sufficiently far advanced to keep the enemy's artillery out of range of the bridges. In addition, room is required for the troops to form up on the farther bank. In former days, with short-range weapons, a bridge-head was often little more than a screen for the bridge itself, but modern conditions have rendered necessary far greater extension of bridge defences.

BRIDGEMAN, WILLIAM CLIVE BRIDGEMAN, 1st Viscount (1864–1935), British politician, was born in London Dec. 31, 1864, and educated at Eton and Trinity college, Cambridge. He became M. P. for the Oswestry division in 1906. He was a junior lord of the Treasury in the first coalition Government and afterwards assistant director of the war trade department. Under Mr. Lloyd George he became successively parliamentary secretary to the Ministry of Labour (1916) and to the board of trade (1919) and was secretary of the mines department (1920–22). In 1923 he became an ecclesiastical commissioner. In the Conservative ministry of Mr. Bonar Law and Mr. Baldwin he was home secretary. His action in ordering the deportation and internment in Ireland of Irish prisoners in England was declared illegal by the court of appeal, and an Indemnity bill was passed for his protection. Having become, in Nov. 1924, first lord of the Admiralty in Mr. Baldwin's second ministry, he revived the proposal for establishing a dockyard at Singapore. He was created a Viscount on June 3, 1929.

BRIDGEND, urban district, Glamorganshire, Wales, on both sides of the River Ogwr (whence its Welsh name Penbont-ar-Ogwr). Pop. (est. 1938) 10,560. Area, 1.9 sq.mi. It is an old agricultural centre on the fertile plain of south Glamorgan, and like most bridge settlements, it seems to have grown up in two parts—Newcastle on the west and Oldcastle on the east of the river. In Newcastle there are ruins of a 12th century Norman castle. The proximity of the high ground of central Glamorganshire made the town a market centre where the produce of the hills could be exchanged for that of the plain, and where, in the last century, the mining population of the Llynfi, Garw and Ogwr valleys gathered to purchase their weekly provisions. The town has a tannery and brewery, and there are brickworks and stone quarries, and much lime was burned in the neighbourhood. The growth of Maesteg limited Bridgend for a time, but the recent growth of road traffic is tending to help Bridgend once more. There was no civil parish of Bridgend before 1905, when one was formed out of the parishes of Newcastle and Coity. It has a station on the G.W.R main line as well as connections with Barry, and the Llynfi and Garw valleys. It was severely affected by the depression of the 1930s, 30.4% of the insured population being unemployed in May 1934.

BRIDGE-OF-ALLAN, small burgh, Stirlingshire, Scotland Pop. (est. 1938) 2,899. It lies on the Allan, a tributary of the Forth, 3 mi. N. of Stirling by the L.M.S. and L.N.E. railways, on the wooded slopes of Westerton and Airthrey hill, sheltered by the Ochils from north and east winds. There is a pump-room and the Macfarlane museum of fine art and natural history. The industries include cotton manufacture and paper-making. The Strathallan gathering, usually held in the neighbourhood, is the most popular athletic meeting in mid-Scotland.

BRIDGEPORT, the leading manufacturing city of Connecticut, United States, and one of the important industrial centres of the country, on Long Island sound, at the mouth of the Pequonnock river, about 60m. N.E. of New York city; a port of entry and the county seat of Fairfield county. It is served by the New York, New Haven and Hartford railroad and by coasting steamers. A municipal airport is under construction. The area is 14·64 sq.mi. The population in 1920 was 143,555, of whom 46,414 (32%) were foreign-born white, including large numbers from southern and eastern Europe; in 1940, 147,121.

The city has a delightful location. Beardsley park (150ac.) contains beautiful rustic scenery; and Seaside park extends nearly 3m. along the sound. A city plan was prepared in 1916. There is a good natural harbour, formed by the estuary of the river and two inlets called Yellow Mill pond and Black Rock harbour. The commerce of the port in 1939 amounted to 1,009,177 tons, valued at $33,694,545. About 90% is incoming tonnage, of which considerably over half is coal, coke and fuel oil, and most of the rest is pig iron, scrap iron, copper, sand, clay, lumber and other materials required by the manufacturing industries. The 361 factories within the city in 1937 had an aggregate output valued at $178,066,579—about 14% of the total for the state. Among the most important manufactures are firearms and ammunition, sewing machines, corsets, gramophones, aeroplanes, electrical machinery and apparatus, drugs, plated ware, bronze, brass, iron, steel and numerous articles made of these and other metals. The assessed valuation of the property in the city in 1939 was $245,865,380.

The first settlement here was made in 1639. It was called Pequonnock until 1701, and then Stratfield. The borough of Bridgeport was incorporated in 1800; the town in 1821; the city in 1836. During the Revolutionary War it was a centre of privateering. P. T. Barnum, the showman, lived here after 1846, and did much for the improvement of the city. For many years it was the winter headquarters of Barnum and Bailey's circus and of Buffalo Bill's Wild West Show. Elias Howe built a large sewing machine factory here in 1863. During the Civil War the city made trainloads of coats, fire-arms, and other supplies for the army, and in the succeeding decade it developed into an important manufacturing centre, with a population in 1880 of 27,643, which increased to 102,054 by 1910.

At the outbreak of the World War large orders were received from the Allies for firearms, ammunition and other articles. Within two years (1914–16) the population increased 50%. Congestion in dwellings, schools, streets and trolleys became serious and there were numerous strikes. Production included 2,000,000,000 cartridges, 1,218,979,300 rounds of ammunition, submarines, Browning guns, automatic rifles, anti-aircraft guns, projectiles, target shells, naval guns, and copper bullets. After the Armistice the industries readjusted themselves to normal demands.

Bridgeport industries, organized for mass production, played an important part in defence production in 1941.

BRIDGES, CALVIN BLACKMAN (1889–1938), American geneticist, was born at Schuyler's Falls, N.Y., on Jan. 11, 1889. In 1912 he graduated at Columbia university where in 1916 he received the degree of doctor of philosophy and was research assistant to T. H. Morgan during 1910 to 1915. From 1915–19 he continued his researches under grants from the Carnegie institution, of whose staff he became a member in the latter year. The chromosome theory of heredity and sex determination engaged his particular attention.

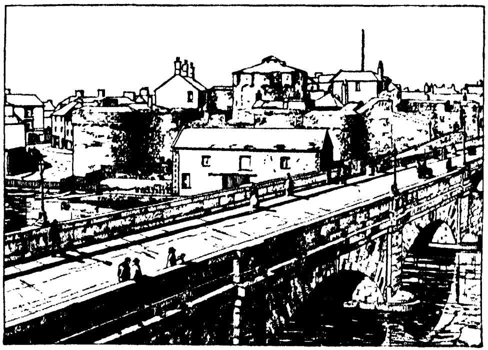
His publications include *The Mechanism of Mendelian Heredity* (1915); *Sex-linked Inheritance in Drosophila* (1916); *Genetics of Drosophila* (1925) and a number of papers.

BRIDGES, ROBERT (1844–1930), English Poet Laureate, born at Walmer Oct. 23, 1844. Educated at Eton and Corpus Christi College, Oxford he afterwards studied medicine and became Consulting Physician at the Children's Hospital, Great Ormond Street, and assistant Physician at the Great Northern Hospital. In 1882, at the age of 38, he abandoned medicine. *Prometheus the Fire-Giver*, published in 1883, could appeal to few but scholars. Eight plays, *Nero* (part I), Palicio, *Ulysses*, *The Christian Captives, Achilles in Scyros, Humours of the Court, The Feast of Bacchus, Nero* (part II) were issued between 1885 and 1894. *Demeter*, a mask, was written for the undergraduates at Somerville College, Oxford, and acted by them in 1904.

Dr. Bridges is to be found in a still more experimental vein in the poems in classical metre which he began to publish in 1903. There has never been an English poet, indeed, who has been more interested in prosody. In the lyrics collected in *Shorter Poems* (1890) he had fortunately shown that poetry was for him something more than a prosodist's laboratory. Here the artist takes control of the scholar, and genius makes use of new measures, not for their own sake, but in order to pour into them the pure treasures of inspiration. In lyric after lyric—"A Passer-by," "London Snow," and "On a Dead Child,"—the novelty of the form, remarkable though it is, does not distract us from the vision that it reveals. Many of the lyrics of Dr. Bridges express a joy in the lovely things of life so pure and unclouded that, as we read, it seems never to have been expressed before. Even though the shadow of death and sorrow falls at times on his verse, the general impression his work leaves on us is one of serene delight. In 1913 Mr. Asquith appointed him to the Poet Laureateship. Probably his anthology, *The Spirit of Man*, compiled during the War (1916), achieved wide popularity. His critical writings on poetry, language and pronunciation are both valuable and original, and he has written in the spirit of a reformer as a founder of the Society for Pure English. But his chief writings in prose are the two essays, *Milton's Prosody* (1887) and *John Keats, a Critical Essay* (1895), and *The Necessity of Poetry, an Address* (1918). In *New Verse* (1925) he tried new metres. He was awarded the O.M., June 3, 1929. In 1929, at the age of 85, Bridges published his last great poem, *The Testament of Beauty*, an ardent confession of philosophical faith, written in "loose Alexandrine" metre, in which he aimed at reconciling scientific knowledge with traditional belief. Bridges died April 21, 1930.

BRIDGES. The function of bridges may be described as the starting of a stream of human traffic hitherto impossible; the surmounting of a barrier, the linking up of two worlds divided by a gulf. One such barrier, the great River Severn, has decided more than once the fate of England. Thus when Margaret of Anjou had crossed to England, just as Edward was disbanding the last of his infantry after Barnet, she attempted to reach Bath, with Edward pounding on out of Cirencester. From then until the battle of Tewkesbury her movements were those of a person who is being chased in the direction of a wall in which there is a gate she cannot find. And eluding, feigning, doubling back, she was brought to a standstill at last and crushed against the barrier she had so desperately striven to cross and could not. In the early hours of May 1, the king, having heard news of her westward march, "toke advise of his counsell of that he had to doe for the stopynge of theyr wayes, at two passagys afore namyd, by Glocestar, or els by Tewkesberye." It was not only that her men were completely exhausted after their march; not only that the king was only half-a-dozen miles behind her, "evar redy, in good array and ordinaunce"; but at Tewkesbury the river became two rivers, and having failed to cross thus far, how could she hope to do so thereafter? With the Severn on its right, and the Avon on its left, her army could only stand still and await the death-blow.

Another drama of the same kind, and even more striking though it ended not in massacre but in withdrawal by sea, was set on the banks of the Chickahominy in Virginia during the American Civil War. After long delays General McClellan had succeeded in carrying his plan for an attack on Richmond. When at last his army had been transported to the peninsula it took two more months before they reached the Chickahominy. During that time the rebels had gathered thousands of recruits and an army of slaves was at work on entrenchments. Already the attack was weeks overdue; every moment wasted increased the exhaustion of the Northern troops and added to the enemy's strength. But for the Chickahominy, Richmond might still have been taken and the subsequent history of the Civil War might have been shorter and very different. Instead, the army, during another disastrous month, lay astride the river, unable finally to cross to this side or that, its ranks daily thinned by malaria and by the unaccustomed heat. If the whole of the men were brought across to the south bank the line of communication with Washington would be imperilled and the stores laid down further north almost certainly destroyed. Yet the army was too small to march on Richmond and leave a guard behind, while to have remained on the north bank would


THE BRIDGE OVER THE RIVER SHANNON AT ATHLONE, IRELAND

have been at once to acknowledge failure and defeat. Caught in the toils of the Chickahominy it could neither advance nor retreat and all the while the men knew that nothing could be more perilous than the immobility into which they were forced by their enemy, the unbridged river. The lines extended 20 miles on either side; and it is true that six or seven dilapidated bridges united them. But six or seven were not enough, and though other bridges were begun in the few places where a crossing seemed approachable, McClellan's troops could never build so many that their movements would become rapid and secure. And so they were held until their danger became too great and began to close round them on every side, so that they had to fight their way out of the trap into which they had so innocently wandered.

The frustration of Margaret's plans was due in part to the immediate action taken by the king, who turned the Severn into his most powerful weapon against her; the Chickahominy did its work unaided, which may explain how the escape of the imprisoned armies was made possible. When man and nature work in alliance the result is usually more certain. The entrapping of Simon de Montfort at Evesham could only have been contrived by a man completely familiar with the River Avon and its bridges and determined to use both the one and the other to their utmost capacity. With half his army Prince Edward came rushing back from the disabling of young Simon at Kenilworth while the other half marched from Worcester in time to meet him at Evesham; and in order to make sure against Simon's escape, each half divided again at carefully arranged points and united, the one at the next bridge upstream (a couple of miles away) and the other at Evesham itself, the duke of Gloucester's division rejoining the northern forces by crossing Evesham bridge from the south. In this skilfully planned manoeuvre the Avon crossings were played against Simon as a hand at cards is played, one crossing after another being used and guarded like the opening and shutting of so many doors, and thus made to contribute to the cumulative result that meant a sudden and decisive victory.

Old Bridge Construction.—The history of all old bridges which have survived complete is one of almost continuous repairs, and the written records that remain tell us of the unceasing labours of those who raised funds for their maintenance. Without such vigilant care no masonry bridge, no matter how well built, was likely to last much over a century. Storm and flood, sun and frost, combining with the vibration of traffic, found a weak point somewhere, and, unless the damage was repaired at once, it spread with startling rapidity. True, in the middle ages, when the foundations of a stable civil government were only gradually being laid, builders made every effort to lessen the need for future repairs by designing their bridges so that an injury would not spread quite so quickly. The piers were so heavily constructed that every arch rested in what was virtually an isolated compartment. But this device brought other dangers and drawbacks, to which some reference must presently be made

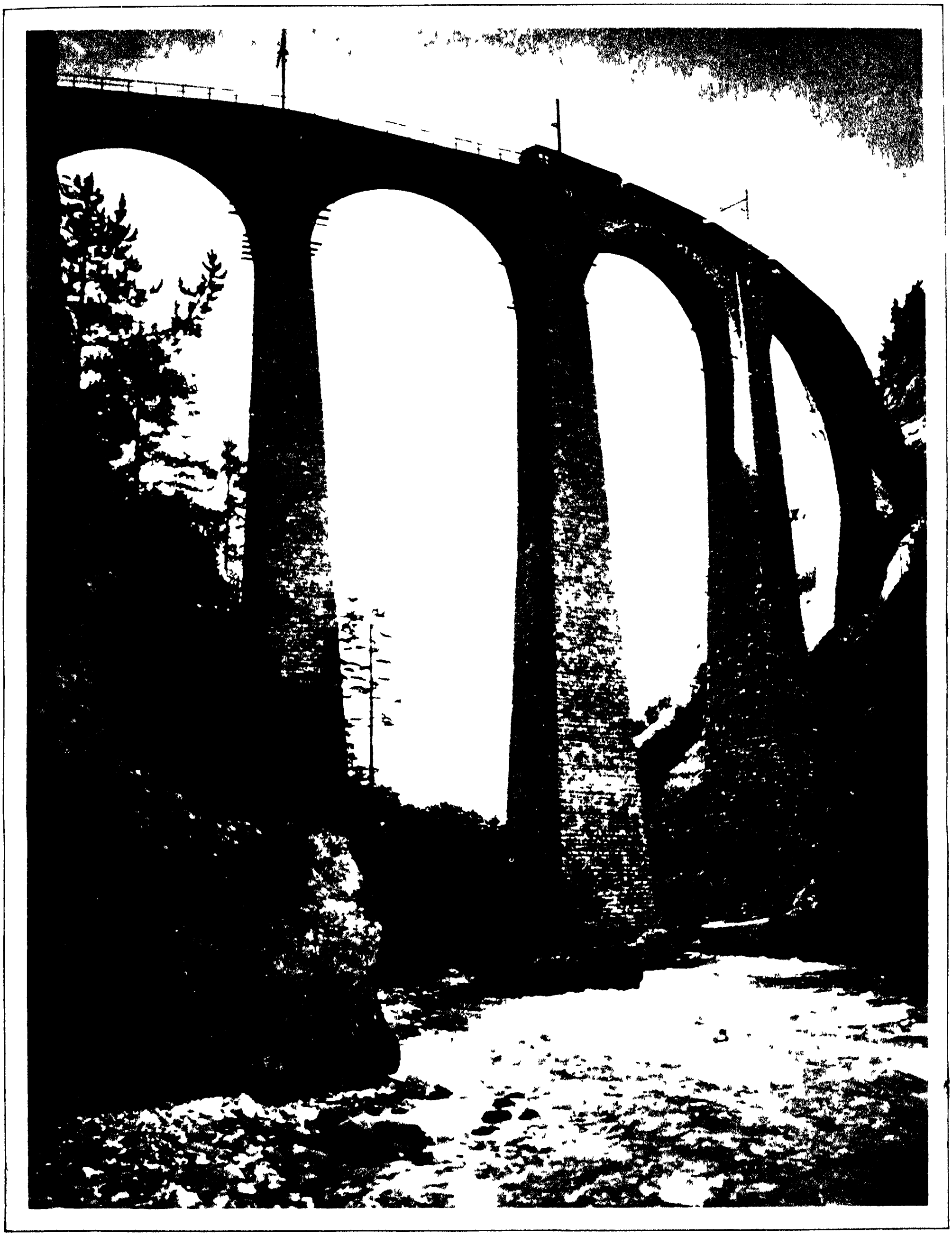
The pounding of horses' hoofs above and of angry waters below were enemies above all to be dreaded. It is easy, when we consider these, to understand why the most perfectly preserved and hence the most celebrated of all Roman bridges in Europe should be not bridges properly speaking, but the aqueducts that carried their water supply across a valley. Many of the so-called Roman bridges in all parts of Europe are not Roman bridges at all. Of the four in Rome itself, not one contains any masonry that can with confidence be dated earlier than the beginning of the 15th century. A ruin such as the beautiful single arch over the Tiber at Narni, 50 m. from Rome, is much more likely to contain original stones.

English Bridges.—English bridges have hardly received their proper regard, for the achievement they embody with such modesty is the result not of a single great effort but of centuries of unremitting labour; great though the effort of building a bridge may have been, it is as nothing beside the efforts required to maintain it. Towards the end of the 14th century, London bridge had attached to it a permanent building staff of a dozen carpenters and masons. Doubtless a great many more were recruited in special emergencies. The financial provisions which enabled these men to be kept at work have made the Bridge House estates committee (the survival of a governing committee set up at the end of Elizabeth's reign) one of the wealthiest bodies of its kind in Europe. The first regular source of revenue enjoyed by London bridge were the rents of the houses and shops on the bridge, which in the 14th century amounted to £160 per annum and in the 18th century to five times as much. But tolls were already being levied on passengers, and landed property bequeathed to Bridge House was bringing in considerable sums; a lucky circumstance when we remember that in the last few decades of its long life the annual maintenance bill for Old London bridge was four thousand pounds. Other and smaller bridges did not present the same problem, but few of them were fortunate enough to be placed in the care of permanent officials at such an early date. Where no warden was appointed the responsibility had to be fixed somewhere by law, and mediaeval records are full of inquisitions and disputes on this point. The case of the Long bridge at Shoreham is typical. The bridge being in a state of dangerous decay, the tenant of the adjacent land (which belonged to the archbishop of Canterbury) was adjudged responsible, and the bailiffs sold his goods and chattels that the neglect might be made good. Most bridges, however, were the subject of some kind of contract with Church or Government which made such hardships less likely to befall a local citizen. The corporation of Berwick, for example, received £100 per annum from the Crown for the maintenance of Berwick bridge, which still survives. No single entry in the Scotch Exchequer Rolls occurs more often than the words *Ad Sustent.* (*Ad Sustentacionem*), under the name of a bridge. Since then, the age of modern local government has of course transferred all responsibility to local authorities.

Gateway Bridges.—Most bridges before the 18th century were furnished with a gateway which was built either on one of the piers of the bridge or at one of the approaches. These gateways had a fiscal as well as a military use, and were often flanked by a toll-house. Only one example remains in the United Kingdom to-day, that which sits astride the Monnow bridge at Monmouth. Our coaching forefathers found them a serious obstruction and it is surprising to find even this one left. The toll-house on St. Ives bridge in Huntingdonshire no doubt had a gate in its day, but it does not stand beside it now.

Age of Bridges.—So close is the connection between the general development of civilization and the development of its bridges that we can best tell the age of a bridge by measuring its girth of masonry. Sometimes, but not often, a bridge or part of a bridge has a date carved on it; more frequently there is some written record of building or repair work. Yet even where such records exist it is often impossible to say whether the date they give is that at which the foundations were put down and the arches first built. The gradual widening of the average span, and the gradual narrowing of the average pier, give us surer evidence of date. In the British Isles, as Harry Inglis has pointed out, the arches start from the neighbourhood of 25 ft., the average span of those of Old London bridge, about the year 1200, to reach a maximum of 75 ft. about the middle of the 18th century, when modern engineering had its birth, and since then the increase has progressed in width with startling rapidity. The obstacle that the bridge presents to the water's flow continually grows smaller, until the suspension bridge leaves next to nothing standing in its way.

The Nodal Bridge.—Among the various parts played by a bridge in human history there is one which is greater than any, and which strangely enough requires that traffic on the river should be considerably impeded. This is the part of what has been described as a nodal bridge. A nodal bridge is one which stands at the point where a busy water-way is crossed by a busy land-way in such a manner that the two streams of traffic are mixed together. Most of the great commercial centres of the world owe their expansion, if not their origin, to such a nodal bridge. It is safe to say that had there been no suitable site for a mediaeval bridge anywhere between Wapping and Charing Cross, London as we know it to-day would never have existed. Moreover, if by some impossible anachronism Old London bridge had been suspended from a



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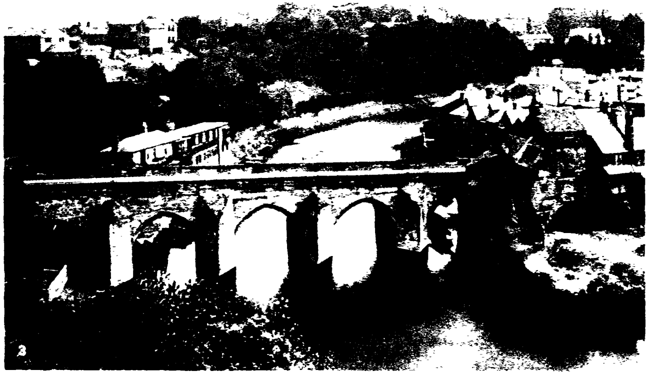
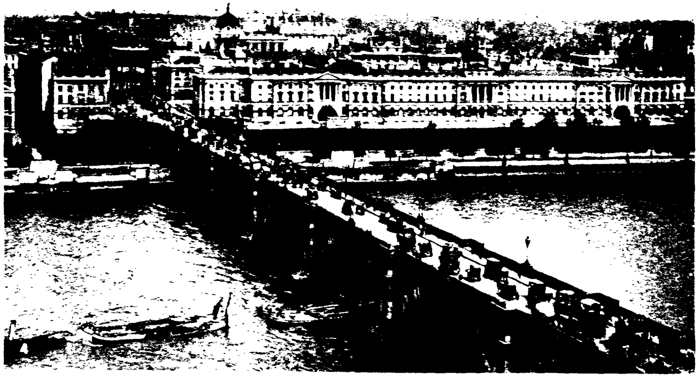
THE LANDWASSER VIADUCT, ACROSS THE ALBULA PASS, IN THE CANTON OF GRISONS, SWITZERLAND





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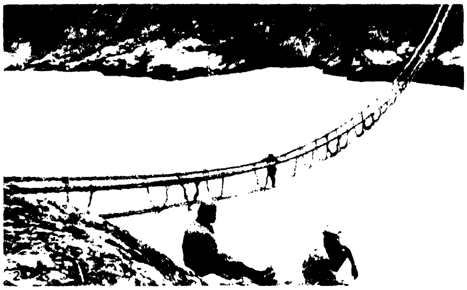
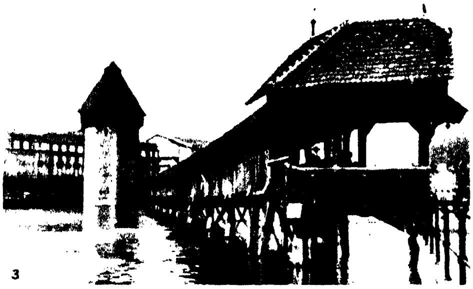
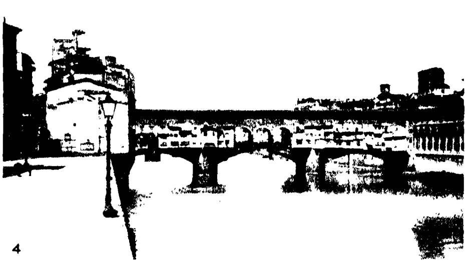
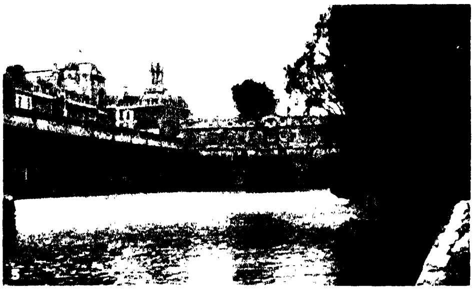
FOUR ARCHED BRIDGES IN ENGLAND

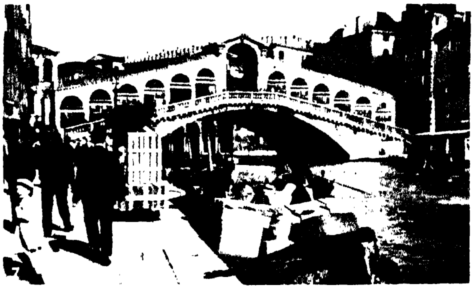
1. **Monnow** bridge, over the river Wye at Monmouth, said to date from 1272, the most perfect existing example of a bridge with fiscal and military tower and gate. These are shown on the bridge at the right of the picture
2. Richmond bridge, over the Thames at Richmond, designed by James Payne, and built in 1774, showing the five central arches of stone; the most famous of the classical Georgian bridges in England
3. Elvet bridge, over the river Wear at Durham, built by Bishop Pudsey in the twelfth century. It has ten pointed arches and is one of the few remaining bridges with a chapel upon them
4. Waterloo bridge, over the Thames in London, designed by Sir John Rennie and built in 1811, shown before the increased volume of motor transport caused a subsidence in the central piers











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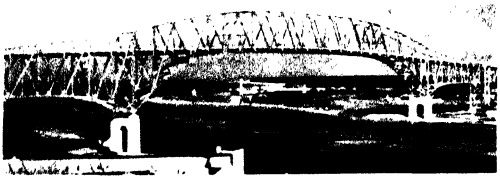
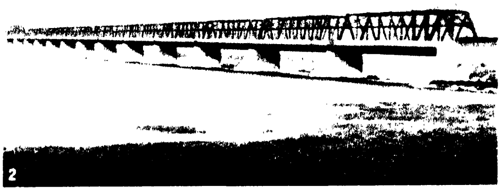
BRIDGES SPANNING RIVERS IN VARIOUS PARTS OF THE WORLD

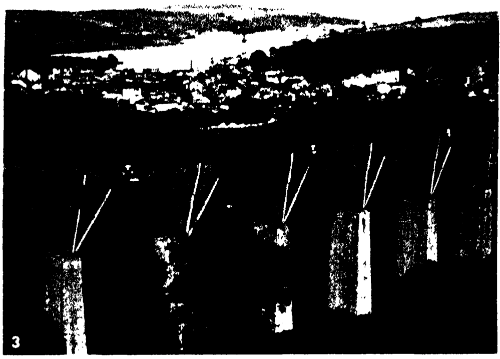
1. A street bridge lined with small shops in Kashmir, India
2. A grass rope bridge over the Indus river in Tibet
3. The Kapell Brücke, which was built at Lucerne, Switzerland, in the middle ages
4. The Ponte Vecchio, over the river Arno at Florence, Italy
5. Three-arched bridge over the Avon at Bath, England, built in 1770
6. Wooden-covered bridge over the Juniata river at Bedford, Pa., U.S.A.
7. The Rialto, in Venice, an arcaded bridge lined with small shops

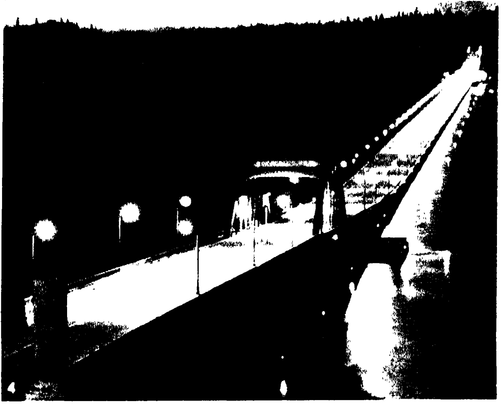
PLATE IV

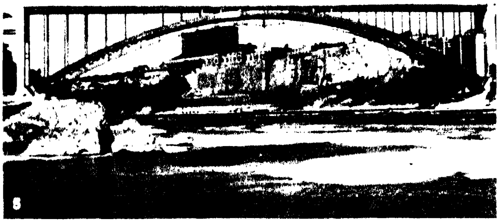
BRIDGES

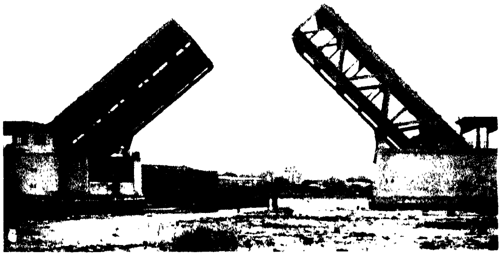












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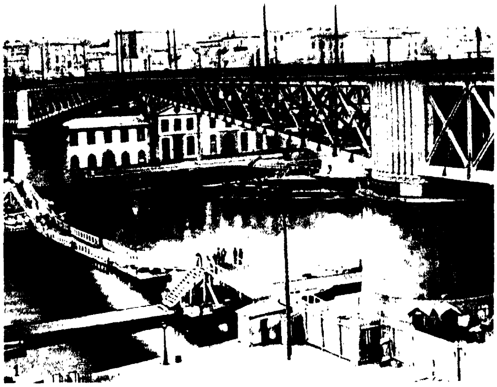
BRIDGES OF NORTH AMERICA AND ENGLAND

1. The Blue Water International bridge, joining Port Huron, Mich., and Sarnia, Ont., Canada. It is a cantilever bridge with a main span of 871 ft.
2. The Victoria Jubilee bridge across the St. Lawrence river, Montreal, has 25 spans and a total length of 6,592 ft.
3. Penryn bridge at Falmouth, England, built for the Great Western railway
4. Lake Washington bridge at Seattle, Wash., a floating bridge 1½ mi long on steel and concrete pontoons
5. Rainbow bridge at Niagara Falls, Ont., a 950-ft. steel-arch span
6. Roosevelt Avenue bridge, bascule type, over the Flushing river, New York city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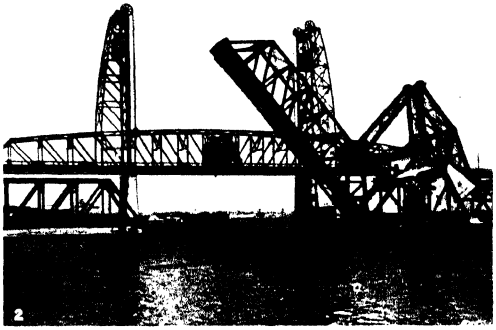
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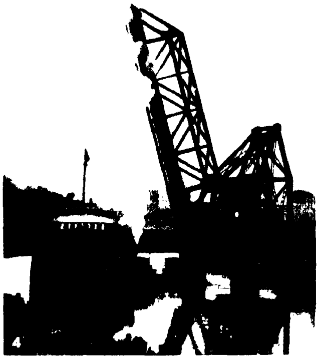
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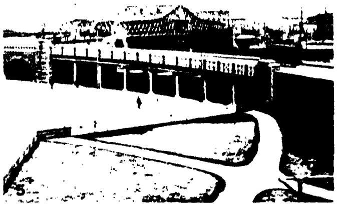
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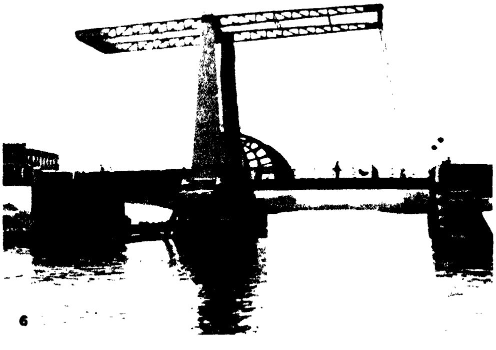
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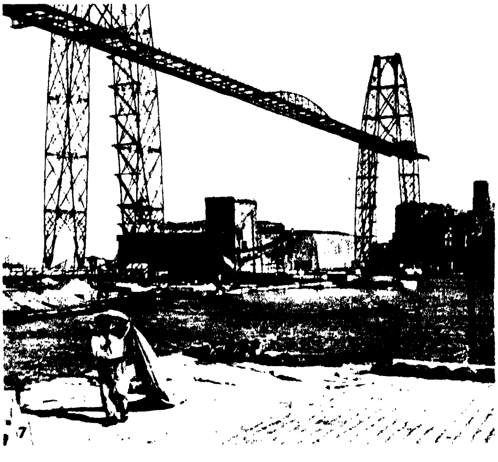
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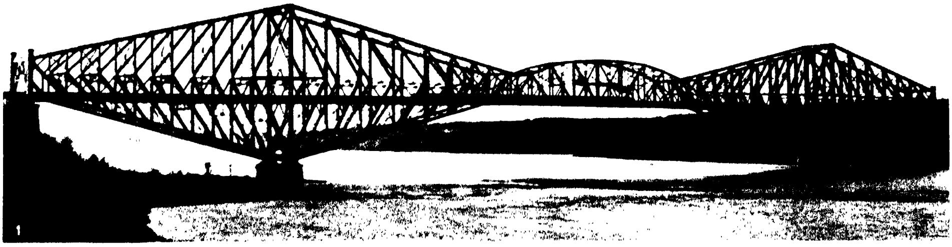
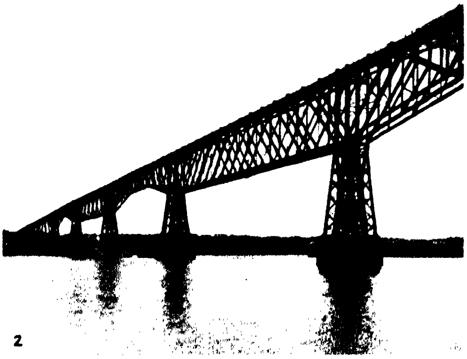
DRAWBRIDGES IN EUROPE AND AMERICA

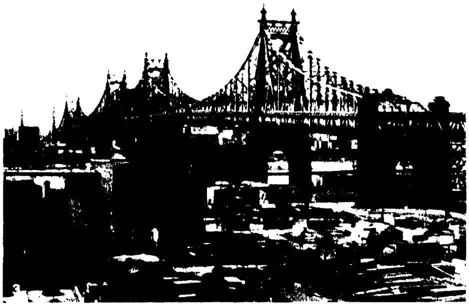
1. The revolving bridge at Brest, France, showing pontoon footbridge below
2. Jacksonville, Florida. Bascule railroad bridge over the St. Johns river
3. Madison Avenue bridge over the Harlem river, New York city, shown
4. The "jack-knife" bridge across the Cuyahoga river at Cleveland, Ohio
5. Third Avenue bridge over the Harlem river, New York city, completed 1898
6. Drawbridge across the canal from Monnickendam to Amsterdam, Holland
7. [illegible]

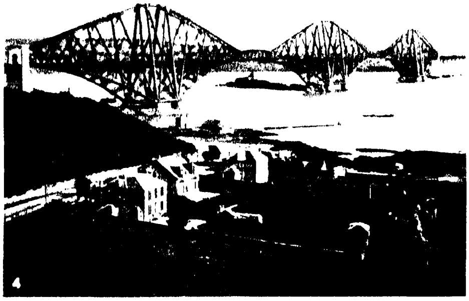
PLATE VI

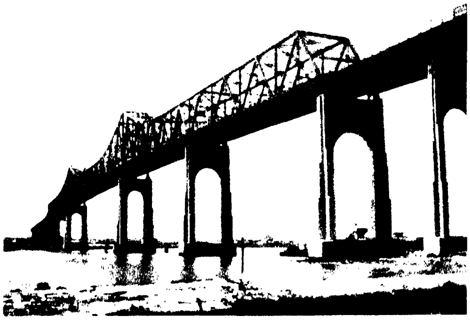
BRIDGES











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CANTILEVER BRIDGES IN EUROPE AND AMERICA

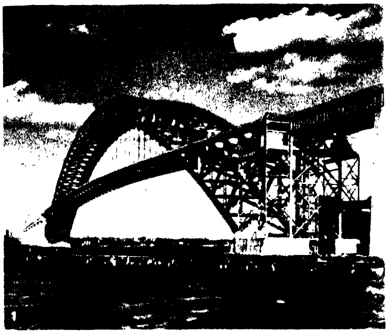
1. View of the Quebec bridge, crossing the St. Lawrence river nine miles west of Quebec. This bridge, having a channel span of 1,800 feet between pier centres, was completed on September 20, 1917, when the 640-foot suspended span was hung on the cantilevers and bolted into its final position. Two serious accidents which occurred in 1907 and 1916 during the process of construction, necessitated changes in the original design and delayed the completion of the bridge

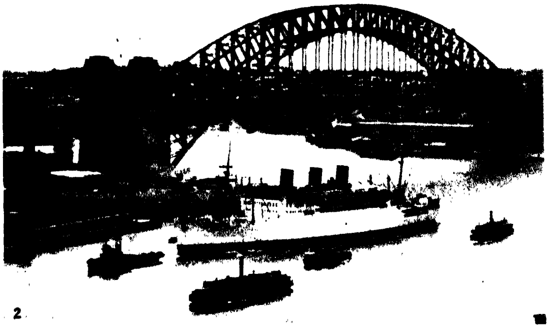
2. The Poughkeepsie railway bridge, crossing the Hudson river at Poughkeepsie, New York. This reverse cantilever bridge, 2,260 feet long and 200 feet above the water, carries the trains of the central New England railroads across the Hudson. It was completed in 1889 and rebuilt in 1904

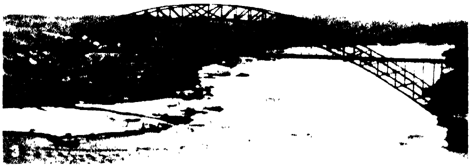
3. The Queensboro cantilever bridge, which crosses the East river between Second avenue, Manhattan, and Long Island City, with sustaining towers on Blackwell's Island (now called Welfare Island)

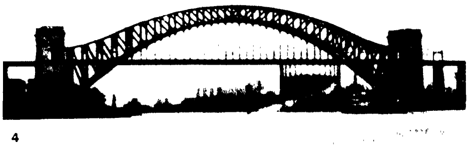
4. The Forth bridge, crossing the Forth river, in Scotland, at a point where the channel is divided by the island of Inchgarvie. The two main spans of this cantilever bridge, completed in 1889, are 1,710 feet each, the length is 5,330 feet, and the extreme height of the towers above high water is 361 feet

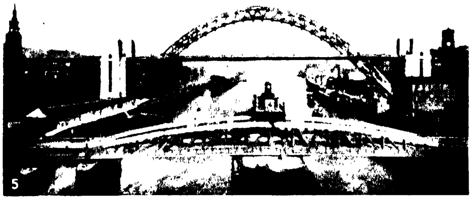
5. The Outerbridge, crossing from Tottenville, Staten Island, to Perth Amboy, New Jersey, opened for traffic on June 29, 1928. The main span, centre to centre of piers, is 750 feet; the total length, plaza to plaza, is 10,140 feet, and the over-all width of the bridge is 55 feet

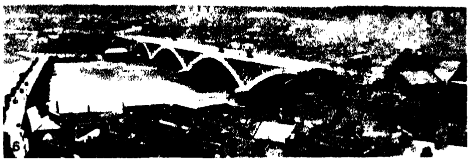


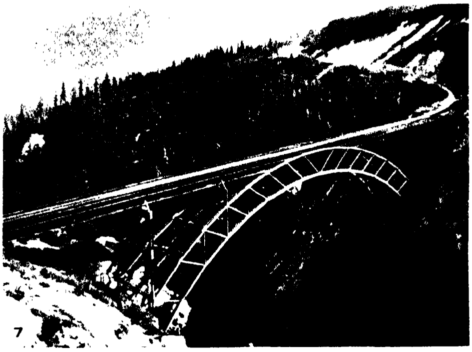


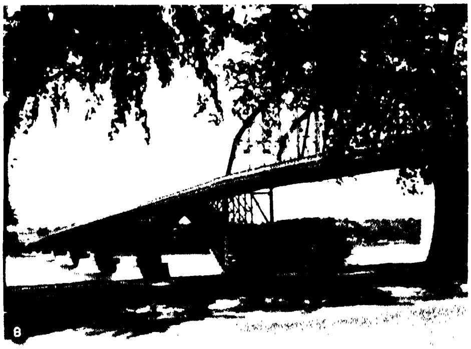








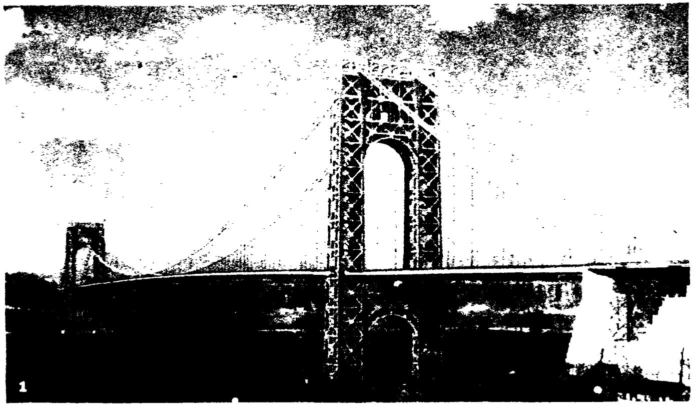




BY COURTESY OF (1) THE PORT OF NEW YORK AUTHORITY, (2) THE DIRECTOR OF AUSTRALIAN TRADE [illegible] LONDON (4) THE PENNSYLVANIA RAILROAD, (5) DORMAN LONG AND CO., LTD., (7) THE CANADIAN PACIFIC RAILWAYS. PHOTOGRAPHS, (3, 8) EWING GALLOWAY, (6) TOPICAL PRESS AGENCY

ARCH SPAN BRIDGES

1. Bayonne bridge, crossing the Kill van Kull from Bayonne, New Jersey, to Port Richmond, Staten Island, U.S.A. The length of the arch span is 1675 feet, of the main structure 5780 feet. Completed in 1931
2. Sydney Harbour Bridge, New South Wales, was completed in 1932. The length of its arch span is 1652 feet, of the main structure, 3770 feet
3. The Old Trails Highway, opened to traffic in 1916, single span arch across the Colorado river connecting California with Arizona, on the route of the Old Trails Highway near Topock, Arizona
4. Hell Gate bridge, single span steel-arch four-track railroad bridge across the East river, New York, U. S. A., opened in 1917. From railing to railing it is 93 feet wide. The towers at each end rise 95 feet above the track level
5. The Newcastle-upon-Tyne bridge, steel arch, constructed in 1925 28 to carry the Great North Road across the Tyne at Newcastle. The total length of the bridge is 1254 feet
6. The Royal Tweed road bridge, a huge ferro-concrete structure crossing the river Tweed at Berwick, opened on May 16, 1928. To the left is the old stone bridge
7. Stony Creek bridge, over the gorge of that name, on the Selkirk range in British Columbia, erected in 1893, has a span of arch of 336 feet and is 300 feet high
8. The International (toll) Peace bridge, Buffalo, New York, connecting the United States with Canada at Fort Erie, Ontario. It was opened August 7, 1927



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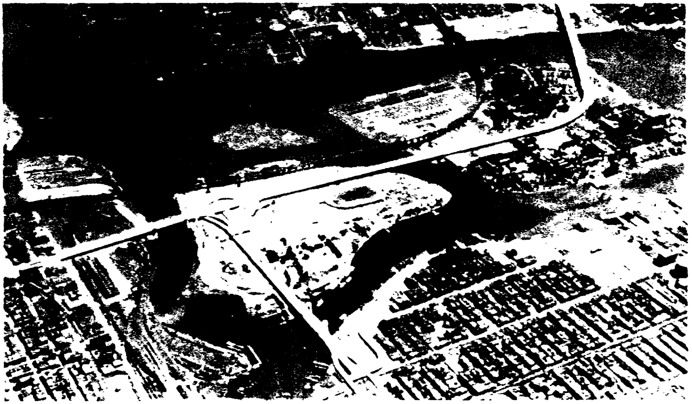

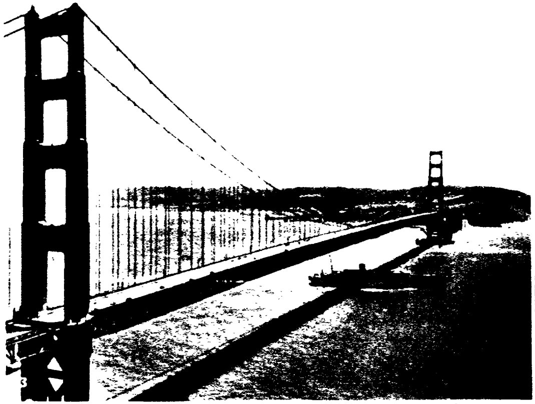

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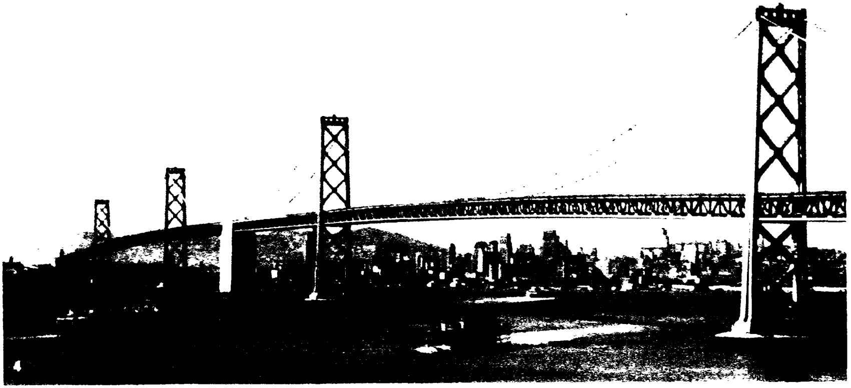

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BY COURTESY OF (1) THE PORT OF NEW YORK AUTHORITY, PHOTOGRAPHS (2) ACME (3, 4) EWING GALLOWAY

BRIDGES OF THE UNITED STATES

1. The George Washington bridge over the Hudson river, connecting 179th street, New York city, and Fort Lee, N. J., is the second longest suspension span. It took four and one-half years to construct it at a cost of about $60,000,000 and was opened to traffic Oct. 25, 1931. There are four roadway lanes and two pedestrian sidewalks. Length of river span, 3,500ft.; height of roadway above river, 250ft.; height of towers, 600ft.; diameter of each cable, 36in.; number of wires in each cable, 26,474

2. Aerial view of the Triborough bridge which connects the boroughs of Manhattan, the Bronx and Queens, New York city. The three arms of the giant bridge meet on Randall's island

3 Golden Gate bridge, San Francisco, completed in 1937. Length of main span, 4,200 ft., the longest in the world; height of tower 746 feet. This bridge has six highway lanes and a foot-bridge on each side of the roadway

4. Western section of the $77,000,000 San Francisco-Oakland bridge. The two suspension bridges have 2,310-ft. main spans. The west half of the bridge is a suspension structure comprising twin suspension bridges anchored into a huge concrete monument in the centre. A double-deck tunnel pierces Yerba Buena island, and the double-deck bridge continues over a 1400-ft. cantilever span, 5 through truss spans, and 14 deck truss spans before it lands on a fill extending out from the Oakland shore. The 51 piers of this bridge go deeper below water than any previous substructure ever built, some as far as 237ft. below low tide

couple of piers as are several of the new bridges above Westminster, or if it had opened itself to waterborne traffic with as much ease as the bascules of Tower bridge, the Port of London would never have attained its present rank among the harbours of the world. It was necessary that ships should come in on the rising tide and be arrested by a bridge whose piers were so wide that they dammed up the Thames like a millrace. And it was also necessary that from this last navigable point there should run roads linking north with south across the Thames. The road was not a wide one, for when the great cross for St. Paul's dome was cast at Mitcham there was not room enough for it to pass. But it was a road nevertheless, and from its marriage with the river all London has been begotten.

See Walter Shaw Sparrow, *A Book of Bridges;* Christian Barman, *The Bridge* (1926); W. F. Watson, *Bridge Architecture* (1927); J. A. Waddell, *Bridge Engineering* (1916). (C. Ba.; X.)

United States.—During the past century, the principal demand for bridge construction was in connection with the building of the railroad transportation systems. At the turn of the century, many of the railroad bridges were being replaced or reconstructed to provide increased strength and clearance for the rapidly increasing size, weight, and speed of locomotives and trains. Since about 1915, however, there has been no further extension of the rail systems, and the economic plight of the railroads has limited the improvement of existing construction. Instead, the phenomenal development of automobile traffic has created a new phase of bridge construction. From 8,000 automobiles in 1900 and 2,000,000 in 1915, the number of automobiles and motor trucks in the U.S. has multiplied to 30,000,000 (1940). This rapidly increasing volume of highway traffic has resulted in a demand for more and better roads and express highways, with the accompanying necessity for more and larger bridges; and it has created both demand and economic justification for bridges of unprecedented dimensions over crossings that previously had to be left unspanned.

For spans of unusual magnitude and cost, also for interstate and international crossings, toll bridges have come to be the solution of the financing problem. Up to 1929, most of these toll spans were built under private ownership, but the more recent toll bridges have all been built by public commissions or "bridge authorities." Toll bridges are financed, as a rule, by issuing revenue bonds which are secured only by the prospective earnings, so that the user pays for them until they become free, instead of adding them to the general tax burden. The motoring public has thus secured the benefit of many needed bridge crossings where such facilities would otherwise have remained unattainable. There were in 1940 over 400 toll bridges in the U.S., representing a total investment of over $500,000,000; only about 200, amounting to $100,000,000, were privately owned. There were over 90,000 steel bridges (not counting timber trestles) on 240,000mi. of railroad in the United States in 1940. The aggregate length of these steel railroad bridges was over 1,500 miles. The number of highway bridges in the U.S. probably exceeds 250,000 (besides over 2,000,000 culverts) on the 3,000,000mi. of roads and highways. The aggregate investment in these highway bridges is over $3,000,000,000.

Cities located at junctions of rivers are particularly dependent upon bridges for their development. The city of Pittsburgh has 18 highway bridges and 9 railroad bridges spanning the Allegheny and Monongahela rivers. In New York city, in a single day, over 480,000 automobiles and trucks cross the highway bridges entering Manhattan island,—300,000 on 12 free bridges (including 100,000 on the Queensboro bridge and 80,000 on the Manhattan bridge), and 180,000 on 3 toll bridges (George Washington, Triborough, and Henry Hudson),—besides over 2,000,000 passengers on rapid transit trains and electric trolley cars. The Henry Hudson bridge (toll) carries 13,000,000 autos a year.

The six longest spans in the world are in the U.S. (Golden Gate, 4,200ft.; George Washington, 3,500ft.; Tacoma Narrows, 2,800ft.; Transbay, 2,310ft.; Bronx-Whitestone, 2,300ft.; Detroit Ambassador bridge, 1,850 feet). All of these have been completed or started since 1929, all are of the suspension type, and all are highway toll bridges. The largest bridge project in the world to date is the Transbay bridge between San Francisco and Oakland, completed in 1936, costing $77,200,000. Its total length of 8mi. includes two joined suspension bridges of 2,310ft. main span each, a cantilever bridge of 1,400ft. main span, and other spans. A record foundation depth of 240ft. was reached for one of the piers. The world's longest span is the Golden Gate Bridge, also at San Francisco, completed in 1937 at a cost of $35,000,000. The main span, 220ft. above the water, is 4,200ft. between towers 746ft. high. The two main cables are 36½ inches in diameter, the largest constructed to date.

The George Washington bridge, spanning the Hudson river at New York with a main span of 3,500ft., was opened in 1932 at an initial cost of $60,000,000. It has four main cables, each 36 inches in diameter. Provision is made for 8 lanes of highway traffic on the present deck and for the future addition of a lower deck.

It took 40 years (1889 to 1929) to increase the world's record span length from 1,700ft. (Forth bridge) to 1,850ft. (Ambassador bridge at Detroit); then, in the next eight years (1929 to 1937), in two leaps (George Washington bridge and Golden Gate bridge), the record span length was more than doubled, from 1,850ft. to 4,200 feet. Plans have been prepared for the proposed Narrows bridge (suspension) to span the entrance to New York harbour with a record-breaking span length of 4,620 feet. A generation ago, the feasibility of a span of 3,000ft. was seriously questioned; now bridge engineers confidently agree that suspension bridge spans as long as 10,000ft. are practically feasible.

It is significant to note that the cantilever bridge has yielded its previously claimed supremacy to the suspension type. For spans exceeding 800ft., and even for shorter spans, the suspension type is generally adopted as preferable. Both aesthetic and economic considerations have governed this change.

Early steel bridges of outstanding beauty are the Brooklyn bridge, the Washington Arch bridge over the Harlem river, and the Hell Gate Arch bridge. The most beautiful concrete bridges in the U.S. include the Ridge Road bridge, Rochester, N.Y.; Connecticut avenue bridge, Washington; Walnut Lane bridge, Philadelphia; Raritan River bridge, New Brunswick, N. J.; Rocky River bridge, Cleveland, Tunkhannock viaduct, Pennsylvania; Colorado River bridge, Austin, Texas; Cappelen Memorial bridge, Minneapolis.

TABLE I. *Notable Suspension Bridges*

Bridge	Location	Date completed	Span, feet	Engineer
Golden Gate	San Francisco	1937	4,200	Strauss
George Washington	New York city	1932	3,500	Ammann
Narrows	Tacoma		2,800	Eldridge
Transbay	San Francisco	1936	2,310	Purcell
Whitestone	New York city	1939	2,300	Ammann
Ambassador	Detroit	1929	1,850	Jones
Delaware River	Philadelphia	1926	1,750	Modjeski
Bear Mountain	Hudson river	1924	1,632	Baird
Williamsburg	New York city	1903	1,600	L. L. Buck
Brooklyn	New York city	1883	1,595½	Roebling
Lions Gate	Vancouver, B. C.	1938	1,550	Monsarrat & Pratley
Mid Hudson	Poughkeepsie	1929	1,500	Modjeski & Moran
Manhattan	New York city	1909	1,470	Lindenthal
Triborough	New York city	1936	1,380	Ammann
St. Johns	Portland, Ore.	1931	1,207	Robinson & Steinman
Mt. Hope	Rhode Island	1929	1,200	Robinson & Steinman

TABLE II. *Notable American Cantilever Bridges*

Bridge	Location	Date completed	Span, feet	Engineer
Quebec	St. Lawrence river	1917	1,800	Modjeski, Monsarrat, Schneider, Duggan
Transbay	Oakland, Calif.	1936	1,400	Purcell, Andrew, Woodruff
Longview	Columbia river	1927	1,200	Strauss
Queensboro	New York city	1909	1,182	Lindenthal
Carquinez Strait	California	1927	1,100	Derleth, Steinman
Harbour Bridge	Montreal	1929	1,097	Monsarrat & Pratley
Cooper River	Charleston, S. C.	1929	1,050	Waddell & Hardesty
Blue Water	Port Huron, Mich.	1938	871	Modjeski & Masters
Monongahela R.	Pittsburgh	1904	812	Boller & Hodge
Baton Rouge	Mississippi river	1940	848	Lant
Vicksburg	Mississippi river	1929	825	Harrington, Howard & Ash
Rip Van Winkle	Catskill, N. Y.	1935	800	Woodruff
Lake Union	Seattle	1932	800	Jacobs & Ober
Cairo, Ill.	Ohio river	1938	800	Modjeski & Masters
Potomac River	Dahlgren, Va.	1940	800	Greiner

The 16 largest suspension bridges in the world are in the U.S.

and Canada. *See* Table I.

The Sky Ride at the Century of Progress Exposition in Chicago (1933 and 1934) was a suspension bridge of 1,850-ft. span, carrying 12-ton passenger cars 215ft. above the ground.

With one exception (Forth bridge Scotland, 1,700-ft. span), the 27 largest cantilever bridges in the world are in the U.S. and Canada.

Of the 14 largest steel arches in the world, 9 are in the U.S.

Table III – *Notable American Steel Arch Bridges*

Bridge	Location	Date com pleted	Span, feet	Engineer
Bayonne	New York city	1931	1,652	Ammann
Hell Gate	New York city	1916	977½	Lindenthal
Henry Hudson	New York city	1936	800	Robinson & Steinman
Croton Lake	Parkway, N Y	1931	750	Baird
Michigan Central R. R.	Niagara river	1924	640	Ibsen
Lee's Ferry	Colorado river	1928	618	Lashmet
Middletown, Conn.	Connecticut river	1938	600	Sumner, Grove
Needles, Calif	Colorado river	1916	592	Sourwine
Cuyahoga River	Cleveland	1917	591	Felgate

Of the 12 largest continuous truss bridges in the world, 10 are in the U.S.

Table IV – *Notable American Continuous Truss Bridges*

Bridge	Location	Date com pleted	Span, feet	Engineer
Sciotoville	Ohio river	1917	775	Lindenthal
Chain of Rocks	Mississippi R.	1929	699	Brown & Fay
Cincinnati	Ohio river	1928	675	Greiner
Cape Girardeau	Mississippi R	1928	672	Harrington, Howard & Ash
Quincy, Ill	Mississippi R	1930	628	Strauss
Bourne, Mass	Cape Cod canal	1934	616	Fay, Spofford & Thorndike
Sagamore, Mass.	Cape Cod canal	1935	616	Fay, Spofford & Thorndike
Hannibal, Mo.	Mississippi R.	1936	562½	Sverdrup & Parcel
St Joseph, Mo	Missouri R.	1928	450	Sverdrup
Lake Champlain	N. Y & Vermont	1929	434	Fay, Spofford & Thorndike

Table V – *Notable Simple Truss Bridges*

Bridge	Location	Date com pleted	Span, feet	Engineer
Metropolis, Ill	Ohio river	1917	720	Cartledge
Paducah, Ky	Ohio river	1929	716	Harrington, Howard & Ash
Tanana River	Alaska	1922	700	Modjeski & Angier
Municipal	St Louis	1911	668	Boller, Hodge & Baird
Louisville, Ky	Ohio river	1912	644	Bland
Castleton, N. Y.	Hudson river	1924	598¼	Welty

A new type of bridge recently developed is the Wichert continuous truss or girder, distinguished by the open quadrilateral over the intermediate piers. The first application was the Pittsburgh-Homestead bridge, over the Monongahela river, completed 1937, with 10 semi-continuous arched trusses, including two spans of 533⅓ feet.

Since then, 7 more Wichert type bridges have been built, including one over the Susquehanna river at Havre de Grace, Md., and one over the Potomac river at Dahlgren, Virginia.

The longest movable bridge spans in the world are in the U.S.

Table VI —*Notable Movable Bridges*

Bridge	Location	Date completed	Span, feet
Vertical lift			
Cape Cod canal	Massachusetts	1935	544
Marine Parkway	New York city	1937	540
Burlington, N. J.	Delaware river	1930	534
Swing span:			
Ft Madison, Iowa	Mississippi R.	1927	525
Portland, Ore	Willamette R	1908	521
East Omaha	Missouri river	1893	520
East Omaha	Missouri river	1903	519
Bascule:			
Sault Ste Marie	Michigan	1914	336
Chattanooga	Tennessee R.	1917	310

Table VII – *Notable American Concrete Arches*

Bridge	Location	Date completed	Span, feet
George Westinghouse	Pittsburgh	1931	460
Cappelen Memorial	Minneapolis	1923	455
Jacks Run	Pittsburgh	1930	400

Of the 6 largest concrete spans in the world, 3 are in the U.S.

The 20 longest-span simple truss bridges in the world are in the U.S. (including one in Alaska). (D. B. S.)

BRIDGES: CONSTRUCTION. The design and construction of a bridge involve a combination of science and practical knowledge to an extent not required in perhaps any other engineering work. Lavish outlay of money and great accumulations of material in the structure itself will not necessarily result in a strong and enduring bridge; the latter may, on the contrary, weaken it by the imposition of material in the wrong place so that the added weight does positive harm. This is particularly the case in bridges of large span, which cannot be built without a thorough knowledge of the materials that can be used in their construction.

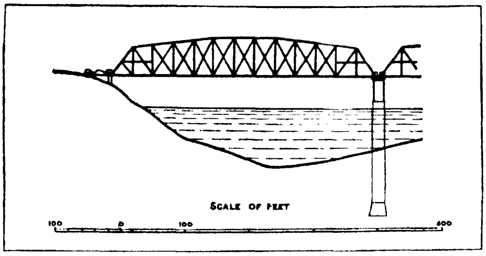


Fig. 1.—One of the seven independent spans, each 416 ft. long, that make up Hawkesbury bridge, N.S.W., Australia

TYPES OF BRIDGE

All bridges belong to two main groups, fixed or opening, and can be divided into the following types:—

Fixed	*Opening*
Independent Span	Swing
Continuous Span	Bascule
Arch	Rolling
Cantilever	Vertical Lift
Suspension	Transporter

There are also bridges supported upon floating pontoons instead of upon solid piers, but essentially they belong either to the fixed or opening group.

FIXED BRIDGES

An independent span, one that reaches from abutment to abutment, or pier to pier, without projecting beyond the supports. The stresses set up by its own weight, or dead load, and by the loads that pass over it, or moving or live load, can be calculated with great accuracy, and it is therefore known as a determinate structure. Bridges of this type usually consist of main girders placed below or above the platform they support, the girders having top and bottom booms, either curved or straight, connected together by web systems of many different types each with its own advantages and name. The girders are proportioned so that the depth is usually from one-eighth to one-twelfth of the span, the greater the depth the stiffer being the girder. The top boom is in compression while the bottom is in tension, the web members being in tension or compression according to their position. The limiting span for this type is about 800 feet. Fig. 1 illustrates Hawkesbury bridge in Australia with seven spans of 416ft. each.

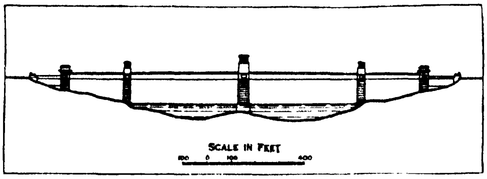


Fig. 2.—Continuous spans of Britannia bridge, Menai Straits, Wales. The two central spans are each 460 ft. long and the smaller pair, 230 feet

Continuous Spans, those that reach over more than one opening, usually three. They have the advantage of being lighter and of being deflected less than independent spans, but the stresses are more difficult to determine and great change of stress takes place in them if the supporting piers subside by even a small amount. While largely discarded in Europe, this type of bridge is being increasingly developed in America. However, in addition to the problems of stress, this type has the disadvantage of alterations in length, due to temperature, which are difficult to arrange for, as they represent the total variations of several openings. Britannia bridge (fig. 2), with two spans of 460ft., and two of 230ft., is continuous over all three piers, and the expansion and contraction to be dealt with at each end amounts to a total of 4 inches.

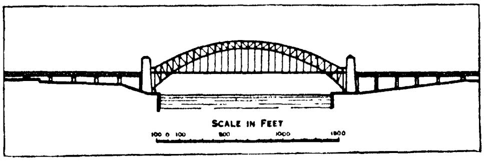


FIG. 3.—ARCH SPAN AT SYDNEY, AUSTRALIA, 1,650 FT. LONG. COMPLETED 1932. IT IS ONE OF THE LARGEST ARCH SPANS IN THE WORLD

The Arch, probably the most graceful type of all, can be constructed in many different materials. An arch usually consists of part of a solid ring or of a series of arched ribs, backed up by solid or open spandrils until a level line is reached upon which the floor or deck is constructed. The arched ring or ribs spring from sloping surfaces called skewbacks formed in the abutments and piers. The stresses in an arch are difficult to determine, and the calculations have to be based upon certain more or less arbitrary assumptions. With a view to making the structure conform with the calculations, especially in the case of large metal ribs, round pins are inserted at the skewbacks, and in some cases at the centre as well, to ensure that the stresses pass through these points. Arches are known according to the number of pins, as no-pinned, two-pinned or three-pinned, and in the latter case the stresses are quite determinate.

The usual proportion of rise of arch to span is about one-tenth, and the depth of the arch ring, or ribs, varies from about one-twenty-fifth of the span in the case of masonry structures, to about one-fortieth in a steel rib. In all arches the arch ring is in compression under the permanent or dead load, but when heavy moving or live loads pass over the bridge, reversals of stress may take place that may lead to the distortion and failure of the arch if these have not been allowed for in the design. Arches up to about 400ft. span have been constructed in masonry or reinforced concrete and, until recently, 600ft. has been considered the limit for mild steel, but with the advance in the knowledge of the theory of structures, Hell Gate bridge, New York, with a span of 1,017ft., has been successfully completed, and Sydney bridge, Australia (fig. 3) with a span of 1,650 ft. was completed in 1932. This bridge is one of the largest arch-spans in the world. It was designed as a two-pinned arch and carries a roadway 57 ft. wide, together with four railway tracks and two footpaths; its total width is 160 feet. Its estimated cost was £4,200,000.

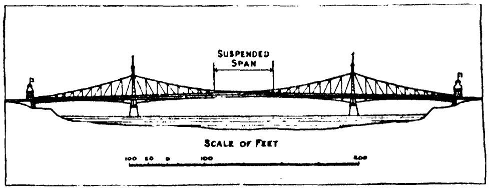


FIG. 4.—CANTILEVER SPANS IN THE BRIDGE AT BUDAPEST. THE MAIN SPAN, 574 FT. LONG, IS MADE UP OF TWO CANTILEVERS, EACH OF 210 FT. AND A SUSPENDED SPAN OF 154 FEET

In the United States increasing numbers of arch bridges, of concrete or reinforced concrete, have been constructed since the World War, especially in connection with the development of streets and highways. Noteworthy examples are the Hampden County Memorial bridge at Springfield, Mass.; the Cappelen Memorial bridge at Minneapolis, Minn.; the Arroyo Seco bridge at Pasadena, Calif.; the Ft. Snelling-Mendota bridge in Minnesota; and the Memorial bridge at Wilmington, Delaware.

The Cantilever type is often adopted when large spans have to be constructed, the limiting size being as high as about 3,000 feet. The principle is that of two projecting arms reaching towards each other, the gap between their ends being bridged by means of an independent, or suspended, span. The weight of all these is balanced by projecting arms reaching shorewards and anchored down. The stresses are quite determinate but, as in all large structures, the calculations are laborious and many secondary stresses have to be investigated. The effect of wind on large structures of this type is very serious and, in the Forth bridge, with spans of 1,710ft., the amount of steel provided to resist the stresses set up by this agency amounts to 47% of the total weight of the cantilevers. Fig. 4 shows the cantilever bridge at Budapest with a main span of 574ft. made up of two cantilevers of 210ft. and a suspended span of 154 feet.

The Suspension, a type which lends itself readily to the construction of the largest spans, the theoretical limit being in the neighbourhood of 7,000 feet. Camden bridge over the Delaware river has been constructed with a span of 1,750ft., and a bridge of double this span has been commenced over the Hudson river at New York. A suspension bridge consists of steel wire ropes or steel links of high tensile strength passing over lofty towers and anchored at each end. The platform for the roadway is suspended from the main ropes or chains by means of vertical ropes, and the change of form and swaying set up by moving loads is largely reduced by means of horizontal stiffening girders placed at road level. This type is not usually adopted for railway bridges on account of the changes of form that take place in spite of the stiffening girders. However, in large spans the inertia of the dead weight of the bridge is so great that this difficulty has been largely overcome, and both the completed large suspension bridges referred to above, together with others of older date, have railway tracks on them. Manhattan bridge, New York (fig. 5), constructed 1903–9, carries eight railway tracks, together with a roadway 35ft. wide and two footpaths.

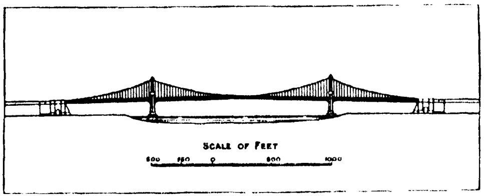


FIG. 5.—MAIN SUSPENSION SPAN, 1,470 FT. LONG, IN MANHATTAN BRIDGE, NEW YORK. EIGHT RAILWAY TRACKS, A ROADWAY, AND TWO FOOTPATHS ARE CARRIED BY THIS BRIDGE

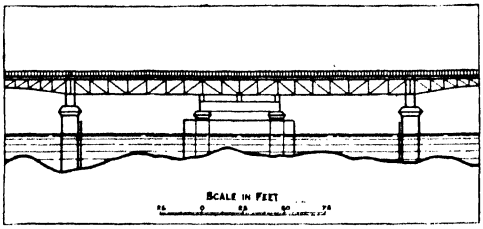


FIG 6.—SWING SPANS: RODAH BRIDGE, CAIRO. THIS SPAN GIVES TWO PASSAGES, EACH 65 FT. 6 IN. WIDE. THE CENTRAL SUPPORT TAKES UP VALUABLE WIDTH, 67 FT. 6 INCHES

OPENING BRIDGES

The Swing Span is probably the most usual type of opening bridge, the structure being pivoted so that it revolves in a horizontal circle. The arms on each side of the pivot may be of equal length, in which case they balance each other, but if of unequal length, the shorter is provided with weights or kentledge until a balance is reached. In common with all opening bridges the motive power may either be human labour or some mechanical power exerted by hydraulic or electric machinery. To reduce the effort required, the weight of the span is usually carried by a number of radially set rollers running on a circular track, the function of the pivot being largely a centring one. The objection to this type of bridge is that the supporting pier, together with its protective works, occupies a large amount of space and if, as is often the case, it is located in the centre of a river, collisions with it are apt to take place, and in any case, valuable width is wasted The Rodah bridge at Cairo (fig 6), has a swing span giving two openings of 65ft 6in. each, but it will be noticed from the drawing that as much as 67ft. 6in. is taken up by the central support and its protective staging

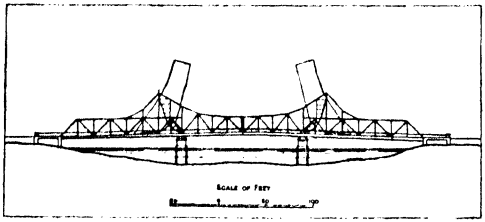


FIG 7 - BASCULE SPANS (SCHERTZER FORM) QUEENSFERRY BRIDGE, CHESTER, ENGLAND

The waterway between the supports is 134 ft. wide. The supporting piers occupy little width in this form, those shown being each 10 ft. wide

The Bascule, a type consisting of one or two counter-weighted leaves working on horizontal pivots. The leaves rotate through about 90°, and the supporting piers being on each side of the waterway, a clear channel in the middle is provided for traffic The weight of the leaves is of necessity concentrated on the pivots or trunnions, and this is a very serious matter in large spans The difficulty has, to some extent, been got over by enlarging the pivots until they are virtually wheels, as in the Schertzer form, but large concentrations of loads seem to be unavoidable with this type of bridge. In the case of the new Schertzer opening bridge at Queensferry, Chester (fig 7), the obstruction in the river has been reduced to two small piers, each 10ft. wide, the opening leaves being constructed somewhat narrower than the approach spans and rotating back on to them.

The Rolling Type.—Here the moving span is mounted upon wheels or rollers that allow it to be moved bodily away from the opening at right angles to it, but in order that this may be accomplished, it must either be lifted vertically in order that it can roll back upon the approach, or the approach must be lowered. This is a somewhat complicated arrangement, and not many bridges of this type have been constructed. Fig 8 shows one of the few constructed in Great Britain and situated at the Newport docks.

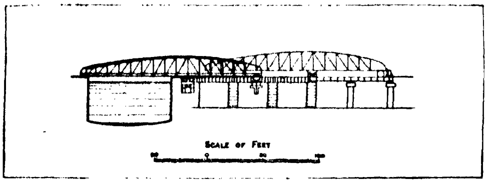


FIG. 8.—ROLLING SPANS NEWPORT DOCKS BRIDGE, ENGLAND

This bridge spans a lock 72 ft. wide, and is rolled into position by hydraulic power

The Vertical Lift Type.—This has many advantages, and quite a number of bridges have been constructed on this principle in recent years in the United States The weight of the bridge is taken by means of wire ropes that pass over pulleys at the top of tall towers and are then attached to counterweights. The height of the towers is such that when the bridge is raised vertically in the manner of a lift, there is sufficient clearance under the moving span for the river traffic to pass. As the weight of the bridge is balanced by the counterweights, the power required to open it is only that necessary to overcome inertia, together with any friction between the guides fixed to the towers that also serve to keep the moving span in position. The bridge at Portsmouth, Me., U.S.A., (fig. 9), completed in 1924, has a lifting span of 300 feet, and the vertical clearance above high water when open is 150 feet.

The Transporter Type, more an aerial ferry than an opening bridge. It consists of an overhead bridge supported on lofty towers, there being a moving cradle on its underside. A platform level with the banks of the opening is slung from the cradle, and on the cradle being set in motion the platform with its load of vehicles and passengers is ferried across the gap. This type has been adopted across wide busy rivers or harbours where the cost of a high level bridge with long approaches would be prohibitive, or where an opening span of a normal type would either be too obstructive or too costly. Examples are to be seen at Newport, Widnes and Middlesbrough in Great Britain. M. Arnodin in France has devoted much attention to perfecting this kind of bridge, and fig. 10 represents one at Rouen erected by him.

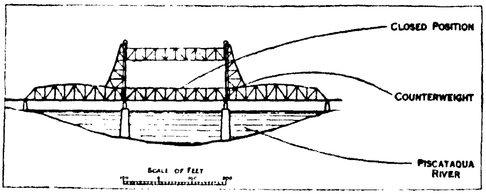


FIG. 9.—VERTICAL LIFT SPAN, 300 FT. WIDE, PORTSMOUTH BRIDGE, MAINE, U S A WHEN RAISED IT GIVES A CLEARANCE ABOVE WATER OF 150 FEET

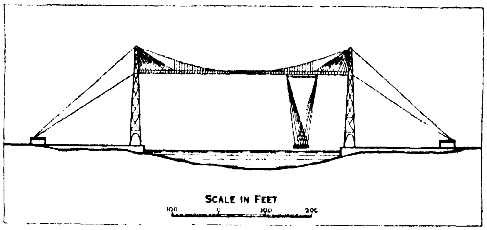


FIG 10.—TRANSPORTER SPAN IN ROUEN BRIDGE, FRANCE

From the overhead span supported on high towers, a moving cradle, at level of banks of waterway, is slung and used to ferry vehicles and passengers

MATERIALS OF CONSTRUCTION

The chief materials are timber, bricks, stone, concrete, reinforced concrete, cast iron, wrought iron, mild steel and high tension steel.

Timber is now chiefly confined to temporary structures, except in development works in new countries. In order to increase its durability, it is often impregnated with creosote.

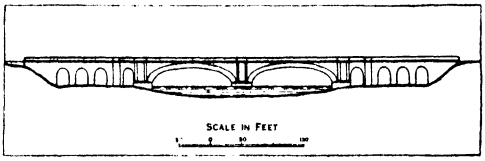


FIG. 11.—MAIDENHEAD BRICK BRIDGE, GREAT WESTERN RAILWAY, ENGLAND

The spans are each 18 ft. wide and the bridge is one of the largest brick bridges in the world. It was built in 1838 and is still used

Bricks, if carefully selected, have a life of hundreds of years. They can, of course, only be used in compression, and the safe working stress varies from about 8 tons per sq.ft., in the case of the softer varieties, to 12 tons per sq.ft. in the harder. The mortar used in setting them usually consists of one part of Portland cement to two parts of clean sand. The Great Western railway bridge at Maidenhead (fig. 11) was constructed in 1838 by Brunel with two spans of 128ft. each, and is one of the largest brick bridges in existence. The arches settled when the centring was struck and doubts were expressed as to their stability, but they have stood the test of time well in spite of the fact that the weights of the trains passing over them have greatly increased since their completion.

Stones.—The stone used in bridge construction ought not only to be strong, but it should also be able to resist the disintegrating effects of heat, frost, rain and vibration. The safe working stress in compression is about 20 tons per sq.ft. for limestones and sandstones, increasing to about 30 tons per sq.ft. for granite and similar hard stones. For arched spans up to about 200ft., stone is the finest material that can be employed, and the resulting structure not only satisfies the eye but, if supported in solid foundations, it should endure for centuries with practically no upkeep. An interesting example is Waterloo bridge (fig. 12) which was completed in 1817 to the design of Sir John Rennie, who was also responsible for London bridge and old Southwark bridge. It has nine arches of 120ft. span. The piers and abutments were founded on wooden platforms placed about flush with the bed of the river and supported on timber piles driven into the London clay.

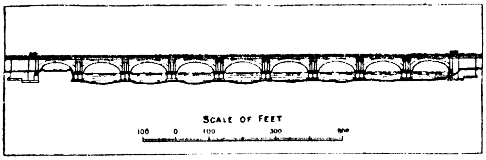


FIG. 12.—STONE BRIDGES: WATERLOO BRIDGE, RENNIE'S MASTERPIECE, LONDON COMPLETED IN 1817. IT CONSISTS OF 9 ARCHES EACH OF 120 FT. SPAN

Concrete is an artificial material consisting of broken stone or other hard aggregate, mixed with sand and Portland cement. These constituents are mixed dry in various proportions according to the strength required of the resulting material, and water is added. A chemical change takes place in the cement rendering it into a binding substance of very considerable strength. The usual working stress allowed in compression varies from 15 tons per sq.ft., for a concrete of one part Portland cement to two parts sand and four parts aggregate, to 5 tons per sq.ft. in a mixture containing these materials in the proportion one to four to ten.

Cast Iron was greatly used in the past on account of its high compressive strength and resistance to corrosion, but its weakness in tension led to its abandonment. In compression a working stress of 10 tons per sq.in is quite allowable on short struts, but in tension this has to be reduced to 2½ tons per square inch. The Wearmouth bridge at Sunderland (fig. 13) was erected in 1796, and was one of the most daring structures ever erected in this material. It has a span of 236ft., and the roadway platform is supported by six cast iron ribs, each 5ft. deep but only 4in. wide. They were lightly braced together by cross-bracing and they safely carried the traffic. In 1859 Robert Stephenson inserted three wrought iron tubular ribs between each pair of cast iron ribs, and this composite structure is now being replaced by a steel arch of 375ft. span, but the original cast iron ribs are in perfect condition.

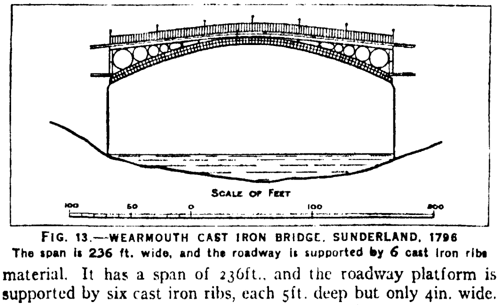


FIG. 13.—WEARMOUTH CAST IRON BRIDGE, SUNDERLAND, 1796
The span is 236 ft. wide, and the roadway is supported by 6 cast iron ribs

Reinforced Concrete is a composite material of construction in which the compressive stresses in the members are taken up by the concrete, while in the parts subjected to tension or shear, mild steel sections (usually round rods) are inserted to resist the tensile or shearing stresses to which the concrete itself can only offer a poor resistance. Being a composite material, whose strength depends upon the correct position of the steel reinforcement, it necessarily follows that, unless the work at the site is kept constantly under observation, errors creep in. The working stresses allowed are 16,000lb. per sq.in. in tension in the steel, and 600lb. per sq.in. in compression in the concrete of a proportion of one part of Portland cement to two parts of sand to four parts of aggregate, none of the latter being large enough to be retained by a mesh ¾ in. square (fig 14).

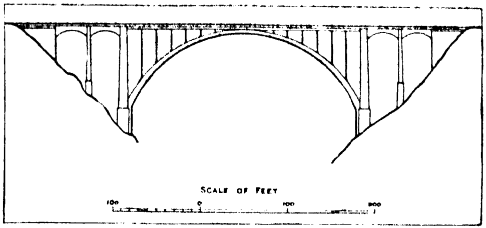


FIG. 14.—REINFORCED CONCRETE BRIDGE, STEIN TEUFEN, SWITZERLAND
The span here is 259 ft. wide. Reinforced concrete permits graceful designs, but requires very careful supervision during construction

Wrought Iron.—The manufacture of this material as a reliable commercial product led to a great development in bridge construction about the middle of the last century, as it permitted the general adoption of types of bridges other than the arched. The usual working stresses are 5 tons per sq.in. in tension, 4 tons per sq.in. in compression in short struts, and 4 tons per sq.in in shear. Wrought iron has a greater resistance to corrosion than mild steel, and there are numbers of bridges that were constructed in this material about 50 or 60 years ago that are still in good condition. The Menai suspension bridge (fig. 15) was constructed over 100 years ago (1819–26), and apart from corrosion at one particular spot, the wrought iron links, of which its main chains are composed, are still perfectly sound.

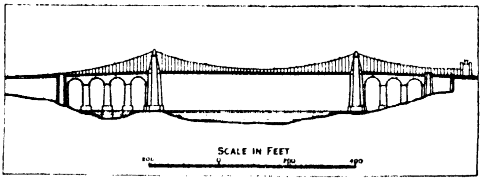


FIG. 15.—MENAI WROUGHT IRON SUSPENSION BRIDGE, WALES, 1826
The main span is 580 ft. wide and the wrought iron link-chains are still perfectly sound

Mild Steel led to another considerable advance, especially in the size of the spans that could be adopted economically. The working stresses allowed are 8 tons per sq in. in tension, 6¼ tons per sq.in. in compression for short struts and 5 tons per sq.in. in shear. The working stresses in compression are usually based upon a formula that takes account of the column action in the member, a common form for compressive members with riveted end connections being $8(1 - \cdot 0033\frac{l}{r})$ tons per sq.in., l being the length of the member in inches, and r its radius of gyration, also in inches. The ultimate breaking strength of mild steel is usually specified as not to vary outside the limits of 28 to 32 tons per sq.in with an extension of 20% in 8 inches. The chemical composition must be such that on analysis it must not show more than ·06% of sulphur or of phosphorus.

The Quebec bridge (fig. 16), with a span of 1,800ft., is the largest cantilever bridge in existence and is an outstanding example of a modern steel structure. It was opened in 1918 after the failure of one on the same site which collapsed in 1907 while being constructed. Misfortune dogged the second structure, as the suspended span fell as it was being erected, owing to faulty erection details, but the main structure was undamaged and a new suspended span was safely got into position. The river cantilevers and the suspended span were constructed of nickel steel.

High Tension Steel has been developed to meet the demand for still greater spans. The material itself is more expensive than mild steel, but the additional cost is largely counterbalanced by the saving in the amount of steel required. The increase in strength beyond mild steel has been obtained either by increasing the proportion of carbon or by the introduction of nickel, chromium or other metals. In the former case, the working stress has been raised to 9 tons per sq.in. in tension with a corresponding increase in compression and shear. For alloy steels, such as nickel and silicon steels, the figure is 10·5 tons per square inch. As was mentioned, nickel steel was used in the suspended spans of Quebec bridge, while silicon steel was used in the stiffening trusses of the Camden bridge, 1,750ft. span, at Philadelphia, and the Bear mountain bridge, 1,632ft. span, over the Hudson. This material is also to be largely used in the Sydney bridge ribs of 1,650ft. span. The main members of the Hell Gate arch (fig. 17) at New York, span 1,017ft., were constructed of high carbon steel.

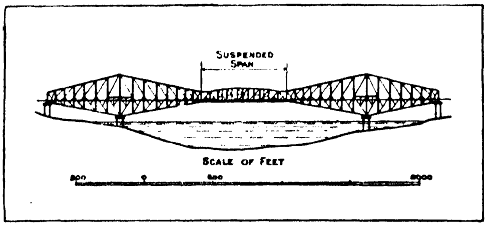


FIG. 16.—QUEBEC STEEL BRIDGE, CANADA, LARGEST CANTILEVER BRIDGE IN THE WORLD
The main span is 1,800 ft. wide; the landward cantilevers are of mild steel while the river cantilevers and the suspended span are of nickel steel

BRIDGE DESIGN

Loads and Forces.—In designing a bridge the following loads and forces have to be taken into account:—dead load, live load, impact, deformation stresses, wind pressure, centrifugal effect, longitudinal forces, temperature effect and erection stresses. The most important of these, in the case of bridges of moderate span, are the dead and live loads and impact.

The *dead load* is the weight of the bridge itself, together with any fixed loads it may have to carry. The *live load* is the weight of the traffic using the bridge. *Impact* is the additional effect set up by the live load due to its speed, and it is usually allowed for by multiplying the live load by a factor based upon the span. The *deformation stresses* are those induced by change of shape in the structure due to riveted and eccentric connections. The *wind pressure* is usually assumed as a moving load of 50lb. per sq.ft., acting on the exposed surface of the unloaded bridge. The leeward surface is also taken into account if it is distant more than twice the depth of the windward girder. With the bridge under live load, the wind pressure is reduced to 30lb. per sq.ft., but the area is increased by the exposed surface of the moving load. This reduction is based upon the fact that the moving load could not reach the bridge at higher wind pressures than 30lb. per sq.ft. as vehicles are overturned at pressures in excess of that amount. The *centrifugal effect* is only taken into account in the case of a railway bridge situated on a curve. The *longitudinal forces* are those due to the tractive effect of the live load and the braking effect resulting from the application of the brakes. *Temperature effect* is that due to variations of temperature, the coefficient of expansion of mild steel being taken at ¼ inch for every hundred feet for a variation of 40° F above or below the normal, which is the amount usually taken in temperate climates. *Erection stresses* are those set up temporarily during erection and for which an excess of 33% over the permanent stresses may be allowed.

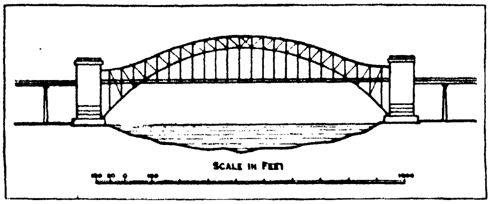


FIG. 17.—HELL GATE ARCH, HIGH TENSION STEEL BRIDGE, NEW YORK
Constructed of high carbon steel, the span is 1,017 ft. wide

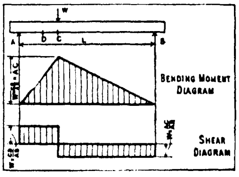


FIG. 18

Straining Actions in a Beam.—When a horizontal beam AB (fig. 18) is supported at its two ends A and B and loaded with a weight W at any point C, the following actions are set up:—(1) A bending action, known as bending moment, whose intensity at any point may be represented graphically as a triangle with its apex at the load, and mathematically, as the reaction at A or B multiplied by the distance to the point selected; *i.e.*, BM at $C = W \times \frac{CB}{AB} \times AC$; and BM at any point $D = W \times \frac{CB}{AB} \times AD$.—(2) A shearing action, whose intensity at any point may be represented graphically by two parallelograms meeting under the load, and, mathematically, as equal to the reactions at A, for the left-hand parallelogram, and to the reaction at B for the right-hand; *i.e.*, Shear A to $C = W \times \frac{CB}{AB}$ and shear C to $B = W \times \frac{AC}{AB}$.—The maximum bending moment occurs when W is in the centre of the span L, *i.e.*, when $AC = CB = \frac{AB}{2}$, and its intensity becomes $\frac{W}{2} \times \frac{C}{2} = \frac{WL}{4}$; while the maximum shear occurs when W is just over A or B, when its intensity becomes W.

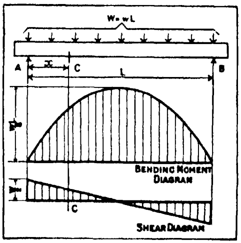


FIG. 19

If the load W is spread uniformly over the span (fig. 19), the bending moment may be represented graphically by a parabola and, mathematically, by the reaction at A multiplied by the distance to any point selected, less the intervening loads, multiplied by their distance from the point selected, *i.e.*,

$$BM \text{ at } C = \frac{W}{2} \times AC - \left(W \times \frac{AC}{AB} \times \frac{AC}{2}\right).$$

If w represents the weight per unit of length, then $W = wL$, and if x be the distance AC, then the foregoing may be written:—

$$\frac{wL}{2} \times x - wL \times \frac{x}{L} \times \frac{x}{2} = \frac{wx}{2}(L - x).$$

The shear may be represented by two triangles meeting at the middle of the span, where its intensity is zero, and, mathematically, as equal to the reaction at either end, less the portion of the load between the point selected and the reaction, *i.e.*, shear at

$$C = \frac{W}{2} - \frac{W \times AC}{AB} = \frac{wL}{2} - \frac{wL \times x}{L} = w\left(\frac{L}{2} - x\right).$$

The maximum bending moment occurs at the centre where $x = \frac{L}{2}$, and its value is, therefore $\frac{wL^2}{8}$ or $\frac{WL}{8}$; while the maximum shear is at the ends, and has the value $\frac{wL}{2}$ or $\frac{W}{2}$.

Straining Actions in a Cantilever.—In the case of a cantilever (fig. 20), with a load W at the extreme end, the bending moment may be represented by a triangle whose maximum depth is at the support, where obviously the intensity is WL, and the value at any other point is W multiplied by the distance from W to the point. The shear can be represented by a parallelogram whose depth is equal to W. If W be spread uniformly over the span (fig. 21), then the bending moment diagram becomes a parabola, the intensity at the support being $\frac{WL}{2}$ or $\frac{wL^2}{2}$ if the load per unit of length is w. The value at any other point is the product of the loads to the right of the point multiplied by half the distance between the point selected and the end of the cantilever. The shear gradually increases from zero, at the end, to a maximum of W, at the support, and so can be represented by a triangle whose depth at the support is equal to W or wL.

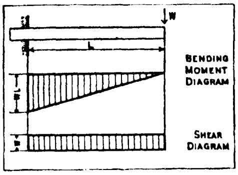


FIG. 20

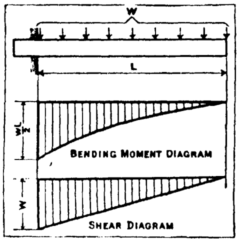


FIG. 21

Calculation of Stresses in a Girder.—The bending moment caused by a load, or system of loads, is resisted by the amount of material in the beam, but this resistance varies, not only with the amount and strength of the material, but with its shape or disposition. The moment of resistance is the summation of the products obtained by multiplying the strength of each small component of the cross section by the distance of its centre of gravity from the central or neutral axis. In the case of a rectangular cross section (fig. 22) width b, depth d, the moment of resistance equals $f\frac{bd^3}{12}$, where f is the strength of the material for unit sectional area. If b were reduced to $\frac{b}{2}$ while d was increased to $2d$, the area of the cross section would be the same, but the moment of resistance would have increased fourfold to $f\frac{bd^3}{3}$. It is evident from this that the greater the depth, or the more the material can be kept away from the neutral axis, the stronger the beam for a given amount of material. This is effected in practice by the use of a thin web with flanges top and bottom (fig. 23). The web is of so little value in comparison with the flanges that it is usually neglected in considering the moment of resistance which is then arrived at by multiplying the area of one flange by the vertical distance between their centre of gravity. If a=area of one flange, d=distance between centres of gravity, and f be the safe working stress of the material, the moment of resistance=fad. This can be equated to the bending moment, as they must be equal for safety, so that BM=moment of resistance=fad. To ascertain the sectional area of the flanges, all that is therefore necessary is to divide the bending moment by the depth of the girder, multiplied by the safe working stress:—$a=\frac{BM}{df}$. The most economical depth varies from about one-tenth to one-fifteenth of the span. When the span exceeds about 50ft., a solid web usually becomes uneconomical, and it can be replaced by a system of vertical posts and inclined ties or struts. These members can be arranged in various ways, each type having its own name, such as Pratt, Warren, Linville, etc.

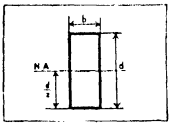


FIG. 22

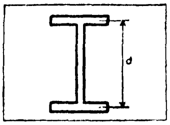


FIG. 23

The stress in each member of such a lattice girder can be obtained either graphically by means of a stress diagram, or analytically. The graphical method is as follows:—make an outline diagram of the girder, or truss, as it is often called (fig. 24), using a definite scale, and letter each compartment according to Bow's notation. Set out the loads below each other using any convenient scale (fig. 25). Calculate the end reactions and mark them off on the scale of loads. Fig. 25 shows a Pratt truss so treated. The truss is in equilibrium and consists of a series of triangles, and, by a proposition in statics, the forces acting on these triangles can be represented by a closed polygon, each side of which is parallel to one force and represents the force in magnitude and direction. From point P, draw PA parallel to member PA on the truss. From O draw OA parallel to member OA. These two lines intersect at A, and the sides of the triangle OPA represent the forces (to scale) acting in members PO, OA and AP in magnitude and direction. The character of the force, whether compression or tension, can also be ascertained by noting the sequence of the reading of the forces. Taking the sequence at point P, PA reads away from P; put an arrow on the truss diagram indicating that direction. OA reads towards P; indicate this with an arrow. Repeat this later at each point and it will be found that arrows >< indicate tension in the member and arrows <> indicate compression. Having solved triangle OPA, draw from point A a line AB parallel to member AB, and from Q a line QB parallel to member QB. These lines AB and QB intersect at B, and the sides of the polygon $PABQ$ represent the forces acting in members PA, AB, BQ and load QP in magnitude and direction. Proceed thus until all the members of the truss have been dealt with.

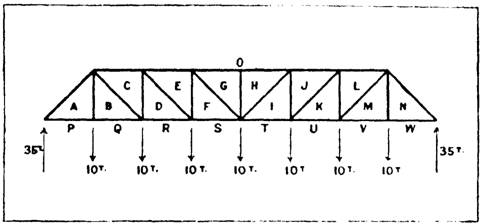


FIG. 24

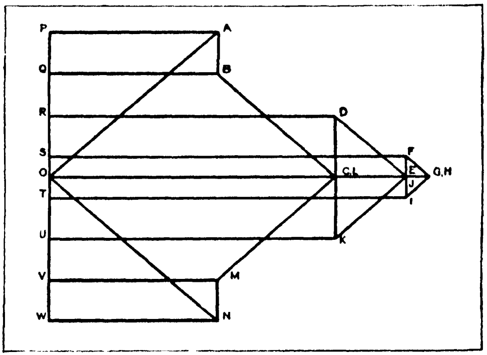


FIG. 25

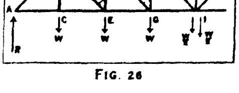


FIG. 26

Analytically, the stresses may be found as follows. Assume for simplicity uniform loadings at each equal panel point (fig. 26), then: $R = 3W + \frac{W}{2} = 3\frac{1}{2}W$. The shearing or vertical forces must obviously be taken by the vertical posts in the truss.

Stress in $FG = R-(W+W+W) = 3\frac{1}{2}W - 3W = \frac{W}{2}$

stress in $DE = R-(W+W) \qquad = 3\frac{1}{2}W - 2W = 1\frac{1}{2}W$

stress in $BC = W$, as it is merely a hanger transmitting load W to the point B.

The stress in the diagonals is due to their transmitting the vertical shearing forces in a diagonal direction from the bottom to the top boom, their values will, therefore, be the vertical shear multiplied by $\frac{\text{length of diagonal}}{\text{length of vertical post}} = \text{shear} \times \sec\theta$, if θ be the angle of the diagonal members to the vertical.

$$\text{Stress in } FI = \frac{W}{2} \times \sec\theta,$$
$$\text{stress in } DG = 1\tfrac{1}{2}W \times \sec\theta,$$
$$\text{stress in } BE = 2\tfrac{1}{2}W \times \sec\theta,$$
$$\text{stress in } AB = 3\tfrac{1}{2}W \times \sec\theta.$$

The stress in the bottom flange AC and CE = stress in $AB \times \sin\theta = 3\frac{1}{2}W\sec\theta . \sin\theta = 3\frac{1}{2}W\tan\theta$.

The stress in the bottom flange EG = stress in AE + stress in $BE \times \sin\theta = 3\frac{1}{2}W\tan\theta + 2\frac{1}{2}W\tan\theta = 6W\tan\theta$.

The stress in the bottom flange GI = stress in EG + stress in $DG \times \sin\theta = 6W\tan\theta + 1\frac{1}{2}W\tan\theta = 7\frac{1}{2}W\tan\theta$.

The stress in top flange BD = stress in $AB \times \sin\theta$ + stress in $BE \times \sin\theta = 3\frac{1}{2}W\tan\theta + 2\frac{1}{2}W\tan\theta = 6W\tan\theta$.

The stress in top flange DF = stress in BD + stress in $DG \times \sin\theta = 6W\tan\theta + 1\frac{1}{2}W\tan = 7\frac{1}{2}W\tan\theta$. The stress in top flange FH = stress in DF + stress in $FI \times \sin\theta = 7\frac{1}{2}W\tan\theta + \frac{1}{2}W\tan\theta = 8W \tan\theta$.

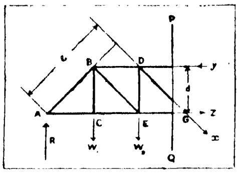


FIG. 27

The stresses may also be obtained by Ritter's method of sections when a section of a girder can be taken cutting only three bars. In fig. 27, BQ cuts three bars. Assume that the forces in these bars are x, y and z. To the left of the section there are three external forces, reaction R and loads W_1 and W_2. Produce the two forces x and z until they intersect at point G. Drop a perpendicular from point G to the extension of force y at a distance d. Taking moments about G and, since the truss is in equilibrium, equating them to zero,—

$$R \times AG - W\,CG - W\,EG - yd = 0.$$
$$y = \frac{3\frac{1}{2}W \times 3EG - 2W\,EG - W\,EG}{DE} = 7\tfrac{1}{2}W\tan\theta.$$

To find the value of z, take moments round point D where forces y and x meet:

$$R \times AE - W\,CE - zd = 0$$
$$z = \frac{3\frac{1}{2}W \times 2CE - W\,CE}{DE} = 6W\tan\theta.$$

To find the value of x, take moments about A after dropping a perpendicular of length l from A to extension of force x:—

$$xl + W\,AC + W\,AE - yd = 0$$
$$x = \frac{yd - W\,AC - 2W\,AC}{l} = \frac{7\frac{1}{2}W\tan\theta DE - 3W\,AC}{3AC\cos\theta} = 1\tfrac{1}{2}W\sec\theta.$$

Generally, if S is the stress in any bar and L the perpendicular distance from the join of the other two bars cut by the section, and M is the moment of the forces on one side of that join, then $SL = M$.

Influence-Lines are curves showing, for one component part of a beam or truss, the shearing force, bending moment, stress, deflection or similar function for all positions of a moving load.

Referring again to the simple beam, the bending moment diagram for a load W at C indicates that the amount of bending at D is represented by the ordinate dd' (fig. 28). Similarly, if the load is moved to E, the corresponding bending moment diagram indicates the amount of bending at D to be dd''. For a number of positions of the load, the amount of bending at D may be plotted as ordinates on a graph whose abscissae are the corresponding positions of the load. The resulting curve will be the influence line for the case in question and as indicated on the figure. This particular influence line further indicates that for all positions of the load there is induced a bending moment of the same type; and for a uniform load, the maximum bending moment at D would be attained by loading the whole span. More generally, where a moving load may induce either a positive or negative effect on a member, the influence line gives a ready means of showing where load should be applied in order that the maximum possible effect may be attained.

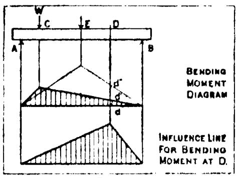


FIG. 28

Calculation of Stresses in a Continuous Girder.—When girders are carried continuously over more than two supports, or where the girders, instead of merely resting, are more or less rigidly built into the supports, the reactions of the supports cannot be established by the usual elementary methods. This is due to the fact that the continuity, or building-in fixity, alters the simple distribution of the reactions. The *theorem of three moments* supplies an equation enabling the bending moments over the supports to be calculated, and hence the reactions may be determined. Fig. 29 indicates the spans of a continuous girder. The general equation for these two spans is:—

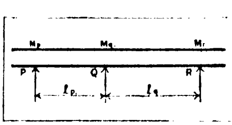


FIG. 29

$$M_p \times l_p + 2M_p(l_p + l_q) + M_r \times l_q + \frac{6A_p \times x_p}{l_p} + \frac{6A_q \times x_r}{l_q} + 6EI\left(\frac{S_p}{l_p} + \frac{S_r}{l_q}\right) = 0$$

M_p, M_q, M_r are the bending moments at P, Q and R respectively. A_p, A_q are the areas of the bending moment diagrams on spans l_p and l_q respectively, due to the loads on these spans, the spans for this purpose being considered as separate independent spans. x_p is the distance of the centre of gravity of A_p from support P. x_r is the distance of the centre of gravity of A_q from support R. E = modulus of elasticity of material of girder. I = moment of inertia of girder. S_p, S_r are the distances which support Q, falls or rises below or above supports P and R respectively.

This equation is applied to consecutive pairs of spans from end to end of the girder, and thus furnishes the necessary equations to solve the bending moments over the supports. Of necessity the section and modulus of elasticity of the girder and the relative deflection of the supports must be known beforehand. Accordingly, the design of continuous girders usually necessitates the adoption of trial and error methods before suitable sections can be chosen. Usually, the moment of inertia is assumed to be constant throughout the girder, otherwise the general equation requires considerable modification in detail.

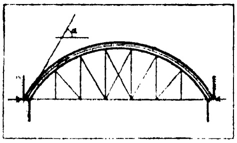


FIG. 30

Calculation of Stresses in a Metal Arch.—The stresses in a metal arch are the same as those in the curved top member of a braced girder in which the bottom tie has been replaced by unyielding abutments, and the web system has been omitted (fig. 30). If the arch is loaded uniformly, the stress at the crown, or the horizontal thrust at the springing, is $H = \frac{WL}{8R}$, where L is the span and R is the height or rise. The thrust in the arch at any other point is proportional to the secant of the angle α that a tangent line to the curve at that point makes with the horizontal, and its value is $H\sec\alpha$.

These values would be absolutely correct in the case of an arch of parabolic outline uniformly loaded, as its centre line would then conform to the outline of the bending moment diagram, and the thrusts would all be absolutely central. In actual practice an arch, even if parabolic in shape, is not subjected to a uniform dead load, on account of the varying dimensions and weight of the spandril filling necessary to secure a horizontal platform, and the arch itself is not rigid but elastic, and changes shape under the moving loads. The foregoing values for the thrust can, therefore, only be looked upon as approximate and the stresses are, in reality, indeterminate, except in the case of the three-pinned arch where pins or hinges have been inserted both at the springings and crown. Many different mathematical studies have been made, based upon assumptions as to the elastic properties of metal arches, or upon the theorem of least work. They yield approximate solutions that, by repeated trial and error, give results within a close margin of each other, and permit the safe design and construction of arches of very large span, the most impressive example of which is the Sydney bridge completed in 1932, with a span of 1,650 feet.

Calculations of Stresses in a Masonry Arch.—As in the case of the steel arch, the masonry arch may be considered as the top chord of a bow-string girder, taking compression and also sheer stress, the thrust from the skewbacks taking the place of the bottom chord tension member. For any loading, the bending moment diagram, as drawn for the equivalent beam span, gives the ideal shape that can be adopted for the arch. Since, however, the loading on a bridge varies, the best design for the arch is that which will most nearly follow the lines of thrust for all cases, and at the same time give as small bending action as possible. Many shapes have been adopted for arches, *e.g.*, semi-circular, segmental, elliptical basket-handle, gothic.

The most generally used materials are brick, stone and concrete. None of these materials is adapted to withstand tensile stress. The normal rule which automatically provides a factor of safety is that the thrust should be confined to the middle third of the rib section. This implies absence of tension, together with the fact that the maximum stress never exceeds twice the average. A further implication is that the average stress is usually low and, consequently, the dead weight of the arch increases rapidly with the span, thus severely limiting this type of construction for large spans. The great majority of masonry arches are hingeless partly due to the fact that until recently the theory of the arch has not been fully understood. The accurate determination of stress where there are no hinges is extremely difficult, owing to the nature of the materials. For instance, when mortar joints set, the consequent general settlement, though minute, may entirely alter the stress distribution. The introduction of reinforced concrete into arch construction, with the consequent permission of tensile stress, has opened the field considerably for larger spans. The largest reinforced arch which has been constructed, namely the Pont Adolphe, Luxembourg, has a span of 278ft., while the bridge at Berwick, commenced in 1925, includes a reinforced concrete span of 361ft. 6 inches.

Manufacture.—In the case of masonry bridges, complete detail drawings are prepared of every stone to be dressed, and these are sent to the quarries from which the material is to be obtained. Each stone is cut exactly to size and numbered so that when sent to the site it fits accurately into place, allowance having been made for the joints and beds which are usually ¼in. thick. For metal bridges, detailed drawings are made of each member, and lists of all the different materials required sent to the rolling mills in the case of mild steel, or to the foundry in the case of cast iron or other castings. While this material is being prepared, the work is drawn out full size on the floor of a building termed the template loft. Here templates of thin wood or sheet iron are cut to the right shape, and holes are drilled through them where every rivet or bolt is to go. When the material arrives at the bridge yard the templates are laid upon it, every hole marked out with steel punches, and the required shape and length outlined.

After that, it is passed to the sawing, shaping, planing and drilling benches. It is then assembled into units and riveted up. The units or members are assembled together temporarily to form complete girders to make certain that they fit each other properly, and after being painted with identification marks, they are dismantled and forwarded to the site.

Piers and Abutments.—The supports upon which a bridge rests are termed abutments in the case of those at the ends, and piers in the case of those occupying intermediate positions. They may take the form of timber or concrete piles driven hard into the ground, or screw piles of cast iron may be used in soft soils. All these are suitable for light structures, but the most usual form of support consists of a mass of concrete or masonry carried down to firm ground. The necessary excavation is done inside a timber or steel cofferdam, or box, to exclude any water that may be present and to hold up the ground, the sides of the cofferdam being formed by rows of piles which are either drawn or cut off at a convenient level at the conclusion of the work.

Another common form of support is obtained by sinking cylindrical or rectangular caissons, and loading them with temporary weights or with the masonry of the pier or abutment itself. The ground inside the area of the caisson is excavated by digging, compressed air being employed if necessary to keep the water out. The weighted caisson keeps following the excavation down, and, when a satisfactory stratum is reached, the whole or remainder of the caisson is filled with concrete. If any doubt exists as to whether the foundations are satisfactory, they are test-loaded by means of weights, temporarily placed upon them, equal to the full load that they may ever have to carry, and the subsidence is noted. In normal circumstances, the cost of the substructure and the cost of the superstructure should be approximately equal, and this serves as a useful check on the efficiency of the design.

ERECTION

Generally speaking, there are four ways of erecting a bridge, viz., by means of temporary staging, by cantilevering out, by rolling out or by floating out. The erection of a bridge very often involves some of the most difficult problems in connection with the project.

Temporary Staging is the most usual method of erection. The staging is arranged so that its upper surface conforms with the outline of the under surface of the bridge to be erected, and it usually consists of timber piles, each 12in. square in cross section, having a sharp point shod with a cast iron shoe, and driven sufficiently far into the ground to be secure against any undermining forces, *e.g.*, the scouring effect of the flow of any water that may come against it. The piles are spaced at such a distance apart that they are sufficient to take the loads that will come upon them from the dead weight of the bridge as it is being erected, together with the necessary cranes, etc., described as "plant."

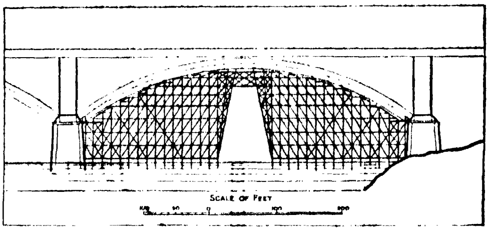


FIG. 31.—TEMPORARY STAGING, WASHINGTON BRIDGE, NEW YORK
The staging consists of timber piles driven into the ground and braced by horizontal and diagonal members, the whole conforming to the shape of the bridge to be built. In this bridge, the staging utilized 1½ million cu. ft. of timber

After the piles have been driven, they are braced together by horizontal and diagonal members to ensure that the structure will not sway or go out of shape. The top surface is decked over to form a supporting and working platform. After the permanent work has been completed and is carrying its own weight, the staging is removed, the piles being either drawn or cut off flush with the bed of the river. Some stagings have to be of a very elaborate character, *e.g.*, those used for the Washington bridge in

New York (fig. 31), where 1½ million cu.ft. of timber were used in piles and bracings. No settlement or displacement occurred.

Cantilevering out is adopted in cases where it is not possible to employ a staging, or where its use would be extremely expensive, for instance, where a wide and deep or a busy river has to be crossed. In such a case the difficulties of erection may often control the whole design of the bridge, ruling out what otherwise would be a cheaper and more convenient type, and the bridge may have to be erected by cantilevering out, *i.e.*, each member is bolted at one end, the other end projecting. The free end is then made secure by another member being added to tie it back to the main structure. This process is repeated until by working from both sides of the opening to be spanned, the members meet in the middle. If there is a central tower the process can be reversed, the work proceeding from the centre of the river or gap shorewards, the only precaution to observe being that the members must be erected so that they balance each other, otherwise the whole structure might overturn

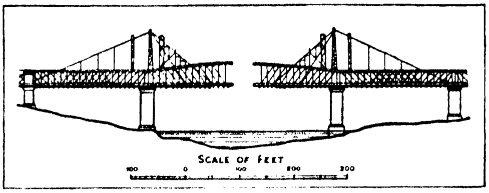


FIG. 32.—CANTILEVERING OUT, WEAR BRIDGE, SUNDERLAND, ENGLAND

The cantilever type of bridge, by virtue of its shape and design, readily lends itself to this method of erection, which, however, can be applied to other types as well though temporary members have to be added. These usually consist of a mast placed over each abutment with ties from the top down to the shore, where an anchorage can be obtained, and to the projecting ends of the work. Independent and continuous girders and arches have all been erected in this way, though in many cases they have to be specially stiffened to resist the stresses temporarily set up during erection as they differ from the final stresses. In large structures, the changes of form, due to the stresses and to the temperature, have also to be taken into account and allowed for. One disadvantage of this method of erection is that it is difficult to supervise the men engaged in the work, and readjustments are difficult to make once a member is in position. Fig. 32 shows the roadway and railway bridge, over the River Wear at Sunderland, under erection. The work was of a heavy character, the stresses in the temporary back stays amounting to 1,200 tons, and special hydraulic Jacks, capable of exerting a force of 1,600 tons, were used for adjusting them so that the two halves of the structure were in perfect alignment and level when they met.

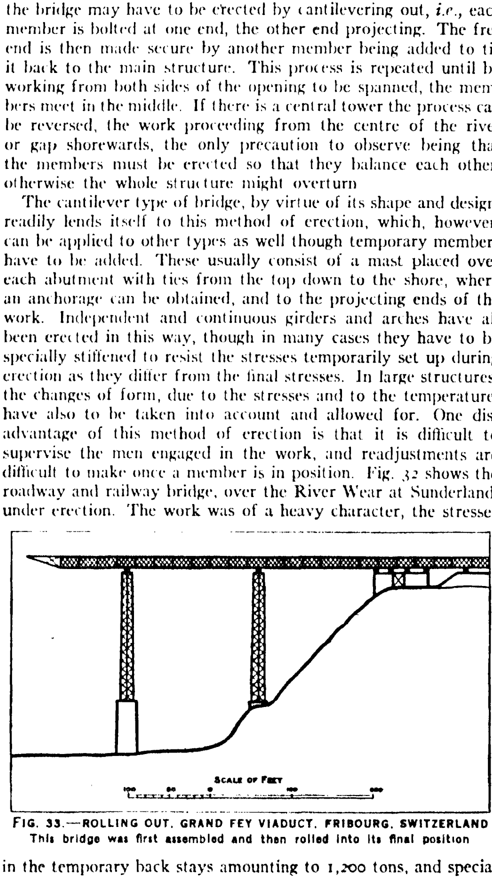


FIG. 33.—ROLLING OUT, GRAND FEY VIADUCT, FRIBOURG, SWITZERLAND
This bridge was first assembled and then rolled into its final position

Rolling Out is a modification of cantilevering out and can only be applied to independent and continuous spans. The bridge is constructed in some convenient position. Roller wheels are then placed under the completed work or unit, and the whole pushed or pulled forward into its final position. A false nose is often fitted to the front end, so that a support on the opposite side, or on intermediate piers, can be obtained as soon as possible, and the rear end is loaded with heavy material to prevent the front end toppling over into the gap over which it is being projected. Temporary stresses and change of form have to be carefully studied as in the cantilever method. In favourable circumstances this is a cheap method of erection, and has the advantage that the actual assembling of the material can be kept under close observation. The viaduct at Grand Fey, Fribourg (fig. 33) was erected in this way.

Floating Out.—The structure is first constructed on a staging or on some convenient site, and then transferred to floating pontoons or barges placed alongside. At a period of slack water, the whole combination is towed to the site of the bridge and adjusted in line with the piers or abutments, but with a small vertical clearance. Water is admitted to the pontoons and they sink until the structure takes its bearings on the masonry, when the pontoons are withdrawn or the falling tide releases them. This method cannot well be adopted where there is a fast running stream or very short periods of slack water as any error in manipulating the pontoons might lead to the total collapse of the bridge. The operation was repeated many times without a hitch during the erection of the Tay bridge (fig. 34). The actual floating out of the 245ft. spans, weighing 514 tons each, and getting them into position occupied only four hours for each span.

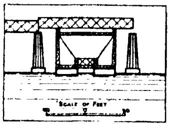


FIG 34.—-FLOATING OUT, TAY BRIDGE, SCOTLAND

DESCRIPTIONS OF SOME IMPORTANT BRIDGES

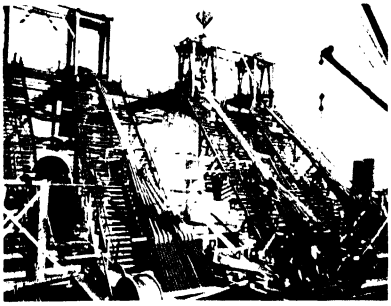
London bridge was designed by Sir John Rennie and built during the period 1824–31. Its arches, of which there are five, vary in size from 130ft., in the case of the side arch, to 152ft. for the centre. It was originally 54ft. wide, but was widened (1902–04) to 65ft. by carrying the footpaths on granite corbels. The bridge is of granite, and its total cost was approximately £1,500,000, of which £692,000 was for the purchase of land.

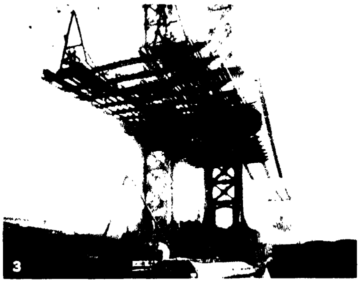
The Forth bridge has a total length of 5,330ft., made up of two cantilever spans of 1,710ft. each, two shore arms of 680ft. each, the remaining distance being occupied by steel towers. It cost £3,200,000, and is probably the most impressive bridge in existence. It was designed by Sir Benjamin Baker, and was constructed during the period 1882–89. The clear headway above high water is 150ft., and the towers are 361ft. high. The cantilevers project 680ft. and support suspended spans of 350ft. in length.

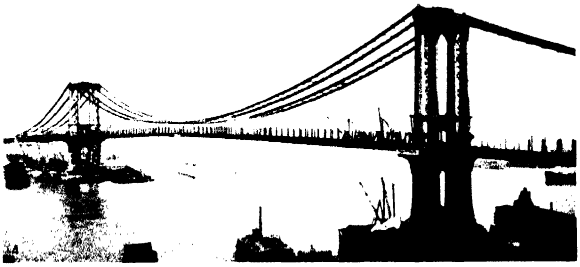
The Camden bridge, Philadelphia, built over the Delaware, 1921–26, at completion the largest suspension bridge in the world, has a span of 1,750ft. It is 125ft. in width, and designed to carry a central roadway 57ft. wide with four railway tracks and two footpaths in addition. It is supported by two main cables, 30in. in diameter, there being 18,666 wires laid parallel to each other in each main cable. The clearance above high water is 135ft. The bridge cost, with its approaches but without land, about $25,000,000, the total cost being nearly $35,000,000. It was designed by Ralph Modjeski and erected by a board of engineers under his direction.

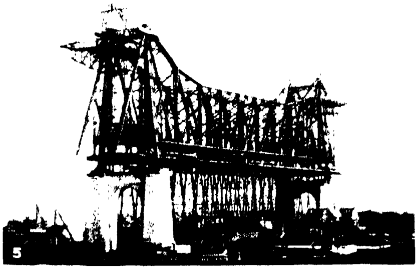
The Hudson river bridge, New York city, was begun in 1927 and is by far the largest span bridge ever built, having a span of 3,500ft. and a width of 120ft. It carries four roadway lines and two pedestrian sidewalks. The roadway is 250ft. above the river and the clearance 213ft. The steel towers stand 600ft. above water. The total cost was about $60,000,000. The bridge may be enlarged to eight vehicular lines on an upper deck and four rapid transit tracks on a lower deck.

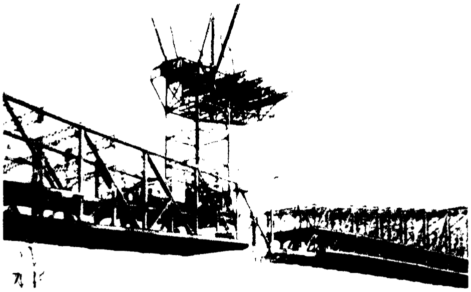
The Tower bridge, London, was built 1886–94 at a total cost of £830,000. It has an opening span of 200ft. clear between the two main towers. The side spans are suspended from braced chains, whose pull is taken up by heavy masonry anchorages at the shores and by a steel tie concealed in the horizontal girder that unites the towers at a height of 141ft. above high water. The towers are of steel, faced with granite and Portland stone.

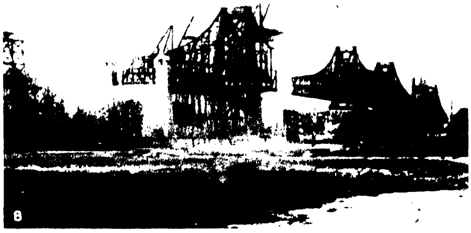










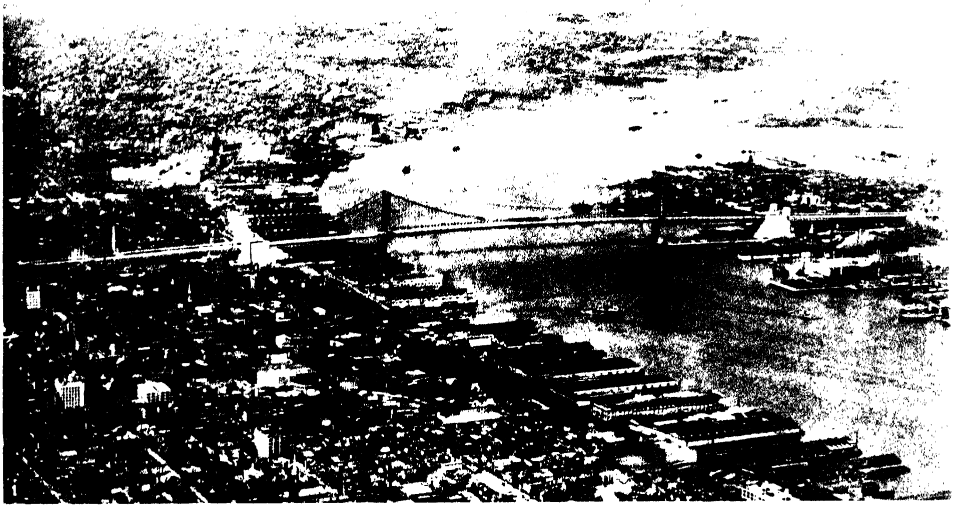


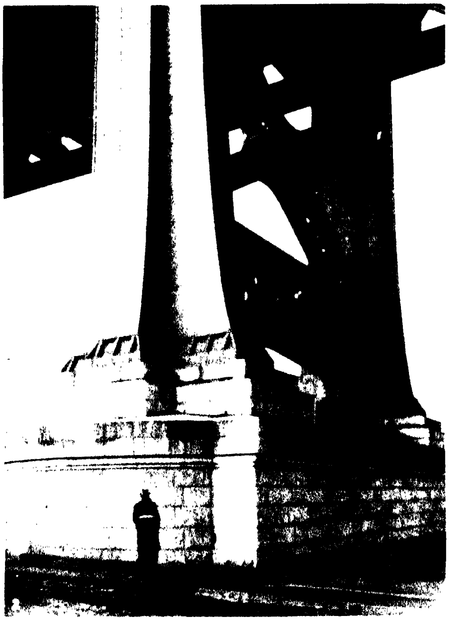
BY COURTESY OF THE DEPARTMENT OF PLANT AND STRUCTURES NEW YORK

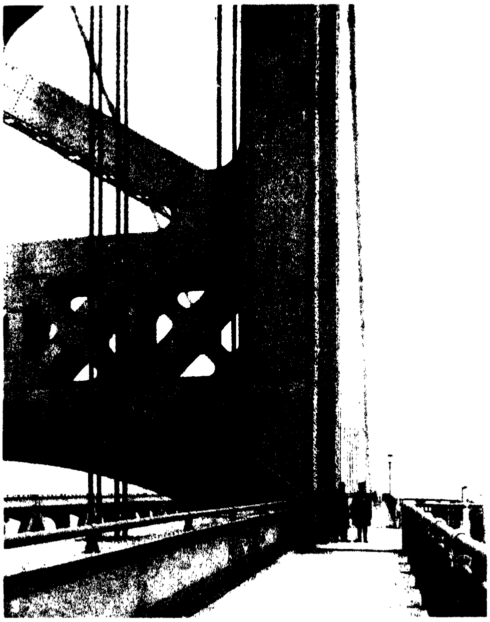
STEPS IN THE CONSTRUCTION AND ERECTION OF MANHATTAN AND QUEENSBORO BRIDGES

Construction work on Manhattan bridge, completed in 1909, with terminals at Canal street, Manhattan, and Nassau street, Brooklyn
Construction work on Queensboro bridge, completed in 1909, and extending from Second avenue, Manhattan, to Long Island City

1. Constructing the anchorage for locking cable ends
2. View showing cable construction and erection
3. A section of the span in process of erection
4. Showing the cables and span of the bridge in place
5. The Blackwell's Island (now called Welfare) span, in construction
6. An early stage of erection of cantilever section, from Blackwell's Island
7. Cantilever section at a later stage of erection (*see* Fig. 1)
8. View of cantilever section as it was nearing completion







BY COURTESY OF (1) THE AERO SERVICE CORPORATION (2, 3) PAUL P. CRET

THE DELAWARE RIVER BRIDGE

1. The Delaware River bridge, between Philadelphia, Pa., and Camden, N.J., the largest suspension bridge in the world at the time of its completion, in July 1926. It has a clear span of 1,750 feet between pier headlines, a gross height of 135 feet, with cables spaced 89 feet apart allowing for a six-lane roadway 57 feet wide, and two 10-foot walks. The actual cost of the bridge was $36,300,000
2. Detail of bridge showing supporting section with steel and masonry construction
3. Detail section of cable tower

STATISTICS OF SOME IMPORTANT BRIDGES

TABLE No. 1—*Arch Bridges*

Name	Date of completion	Locality	Road or rail	Width	Span or spans	Length back to back of abutments	Total cost	Estimated or actual cost of approaches	Cost back to back of abutments	Cost per sq.ft.	Remarks	Reference
				Ft.	Ft.	Ft.	£	£	£	£		
Hell Gate (N.Y.)	1915	U.S.A.	Rly.	93·0	977	1,017	2,500,000	1,250,000	1,250,000	13·2	Single arch span of 977ft.	*Engineering* (1919)
London	1831	London	Road	65·0	152	1,005	1,600,000	750,000	850,000	13·01	Total cost includes cost of widening, masonry.	J. Dredge, *Thames Bridges* (1896)
St. Louis (Eads)	1874	U.S.A.	Rly. above Rd.	54 and 26	520	1,540	..	.	998,000	8·10	Spans 502ft., 520ft., 502 ft., double deck.	*Proc. Inst. Civ. Eng.* (1903)
Southwark	1921	London	Road	55·0	140	820		..	327,000	7·25	Spans 123ft., 132ft., 140 ft., 132ft., 123ft.	
Black-friars	1869	London	Road	105·0	186·5	1,000	605,000	.	475,000	4·50	Spans 155ft., 175ft. and 186·5ft. Wrought iron.	J. Dredge, *Thames Bridges*
Austerlitz	1905	Paris	Rly.	25·5	450	459	60,400	11,500	48,900	4·17	Single arch span of 450ft.	*Eng. News* (1905)
Victoria Falls	1905	South Africa	Rly.	28·0	500	650	..		72,000	3·96	Bridge across a chasm.	*Proc. Inst. Civ. Eng.* (1907)
West-minster	1862	London	Road	82·0	120	755	..	..	145,000	2·34	Cast and wrought iron. Seven arches ranging from 120ft. to 95ft.	J. Dredge, *Thames Bridges*
Düssel-dorf	1898	Ger-many	Road	46·0	595	2,094	..	..	186,000	1·93	Two spans of 595ft.; others 208ft., 180ft., 166ft., 198 ft.	*Engineering* (1900)
Niagara Falls	1898	U.S.A.-Canada	El. Rly.	46·0	840	1,240	108,000	Nil	108,000	1·89	Spans: 190ft., 840ft., 210ft.	*Proc. Inst. Civ. Eng.* (1901)

The opening span consists of two leaves or bascules, pivoted at the faces of the towers and counterweighted at their shorter end; they are operated by hydraulic power and take about one and a half minutes to open fully. The bridge was designed by Sir John Wolfe Barry and his partners.

The Newcastle-on-Tyne bridge was begun in 1925 and was opened in the autumn of 1928; it is the largest arched bridge in Great Britain. It has a span of 531ft. and a width of 64ft. between parapets with a headway for navigation of 84ft. The main arch springs from the quay levels on each side of the river, and is supported by concrete abutments carried down to the sandstone rock. The abutment towers have been designed to contain lifts for giving access from the bridge roadway to the quays. The approximate cost was £750,000 excluding land and property, which brought the total amount up to about £1,200,000—little short of half as much again as the Tower Bridge.

Alexander III. bridge, Paris, built during the period 1896–1900, is remarkable on account of the very flat rise given to its arch in order to provide easy gradients from the quays on each side of the river. The rise of 20ft. 7in. is only one-seventeenth of the span of 353ft. The ribs are of cast steel, and they have pins both at the abutments and at the centre.

TABLE No. 2—*Cantilever Bridges*

Name	Date of completion	Locality	Road or rail	Width	Span or spans	Length back to back of abutments	Total cost	Estimated or actual cost of approaches	Cost back to back of abutments	Cost per sq.ft.	Remarks	Reference
				Ft.	Ft.	Ft.	£	£	£	£		
Forth	1890	Scotland	Rly.	27·0	1,710	5,330	2,927,200	126,700	2,800,500	19·5	Spans: 684ft. 9in:, 145ft., 1,710ft., 260ft., 1,710ft., 145ft., 684ft. 9in.	*Engineering* (1890)
Ironton (Ohio)	1922	U.S.A.	Road	20·0	725	1,425	162,000	30,000	132,000	3·19	Spans: 350ft., 725ft., 350 ft.	*Eng. News Rec.* (1923)
Mirabeau	1896	Paris	Road	68·0	306	530	103,000	..	103,000	2·04	Spans: 106ft., 306ft., 106 ft.	*Proc. Inst. Civ. Eng.* (1896)
Burlington	1917	U.S.A.	Road	26·0	480	2,463	41,600	3,000	38,600	0·63	Main span 480ft., 14 girder spans of 30ft. to 70ft., 5 deck trusses of 130ft. to 175ft.	*Eng. News* (1917)
Harahan Memphis (Tenn.)	1916	U.S.A.	Road and Rly.	68·3	790	4,912	1,000,000	..	..	..	Main bridge spans: 186 ft., 790ft., 621ft., 604 ft., 345ft.	*Jour. Frankl. Inst.* (1917)
Quebec	1917	Canada	Rly.	88·0	1,800	3,238	1,800,000	..	..	..	Spans: 515ft., 580ft., 640 ft., 580ft., 515ft.	*Can. Gov. Bd. Eng.*
Carquinez Strait (Calif.)	1927	U.S.A.	Road	38·0	1,100	4,482	1,600,000	..	..	..	Spans: 500ft., 1,100ft., 150ft., 1,100ft., 500ft., and steel viaduct approach 1,132ft.	*Trans. Am. Soc. C. E.* (1928)
Queens-boro (N.Y.)	1909	U.S.A.	Road and Rly.	88·0	1,182	7,449	4,000,000	..	..	..		

TABLE NO. 3—*Girder Bridges*

Name	Date of completion	Locality	Road or rail	Width	Span or spans	Length back to back of abutments	Total cost	Estimated or actual cost of approaches	Cost back to back of abutments	Cost per sq.ft.	Remarks	Reference
				Ft.	Ft.	Ft.	£	£	£	£		
Britannia	1850	Wales	Rly.	30·0	459	1,510			597,900	13·21	Spans: 230 ft., 459 ft., 459 ft., 230 ft.	E. Clark, *Britannia Tubular and Conway Tubular Bridges* (1850)
King Edward VII.	1906	England	Rly.	47·0	300	1,097	500,000	14,000	486,000	9·40	Spans: 231ft., 300ft., 300 ft., 191ft.	*Proc. Inst. Civ. Eng.* (1906)
Hardinge	1914	India	Rly. and Ft	40·0	345	5,380		.	1,891,000	8·80	15 spans of 345ft.	*Proc. Inst. Civ. Eng.* (1803)
Tanana R (Alaska)	1923	U.S.A.	Rly.	36·0	700	700	268,000	74,000	194,000	7·70	Single span of 700ft. Special steel.	*Eng. News Rec.* (1923)
Metropolis (Illinois)	1917	U.S.A.	Rly.	37·0	720	3,502	720,000	37,000	692,000	5·35	1 span of 720ft., 4 of 556 ft., 1 of 304ft., 1 of 250 ft. Nickel steel.	*Jour. West. Soc. Eng.*, 24:2 (Feb. 1919)
Tay Viaduct	1887	Scotland	Rly.	25·5	245	10,527	670,000	Negligible	670,000	2·50	Viaduct consists of 81 girder spans.	*Proc. Inst. Civ. Eng.* (1888)
Charing Cross	1863	London	Rly. and Ft.	67·0	154	1,362	180,000	20,200	159,800	1·75	3 spans of 100ft. and 6 spans of 154ft. Wrought iron.	W. Humber, *Iron Bridge Construction* (1870)
Netravati	1906	India	Rly. and Ft.	27·2	150	2,500	.	..	97,300	1·20	16 spans of 150ft.	*Proc. Inst. Civ. Eng.* (1906)
Curzon	1905	India	Rly. and Rd	23 and 16	211	3,160		.	154,100	1·25	Double deck: 15 spans.	*Proc. Inst. Civ. Eng.* (1906)

TABLE NO. 4 *Suspension Bridges*

Name	Date of completion	Locality	Road or rail	Width	Span or spans	Length back to back of abutments	Total cost	Estimated or actual cost of approaches	Cost back to back of abutments	Cost per sq.ft.	Remarks	Reference
				Ft.	Ft.	Ft.	£	£	£	£		
Brooklyn	1883	U.S.A.	Road and Rly.	85 0	1,595	3,455	3,730,000	1,000,000	2,730,000	9.31	Spans: 930ft., 1,595ft., 930ft.	*Kanz*, also *Eng. News* (1901)
Manhattan	1909	U.S.A.	Road and Rly.	120.0	1,470	2,920	3,470,000	1,000,000	2,470,000	7.06	Spans: 725ft., 1,470ft., 725ft.	*Eng. News* (1905–08)
Menai	1826	Wales	Road	28.0	580	630	127,000	9,300	117,700	6.68	Single span of 580ft.	W. A. Provis
Williamsburg (N.Y.)	1904	U.S.A.	Road and Rly.	118.0	1,600	2,790	3,140.000	1,000,000	2,140,000	6.50	Spans: 596ft., 1,600ft., 596ft.	*Eng. News* (1961–08)
Cologne	1914	Germany	Road	62.7	605	1,208	375,000	31,000	344,000	4.57	Spans: 302ft., 605ft., 302 ft.	*Eng. News Rec.* (1913)
Bear Mt. (N.Y.)	1924	U.S.A.	Road	55.0	1,632	2,238	550,000	Nil	550,000	4.46	Spans: 210ft., 1,632ft., 210ft., 100ft., 50ft., 50ft.	*Eng. News* (1924)
Camden (Pa.-N.J.)	1926	U.S.A.	Road-Rly.	89	1,750	8,126	7,000,000	1,500,000	..	..	Spans: 716ft., 1,750ft.	*Eng. News Rec.* (1926)
Ambassador (Detroit)	1929	U.S.A.-Can.	Road	55 0	1,850	3,630*	4,625,000	..	..	..	Tot. length 7,400ft., with approaches, 9,000ft.	*Detroit Internat. Bridge Co.*
Hudson River (N.Y. City)	1932	U.S.A.	Vehicular	120.0	3,500	4,760*	12,350,000	6,175,000	..	10.98	Height: towers 600ft., mid-span, 250ft., clearance 213ft.	*Port of N. Y. Authority*

*Length between anchorages.

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BRIDGET, SAINT (453–523), one of the patron saints of Ireland, was born at Fochart, in county Louth, her father being a prince of Ulster, and her mother a bondmaid. Bridget and her mother were sold to a wizard, who brought up the little girl, and on being converted by her to Christianity, gave her back her freedom. Thereupon she returned to her father's house, where she gave so many of his goods to the poor that on her refusal to marry he tried to sell her to the king of Ulster. The latter was so struck by her piety that he freed her from parental control, and she founded a church and monastery at Kildare. She died on Feb. 1, which is celebrated as her feast day. Under the name of St. Bride she became a favourite saint in England, and numerous churches were also dedicated to her in Scotland.

See the five lives given in the Bollandist *Acta Sanctorum*, Feb. 1, i. 99, 119, 950. *Cf.* Whitley-Stokes, *Three Middle-Irish Homilies on the Lives of Saint Patrick, Brigit and Columba* (Calcutta, 1874); Colgan, *Acta SS. Hiberniae;* D. O'Hanlon, *Lives of Irish Saints*, vol. ii.; Knowles, *Life of St. Brigid* (1907); further bibliography in Chevalier, *Répertoire des sources hist. Bio.-Bibl.* (1905).

BRIDGET, BIRGITTA, OF SWEDEN, SAINT (*c.* 1302–1373), the most famous saint of the northern kingdoms, was the daughter of Birger Persson, governor and provincial judge of Uppland. In 1316 she married Ulf Gudmarson, lord of Nericia, and of her eight children, one became St. Catherine of Sweden. About 1342 she went with her husband on pilgrimage to St. James of Compostella, but shortly after their return, Ulf died in the Cistercian monastery of Alvastra and Bridget, already famous for her saintly and charitable life, devoted herself wholly to religion. The spiritual impressions which she had experienced in her childhood now became more frequent, and her records of them, translated into Latin by Matthias, canon of Linköping, and by her confessor, Peter, prior of Alvastra, obtained a great vogue during the middle ages. She founded the order of St. Saviour, or Bridgittines (*q.v.*), of which the principal house, at Vadstena, was richly endowed by King Magnus II. and his queen. About 1350 she went to Rome, partly to obtain from the pope the authorization of the new order, partly in pursuance of her desire to elevate the moral tone of the age. It was not till 1370 that Urban V. confirmed the rule of her order; but meanwhile Bridget had made herself universally beloved in Rome. Save for occasional pilgrimages, including one to Jerusalem in 1373, she remained in Rome till her death on July 23, 1373. She was canonized in 1301 by Boniface IX.

BIBLIOGRAPHY.—The Revelations were published several times, the best edition being that of G. E. Klemming (1857–84) (Eng. trans. 1873). *Cf.* the Bollandist *Acta Sanctorum*, Oct. 8, the *Vita Sanctae Brigittae*, ed. by C. Annerstedt in *Scriptores rerum Suedicarum medii aevi*, iii. 185–244 (Uppsala, 1871); de Flavigny, *Sainte Brigitte de Suède, sa vie, ses révélations et son oeuvre* (1892); Binder: *Die hl. Birgitta von Schweden u. ihr Klosterorden* (Munich, 1801). For full bibliography *see* Chevalier, *Répertoire des sources hist. Bio.-Bibl.*

BRIDGETON, a city in southern New Jersey, United States, 38 mi. S. of Philadelphia, at the head of navigation on the Cohansey river; the county seat of Cumberland county. It is served by the Central railroad of New Jersey and the Pennsylvania railroad. The population in 1930 was 15,699, and in 1940 was 15,992 by federal census. It is the social and commercial centre of a rich agricultural region, and has well established industries, the most important of which are the manufacture of glass bottles, jars; the canning and freezing of fruits and vegetables; iron works, and machine shops. The output of the establishments in the city in 1940 was valued at $20,000,000. Considerable local capital is invested in the oyster industry at Bivalve, in the southern part of the county. Bridgeton still has its "Liberty Bell," which rang from the court house in 1776; and there are numerous survivals of 18th century architecture, notably the Broad Street Presbyterian church, built in 1792 from the proceeds of a lottery authorized by the legislature for the purpose. City park and lakes contain 1,000 ac. of picturesque natural beauty.

The first rude bridge across the Cohansey, which gave the town its name, was built in 1716. In 1749 the hamlet was chosen by popular election for the county seat, and in 1754 a town was laid out. The first newspaper in New Jersey was published there in 1775. A mail route to Philadelphia, with daily deliveries, was established in 1802. At this time the principal industry was cutting cordwood for the Philadelphia market. A woollen mill was established in 1811, a nail and iron works in 1815, the first glass works in 1830, and the first canning factory in 1860. The city was incorporated in 1864.

In 1907 a new charter was adopted, providing for a modified commission form of government.

BRIDGEWATER, FRANCIS EGERTON, 3RD DUKE OF (1736–1803), the originator of British inland navigation, younger son of the first duke, was born on May 21, 1736. Scroop, first duke of Bridgewater (1681–1745), was the son of the third earl of Bridgewater, and was created a duke in 1720; he was the great-grandson of John Egerton, first earl of Bridgewater (d. 1649; cr. 1617), whose name is associated with the production of Milton's *Comus;* and the latter was the son of Sir Thomas Egerton (1540–1617), Queen Elizabeth's lord keeper and James I.'s lord chancellor, who was created baron of Ellesmere in 1603, and in 1616 Viscount Brackley (*q.v.*).

Francis Egerton succeeded to the dukedom at the age of 12, on the death of his brother, the second duke. Shortly after attaining his majority he became engaged to the beautiful duchess of Hamilton, but her refusal to give up the acquaintance of her sister, Lady Coventry, led to the breaking off of the match. Thereupon the duke broke up his London establishment, and retiring to his estate at Worsley, devoted himself to the making of canals. The navigable canal from Worsley to Manchester, which he projected for the transport of the coal obtained on his estates, was (with the exception of the Sankey canal) the first great undertaking of the kind executed in Great Britain in modern times. The construction of this work, with its famous aqueduct across the Irwell, was carried out by James Brindley, the celebrated engineer. In 1762 he obtained parliamentary powers to provide an improved waterway between Liverpool and Manchester by means of a canal, which was completed in 1772. The difficulties were still more formidable than those of the Worsley canal, involving, as they did, the carrying of the canal over Sale Moor Moss.

He died unmarried on March 8, 1803, when the ducal title became extinct, but the earldom of Bridgewater passed to a cousin, John William Egerton, who became seventh earl. By his will he devised his canals and estates on trust, under which his nephew, the marquess of Stafford (afterwards first duke of Sutherland), became the first beneficiary, and next his son, Francis Leveson Gower (afterwards first earl of Ellesmere) and his issue. The trust did not expire till Oct. 10, 1003, when the whole property passed under the undivided control of the earl of Ellesmere. The canals, however, had in 1872 been transferred to the Bridgewater Navigation Company by whom they were sold in 1887 to the Manchester Ship Canal Company.

BRIDGEWATER, FRANCIS HENRY EGERTON, 8TH EARL OF (1756–1829), was educated at Eton and Christ Church, Oxford, and became fellow of All Souls in 1780, and F.R.S. in 1781. He succeeded to the earldom in 1823, and spent the latter part of his life in Paris. He was a fair scholar and a zealous naturalist and antiquarian. At his death the earldom became extinct. He bequeathed to the British Museum the valuable Egerton mss. dealing with the literature of France and Italy, and also £12,000. He also left £8,000 to the president of the Royal Society for a work on apologetics by a writer or writers to be selected. The work was divided among eight authors, whose treatises, known as the Bridgewater treatises, appeared between 1833 and 1840.

The Bridgewater treatises were published as follows:—1. *The Adaptation of External Nature to the Moral and Intellectual Condition of Man*, by Thomas Chalmers, D.D. 2. *The Adaptation of External Nature to the Physical Condition of Man*, by John Kidd, M.D. 3. *Astronomy and General Physics considered with reference to Natural Theology*, by William Whewell, D.D. 4. *The Hand, its Mechanism and Vital Endowments as evincing Design*, by Sir Charles Bell. 5. *Animal and Vegetable Physiology considered with reference to Natural Theology*, by Peter Mark Roget. 6. *Geology and Mineralogy considered with reference to Natural Theology*, by William Buckland, D.D. 7. *The Habits and Instincts of Animals with reference to Natural Theology*, by William Kirby. 8. *Chemistry, Meteorology, and the Function of Digestion, considered with reference to Natural Theology*, by William Prout, M.D. The works are of unequal merit; several of them took a high rank in apologetic literature. They were reprinted in Bohn's Scientific Library.

BRIDGEWATER, a town of Plymouth county, Mass., U.S.A., 27 mi. south of Boston. It is served by the New York, New Haven and Hartford railroad. The population in 1940 (federal census) was 8,902. The manufactures include shoes, nails, lumber, leatherboard, machinery and brick. A state teachers' college (established 1840) is pleasantly situated near the centre of the town. In 1656 the part of Duxbury called New Plantation was established as the town of Bridgewater. North, West and East Bridgewater were separately established in 1821, 1822 and 1823.

BRIDGING, MILITARY. In the course of most military operations it is necessary to cross rivers at places where no bridges exist or where they have been demolished by the enemy. It is the duty of the engineers of an army to provide the means for such crossings. For small detachments ferrying with boats or rafts is resorted to: but for forces of any size accompanied by artillery and transport, bridges must be built. Floating bridges are the most rapidly built and have consequently been most frequently employed; they are built either with material obtained locally or with special "pontoon" equipment accompanying the army on wagons. Many other types of construction have been employed such as trestle bridges in which the roadway is supported by a series of timber trestles, cribwork bridges in which the supports consist of timber cribs usually filled with stone, pile bridges, suspension bridges and steel girder or truss bridges. So long as transport and guns were drawn by animals the weight of vehicles was limited and consequently the strength required of military bridges remained approximately constant until the beginning of the 20th century. With the introduction of motor vehicles and tanks, however, weights increased enormously and all bridging standards had to be reconsidered.

HISTORY AND DEVELOPMENT

From time immemorial floating bridges of vessels bearing a roadway of beams and planks have been employed for the passage of rivers and arms of the sea. Xerxes crossed the Hellespont on a double bridge, one line supported on 360, the other on 314 vessels anchored head and stern with their keels in the direction of the current. Darius threw similar bridges across the Bosphorus and the Danube in his war against the Scythians, and the Ten Thousand employed a bridge of boats to cross the river Tigris in their retreat from Persia. Floating bridges have been repeatedly constructed over rivers in Europe and Asia, not merely temporarily for the passage of an army, but permanently for the requirements of the country; and to this day many of the great rivers in India are crossed by floating bridges which are for the most part supported on boats such as are employed for ordinary traffic on the river. Alexander the Great is said to have carried his army over the Oxus by means of rafts made of the hide tents of his soldiers stuffed with straw when he found that all the river boats had been burnt. Cyrus crossed the Euphrates on stuffed skins. In the 4th century the emperor Julian crossed the Tigris, Euphrates and other rivers by bridges of boats made of skins stretched over osier frames.

In more recent times bridges have been supported on floating piers made of barrels lashed together. During the World War light footbridges for the assaulting infantry were frequently supported by floats composed of cork or empty petrol tins held together in light crates.

Principles of Pontoon Equipments.—All the devices mentioned above are still occasionally used but they depend upon materials to be found on the spot and these are rarely available in sufficient quantities and furthermore take time to collect. For these reasons pontoon equipments were introduced. Such equipments consist of specially prepared materials for construction of floating bridges; packed on wagons they accompany an army and are available for use wherever required. There are three essential parts: floating supports called "pontoons" anchored at intervals in the stream with their keels in the direction of the current; beams called "baulks" or "road-bearers" spanning the intervals between pontoons and supporting the roadway; and finally the roadway itself composed of planks technically known as "chess." To understand the history of their development the qualities desirable in these parts must first be considered.

The pontoons must have sufficient buoyancy to support the loads which are to use the bridge; within limits the power of support can be increased by placing pontoons closer together, but floating debris is thereby more obstructed in passage and such bridges have been washed away. They must be light enough to be man-handled and to be loaded upon wagons. They must be strong enough to withstand rough usage and should be easily repairable in the field. These requirements are contradictory and the history of pontoon design is a history of compromise. The most usual form is that of a flat-bottomed boat either with or without a deck; decked it can with safety be more deeply loaded, but its interior is inaccessible and it is less convenient for use as a boat.

The road-bearers must be strong enough to support the roadway, and must also be as light as possible for transport. Evidently, the greater the intervals between the pontoons the greater the strength required. They may rest either on a central saddle placed longitudinally on each pontoon vertically above the keel—"saddle loading"—or simply upon the gunnels of the pontoons—"gunnel loading." Saddle loading makes for great simplicity in constructing the bridge, each set of road-bearers spanning from the centre of one pontoon to the next with claws or pins on their ends which engage in the saddles. In gunnel loading the road carriers usually extend across the bridge to both gunnels. The spans are thus shorter, but the bridge is much stiffer and stronger. Until the advent of mechanical transport, wooden road-bearers about 5in. by 5in. in section and 15 to 20ft. long were usually employed.

The chess must be as light as is consistent with strength. In the days of horse-drawn traffic 1½in. was the usual thickness; for heavy traffic a second layer was laid on top of the first.

History of Pontoon Equipment.—Alexander the Great occasionally carried with his army vessels divided into portions which were put together on reaching the banks of a river, as in crossing the Hydaspes. The practice of carrying skins to be inflated when the troops had to cross a river was adopted by the Greeks, the Romans and the Mongols and indeed still exists in the East. In the wars of the 17th century pontoons were taken as regular components of the trains of armies, the Germans using a leather, the Dutch a tin and the French a copper "skin" over stout timber frames. In the middle of the 18th century the Russians introduced a collapsible pontoon consisting of a tarpaulin skin stretched on a wooden frame. For transport the frame was dismantled and the tarpaulin rolled up. This type they retained for a hundred years.

During the 19th century a great number of designs were introduced only a few of which can be mentioned here. No armies had more experience of pontooning than the French; during the wars of the Revolution and the Empire they constructed pontoon bridges over most of the principal rivers of Europe. They experimented with many types ranging from large wooden boats weighing about 2 tons to small copper ones weighing 7cwt.; the heavy wooden type, the Gribeauval, was discarded in 1805 as it could not keep up with the movements of the armies; in 1853 they adopted a flat-bottomed open wooden boat 31ft. long and weighing 1,450 lb., which appears to have been very successful. The Northern States during the American Civil War used this type extensively as heavy equipage, and used dismountable wooden frames covered with canvas as light equipage.

During the Peninsular War the English employed open pontoons, but the experience gained during that war induced them to introduce the closed form. Then Gen. Sir Charles Pasley introduced demi-pontoons, called sectional pontoons in America, being like decked canoes with pointed bows and square sterns, a pair, attached stern-wise, forming a single "pier" of support for the roadway; they were constructed of light timber frames covered with sheet copper and were decked with wood. Each demi-pontoon was divided into watertight compartments and provided with means for pumping out water; for transport a pair of demi-pontoons and the superstructure for one bay of bridge were loaded on a single wagon. The Pasley was superseded by the Blanshard pontoon, a tin-coated cylinder with hemispherical ends for which

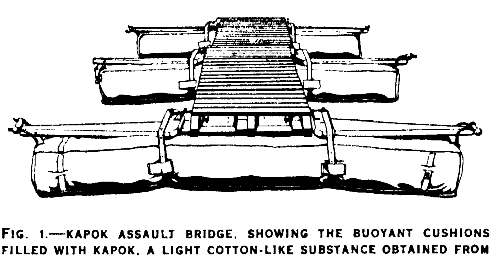


FIG. 1.—KAPOK ASSAULT BRIDGE, SHOWING THE BUOYANT CUSHIONS FILLED WITH KAPOK, A LIGHT COTTON-LIKE SUBSTANCE OBTAINED FROM TREES NATIVE TO JAVA AND THE INDIAN ARCHIPELAGO. THESE CUSHIONS REMAIN AFLOAT EVEN WHEN REPEATEDLY PUNCTURED BY RIFLE FIRE

reat mobility was claimed, two pontoons and two bays of super:ructure being carried on one wagon. The Blanshard pontoon 'as long used in the British army, but was ultimately discarded, nd British engineers reverted to the open pontoon to which engieers of the Continental armies had meanwhile constantly adered. In 1889 Lieut. Clauson, R.E. invented a two section pon)on coupled with easily manipulated couplings of phosphor ronze. For light bridges the sections could be used independently;)r heavy bridges three sections could be coupled together end to ıd. Except for minor modifications this equipment was retained ı the British service until 1924. During the World War it was ıuch used in Mesopotamia and during the early and final stages ı France; it was found unsuitable in the rapid current of the iave on the Italian front.

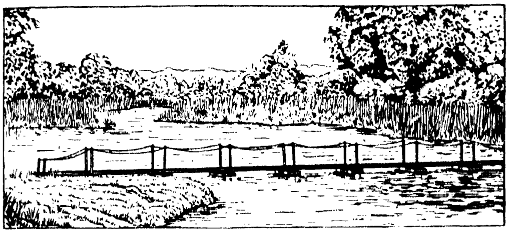


FIG. 2.—KAPOK ASSAULT BRIDGE IN POSITION. IT IS RAPIDLY LAUNCHED, AND PROVIDES PASSAGE FOR INFANTRY

Historically the most important equipment is that introduced ı the Austrian army by Col. Birago in 1841; it was either adopted r copied by many other armies. The Birago pontoon was a flat-ottomed open boat constructed in sections two or more of which ɔuld be coupled together end to end to form piers of the buoyncy required. This idea had first been proposed by Col. Pompei loriani about the middle of the 17th century but had not preiously been fully developed; as already mentioned it was subseuently adopted in British equipments. The Birago pontoons 'ere in the first instance made of wood, later they were made enrely in iron and later still in steel. One reason given for the ıange was that metal pontoons were more easily repaired in the eld than wooden ones; this argument, however, was not genrally accepted. Saddle loading was adopted, the saddle being rranged to slew in the pontoon so that a bridge could be built iagonally across a river, the pontoons still pointing in the direcon of the current; great importance was attached to this feature t the time but it was subsequently found to be impracticable.

An interesting equipment was introduced into the American rmy in 1846. The pontoons were made entirely of india-rubber nd each consisted of three parallel pointed cylinders 20ft. long ɔined together side by side by an india-rubber web. When the ontoon was required for use these cylinders were inflated through ozzles with a pair of bellows; for transport the entire pontoon 'as folded up and packed in a box. After considerable experience uring the American Civil War the engineers of the Northern tates much preferred the French equipment.

Methods of Bridge Building with Pontoon Equipment.—'here are four recognized methods of building pontoon bridges; ıe choice depends partly upon the actual equipment in use and ıore upon the site of the bridge and nature of the river. (*a*) Successive pontoons." The pontoons are added successively to ıe "head" or far end of the bridge and the roadway added on ɔp of them; this is perhaps the simplest method. (*b*) "Boomıg out." Pontoons are added successively at the "Tail" or shore nd and the whole bridge pushed out, this saves carrying all the tores for the roadway to the far end of the bridge. (*c*) "By ıfts." Complete sections of the bridge are built in convenient ositions by the near bank, floated into position and joined toether; this method will often be quicker than (*a*) or (*b*). (*d*) Swinging Bridge." The entire bridge is built alongside the near ank, that is, at right angles to its final position; when complete : is allowed to swing round with the current on its near end as a pivot, anchors are dropped in their appropriate positions as it swings and the entire bridge is checked by the anchor cables as it reaches its correct alignment. On a suitable site this method is extremely rapid, but in fast streams the operation is risky and the bridge often is lost or severely damaged.

Trestle Bridges.—It is not always feasible to construct a floating bridge, pontoons may not be available, the water may be too shallow or the gap may be entirely dry. In such cases timber trestles have frequently been used to replace pontoons as supports for the road-bearers. Such trestles consist essentially of a horizontal bottom piece or "ground sill," two or more legs which are vertical or slightly inclined inwards at the top, and a horizontal top piece or "transom" on which the ends of the road-bearers rest as they would on the saddle of a pontoon; the whole is stiffened up by diagonal braces. The size of the timber used varies with the nature of the bridge, ranging from light army signal poles used for the trestles of infantry assault bridges during the World War to timber baulks 12in. square or even larger used for railway bridges during the American Civil War and the Boer War and for heavy road bridges during the World War. In the case of light and very temporary trestles the members may be fastened together by means of wire or even rope lashings, but where any strength or permanency is required they must be properly fitted and spiked or dogged together. High railway viaducts have been built by placing two or even three heavy trestles on top of each other to form each pier and bracing the whole together. Trestles are usually constructed on shore, carried into position and up-ended; in the case of the heaviest trestles derricks have to be employed. In the Boer War, the British built many trestle bridges. The Koop river bridge, 306ft. long, of trestles 20ft. high, was built by 100 engineers and 300 natives in 4 days. Most pontoon equipments have included specially designed trestles for use where the water close to the shore is not deep enough to float a pontoon.

Cribwork.—Timber cribs have been used instead of trestles for railway and heavy road bridges when timber was plentiful and the height required small. They were much used during the Boer War in the repair of demolished railway bridges, railway sleepers being employed in their construction. Timber crib construction is very convenient since no skilled labour is required but cribs are wasteful of material. When placed in water they are usually spiked together and filled with stone. During the World War 3ft. cubes made of light steel angles riveted together were kept as an article of store and extensively used for building up piers of moderate height for heavy road bridges. An instance occurred in 1918 in the crossing of the Selle where, under the nose of the enemy holding the opposite bank, a crib causeway for tanks, built of railway sleepers, bolted together and sunk in the bed of the river was constructed during the nights immediately preceding the attack and kept concealed from view and from aerial photography by being completed just below water-level.

Pile Bridges.—Trestles or cribwork are often not feasible in rapid currents owing to the scour and if pontoon equipment is not available pile driving has to be resorted to, but it is a slow method. In 1809, before the battle of Wagram, Napoleon's engineers under Gen. Bertrand constructed a pile bridge 800yd. long across the Danube at Vienna in 20 days; upstream, piles were driven to form a "boom" to protect the bridge from floating bodies sent down by the enemy.

Girder or Truss Bridges.—Where bridges must be built across deep ravines or where the foundation is unsuitable, it is necessary that the bridges span clear gaps of 100ft. or more without intermediate support. In such cases, the superstructure is supported by standard truss bridges or wooden or metal girders. The bridges are made in panels of interchangeable parts; and the total length of any bridge can be that of any multiple of the fixed panel. The total practicable length depends upon the material used. The standard girders are very similar to ordinary commercial girders; except that bolts are used instead of rivets, so that the girders may be taken apart for transportation. The trusses are usually composed of telescoping pipe connected into special cast junction pieces by pins and locking rings. In constructing the girder or truss bridges, the parts are put together over rollers on land in rear of the gap and then launched into position with support by cranes on the far bank

DEVELOPMENTS SINCE THE WAR OF 1914-18

Assault Bridging.—Forcing the passage of a river in the face of the enemy is a difficult operation under modern conditions. It will usually be necessary to pass the assaulting infantry over as rapidly as possible under cover of darkness and without making any preparations which would put the enemy on his guard. The use of improvised floating assault bridges during the World War has been referred to above. A special equipment for this purpose has since been introduced into the British service; it is known as the kapok assault bridge and is shown in figs. 1 and 2. This bridge consists of canvas floats stuffed with kapok, each bearing, strapped to it, a transom plate or saddle with a metal coupling to which are affixed the timber duckboards which form the bridge from float to float At each end of the floats are handles so that the bridge, after being assembled at a convenient spot near the river, can be lifted bodily by two men for each float and carried forward for launching.

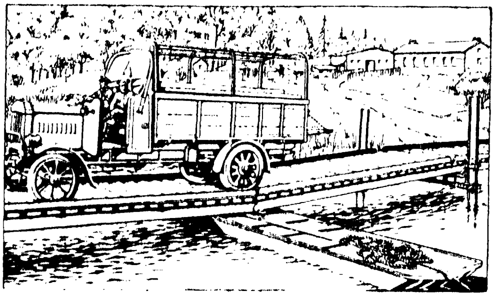


FIG. 3.—THE CONSUTA MEDIUM BRIDGE, A COMBINATION OF TRESTLE AND PONTOON BRIDGES

It serves for the passage of medium weight lorries, artillery, etc. behind advancing troops

The operation of launching and pushing the bridge across the river can be effected in a few seconds, and as soon as it has been secured on the far bank the assaulting infantry can commence to cross. The articulation of the saddle joint allows sufficient play for the bridge to be carried and launched over rough ground whilst providing sufficient lateral rigidity to steer its head across the stream, even against cross-wind and current. The buoyancy of the floats is ample and the bridge is stable in the water. The virtue of the kapok float lies in its lightness and in the fact that it is little affected by rifle fire; even when repeatedly punctured it absorbs water very slowly. For the formation of a bridge to take pack transport three kapok assault bridges are placed side by side and planked over to form a roadway.

Other armies have devised assault bridges of rafts complete in themselves. The floating power is composed of kapok rafts or of cylindrical metal rafts; and each raft supports a foot walk. The rafts are hooked or tied together, so as to form one continuous walk; and the whole foot walk complete is launched at one time across the stream.

Pontoon Equipments.—Prior to 1914 the majority of military transport was still horse-drawn and vehicles weighed about 2 tons. The weight of field guns and howitzers was of the same order and heavier artillery was an exception for which it was not usually necessary to provide. The horse-drawn wagon has now been replaced by the motor lorry weighing four times as much. Medium and heavy artillery are common and tanks weighing 12 tons or more must be passed across rivers with the minimum of delay. It has therefore been necessary to redesign pontoon equipments. The pattern adopted in the British service is shown in fig. 3. The pontoons are flat-bottomed boats with scow bows and are completely decked in. They are 21ft. long, 5ft. 6in. wide and 2ft. 9in. deep and weigh about 1,400 lb They are built with a skin of two or three ply consuta wood on a mahogany framework and are designed so that two pontoons can be coupled stem to stern. The road-bearers are nickel chrome steel joists and are fitted at their ends with steel pins to engage in slots in the saddles which rest centrally on the pontoons. The chess are 3in. thick and are held in place by wheel guides or "ribands" racked down by chains with a screw attachment. There are three general forms in which the pontoon bridge may be made up; as a light bridge to carry field artillery and horsed transport, the pontoons being used singly with five steel road-bearers from saddle to saddle; as a medium bridge to carry medium artillery and lorries in which two pontoons are coupled stern to stern and seven road-bearers are used in each bay; as a heavy bridge to carry heavy artillery and track vehicles up to the 18 ton tank in weight, the piers of which are formed of four pontoons coupled in pairs and carrying an extra central saddle on which 11 road-bearers are placed to carry the roadway. In all forms each bay of bridge spans 21 feet. A steel trestle is provided as part of the equipment. It consists of two mild steel legs with pitch pine mud shoes, a nickel chrome steel transom and two jacks for raising or lowering the transom. The legs are drilled with holes along the centre of the web into which the pins of the transom engage so that the transom and, with it, the roadway can be raised or lowered by means of the jacks as occasion requires. When used in conjunction with a heavy bridge as shown in fig. 2, a double trestle pier is formed, but with a medium bridge a single trestle suffices to form a pier.

The French have adopted an undecked pontoon made of galvanized steel sheet on a steel framework; it is 33ft. long, 6ft. 6in. wide and 3ft. 3in. deep, weighs 2,420 lb. and is designed for gunnel loading. Experiments have been carried out with two systems of construction. In the first ordinary wooden road-bearers are used and lashed down to the pontoons; in the second an ingenious arrangement of articulating steel girders is added outside the roadway on each side to distribute the load between pontoons; the road-bearers in this case are of steel.

It will be seen that there is still wide divergence of opinion as to the best design for a pontoon equipment; on the whole it may be said that the metal pontoon is, in spite of its weight, gaining ground at the expense of the wooden one; that the boat-shaped pontoon has asserted its superiority over all other designs; and that decked pontoons are in the minority. Opinion on saddle versus gunnel loading is divided. Experiments with aluminium alloy pontoons have been undertaken in several countries, but nowhere have the practical difficulties yet been overcome.

Girder or Truss Bridges.—On the lines of communications pontoon equipment is not suitable and it is needed at the front. Girder or truss bridges of semi-permanent character are used; and the only military requirement is that they must be such as can be quickly constructed. Standard panels of trusses are prepared and kept in supply depots; they are rushed to the area where needed and quickly erected. Even in the combat area aluminium truss panels of telescoping pipe demountable for transportation are deemed suitable; but they are very expensive and have therefore not been used except for experiment.

Box girders (fig. 6 of the plate) have been designed to enable spans up to about 100ft. to be bridged in the simplest manner and also to secure that the bridge so built will be strong enough to carry either light, medium or heavy loads. The bridge is of the deck type and the chess lie flat on the top of the box girders. The girders are skeleton steel boxes made up in sections, each 8ft. long. The sections are joined together by plain pin joints; no nuts or bolts are required. There are thus only two essential parts, viz., the box girders and the chess.

Three types of bridge can be built by using two, three or four box girders under the chess. In fact the gap is to all intents and purposes spanned by using skeleton steel road-bearers which can be made up to any desired length in 8ft. sections. To obtain a wider bridge it is merely necessary to add more box girders and use longer chess, or a double row of chess. The decking is held in position by angle steel kerbs fixed down by hook bolts, and the handrail consists of posts which fit into the sockets in the centre of each 8ft. length of kerb and piping. The handrail pipes are also used as carrying bars for carrying sections of the girders. The girders will usually be fitted with horn beams at each end, a construction which enables them to be lowered on to masonry abutments, or on to a timber bankseat so that the level of the roadway may be kept down and a ramp-up approach avoided; but where head-room under the bridge is required or the approach level is suitable, these are not necessary. The girders may be launched by means of a derrick on the far bank or a cantilever method may be adopted if the bridge is a heavy one with three or four girders. In this case each girder is used in turn as a counter-weight for the next.

The construction of approach roads to a heavy bridge is often a work of greater magnitude than the construction of the bridge itself as they must be sufficiently permanent to carry the heavy strain of mechanical transport. Thus, whilst the assault bridges are intentionally thrown well away from the main lines of traffic and the lighter forms of pontoon bridge can be used wherever a reasonable cross country approach track can be made, the heavy bridges are confined closely to the route of the main roads.

Probable Effect of Mechanical Warfare.—Mechanical warfare is still in its infancy and the direction of its future development is uncertain. The effect on military bridging is therefore a matter of speculation. One of the chief assets of a mechanical force of tanks, armoured cars, etc., is its speed and power of movement over favourable ground independently of roads. Obviously it will frequently use this mobility to go to existing bridges instead of spending time constructing bridges. Even so, unless it is provided with some means of rapidly crossing streams of moderate width much of the value of its mobility will be lost.

During World War I the Mark VIII tank, weighing 40 tons, was too heavy for the pontoon bridges of that time. Since the World War, the difficulties of providing pontoon bridges for such heavy tanks have in some cases led to the belief that only the lighter tanks will be used in war. On the other hand, many believe that very heavy tanks will be used, and that the engineers must provide the necessary pontoon bridges. In the extreme case, the pontoons for very heavy tanks will simply be large buoyant boxes transported on trucks. They will be very difficult to manipulate.

See Official army manuals on bridging (English, French, American, etc.), which are the best source of information. *The Work of the Royal Engineers in the European War 1914–1919, Bridging,* Institution of Royal Engineers, Chatham (1921). (R. D. D.; W. A. M.)

BRIDGITTINES, an order of Augustinian canonesses founded by St. Bridget of Sweden (*q.v.*) *c.* 1350, and approved by Urban V. in 1370. It spread widely in Sweden and Norway and in Northern Europe, and played a remarkable part in promoting culture and literature in Scandinavia; to this is to be attributed the fact that the head house at Vastein, by Lake Vetter, was not suppressed till 1595. In England, the famous Bridgittine convent of Syon at Isleworth, Middlesex, was founded and royally endowed by Henry V. in 1415, and was among the few religious houses restored in Mary's reign. On Elizabeth's accession the community migrated to the Low Countries, and finally (1594) settled in Lisbon. Here they remained, always recruiting their numbers from England, till 1861, when they returned. Syon House is now established at Chudleigh in Devon; and there are a few Bridgittine convents on the Continent.

See A. Hamilton in *Dublin Review,* 1888, "The Nuns of Syon"; Max Heimbucher, *Orden u. Kongregationen* (1907), ii. § 83; Herzog-Hauck, *Realencyklopädie* (ed. 3), art. "Birgitta." (E. C. B.)

BRIDGMAN, FREDERIC ARTHUR (1847–1928), American artist, was born at Tuskegee, Ala., on Nov. 10, 1847. He began as a draughtsman in New York for the American Bank Note Company in 1864–65, and studied art in the same years at the Brooklyn Art school and at the National Academy of Design; but he went to Paris in 1866 and became a pupil of J. L. Gérôme. Paris then became his headquarters. A trip to Egypt in 1873–74 resulted in pictures of the East that attracted immediate attention, and his large and important composition, "The Funeral Procession of a Mummy on the Nile," in the Paris Salon (1877), bought by James Gordon Bennett, brought him the cross of the Legion of Honour. Other paintings by him were "An American Circus in Normandy," "Procession of the Bull Apis" (now in the Corcoran Art Gallery, Washington), and a "Rumanian Lady" (in the Temple collection, Philadelphia).

He was an officer of the Légion d' honneur, and of the order of St. Michael of Bavaria. He was made a member of the National Academy in 1881. He was the author of *Winters in Algeria* and of *Anarchy in Art.* He also composed orchestral music.

BRIDGMAN, LAURA DEWEY (1829–1889), American blind deaf-mute, was born on Dec. 21, 1829, at Hanover (N.H.), U.S.A. When two years old she had an attack of scarlet fever which permanently destroyed her sight and hearing. Through an article published by Dr. Mussey, head of the medical department of Dartmouth college, her case was brought to the attention of Dr. S. G. Howe, head of the Perkins institution for the blind at Boston. In Oct. 1837 Laura entered the school. Dr. Howe at once set himself to teach her the alphabet by touch. He first pasted on several common articles, such as keys, spoons, knives, little paper labels with the names of the articles printed in raised letters. As soon as she had learned all the names in this fashion she was taught the individual letters, and gradually learned the alphabet and the ten digits. In Jan. 1842 Charles Dickens visited the institution, and afterwards wrote enthusiastically in *American Notes* of Dr. Howe's success with Laura. In 1843, funds were obtained for devoting a special teacher to her, and first Miss Smith, then Miss Wight, and then Miss Paddock were appointed; Laura by this time was learning geography and elementary astronomy. In 1887 her jubilee was celebrated at the institution. In 1889 she was taken ill and died on May 24. She was buried at Hanover.

See Maud Howe and Florence Howe Hall, *Laura Bridgman* (1903), which contains a bibliography; Mary S. Lamson, *Life and Education of Laura Dewey Bridgman* (1878).

BRIDGNORTH, municipal borough in the Ludlow parliamentary division of Shropshire, England, situated on a high red sandstone rock bounded on the east by the River Severn. Pop. (est. 1938) 5,210. Area 3.9 sq.mi. The approach from all sides involves steep ascents or descents. The early history of Bridgnorth is connected with Aethelflaed, lady of the Mercians, who raised a mound there in 912 as part of her offensive policy against the Danes. William I granted the manor to earl Roger of Shrewsbury, whose son built a castle on the sandstone rock in 1101. The castle was finally destroyed by the parliamentarian forces in the Civil War, with the exception of part of the keep. Castle and grounds were presented to the corporation in 1897. Early charters were confirmed by several later kings, and the town was incorporated in 1546. A "Low Town" has grown at the foot of the cliff beyond the Severn, here crossed by a bridge which is the successor of others dating back probably to Saxon times. Communication between Low and High Towne is by flights of steps, the best known being Stoneway steps, about 200 in number. The name of the town may refer to the former existence of another bridge at Quatford to the south. There are numerous half-timbered buildings, including Bishop Percy's birthplace (1580) and the town hall (removed from another site in 1652); and many houses have cellars cut in the rock. The chief industries of the town are carpet weaving, spinning and malting, but lace and stockings were formerly made, and boatbuilding flourished in connection with barge traffic on the Severn. The town was also a rival of Shrewsbury in the cloth and hide trades. Of the two parish churches, St. Mary's was erected by Telford about 1800. The borough returned two members to parliament from 1295 to 1867, and one from then until 1885.

BRIDGWATER, seaport and municipal borough, Somerset, England. Pop. (1938) 18,292. It lies in the level country east of the Quantock Hills, on the River Parret, 10m. from its mouth; and its two portions are connected by an iron bridge. The settlement (Briges, Briggewalteri, Brigewauter) is probably Saxon in origin, owing its growth to a favourable position on the chief river of Somerset. It became a free borough, having a Saturday market and an annual fair, by a charter of 1201. Fairs for the sale of wool and wine were important in mediaeval times. Numerous charters were granted in the 14th century, and the borough was incorporated in 1468. The trade of the port revived after the construction of the new dock in 1841. The principal church is that of St. Mary Magdalene, in part of 14th century date. The town was the birthplace of Admiral Blake (1598). Five miles to the south-east is Sedgemoor, a marshy tract where the Monmouth rebellion was crushed in 1685. The river is navigable to the town for vessels of 300 tons, but is liable to a bore which sometimes attains nine feet. There is a considerable coasting trade, the chief article of export being bath bricks, in which the town has a monopoly, made of the mingled sand and clay deposited by tides. Industries are cellophane making, brewing and malting, and the making of oil cake and cement. There is a station on the G.W. and Somerset and Dorset railways. The town is in the Bridgwater parliamentary division, though from 1295 until 1870 it returned two members. It is a tourist centre. Area, 2.9 sq.mi.

BRIDLINGTON, municipal borough, East Riding of Yorkshire, England, 31 mi. N.N.E. of Hull by the L.N.E.R. Pop. (est. 1938) 21,720. Area 9 sq.mi. It is divided into two parts, the ancient market town lying about 1 mi. from the coast, while the modern houses of Bridlington Quay, the watering-place, fringe the shore of Bridlington bay. Southward the coast becomes low, but northward it is steep and very fine, where the great spur of Flamborough head (*q.v.*) projects eastward. Bridlington seems to have been a borough before the Conquest, as mention of its burgesses occurs in Domesday. Its mediaeval history is linked up with its markets and fairs, first mentioned in a grant of 1200, and its port, first mentioned in Stephen's reign. The church of St. Mary and St. Nicholas consists of the fine Decorated and Perpendicular nave, with Early English portions, of the priory church of an Augustinian foundation of Walter de Gaunt about 1154. There remains also the Perpendicular gateway. The institution flourished until 1537. Bridlington was an early centre of Nonconformity, and a Congregational society was founded in 1662. In the late 18th century it became fashionable with a chalybeate spring. Bridlington was created a municipal borough in 1899. It is in the Buckrose parliamentary division. In the 20th century developments as a resort were extensive. They include the Spa Royal hall (1932), a promenade 400 yds. long (1931), a concert hall (1937) and the provision of pleasure gardens in the Sewerby estate. A new town hall was opened in 1932. In World War II 3,000 houses had been damaged in air raids by the end of 1941.

BRIDPORT, ALEXANDER HOOD, VISCOUNT (1727–1814), British admiral, was the younger brother of Samuel, Lord Hood Entering the navy in Jan. 1741, he was appointed lieutenant of the "Bridgewater" six years later, and served under Saunders in the Mediterranean and under Hawke at Quiberon Bay (Nov. 20, 1759). He was present in the "Robust," at the battle of Ushant in 1778, and gave evidence against Keppel in the court-martial which followed this action. Two years later he was made rear-admiral of the white, and succeeded Kempenfeldt as one of Howe's flag-officers, and in the "Queen" he was present at the relief of Gibraltar in 1782. On the outbreak of the war with France in 1793 Sir Alexander Hood, as Howe's second in command, shared in the operations which culminated in the "Glorious First of June," and for his services was made Baron Bridport of Cricket St. Thomas, in Somerset, in the Irish peerage. Henceforth Bridport was practically in independent command. In 1795 he fought the much-criticized partial action of June 23 off Belle-Ile. His peerage was made English, and he became vice-admiral of England. In 1796–97 he practically directed the war from London. In the following year he was about to put to sea when the Spithead fleet mutinied. After this Bridport took the fleet to sea as commander-in-chief in name as well as in fact, and from 1798 to 1800 personally directed the blockade of Brest. In 1800 he was relieved by St. Vincent, and retired from active duty. The viscounty in the English peerage died with him; the Irish barony passed to the younger branch of his brother's family, for whom the viscounty was re-created in 1868.

See Charnock, *Biographia Navalis*, vi. 153; *Naval Chronicle*, i. 265; Ralfe, *Nav. Biog.*, i. 202.

BRIDPORT, municipal borough, Dorsetshire, England, 15 mi. W. of Dorchester on a branch of the G.W.Ry. Pop. (est. 1938) 5,732. Area, 1.1 sq.mi. It takes its name from the small river Brit. The main part of the town is about a mile inland, but is connected by a winding street with the fishing village of West Bay. A museum and art gallery were opened in 1932.

Bridport was of some importance before the Conquest, when it consisted of 120 houses rated for all the king's services. The town is first mentioned as a borough in the Pipe Roll of 1189. Charters were granted in the 13th century and markets seem to have been held from the same time. It was incorporated by James I. in 1619, but Charles II. granted a new charter which held until 1835. As early as 1213 the town was noted for the manufacture of ropes and cables. The royal navy procured its hawsers, etc., from Bridport in the 16th century.

Sailcloth, cordage linen and fishing-nets are manufactured for export. There is some import trade in flax, timber and coal, but the harbour is accessible only to small vessels. Bridport returned two members to parliament from 1295 to 1867 and one member from then until 1885, but is now in the Western division of the county.

BRIE, an agricultural district of north France, to the east of Paris, bounded west and south by the Seine, north by the Marne. Area about 2,400 square miles. It includes most of the department of Seine-et-Marne, with portions of Seine, Seine-et-Oise, Aisne, Marne and Aube. The western half was known as the *Brie française*, the eastern as the *Brie champenoise*. It varies in altitude between 300 and 500ft. in the west, and between 500 and 650ft. in the east. The region includes the Forêt de Senart, the Forêt de Crécy and the Forêt d'Armainvilliers. The surface soil is clay with embedded fragments of siliceous sandstone, used for millstones and constructional purposes; the subsoil is limestone. The Yères, a tributary of the Seine, and the Grand Morin and Petit Morin, tributaries of the Marne, are the chief rivers, but the region is not very well watered and the rainfall is only between 20 and 24 inches. The Brie is famous for its grain and its dairy products, especially cheese.

BRIEF, a statement prepared by a solicitor for the use of counsel at the trial of a cause with the "proofs" of witnesses, if any. Accompanying the brief may be copies of the pleadings (*see* PRACTICE AND PROCEDURE), and all pertinent documents. The brief is always endorsed with the title of the court in which the action is to be tried, with the title of the action, and the names of the counsel and of the solicitor who delivers the brief. Counsel's fee is also marked. The delivery of a brief to counsel gives him authority to act for his client in all matters relevant to the case. The result of the action is noted on the brief by counsel, or, if the action is compromised, the terms of the compromise are endorsed on each brief and signed by the leading counsel on the opposite side. In Scotland a brief is called a memorial.

In the United States the word has, to a certain extent, a different meaning, a brief in its English sense not being required, for the American attorney exercises all the functions distributed in England between barristers and solicitors. A lawyer sometimes prepares for his own use what is called a "trial brief" for use at the trial. This corresponds in all essential particulars with the English "brief." But the more distinctive use of the term in America is that of the brief "in error or appeal," before an appellate court. This is a written or printed document embodying the argument on the case. Most of the appellate courts require the filing of printed briefs for the use of the court and opposing counsel. In the United States Supreme Court and circuit courts of appeal the brief is required to contain a concise statement of the case, a specification of errors relied on, including the substance of evidence, the admission or rejection of which is to be reviewed, or any extract from a charge excepted to, and an argument exhibiting clearly the points of law or fact to be discussed. This form of brief is also adopted for use at the trial in certain states of the Union which require printed briefs to be delivered to the court.

The *brief-bag*, in which counsel's papers are carried to and from court, now forms part of a barrister's outfit, but in the early part of the 19th century the possession of a brief-bag was strictly confined to those who had received one from a king's counsel. King's counsel were then few in number, and had a salary of £40 a year, with a supply of paper, pens and purple bags. These bags they distributed among rising juniors of their acquaintance, whose bundles of briefs were getting inconveniently large to be carried in their hands. These perquisites were abolished in 1830. English brief-bags are now either blue or red. Blue bags are those with which barristers provide themselves on their call, and it is a breach of etiquette to let this bag be visible in court. The only brief-bag allowed to be placed on the desks is the red bag, which by the etiquette of the bar is given by a leading counsel to a junior who has been useful to him in some important case. In the United States the brief-bag is green.

BRIEG, a town of Germany, in Prussian Silesia, on the left bank of the Oder, 27 mi. S.E. of Breslau. Pop. (1939) 37,594. Brieg (*Civitas Altae Ripae*), obtained municipal rights in 1250 from Duke Henry III of Breslau, and was fortified in 1297; its name is derived from the Polish *brzeg* (shore). Burned by the Hussites in 1428, but soon rebuilt, it was again fortified by Joachim Frederick, duke of Brieg, in 1595, and suffered severely in the wars of the subsequent centuries. From 1311 to 1675 Brieg was the capital of an independent line of dukes, by one of whom the castle was built in 1341. On the death of the last duke in 1675 the duchy was annexed by Austria, and eventually fell to Prussia with Silesia in 1742. The fortifications of the town, now marked by handsome promenades, were destroyed by the French in 1807. It has a renaissance castle, formerly the residence of the counts of Brieg. It is an agricultural centre with important cattle markets. Metal work, soap, wire goods, cement and pianos are also produced.

BRIELLE or **DEN BRIEL,** in the province of South Holland, Holland. Pop. (1940) 3,387. It has a long sea-faring tradition and a large number of its inhabitants are fishermen or pilots. It was captured in 1572 by the *Gueux* (Geuzen), a band of privateers raiding the Dutch coast under commission of the prince of Orange. It was the home of the admirals Van Tromp and Van Almonde. There is a quaint town hall and an orphanage dating from 1533, while the tower of the *Groote Kerk* of St. Catherine serves as a lighthouse. Brielle lost its trade to Hellevoetsluis through the cutting of the Voornsche canal in 1829.

BRIENNE-LE-CHÂTEAU, a town of northeastern France, department of Aube, 1 mi. from the Aube and 26 mi. N.E. of Troyes. Pop. (1936) 1,935. The château, which overlooks the town, was built in the 18th century by Cardinal de Brienne. The church dates from the 16th century and contains good stained glass. In 1814 Brienne was the scene of fighting between Napoleon and the allies. Brewing is carried on.

Counts of Brienne.—Under the Carolingian dynasty Brienne-le-Château was the capital town of a French countship. In the 10th century it was captured by two adventurers named Engilbert and Gobert, and from the first of these sprang the noble house of Brienne, which played an important part in history in the 13th century.

BRIENZ, LAKE OF, Canton Berne, Switzerland, an expansion of the Aar, 9 mi. long, 1½ mi. wide, 856 ft. maximum depth, 11½ sq.mi. area, surface 1,857 ft. above sea. It is gloomy and in a deep hollow with Brienz on the east and Bönigen on the west. The Giessbach falls are on the south shore, and small villages on the north shore (*see* THUN, LAKE OF). Its chief affluent is the Lütschine from Grindelwald.

BRIERLEY, BENJAMIN (1825–1896), English weaver and writer in Lancashire dialect. He started in 1869 *Ben Brierley's Journal*, a weekly, which continued till 1891, and he gave public readings from his own writings, visiting the U.S. in 1880 and 1884. His sketches, produced under the name of "Ab-o'-th'-Yate" (about America, London, etc.), and his pictures of Lancashire common life were collected after his death. He died on Jan. 18, 1896.

BRIERLY, SIR OSWALD WALTERS (1817–1894), English marine painter, was born at Chester. He exhibited some drawings of ships at the Royal academy in 1839. In 1841 he started round the world with Benjamin Boyd (1796–1851), in the latter's ship "Wanderer," and made his home at Auckland for ten years. Brierly point is called after him. He sailed on H.M.S. "Rattlesnake" in 1848, and with Sir Henry Keppel on the "Meander" in 1850, he returned to England in 1851 on this ship, and illustrated Keppel's book about his cruise (1853). Brierly was attached to the suites of the duke of Edinburgh and the prince of Wales on their tours by sea and in 1874 he was made marine painter to the queen. His more important works include the historical pictures, "The Retreat of the Spanish Armada" (1871) and "The Loss of the Revenge" (1877). In 1885 he was knighted and he died on Dec. 14, 1894.

BRIEUX, EUGÈNE (1858–1932), French dramatist, was born in Paris of poor parents. A one-act play, *Bernard Palissy*, written in collaboration with M. Gaston Salandri, was produced in 1879, but he had to wait 11 years before he obtained another hearing, his *Ménage d'artistes* being produced by Antoine at the Théâtre Libre in 1890. His plays are essentially didactic, being aimed at some weakness or iniquity of the social system. *Blanchette* (1892) pointed out the evil results of education of girls of the working classes; *M. de Réboval* (1892) was directed against pharisaism; *L'Engrenage* (1894) against corruption in politics; *Les Bienfaiteurs* (1896) against the frivolity of fashionable charity; and *L'Évasion* (1896) satirized an indiscriminate belief in the doctrine of heredity. *Les Trois Filles de M. Dupont* (1897) is a powerful, somewhat brutal study of the miseries imposed on poor middle-class girls by the French system of dowry; *Le Résultat des courses* (1898) shows the evil results of betting among the Parisian workmen; *La Robe rouge* (1900) was directed against the injustices of the law; *Les Remplaçantes* (1901) against the practice of putting children out to nurse. *Les Avariés* (1901), forbidden by the censor on account of its medical details, was read privately by the author at the Théâtre Antoine; and *Petite amie* (1902) describes the life of a Parisian shop girl. Later plays are *La Couvée* (1903, acted privately at Rouen in 1893); *Maternité* (1904); *Les Hannetons*, a comedy in three acts (1906); *Suzette* (1909); *La femme seule* (1913); *Les Américains chez nous* (1920); *Puisque je t'aime* (1929). *See* also *Théâtre complet de Brieux* (1921–1928).

BRIG (Fr. *Brigue*, Ital. *Briga*), a town in the Swiss canton of the Valais, situated at the foot of the northern slope of the Simplon pass, south of the Rhone. Its older houses are very Italian in appearance, while its most prominent buildings (castle, former Jesuits' college and Ursuline convent) all date from the 17th century, and are due to the generosity of a member of the local Stockalper family. The prosperity of Brig was bound up with the Simplon pass (*q.v.*) so that it gradually supplanted the ancient village of Naters opposite, becoming a separate parish in 1517. Its mediaeval name was *Briga Dives*. The opening of the carriage road across the Simplon (1807) and of the tunnel (1906), as well as the development of the tourist industry in the upper Valais, have increased the importance and size of the town. The opening of the Lötschberg tunnel beneath the Lötschen pass (1913) affording direct communication between Milan and Berne and the Bernese oberland, further contributed to its prosperity.

It is an important frontier station on the international railway from Paris through Lausanne (or Berne) to Italy. Pop. 2,961, almost all of whom are Roman Catholic and most of whom are German-speaking.

See *Dict. hist. et biogr. de la Suisse*, ii.

BRIGADE, a unit in military organization commanded by a major-general, brigadier or colonel, and composed of two or more regiments of infantry, cavalry or artillery (Fr. and Ger. *brigade*, Ital. *brigata*, Span. *brigada;* the English use of the word dates from the early 17th century). In most armies the infantry brigade has been abolished, as there are but three regiments of infantry to the brigade. An artillery "brigade" is in Britain a smaller unit, forming a lieutenant-colonel's command and consisting of four batteries. (*See* ARMY; ARTILLERY; CAVALRY; INFANTRY.) The staff of an infantry or cavalry brigade in peace consists of the brigadier (*q.v.*) commanding, and the brigade-major, a staff officer whose duties are intermediate between those of an adjutant and those of a general staff officer.

In war, a staff captain is added for administrative duties, as well as various specialist officers, *e.g.*, intelligence, machine-gun, transport.

BRIGADIER, a military rank conferred by Louis XIV. upon the commander of several regiments. The British copied it from the French very early and a Royal warrant of 1699 states that "the Major General of Our Ordnance within our Kingdom for the time being shall have rank and precedency as Brigadier," evidence that the title was stabilized at that date. In fact the corporals of the Life Guards in 1679 were commissioned officers, their rank being "eldest Lieutenants of horse" but they were generally styled brigadiers. In the French army at present a "brigadier" is a corporal (*i.e.*, an N.C.O.). In the British service the rank of brigadier-general (held by the officer commanding a brigade of cavalry or infantry, or an equivalent staff appointment) was abolished just after the World War, being superseded by "colonel-commandant," but since 1928 "colonel-commandant" has been abolished and superseded by "brigadier."

See F. Grose *Military Antiquities* (1812); J. Sibbald Scott *The British Army* (1868–80).

BRIGANDAGE. The brigand is the outlaw who conducts warfare by skirmishes and surprises; who makes the war support itself by plunder, by extorting blackmail, by capturing prisoners and holding them to ransom; who enforces his demands by violence, and kills the prisoners who cannot pay. Brigandage may be, and not infrequently has been, the last resource of a people subject to invasion. Italy and Spain suffered for a long time from the disorder developed out of the popular resistance to the Napoleonic invasions. Numbers of guerilla warriors of both countries, who in normal conditions might have been honest, had acquired a preference for living by brigandage, which they could not resign when the enemy had retired.

The conditions which favour the development of brigandage may be easily summed up. They are: first, bad administration; and, in a less degree, the possession of convenient hiding-places. But no forest, thicket nor mountain is a lasting protection against a good police, used with intelligence by the Government, and supported by the law-abiding part of the community. The great haunts of brigands in Europe have been central and southern Italy and the worst administered parts of Spain, except those which fell into the hands of the Moors. Such curable evils as the highwaymen of England, and their like in the United States, are not to be compared with the "Écorcheurs," or Skinners, of France in the 15th century, or the "Chauffeurs" of the revolutionary epoch. The first were large bands of discharged mercenary soldiers who pillaged the country. The second were ruffians who forced their victims to pay ransom by holding their feet in fires. Both flourished because the Government was for the time disorganized by foreign invasion or by revolution.

The brigandage of Greece, southern Italy, Corsica and Spain had deep roots, and has never been quite suppressed. All four countries are well provided with natural hiding-places. In all the Administration has been bad, the law and its officers have been regarded as dangers, if not as deliberate enemies, so that they have found little native help, and, what is not the least important cause of the persistence of brigandage, there have generally been local potentates who found it to their interest to protect the brigand. In 1870 an English party, consisting of Lord and Lady Muncaster, Mr. Vyner, Mr. Lloyd, Mr. Herbert and Count de Boyl, was captured at Oropos, near Marathon, and a ransom of £25,000 was demanded. Lord and Lady Muncaster were set at liberty to seek for ransom, but the Greek Government sent troops in pursuit of the brigands, and the other prisoners were then murdered. The scoundrels were hunted down, caught and executed. In Aug. 1928 two former Greek deputies, MM. Mélas and Milonas, were captured by brigands in Epirus and ransomed for a considerable sum. In the Balkans, under Turkish rule, brigandage continued to exist in connection with the Christian revolt against the Turk, and the race conflicts of Albanians, Walachians, Pomuks, Bulgarians and Greeks. In Corsica the "maquis" has never been without its brigand hero, because industry has been stagnant, family feuds persist, and the Government has never quite succeeded in persuading the people to support the law. The brigand is always a hero to at least one faction of Corsicans.

The conditions which favour brigandage have been more prevalent, and for longer, in Italy than elsewhere in western Europe, with the standing exception of Corsica, which is Italian in all but political allegiance. Until the middle of the 19th century Italy was divided into small States, so that the brigand who was closely pursued in one could flee to another. Thus it was that Marco Sciarra of the Abruzzi, when hard-pressed by the Spanish viceroy of Naples—just before and after 1600—could cross the border of the papal States and return on a favourable opportunity. When Pope and viceroy combined against him, he took service with Venice, whence he could communicate with his friends at home, and pay them occasional visits. On one such visit he was led into a trap and slain. Marco Sciarra had terrorized the country far and wide at the head of 600 men. He was the follower and imitator of Benedetto Mangone, of whom it is recorded that, having stopped a party of travellers which included Torquato Tasso, he allowed them to pass unharmed out of his reverence for poets and poetry. Mangone was finally taken, and beaten to death with hammers at Naples. He and his like are the heroes of much popular verse, written in *ottava rima* and beginning with the traditional epic invocation to the muse.

In Naples the Bourbon dynasty reduced brigandage very much, and secured order on the main high-roads. But it was not extinguished, and it revived during the French invasion. When Ferdinand was restored on the fall of Napoleon, he employed an English officer, Gen. Sir Richard Church, to suppress the brigands. Gen. Church, who kept good order among his soldiers, and who made them pay for everything, gained the confidence of the peasantry, and restored a fair measure of security. It was he who finally brought to justice the villainous Don Ciro Anicchiarico—priest and brigand—who declared at his trial with offhand indifference that he supposed he had murdered about 70 people.

Every successive revolutionary disturbance in Naples saw a recrudescence of brigandage down to the unification of 1800–61, and then it was years before the Italian Government rooted it out. The source of the trouble was the support the brigands received from various kinds of *manuténgoli* (maintainers)—great men, corrupt officials, political parties, and peasants who were terrorized, or who profited by selling the brigands food and clothes. What is true of Naples is true of other parts of Italy *mutatis mutandis*.

The history of brigandage in Spain is very similar. It may be said to have been endemic in and south of the Sierra Morena. In the north it has flourished when Government was weak, and after foreign invasion and civil wars. But it has always been put down easily by a capable Administration. It reached its greatest heights in Catalonia, where it began in the strife of the peasants against the feudal exactions of the landlords. It had its traditional hero, Roque Guinart, who figures in the second part of *Don Quixote*. The revolt against the house of Austria in 1640, and the War of the Succession (1700–14), gave a great stimulus to Catalan brigandage. But it was then put down in a way for which Italy offers no precedent. A country gentleman named Pedro Veciana, hereditary *balio* (military and civil lieutenant) of the archbishop of Tarragona in the town of Valls, armed his farm-servants, and resisted the attacks of the brigands. With the help of neighbouring country gentlemen he formed a strong band, known as the *Mozos* (Boys) of Veciana. The brigands combined to get rid of him by making an attack on the town of Valls, but were repulsed with great loss. The Government of Philip V. then commissioned Veciana to raise a special corps of police, the "escuadra de Cataluna." Since the organization of the excellent constabulary called "La Guardia Civil" by the Duke of Ahumada, about 1844, brigandage has been well kept down. More sympathy is felt for "bandoleros" in the south, and there also they find Spanish equivalents for the *manuténgoli* of Italy.

On Oct. 8 1927 two French children were kidnapped by Moroccan brigands and their parents murdered. This outrage was followed a fortnight later by the capture of four French subjects, one of whom, M. Yves Steeg, was a nephew of the resident general of Morocco. The prisoners were only released on the payment of a considerable ransom on Nov. 17.

The "dacoits" or brigands of India were of the same stamp as their European colleagues. The Pindaris were more than brigands, and the Thugs (*q.v.*) were a religious sect.

Bibliography.—The literature of brigandage, apart from pure romances or official reports of trials, is naturally extensive. Mr. McFarlane's *Lives and Exploits of Banditti and Robbers* (1837) is a useful introduction to the subject. The author saw a part of what he wrote about, and included in his work many references, particularly for Italy. A good bibliography of Spanish brigandage will be found in Eugenio de la Iglesia's *Reseña Historica de la Guardia Civil* (1898). For actual pictures of the life, nothing is better than W. J. C. Moens' *English Travellers and Italian Brigands* (1866), and S. Soteropoulos' *The Brigands of the Morea,* translated by the Rev. J. O. Bagdon (1868).

BRIGANDINE, a French word meaning the armour for the *brigandi* or *brigantes,* light-armed foot soldiers; part of the armour of a foot soldier in the middle ages, consisting of a padded tunic of canvas, leather, etc., and lined with closely sewn scales or rings of iron.

BRIGANTES, a people of northern Britain, who inhabited the country from the mouth of the Humber on the east, and Mersey on the west, as far northwards as the Wall of Antoninus. Their chief town was *Eburacum* (or *Eboracum;* York). They first came into contact with the Romans during the reign of Claudius, when they were defeated by Publius Ostorius Scapula. Under Vespasian they submitted to Petillius Cerealis, but were not finally subdued till the time of Antoninus Pius (Tac. *Agricola,* 17; Pausan. viii. 43. 4). A branch of the Brigantes also settled in the south-east corner of Ireland, near the river Birgus (Barrow). The name Brigantes is said to mean "mountaineers."

See A. Holder, *Altceltischer Sprachschatz,* i. (1896), for ancient authorities; J. Rhys, *Celtic Britain* (3rd ed., 1904); Pauly-Wissowa, *Realencyklopädie,* iii. pt. i. (1897).

BRIGG (or Glanford Brigg), a market town and urban district of Lindsey, Lincolnshire, England, situated on the river Ancholme, which affords water communication with the Humber. Pop. (1938 est.) 4,282. Area 1.5 sq.mi. It is 23 mi. by road north of Lincoln and is served by the L.N.E. railway. Trade is principally agricultural.

BRIGGS, CHARLES AUGUSTUS (1841–1913), American Hebrew scholar and theologian, was born in New York city, Jan. 15, 1841. He was educated at the University of Virginia, the Union Theological Seminary, and the University of Berlin. After a pastorship in the Presbyterian church of Roselle (N.J.), he went to the Union Theological seminary, where he held successively three different professorships. In 1892 he was tried for heresy by the presbytery of New York and acquitted. The General Assembly, to which the case was appealed, suspended Dr. Briggs in 1893, being influenced, it would seem, in part, by what his colleagues called the "dogmatic and irritating" nature of his inaugural address. He was ordained a priest of the Protestant Episcopal Church in 1900. With S. R. Driver and Francis Brown he prepared a revised *Hebrew and English Lexicon* (1891–1905), and with Driver edited the *International Critical Commentary.* His publications include *Biblical Study* (1883); *American Presbyterianism* (1885); *Messianic Prophecy* (1886); *Whither? A Theological Question for the Times* (1889); *The Bible, the Church and the Reason* (1892); *New Light on the Life of Jesus* (1904); *A Critical and Exegetical Commentary on the Book of Psalms* (1906–07), in which he was assisted by his daughter; *Church Unity* (1909); *The Fundamental Christian Faith* (1913); and, posthumously, *Theological Symbolics* (1914). He died in New York, on June 8, 1913.

BRIGGS, HENRY (1561–1630), English mathematician, was born at Warley Wood, near Halifax, in Yorkshire. He graduated at St. John's college, Cambridge, in 1581, and obtained a fellowship in 1588. In 1592 he was made reader of the physical lecture founded by Dr. Thomas Linacre, and in 1596 first professor of geometry in Gresham House (afterwards College), London. In his lectures at Gresham House he proposed the alteration of the scale of logarithms from the hyperbolic form which John Napier had given them, to that in which unity is assumed as the logarithm of the ratio of ten to one. In conferences with Napier the alteration proposed by Briggs was agreed upon; and on his return from his second visit to Edinburgh in 1617 he accordingly published the first chiliad of his logarithms. (*See* Napier, John.) In 1619 he was appointed Savilian professor of geometry at Oxford. In 1622 he published a small tract on the *North-West Passage to the South Seas, through the Continent of Virginia and Hudson's Bay;* and in 1624 his *Arithmetica Logarithmica,* in folio, a work containing the logarithms of 30,000 natural numbers to 14 places of figures besides the index. He also completed a table of logarithmic sines and tangents for the hundredth part of every degree to 14 places of figures besides the index with a table of natural sines to 15 places, and tangents and secants for the same to ten places; all of which were printed at Gouda in 1631 and published in London in 1633 under the title of *Trigonometria Britannica* (*see* Mathematical Tables). Briggs died on Jan. 26, 1630.

Other works are: *A Table to find the Height of the Pole, the Magnetical Declination being given* (1602); "Tables for the Improvement of Navigation," printed in the second edition of Edward Wright's treatise entitled *Certain Errors in Navigation detected and corrected* (1610); *A Description of an Instrumental Table to find the part proportional, devised by Mr. Edward Wright* (1616 and 1618); *Euclidis Elementorum VI. libri priores* (1620); *A Treatise on the North-West Passage to the South Sea* (1622), reprinted in Purchas's *Pilgrims,* vol. iii. p. 852; *Mathematica ab Antiquis minus cognita.* Some other works, as his *Commentaries on the Geometry of Peter Ramus,* and *Remarks on the Treatise of Longomontanus respecting the Quadrature of the Circle,* have not been published.

BRIGHAM, a city in northern Utah, U.S.A., near the Bear river bay of Great Salt lake, 20 mi. N. of Ogden; the county seat of Box Elder county. It has an elevation of 4,307 ft. and lies at the mouth of the canyon formed by Box Elder creek. It is on Federal Highway 91, and is served by the Southern Pacific and the Union Pacific railways. The population in 1940 was 5,641. Brigham was settled in 1853 by Mormons, who by irrigation transformed the sagebrush desert into a garden. The region is famous for its peaches and other fruits, and the city itself is practically a huge orchard, with an irrigating ditch along every street. On Peach Day, early in September, fruit is given freely to the thousands of visitors. Among the manufacturing industries are large tomato canneries and beet sugar mills. The Bear river bay marshes are one of the noted bird grounds of the country, attracting both sportsmen and students. Brigham was incorporated as a city in 1867, and in 1918 adopted a city manager form of government.

BRIGHOUSE, municipal borough, West Riding, Yorkshire, England, 5½ mi. N. of Huddersfield by the L.M.S. Railway, on the river Calder. Pop. (est. 1938) 30,140. Area 12.3 sq.mi. It has large woollen and worsted factories. Much of the machinery and many tools used in the textile industry are made locally. Iron founding, especially moulding, quarry working and chemical dye mixing are pursued. The town was incorporated in 1893 and is governed by a mayor, 12 aldermen and 36 councillors. Brighouse is in the Elland parliamentary division of Yorkshire (West Riding). The borough was considerably extended in 1937.

BRIGHT, SIR CHARLES TILSTON (1832–1888), English telegraph engineer, who came of an old Yorkshire family, was born on June 8, 1832, at Wanstead, Essex. At the age of 15 he became a clerk under the Electric Telegraph Company. In 1852 he was appointed engineer to the Magnetic Telegraph Company, and superintended the laying of lines in various parts of the British Isles, including in 1853 the first cable between Great Britain and Ireland, from Portpatrick to Donaghadee. His experiments convinced him of the practicability of an electric submarine cable connection between Ireland and America; and having in 1855 already discussed the question with Cyrus Field, who with J. W. Brett controlled the Newfoundland Telegraph Company on the other side of the ocean, Bright organized with them the Atlantic Telegraph Company in 1856 for the purpose of carrying out the idea, himself becoming engineer-in-chief. The story of the first Atlantic cable is told elsewhere (*see* Telegraph), and it must suffice here to say that in 1858, after two disappointments, Bright successfully accomplished what to many had seemed an impossible feat. Within a few days of landing the Irish end of the line at Valentia he was knighted in Dublin. Subsequently Bright supervised the laying of submarine cables in various regions of the world, and took a leading part as pioneer in other developments of the electrical industry. In conjunction with Josiah Latimer Clark, with whom he entered into partnership in 1861, he invented improved methods of insulating submarine cables, and a paper on electrical standards read by them before the British Association in the same year led to the establishment of the British Association committee on that subject, whose work formed the foundations of the system still in use. From 1865 to 1868 he was Liberal M.P. for Greenwich. He died on May 3, 1888, at Abbey Wood, near London.

See *Life Story of Sir C. T. Bright,* by his son Charles Bright (revised ed. 1908).

BRIGHT, JOHN (1811–1889), British statesman, was born at Rochdale on Nov. 16, 1811 of Quaker stock. His father, Jacob Bright had started a cotton-mill at Rochdale in 1809; his mother, Martha Wood, Jacob Bright's second wife, was a woman of great strength of character and refined taste. John being a delicate child, was sent as a day-scholar to a boarding-school near his home. A year at the Ackworth school, two years at a school at York, and a year and a half at Newton, near Clitheroe, completed his education. He learned, he himself said, but little Latin and Greek, but acquired a love of English literature. In his 16th year he entered his father's mill, and in due time became a partner in the business. Two agitations were then going on in Rochdale—the first (in which Jacob Bright was a leader) in opposition to a local church-rate, and the second for parliamentary reform, by which Rochdale successfully claimed to have a member allotted to it under the Reform bill. In both these movements John Bright took part. He was an ardent Nonconformist, proud to number among his ancestors John Gratton, a friend of George Fox, and one of the persecuted and imprisoned preachers of the Society of Friends. His political interest was probably first kindled by the Preston election in 1830, in which Lord Stanley, after a long struggle, was defeated by "Orator" Hunt. Bright was one of the founders of the Rochdale Literary and Philosophical Society, took a leading part in its debates, and on returning from a holiday journey in the East, gave the society a lecture on his travels. He first met Richard Cobden in 1836 or 1837. Cobden urged him to speak against the Corn laws. His first speech on the Corn laws was made at Rochdale in 1838, and in the same year he joined the Manchester provisional committee which in 1839 founded the Anti-Corn Law league. He was still only the local public man, taking part in all public movements, especially in opposition to John Feilden's proposed factory legislation, and to the Rochdale church-rate. In 1839 he married Elizabeth, daughter of Jonathan Priestman of Newcastle-on-Tyne. A daughter, Helen, was born to them; but the young wife, after a long illness, died of consumption in Sept. 1841. Three days after her death at Leamington, Cobden called to see him. Cobden spoke some words of condolence, but "after a time he looked up and said, 'There are thousands of homes in England at this moment where wives, mothers and children are dying of hunger. Now, when the first paroxysm of your grief is past, I would advise you to come with me, and we will never rest till the Corn laws are repealed.' I accepted his invitation," added Bright, "and from that time we never ceased to labour hard on behalf of the resolution which we had made."

At the general election in 1841 Cobden was returned for Stockport, and in 1843 Bright was the Free Trade candidate at a by-election at Durham. He was defeated, but his successful competitor was unseated on petition, and at the second contest Bright was returned. He took his seat in the House of Commons on July 28, 1843 in an atmosphere of suspicion and hostility, due to the reputation he had gained in the last two years as the most formidable agitator against the Corn laws. Wherever John Bright was announced as the speaker vast crowds assembled, for he had the passion which Cobden lacked. His "more stately genius," as Mr. John Morley called it, was already making him the undisputed master of the feelings of his audiences. In the House of Commons his progress was slower. Cobden's argumentative speeches were regarded more sympathetically than Bright's more rhetorical appeals, and in a debate on Villiers's annual motion against the Corn laws Bright was heard with so much impatience that he was obliged to sit down. In the next session (1845) he moved for an inquiry into the operation of the Game laws. At a meeting of county members earlier in the day Peel had advised them not to be led into discussion by a violent speech from the member for Durham, but to let the committee be granted without debate. Bright was not violent, and Cobden said that he did his work admirably, and won golden opinions from all men. The speech established his position in the House of Commons.

In this session Bright and Cobden came into opposition, Cobden voting for the Maynooth Grant and Bright against it. On only one other occasion—a vote for South Kensington—did they go into opposite lobbies during twenty-five years of parliamentary life. In the autumn of 1845 Bright retained Cobden in the public career to which Cobden had invited him four years before. Bright was in Scotland when a letter came from Cobden announcing his determination, forced on him by business difficulties, to retire from public work. Bright replied that if Cobden retired the mainspring of the league was gone, and a few days later set off for Manchester, posting in that wettest of autumns through "the rain that rained away the Corn laws." On his arrival he raised the money which tided Cobden over the emergency. The crisis of the struggle had come. The bad harvest and the potato disease drove him to the repeal of the Corn laws, and at a meeting in Manchester on July 2, 1846 Cobden moved and Bright seconded a motion dissolving the league. A library of twelve hundred volumes was presented to Bright as a memorial of the struggle.

Bright married, in June 1847, Margaret Leatham, of Wakefield, by whom he had seven children. In the succeeding July he was elected for Manchester, with Milner Gibson, without a contest. In the new parliament, as in the previous session, he opposed legislation restricting the hours of labour, and as a Nonconformist, spoke against clerical control of national education. In 1848 he voted for Hume's household suffrage motion, and introduced a bill for the repeal of the Game laws. When Lord John Russell brought forward his Ecclesiastical Titles bill, Bright opposed it as "a little, paltry, miserable measure," and foretold its failure.

In a speech in favour of the government bill for a rate in aid in 1849, he won loud cheers from both sides, and was complimented by Disraeli for having sustained the reputation of that assembly. From this time forward he had the ear of the House, and took effective part in the debates. He spoke against capital punishment, against church-rates, against flogging in the army, and against the Irish Established Church. He supported Cobden's motion for the reduction of public expenditure, and in and out of parliament pleaded for peace. In the election of 1852 he was again returned for Manchester on the principles of free trade, electoral reform and religious freedom. But war was in the air, and the most impassioned speeches he ever delivered were addressed to this parliament in fruitless opposition to the Crimean war. Neither the House nor the country would listen. "I went to the House on Monday," wrote Macaulay in March 1854, "and heard Bright say everything I thought; and I heard Palmerston and Graham expose themselves lamentably." His most memorable speech, the greatest he ever made, was delivered on Feb. 23, 1855. "The angel of death has been abroad throughout the land. You may almost hear the beating of his wings," he said, and concluded with an appeal to the prime minister that moved the House as it had never been moved within living memory.

Bright was disqualified by illness during the whole of 1856 and 1857. In Palmerston's penal dissolution in the latter year, Bright was rejected by Manchester, but in August, while ill and absent, Birmingham elected him without a contest. He returned to parliament in 1858, and in February seconded the motion which threw out Lord Palmerston's government. Lord Derby thereupon came into office for the second time, and Bright had the satisfaction of assisting in the passing of two measures which he had long advocated—the admission of Jews to parliament and the transfer of the government of India from the East India Company to the

Crown. In October he addressed his new constituents, and started a movement for parliamentary reform. He spoke at great gatherings at Edinburgh, Glasgow, Bradford and Manchester, and for the next nine years he was the protagonist of Reform. In the debates on the Reform bills submitted to the House of Commons from 1859 to 1867, Bright's was the most influential voice. He rebuked Lowe's "Botany Bay view," and described Horsman as retiring to his "political cave of Adullam," and hooking in Lowe. "The party of two," he said, "reminds me of the Scotch terrier, which was so covered with hair that you could not tell which was the head and which was the tail." These and similar phrases, such as the excuse for withdrawing the Reform bill in the year of the great budget of 1860—"you cannot get twenty wagons at once through Temple Bar"—were in all men's mouths. Bright's oratory constantly produced these popular cries. The phrase "a free breakfast table" was his; and on the rejection of Forster's Compensation for Disturbance bill he used the phrase as to Irish discontent, "Force is not a remedy."

During his great reform agitation Bright had vigorously supported Cobden in the negotiations for the treaty of commerce with France, and had taken the side of the North in the discussions in England on the American Civil War. He had a profound admiration for Abraham Lincoln, as an inscription written by him on a copy of Lincoln's portrait shows: "And if there be on earth and among men any 'Divine' right to govern, surely it rests with the Ruler so chosen and so appointed." (Dec. 4, 1861.) He believed that the government of the United States rested more than any other, on the free choice of a free people. No Englishman of his time was so outspoken on the Alabama case as Bright. It is interesting to read his conception of the future of the American continent. "I should say that if a man had a great heart within him, he would rather look forward to the day when, from that point of land which is habitable nearest to the Pole, to the shores of the Great Gulf, the whole of that vast continent might become one great confederation of States—without a great army and without a great navy, not mixing itself up with the entanglements of European politics, without a custom-house inside, through the whole length and breadth of its territory, and with freedom everywhere, equality everywhere, law everywhere, peace everywhere—such a confederation would afford at least some hope that man is not forsaken of Heaven, and that the future of our race may be better than the past." (Speech at Rochdale, Nov. 1861.) In March 1865 Cobden died, and Bright told the House of Commons he dared not even attempt to express the feelings which oppressed him, and sat down overwhelmed with grief. Their friendship was one of the most characteristic features of the public life of their time. "After twenty years of intimate and almost brotherly friendship with him," said Bright, "I little knew how much I loved him till I had lost him." In June 1865 parliament was dissolved, and Bright was returned for Birmingham without opposition. Palmerston's death in the early autumn brought Lord John Russell into power, and for the first time Bright gave his support to the government. Russell's fourth Reform bill was introduced, was defeated by the Adullamites, and the Derby-Disraeli ministry was installed. Bright declared Lord Derby's accession to be a declaration of war against the working classes, and roused the great towns in the demand for reform. Bright was the popular hero of the time. The winter of 1866–67 was the culminating point in his career as a political leader. The Disraeli Reform bill was carried. Lord Cranborne (3rd marquis of Salisbury), who had resigned from the Government when he saw the text of the Bill, remarked that "if the adoption of the principles of Mr. Bright be a triumph, then the Conservative party, in the whole history of its previous annals, has won no triumph so signal as this." In the autumn of 1868 Bright, with two Liberal colleagues, was again returned for Birmingham. Mr. Gladstone came into power with a programme of Irish reform in church and land such as Bright had long urged, and he accepted the post of president of the Board of Trade. He made a great speech on the second reading of the Irish Church bill, and wrote a letter on the House of Lords, in which he said, "In harmony with the nation they may go on for a long time, but throwing themselves athwart its course they may meet with accidents not pleasant for them to think of." He also spoke strongly in the same session in favour of the bill permitting marriage with a deceased wife's sister. A severe illness compelled his retirement and kept him out of public life for four years. In August 1873 Mr. Gladstone reconstructed his cabinet, and Bright returned to it as chancellor of the duchy of Lancaster. But he was now an old man. In the election in January 1874 Bright and his colleagues were returned for Birmingham without opposition. When Mr. Gladstone resigned the leadership of his party in 1875, Bright was chairman of the party meeting which chose Lord Hartington as his successor. He took a less prominent part in political discussion, till the Eastern Question brought Great Britain to the verge of war with Russia, and his old energy flamed up afresh. In the debate on the vote of credit in February 1878, he urged the government not to increase the difficulties manufacturers had in finding employment for their workpeople by any single word or act which could shake confidence in business. The debate lasted five days. On the fifth day a telegram from Mr. Layard (afterwards Sir Austen) was published announcing that the Russians were nearing Constantinople. In both Houses Mr. Layard's despatch was read, and in the excited Commons Mr. Forster's resolution opposing the vote of credit was withdrawn. Bright, however, distrusted the ambassador at the Porte, and gave reasons for doubting the alarming telegram. While he was speaking a note was put into the hands of Sir Stafford Northcote, and when Bright sat down he read it to the House. It was a confirmation from the Russian prime minister of Bright's doubts: "There is not a word of truth in the rumours which have reached you." At the general election in 1880 he was re-elected at Birmingham, and joined Mr. Gladstone's new government as chancellor of the duchy of Lancaster. For two sessions he spoke and voted with his colleagues; he supported Forster's Coercion bill in 1881, believing that without it a Land bill could not be got through parliament. But after the bombardment of the Alexandria forts he left the ministry and never held office again. He, however, gave a general support to Mr. Gladstone's government. In June 1883 he was the object of an unparalleled demonstration at Birmingham to celebrate his 25 years of service as its representative. At this celebration he spoke strongly of "the Irish rebel party," and accused the Conservatives of "alliance" with them, but withdrew the imputation when Sir Stafford Northcote moved that such language was a breach of the privileges of the House of Commons. At a banquet to Lord Spencer he accused the Irish members of having "exhibited a boundless sympathy for criminals and murderers." He refused in the House of Commons to apologize for these words, and was supported in his refusal by both sides of the House. At the Birmingham election in 1885 he stood for the central division of the redistributed constituency; he was opposed by Lord Randolph Churchill, but was elected by a large majority. In the new parliament he voted against the Home Rule bill, and in the election of 1886 which followed its defeat, when he was re-elected without opposition, his letters told with fatal effect against the Home Rule Liberals. He suggested that the Irish members should form a grand committee to which every Irish bill should go after first reading. But though he was himself a dissentient, the break-up of the Liberal party filled him with gloom. His last speech at Birmingham was on March 29, 1888, at a banquet to celebrate Mr. Chamberlain's return from his peace mission to the United States. He spoke of imperial federation as a "dream and an absurdity." In May his illness returned, he took to his bed in October, and died on March 27, 1889. He was buried in the graveyard of the meeting-house of the Society of Friends in Rochdale.

The 3rd marquess of Salisbury said of him, and it sums up his character as a public man: "He was the greatest master of English oratory that this generation—I may say several generations—has seen. . . . At a time when much speaking has depressed, has almost exterminated eloquence, he maintained that robust, powerful and vigorous style in which he gave fitting expression to the burning and noble thoughts he desired to utter."

See *Speeches on Parliamentary Reform by John Bright, M.P., revised by Himself* (1866); *Speeches on Questions of Public Policy,* *by John Bright, M.P.*, ed. J. E. Thorold Rogers (1868); *Public Addresses*, ed. J. E. Thorold Rogers (1879); G. Barnett Smith, *The Life and Speeches of the Right Hon. John Bright, M.P.* (1881); *Public Letters of the Right Hon. John Bright, M.P.*, collected by H. J. Leech (1885); Barry O'Brien, *John Bright* (1910); G. M. Trevelyan, *The Life of John Bright* (1913, 2nd ed. 1925).

BRIGHT, RICHARD (1789–1858), English physician, was born on Sept. 28, 1789, at Bristol. After an expedition to Iceland and a short period of study at Guy's hospital, London, Bright took his M.D. at Edinburgh in 1812. From 1814–15 he visited continental hospitals, and receiving his L.R.C.P. in 1816, became assistant physician to the London fever hospital. In 1820 he was made assistant physician at Guy's and four years later full physician. The results of his researches first appeared in *Reports of Medical Cases Selected with a View of Illustrating the Symptoms and Cure of Disease by a Reference to Morbid Anatomy* (1827), a work which described dropsical cases and showed that they involved a diseased condition of the kidney. "Bright's disease" soon became world-known, and its discoverer's reputation was ensured by subsequent papers on renal disease in the second volume of reports in 1831 (this also contained studies of the central nervous system and of diseases of the brain, meninges and cord) and in the important first volume of *Guy's Hospital Reports* of 1836. To these latter reports, from 1836 onwards, Bright contributed many papers on abdominal tumours, fever, diseased arteries of the brain, etc. He resigned his post at Guy's in 1843. He died in London on Dec. 16, 1858.

See *Guy's Hospital Reports, Bright Centenary Number* (1927).

BRIGHTLINGSEA, urban district, seaport and fishing station, Essex, England, on a creek of the Colne estuary, the terminus of a branch from Colchester (8 mi.) of the L.N.E. ry. Pop. (1938 est.) 4,210. Area 8.8 sq.mi. The Colchester oyster beds are mainly in this part of the Colne, and the oyster fishery is the chief industry. Boat building is carried on, and the place is also a yachting centre. Brightlingsea, which appears in Domesday, is a member of the Cinque Port of Sandwich in Kent. Near the opposite shore of the creek is St. Osyth's priory, which originated as a nunnery founded by Osyth, a granddaughter of Penda, king of Mercia; it became a foundation for Augustinian canons early in the 12th century. The remains, incorporated with a modern residence, include a late Perpendicular gateway.

BRIGHTON, a watering-place of Bourke county, Victoria, Australia. It is now included within the bounds of Melbourne (*q.v.*), since it is only 5 mi S. of the centre of that city. It has two piers and a growing population (29,707 in 1933).

BRIGHTON, municipal, county and parliamentary borough, and seaside resort, Sussex, England, 51 mi. S. of London by the Southern railway. Pop. (est. 1938) 146,500; area 19.6 sq.mi. Accessibility from London is the chief factor in its popularity. The sea-front, one long promenade, overlooks the English channel and stretches nearly four miles from Kemp Town on the east to Hove on the west. The extended borough (1927) includes Patcham, Rottingdean, Ovingdean and part of Falmer and Saltdean. Encroachments of the sea were frequent until the erection of a massive sea-wall, begun about 1830, 60 ft. high, 23 ft. thick at the base, and three ft. at the summit. In 1930 extensive sea defense works between Black Rock and Saltdean were undertaken, including a promenade and sea-wall. Romans and Saxons occupied the site, but the earliest mention of Brighton (Bristelmeston, Brichelmestone, Brighthelmston) is the Domesday record that three holdings composing Brighton belonged to William de Warenne. One had belonged to Earl Godwin and from this a rent of 4,000 herrings was due, indicating the existence of a large fishing village. This holding is probably identical with the manor later known as Brighton-Lewes which in 1440 fell to John Mowbray, 3rd duke of Norfolk. In 1340 there were no merchants, only tenants of lands, but its prosperity increased during the 15th and 16th centuries, and it was assessed at *£6 12s. 8d.* in 1534. There is, however, no indication that it was a borough. In 1580 commissioners introduced, to assist the constable, a body of eight fishermen and four landsmen, known as the Society of the Twelve. This constitution disappeared before 1773 when commissioners were appointed. Brighton became a parliamentary borough in 1832, was incorporated in 1854 and became a county borough in 1888. From a fishing town in 1656 it rose 100 years later to be a fashionable resort. Its popularity increased after the visit of the prince of Wales (*see* GEORGE IV) to the duke of Cumberland in 1783, and was ensured by his building the Pavilion in 1784–87. His association with Mrs. Fitzherbert at Brighton was the starting point of its fashionable repute. The Pavilion contains a museum, art galleries and assembly rooms. Some portions of the former parish church of St. Nicholas remain, but most churches and chapels are modern, and new parishes have been added. There are imposing institutions contributing to the entertainment of visitors. The aquarium, founded in 1872, was reconstructed in 1928–29 and contains over 10,000 living specimens. Preston and Queen's parks are the principal of several public recreation grounds; the corporation also acquired over 7,000 ac. of downland, including Devil's Dyke, for its preservation, besides other lands. The race-course of 122 ac. at Kemp Town is also town property. Educational establishments include Brighton college, a public school and Roedean Girls' school. Preston manor house was opened as a museum in 1933. Building improvements and extensions are being made every year, but during World War II 4,500 houses in Brighton and Hove were damaged by the German air raids of 1940–41. There are two piers, of which the Palace pier (1,710 ft. long), near the site of the old chain pier (1823) washed away in 1896, is near the centre of the town, while the West pier is toward Hove. After 1921, facilities for landing steamer traffic were improved. There are extensive mackerel and herring fisheries and a large new covered market, erected in 1936. In 1935 Brighton, Hove and Worthing established a joint municipal aerodrome at Shoreham-by-Sea. The parliamentary borough, which includes Hove, returns two members.

BRIGHT'S DISEASE, a term in medicine applied to a class of diseases of the kidneys (acute and chronic nephritis) which have as their most prominent symptom the presence of albumen in the urine, often accompanied by dropsy. These associated symptoms in connection with kidney disease were first described in 1827 by Dr. Richard Bright, but instead of being, as was formerly supposed, the result of one form of disease of the kidneys, may be dependent on various morbid conditions (*see* KIDNEY, DISEASES OF). Hence the term Bright's disease now has a generic application.

The symptoms of acute Bright's disease are severe. Pain in the back, vomiting and fever commonly usher in the attack. Dropsy, varying in degree from slight puffiness of the face to an accumulation of fluid sufficient to distend the whole body, and to occasion serious embarrassment to respiration, is a very common accompaniment. The urine is reduced in quantity, is of dark, smoky or bloody colour, and exhibits to chemical reaction the presence of a large amount of albumen, while, under the microscope, blood corpuscles and casts are found in abundance. Such a condition may supervene upon scarlatina or exposure to cold during drunkenness.

Acute inflammation may by its severity destroy life, or terminate in a chronic form of Bright's disease. On the other hand arrest of the inflammatory action frequently occurs, marked by increased amount of the urine, gradual disappearance of its albumen and other abnormal constituents, subsidence of the dropsy and rapid recovery of strength. Nevertheless recovery is rarely complete and relapses are common.

In the treatment of acute Bright's disease, good results are often obtained from local depletion, warm baths and the careful employment of diuretics and purgatives. Chronic Bright's disease is much less amenable to treatment, but efforts to spare the kidneys by restriction of nitrogenous food and by residence in a warm, dry climate (*e.g.*, Egypt) are indicated. (*See* KIDNEY, DISEASES OF; and ALBUMINURIA.)

BRIGNOLES, a town in southeast France, in the department of Var, 36 mi. by rail N.N.E. of Toulon. Pop. (1936) 4,856. It lies 754 ft. above sea level, in the fertile valley of the Caramy, contains an old palace of the counts of Provence, and has an active trade in olive oil, besides tanneries and bauxite mines.

BRIHASPATI or **BRAHMANASPATI** ("Lord of prayer"), a deity in the Vedic Hindu mythology, an ally of Indra in his conquest of the cloud demon. In the *Rig Veda* he is identified with Agni (*q.v.*). Offspring of Heaven and Earth, he inspires prayer and protects the pious. Depicted as having seven mouths, 100 wings and sharp horns, he is armed with bow and axe and his chariot is drawn by red horses. In the epics he is merely a priest or sage.

See A. A. Macdonell, *Vedic Mythology* (Strasbourg, 1897); E. W. Hopkins, *Epic Mythology* (Strasbourg, 1915).

BRIL, PAUL (1554–1626), Flemish painter, born at Antwerp. On the death of his brother Matthew (1550–84), Paul succeeded to his pensions and employments at the Vatican. He painted landscapes with a depth of chiaroscuro then little practised in Italy, and introduced into them figures well drawn and finely coloured. One of his best compositions is the "Martyrdom of St. Clement," in the Sala Clementina of the Vatican.

BRILL (*Rhombus laevis*), a flatfish closely related to the turbot, differing from it in having very small scales and no bony tubercules in the skin. It abounds on parts of the British coast, and is only less favoured for the table than the turbot itself.

BRILLAT-SAVARIN, ANTHELME (1755–1826), French gastronomist, was born at Belley, France, on April 1, 1755, and died in Paris on Feb. 2, 1826. In 1789 he was a deputy, in 1793 mayor of Belley. To escape proscription he fled from France to Switzerland, and from there to the United States. On the fall of Robespierre he returned to France, and in 1797 became a member of the court of cassation. He wrote various volumes on political economy and law, but his name is famous for his *Physiologie du goût* (1825) a witty compendium of the art of dining, of which a translation, *The Physiology of Taste*, was published, with introduction by Arthur Machen, in 1925.

BRIN, BENEDETTO (1833–1898), Italian naval administrator, was born at Turin on May 17, 1833, and until the age of 40 worked with distinction as a naval engineer. In 1873 Admiral Saint-Bon, minister of marine, appointed him under-secretary of state. The two men worked together: Saint-Bon conceived a type of ship, Brin made the plans and directed its construction. On the advent of the Left to power in 1876, Brin was appointed minister of marine by Depretis, a capacity in which he continued the program of Saint-Bon, while enlarging and completing it in such a way as to form the first organic scheme for the development of the Italian fleet. The huge warships "Italia" and "Dandalo" were his work, though he afterward abandoned their type in favour of smaller and faster vessels of the "Varese" and the "Garibaldi" class. By his initiative Italian naval industry, almost non-existent in 1873, made rapid progress. During his eleven years' ministry (1876–1878 with Depretis, 1884–1891 with Depretis and Crispi, 1896–1898 with Rudini), he succeeded in creating large private shipyards, engine works and metallurgical works for the production of armour, steel plates and guns. In 1892 he entered the Giolitti cabinet as minister for foreign affairs, accompanying, in that capacity, the king and queen of Italy to Potsdam, but showed weakness toward France on the occasion of the massacre of Italian workmen at Aigues-Mortes. He died on May 24, 1898, while minister of marine. He, more than any other man, must be regarded as the practical creator of the Italian navy.

BRINDABAN, a town of India, in the Muttra district of the United Provinces, on the right bank of the Jumna, 6 mi. N. of Muttra. Pop. (1941) 20,718. Brindaban is one of the most popular places of pilgrimage in India, being one of the group of Vaishnavite holy places, associated with the cult of Krishna as a youthful shepherd. It contains bathing stairs, tanks and wells, and a great number of handsome temples, of which the finest is that of Govind Deva, a cruciform vaulted building of red sandstone, dating from 1590. The river is unfortunately shifting away from the town and leaving the bathing ghats high and dry.

BRINDISI (anc. *Brundisium, q.v.*), archiepiscopal see, Apulia, Italy, province of Lecce, 24 mi. N.W. by rail from Lecce, and 346 mi. from Ancona. Pop. (1936), 35,984 (town); 41,699 (commune). The sheltered inner harbour, 30 ft. and more in depth, allows ocean steamers to lie at the quays.

The castle of Frederick II with huge round towers, guarded the inner harbour. The cathedral, ruined by earthquakes, was restored in 1743–49, but has some remains of its mosaic pavement (1178). The baptismal church of S. Giovanni al Sepolcro (11th century) is now a museum. S. Benedetto (1080) is another interesting church. The town was destroyed in 836 by Saracens, but rebuilt (11th century) by Lupus the protospatharius or Byzantine governor. In 1071 it fell into the hands of the Normans, and it frequently appears in the history of the Crusades. Early in the 14th century the inner port was blocked by Giovanni Orsini, prince of Taranto; the town was devastated by pestilence in 1348, plundered in 1352 and 1383; but even greater damage was done by the earthquake of 1456. It was an important naval base in 1915–18, when the harbour was considerably deepened.

BRINDISI, a drinking song, the name being derived from the Italian *brindisi*, a toast.

BRINDLEY, JAMES (1716–1772), English engineer, was born at Thornsett, Derbyshire. He was apprenticed to a millwright near Macclesfield, and set up as a wheelwright at Leek. In 1752 he designed and set up an engine for draining some coalpits at Clifton in Lancashire. Three years later he extended his reputation by completing the machinery for a silk mill at Congleton. In 1759, when the duke of Bridgewater was anxious to improve the outlets for the coal on his estates, Brindley advised the construction of a canal from Worsley to Manchester. The difficulties in the way were great, but all were surmounted by his genius, and his crowning triumph was the construction of an aqueduct to carry the canal at an elevation of 39 ft. over the river Irwell at Barton. The great success of this canal encouraged similar projects, and Brindley was soon engaged in extending his first work to the Mersey, at Runcorn. He then designed and nearly completed what he called the Grand Trunk Canal, connecting the Trent and Humber with the Mersey. The Staffordshire and Worcestershire, the Oxford and the Chesterfield canals were also planned by him, and altogether he laid out over 360 mi. of canals. He died at Turnhurst, Staffordshire, on Sept. 30, 1772. Brindley retained to the last a peculiar roughness of character and demeanour; he remained practically illiterate all his life, working without written calculations or drawings.

BRINTON, DANIEL GARRISON (1837–1899), American archaeologist and ethnologist, was born at Thornbury, Pa., on May 13, 1837. He graduated at Yale in 1858, studied for two years in the Jefferson Medical college, and for one year in Paris and Heidelberg. From 1862 to 1865, during the Civil War in America, he was a surgeon in the Union army, acting for one year, 1864–65, as surgeon in charge of the U.S. army general hospital at Quincy, Ill. After the war he practised medicine at Westchester, Pa., for several years; was the editor of a weekly periodical, the *Medical and Surgical Reporter*, in Philadelphia, from 1874 to 1887; became professor of ethnology and archaeology in the Academy of Natural Sciences in Philadelphia in 1884, and was professor of American linguistics and archaeology in the University of Pennsylvania from 1886 until his death at Philadelphia on July 31, 1899. He was president at different times of the Numismatic and Antiquarian Society of Philadelphia, of the American Folk-Lore Society and of the American Association for the Advancement of Science.

His principal works are:—*The Myths of the New World* (1868), the first attempt to analyse and correlate, according to true scientific principles, the mythology of the American Indians; *The Religious Sentiment: Its Sources and Aim: A Contribution to the Science and Philosophy of Religion* (1876); *American Hero Myths* (1882); *Essays of an Americanist* (1890); *Races and Peoples* (1890); *The American Race* (1891); *The Pursuit of Happiness* (1893); and *Religions of Primitive People* (1897). In addition, he edited and published a *Library of American Aboriginal Literature* (8 vols., 1882–90). *See* "The Brinton Memorial Meeting," *American Philos. Society Proceedings* (vol. 1, p. 210, 1900), which contains a complete bibliography.

BRINVILLIERS, MARIE MADELEINE MARGUERITE D'AUBRAY, Marquise, de (*c.* 1630–1676), French poisoner, daughter of Dreux d'Aubray, civil lieutenant of Paris, was born in Paris about 1630. In 1651 she married the marquis de Brinvilliers. Contemporary evidence describes her as a much-courted little woman, with a fascinating air of child-like innocence. In 1659 her husband introduced her to his friend Godin de Sainte-Croix, whose mistress she became. Her father then secured the arrest of Sainte-Croix on a *lettre de cachet* (*q.v.*). When Sainte-Croix left the Bastille he plotted with his mistress his revenge upon her father. She undertook to experiment with the poisons which Sainte-Croix prepared, and found subjects in the poor who sought her charity and the sick whom she visited. Meanwhile Sainte-Croix determined that not only M. Dreux d'Aubray but also the latter's sons and other daughter should be poisoned, so that the marquise and himself might come into possession of the family fortune. In Feb. 1666, the marquise poisoned her father, and in 1670 her two brothers. Before any attempt could be made on the life of Thérèse d'Aubray, Sainte-Croix died suddenly (1672), his glass mask having fallen off while he was preparing his poisons. The police were called in and discovered among his belongings documents incriminating the marquise and her valet. He was arrested, tortured into a complete confession, and broken alive on the wheel (1673), but the marquise took refuge in a convent where she was decoyed by a police emissary disguised as a priest. A full account of her crimes was found among her papers. She was taken to Paris, tortured and beheaded, and her body burned on July 16, 1676.

See Loiseleur, *Trois énigmes historiques* (1882); G. Roulier, *La Marquise de Brinvilliers* (1883); H. Stokes, *Madame de Brinvilliers and her Times* (1912, 2nd ed., 1924).

BRIONI, a group of islands northwest of Pola, Italy, in the Adriatic sea, separated from the west coast of Istria by the Strait of Fasana. The largest island, Brioni Maggiore, previously barren, was converted into a favourite resort with large hotels, being supplied with water by an underground channel from the mainland. The vegetation is almost tropical. A fine Roman villa has been found on the beautiful bay of Val Catena, on the south of the island. Pop. (1936) 241 (town), 310 (commune).

BRIOSCO, ANDREA (*c.* 1470–1532), Italian sculptor and architect, known as Riccio ("curly-headed"), was born at Padua. He is known by the church of Sta. Giustina in Padua, but he is most famous as a worker in metal. His masterpieces are the bronze Paschal candelabrum (11 ft. high) in the choir of the Santo (S. Antonio) at Padua (1515) and the two bronze reliefs (1507) of "David dancing before the Ark" and "Judith and Holofernes" in the same church. His bronze and marble tomb of the physician Girolamo della Torre in San Fermo at Verona was beautifully decorated with reliefs, which are now in the Louvre.

BRIOUDE, town of France, capital of an arrondissement in the department of Haute Loire, on the left bank of the Allier, 47 mi. N.W. of Le Puy on the P.L.M. railway. Pop. (1936) 4,841. Brioude (anc. Brivas) was in turn captured by Goths (532), Burgundians, Saracens (732) and Normans. After 1361 the town was the headquarters of Bérenger, lord of Castelnau, who was leader of one of the bands of military adventurers which then devastated France. The knights (or canons) of St. Julian bore the title of counts of Brioude. The town has to a great extent escaped modernization, and its streets are narrow and irregular. The church of St. Julian (12th and 13th centuries) is in the Romanesque style of Auvergne, of which the choir, with its apse and radiating chapels and the mosaic ornamentation of the exterior, is a fine example. The plain in which it is situated is of great fertility; trade in grain, wood and wine is considerable, and market gardening is carried on in the outskirts. Brioude is the seat of a sub-prefect, and of tribunals of first instance and of commerce.

BRIQUETTING. When coal is hewn and transported, much of it is unavoidably reduced to small pieces and dust, the supply of which frequently exceeds the demand. The material tends to accumulate, a loss to the coal mining industry and an obstacle to its further development. One of the most effective methods of overcoming this difficulty is a process in which the small coal is mixed with some binding material, such as pitch, and then compressed into blocks or briquettes (also known as "patent fuel") of various convenient shapes and sizes.

Commercial briquettes should be relatively free from ash and clinker forming ingredients, water-proof, and sufficiently hard to stand transportation with a minimum of breakage. They should not crumble unduly during combustion, and the binder must not be too expensive.

Many binders have been tried, inorganic substances such as Portland cement, silicate of soda, lime and clay; and organic, such as resin, pitch, molasses, mucilage and starch. None of these so nearly approaches the ideal binder as a medium-soft coal-tar or asphaltic pitch. The pitch and coal are blended in proportions depending on the character of the coal and the purpose for which the fuel is intended. A good fuel for domestic use, yielding a high degree of radiant heat, can be made from a mixture of 80% anthracite, 11% bituminous coal, and 9% pitch. For steam-raising purposes a long flame is required, which cannot be obtained from anthracite. Steam coal therefore forms the chief ingredient; standard practice approximating to 65% steam coal, 10% bituminous coal, 16% anthracite, and 9% pitch. The price of pitch makes it imperative to use as little as possible consistent with adequate cohesion; most American plants use 5–7%.

In both types of fuel the pitch burns off rapidly, bringing the coking effect of the bituminous coal into play, thus keeping the briquetted material coherent long after the pitch itself has been consumed.

Making the Blocks.—The actual processes of manufacture are simple. The coal is washed to reduce the ash content, then dried, after which both coal and pitch are ground to a powder, mixed, made plastic by heating with steam, and pressed. Domestic briquettes are most frequently pillow-shaped, cubes, cylinders or ovoids, and are produced by passing the plastic material between rolls having matched recesses in their faces. Into these recesses the material is compressed, emerging as briquettes weighing, in general, from one to five ounces. Steam-raising briquettes are usually rectangular in shape, made in blocks weighing from 10 to 25 lb. The mixture falls into suitable moulds or recesses in a rotating table, the motion of which is intermittent. During each pause a stamp is forced into one of the moulds, compressing the material to the required shape and size.

The briquetting of lignite or brown coal as practised in Germany and elsewhere follows somewhat different lines. Lignite does not usually require any binder other than that contained within itself in the form of bitumen and water. Again, lignite may contain as much as 60% water, necessitating much more elaborate drying equipment. Owing to the highly inflammable and explosive nature of dry lignite dust it is essential that steam dryers only should be used.

Briquette manufacture originated in Germany, but has since spread to other countries. Of the total world output of approximately 60,000,000 metric tons, Germany accounted for 76%, France 12%, Belgium 3%, Netherlands 2%, United States, Great Britain and Czechoslovakia each 1 per cent. Of the total, over three quarters is made from brown coal (98% of which is in Germany), other raw materials include anthracite, semi-anthracite, high and low volatile bituminous coals, low-temperature coke, and petroleum coke. In 1937 Great Britain used 763,807 long tons of various types of coal in the production of 813,543 long tons of briquettes, while 31 plants in the United States consumed 951,663 short tons of coal and other raw fuels in the production of 905,930 short tons of briquettes. The bulk of the output of all countries is for domestic consumption, only about 5% entering into international trade.

BIBLIOGRAPHY.—Literature on the subject is scanty. Reference may be made to vol. i. of Franke's *Handbook of Briquetting* (London); and Stillman's *Briquetting* (New York, 1923). Much information lies buried in the proceedings and publications of various British, European and American engineering and research societies and institutions.

(H. P. V.; G. A. Ro.)

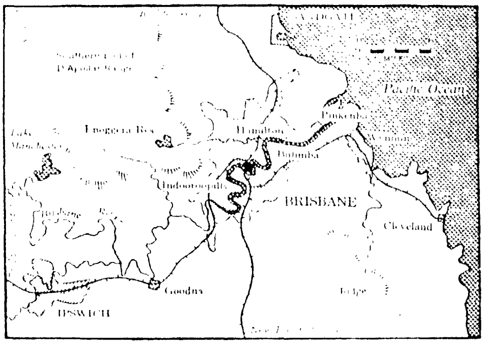
BRISBANE, ARTHUR (1864–1936), American newspaper editor, was born in Buffalo, N.Y., Dec. 12, 1864. After an education in the American public schools and five years spent in France and Germany, he entered the employ of the New York *Sun* in 1882 or 1883 as a reporter, later becoming its London correspondent and subsequently editor of the *Evening Sun*. From 1890 to 1897 he was connected with the New York *World*, as managing editor of different editions, and from 1897 to 1921 he was editor of the New York *Evening Journal*. He purchased the *Washington Times* of Washington (D.C.), in 1917, and the *Evening Wisconsin* of Milwaukee (Wis.) in 1918, selling both papers to William Randolph Hearst in 1919. After 1918 he was editor of the Chicago *Herald and Examiner.* His editorials, which for more than two decades appeared in all the newspapers owned by W. R Hearst, obtained for Mr Brisbane a national reputation

Among his publications are *Editorials from the Hearst Newspapers* (1906), *Mary Baker G. Eddy* (1908); and *To-day and the Future Day* (1925).

BRISBANE, SIR THOMAS MAKDOUGALL (1773–1860), Scottish soldier and astronomer, was born on July 23 1773, at Brisbane House, near Largs, in Ayrshire. He entered the army in 1789, and served in Flanders, the West Indies and the Peninsula. In 1814 he was sent to North America; on the return of Napoleon from Elba he was recalled, but did not arrive in time to take part in the battle of Waterloo. In 1821 he was appointed governor of New South Wales During his four years of office, although he allowed the finances of the colony to get into confusion, he endeavoured to improve its condition by introducing the vine, sugar-cane and tobacco plant, and by encouraging the breeding of horses and the reclamation of land At his instigation exploring parties were sent out, and one of these discovered the Brisbane river which was named after him. He established an astronomical observatory at Paramatta in 1822, and the *Brisbane Catalogue*, which was printed in 1835 and contained 7,385 stars, was the result of observations made there in 1822–26. The observatory was discontinued in 1855. After his return to Scotland he resided chiefly at Makerstoun in Roxburghshire, where he had a well-equipped observatory. Important magnetic observations were begun at Makerstoun in 1841, and the results gained him in 1848 the Keith prize of the Royal Society of Edinburgh, in whose *Transactions* they were published In 1836 he was made a baronet, and G C B. in 1837; and in 1841 he became general In 1833, he was elected president of the Royal Society of Edinburgh, after the death of Sir Walter Scott. He died at Brisbane House on Jan. 27 1860.

BRISBANE, the capital city of Queensland, Australia, situated (27° 28′ S., 153° 2′ E.) near the south-eastern corner of the state on the Brisbane River about 14m. from its mouth in Moreton Bay The city lies astride the river, which here winds through gently hilly country; the low-lying river flats have been visited by disastrous floods. Inland the roomy basins and valleys of the Brisbane and Logan give access to the uplands of the Darling Downs and of northern New South Wales.

Northwards lowlands, interrupted by hill-ranges (Glasshouse Mountains), lead towards the central coastal basins. The climate is sub-tropical: mean ann. temps. about 78°–60° F (absol. extremes: 109°–36° F) with about 2,640 hours sunshine, av. ann. rainfall 45 in. (variation 88 in.–24 in.), falling chiefly in Dec.–March. Spells of excessive heat are very rare, but the heat for two or three months in summer is moist and oppressive. Brisbane began (1824) as a penal settlement, and was named after the Governor, Sir T. M Brisbane. Its civil status was established in 1842, and after a period of difficulties, it became (1859) the official capital of the newly-created colony of Queensland. The present metropolitan area (Greater Brisbane) covers some 10 sq.m. (including South Brisbane), and has a population of about 299,748 (1933) or about 31% of the total population of Queensland (birth-rate about 23: deaths about 10 per 1,000). Like the other Australian capitals, Brisbane is spacious, solidly built and well laid-out. There are also ample and beautiful recreation grounds, parks and public gardens. The city is served with electricity, has an abundant water supply and good sanitation. The river is crossed by bridges and services of ferry-boats. The centre of a rich agricultural, pastoral and mining area, stretching back to the Darling Downs and the western plains beyond, Brisbane has attracted to itself considerable trade and manufacturing industry There were some 677 factories in all, employing 23,000 hands, and having a total output valued at nearly £17,225 000 (gross) The industries are connected mainly with the production of foodstuffs and clothing, but include also engineering, saw-milling, tanning and motor-building. Coal is conveyed down-stream from Ipswich. Railways radiate inland in various directions, and link the Darling Downs (Warwick, Toowoomba, etc.) to the capital, while the Charleville line, in particular, opens up the heart of pastoral Southern Queensland. Northwards the coastal line links the "sugar" ports and southwards main-line connection exists with Sydney (via Warwick), while a new (4′ 8½″ standard gauge) through-link has been constructed by the coastal route (South Brisbane–Kyogle) A dredged channel in the lower Brisbane river (400 ft. wide, 20–24 ft deep low water with 7 ft [max.] tidal rise) gives access to Brisbane from the sea There are over 14,000 ft of wharfage with depths alongside of 23–30 ft; a proposed basin at Hamilton (about 4 mi downstream) was to provide a further 18,000 ft.; there are also a dry dock and three patent slip ways In 1936–37 4,409,773 tons of shipping entered the port, including ships of the regular ocean lines. The total trade is valued at about £29,500,000, of which £18,000,000 represents exports (wool, meat, and other cattle products, sugar, dairy products, and maize, wool representing more than half of the total value).



ENVIRONS OF BRISBANE AND IPSWICH DARK SPOT SHOWS CENTRE OF CITY OF BRISBANE

In spite of the extended nature of the coast and the relatively uncentralized nature of economic development in Queensland, Brisbane is by far the largest and most rapidly growing port.

See C. M. Zierer, *Brisbane* (Econ Geog Worcester, 1940).

BRISEUX, CHARLES ÉTIENNE (*c.* 1680–1754) French architect. He was especially successful as a designer of internal decorations—mantel-pieces, mirrors, doors and overdoors, ceilings, consoles, candelabra, wall panellings and other fittings, chiefly in the Louis Quinze mode. He also wrote on architectural subjects.

BRISSAC, DUKES OF. The fief of Brissac in Anjou was acquired at the end of the 15th century by a noble French family named Cossé belonging to the same province Brissac was made a countship in 1560 for Charles de Cossé, who was grand master of artillery and governor of Piedmont and of Picardy The second Charles de Cossé fought for the League and as governor of Paris opened the gates of that town to Henry IV., who created him marshal of France in 1594. Brissac was raised to a duchy in the peerage of France in 1611. Louis Hercule Timoléon de Cossé, duc de Brissac and commandant of the constitutional guard of Louis XVI., was killed at Versailles on Sept. 9, 1792

BRISSON, EUGÈNE HENRI (1835–1912), French statesman, was born at Bourges on July 31, 1835, and died in April 1912. He was elected to the Assembly on Feb 8, 1871, as a member of the extreme Left He was the first to propose amnesty for the condemned Communards (Sept 13, 1871), but the proposal was voted down He strongly supported obligatory primary education and was a firm anti-clerical. He was president of the chamber from 1881—replacing Gambetta—to March 1885, when he became prime minister upon the resignation of Jules Ferry; but he resigned when, after the general elections of that year, he only just obtained a majority for the vote of credit for the Tongking expedition. He took a prominent part in exposing the

Panama scandals, was a powerful candidate for the presidency after the murder of President Carnot in 1894, and was again president of the chamber from December 1894 to 1898. In June of the latter year he formed a cabinet, when the country was violently excited over the Dreyfus affair, his firmness and honesty increased the respect in which he was already held by good citizens, but a chance vote overthrew his ministry in October. He actively supported the ministries of Waldeck-Rousseau and Combes, especially concerning the laws on the religious orders and the separation of Church and State. In 1899 he was a candidate for the presidency. In May 1906 he was elected president of the Chamber of Deputies and re-elected in 1910.

BRISSON, MATHURIN JACQUES (1723–1806), French zoologist and natural philosopher, was born at Fontenay le Comte on April 30, 1723. The earlier part of his life was spent in the pursuit of natural history, but after the death of R. A. F. Réaumur (1683–1757), whose assistant he was, he abandoned natural history, and was appointed professor of physics in Paris. His most important works were *Poids spécifiques des corps* (1787) and *Dictionnaire raisonné de physique* (2nd ed. 1800). He died at Croissy near Paris, on June 23, 1806.

BRISSOT, JACQUES PIERRE (1754–1793), who assumed the name of DE WARVILLE, French Girondist, was born at Chartres, where his father was an innkeeper, on Jan. 14, 1754. Brissot received a good education and entered the office of a lawyer at Paris. His first works, *Théorie des lois criminelles* (1781) and *Bibliothèque philosophique du législateur* (1782), were on the philosophy of law, and showed how thoroughly Brissot was imbued with the ethical precepts of Rousseau. The first work was dedicated to Voltaire. Brissot was a prolific journalist and pamphleteer, and on an enforced absence from France he met some of the English abolitionists and visited the United States in 1788 in connection with the abolitionist movement.

From the first, Brissot threw himself heart and soul into the Revolution. He edited the *Patriote français* from 1789 to 1793, and being a well informed and capable man took a prominent part in affairs. Upon the demolition of the Bastille the keys were presented to him. Famous for his speeches at the Jacobin club, he was elected a member of the municipality of Paris, then of the legislative assembly, and later of the national convention. During the legislative assembly his knowledge of foreign affairs enabled him as member of the diplomatic committee practically to direct the foreign policy of France, and the declaration of war against the emperor on April 20, 1792, and that against England on July 1, 1793, were largely due to him. While to others these were a crusade for liberty, to Brissot they were a convenient way of exposing and dethroning the king. He was inferior in many ways to the nobler Girondins like Vergniaud, but he was immensely their superior in parliamentary intrigue and political manoeuvring. So much did he become their leader that they were often named "Brissotins," and contemporary opinion often ascribed the violence of the conflict to the personal hatred between Robespierre and Brissot. He was involved in the downfall of his party and perished courageously by the guillotine on Oct. 31, 1793.

See Helena Williams, *Souvenirs de la Révolution française* (1827); *Mémoires de Brissot, sur ses contemporains et la Révolution française*, published by his sons, with notes by F. de Montrol (1830); F. A. Aulard, *Les Portraits littéraires à la fin du XVIIIe siècle, pendant la Révolution* (1883); F. A. Aulard, *Les Orateurs de la Législative et de la Convention* (2nd ed. 1905).

BRISTLE. The stiff hair of swine. Its forked tips, resiliency, and minutely ridged surface have made it a basic material in brush manufacture for many centuries. It is produced and prepared chiefly in China, the Soviet Union, Japan, Poland, India, Germany, and France. The increased use of brushes has made bristle an important article of commerce. The United States imports annually an average of about 4,000,000lbs., 1938 imports being 3,200,000lbs. valued at $5,500,000.

BRISTOL, EARLS AND MARQUISES OF. This English title has been held in the Hervey family since 1714, though previously an earldom of Bristol, in the Digby family, is associated with two especially famous representatives, of whom separate biographies are given. The Herveys are mentioned during the 13th century as seated in Bedfordshire, and afterwards in Suffolk, where they have held the estate of Ickworth since the 15th century. John Hervey (1616–79), eldest son of Sir William Hervey (died 1660), was treasurer to Catherine, wife of Charles II. He left no children, and his estates passed to his brother, Sir Thomas Hervey, (died 1694).

His son JOHN HERVEY, 1st earl of Bristol (1665–1751) was educated at Clare Hall, Cambridge, and became member of parliament for Bury St. Edmunds in March 1694. In March 1703 he was created Baron Hervey of Ickworth, and in Oct. 1714 earl of Bristol. By his first wife, he had only one son, Carr, Lord Hervey (1691–1723), who was educated at Clare Hall, Cambridge, and was member for Bury St. Edmunds from 1713 to 1722. (It has been suggested that Carr, who died unmarried on Nov. 14, 1723, was the father of Horace Walpole.) He married secondly Elizabeth Felton, of Playford, Suffolk. His eldest son, John (1696–1743), gained some renown as a writer and a politician (*see* HERVEY OF ICKWORTH). Another son, Thomas (1699–1775), was one of the members for Bury from 1733 to 1747 and held various offices at court. A third son, Felton (1712–73), was also member of the family borough of Bury St. Edmunds. Having assumed the additional name of Bathurst, Felton's grandson, Felton Elwell Hervey-Bathurst (1782–1819), was created a baronet in 1818, and on his death a year later the title descended to his brother, Frederick Anne (1783–1824), the direct ancestor of the present baronet. The 1st earl died in Jan. 1751, the title and estates descending to his grandson.

GEORGE WILLIAM HERVEY, 2nd earl of Bristol (1721–1775), the eldest son of John, Lord Hervey of Ickworth, by his marriage with Mary (1700–68), daughter of Nicholas Lepell, was born on Aug. 31 1721. He served for some years in the army, and in 1755 was sent to Turin as envoy extraordinary. He was ambassador at Madrid from 1758 to 1761, and ranked among the followers of Pitt. Appointed lord-lieutenant of Ireland in 1766, he never visited that country during his short tenure of this office, and, after having served for a short time as keeper of the privy seal, became groom of the stole to George III in Jan. 1770. He died unmarried in March 1775, and was succeeded by his brother.

AUGUSTUS JOHN HERVEY, 3rd earl of Bristol (1724–1779), entered the navy, served under Byng in the Mediterranean, and gave evidence at his trial in 1757. He was of great assistance to Admiral Hawke in 1759. Having served with distinction in the West Indies under Rodney, his active life at sea ceased when the Peace of Paris was concluded in Feb. 1763. Hervey was member of parliament for Bury from 1757 with a short interval, until he succeeded his brother in the peerage in 1775. Having served as a lord of the admiralty from 1771 to 1775 he won some notoriety as an opponent of the Rockingham ministry and a defender of Admiral Keppel. In Aug. 1744 he had been secretly married to Elizabeth Chudleigh (1720–88), afterwards duchess of Kingston (*q.v.*), but this union was dissolved in 1769. The earl died in London on Dec. 23, 1779, leaving no legitimate issue, and having, as far as possible, alienated his property from the title. He was succeeded by his brother. Many of his letters are in the Record Office, and his journals in the British Museum. Other letters are printed in the *Grenville Papers*, vols. iii. and iv. (London, 1852–53), and the *Life of Admiral Keppel*, by the Hon. T. Keppel (London, 1852.)

FREDERICK AUGUSTUS HERVEY, bishop of Derry (1730–1803), 4th earl of Bristol, was educated at Westminster school and Corpus Christi college, Cambridge, graduating in 1754. Entering the church he became a royal chaplain. In Feb. 1767, he was made bishop of Cloyne, and a year later of Derry. In Dec. 1779 he became earl of Bristol. In 1782 he threw himself ardently into the Irish volunteer movement. His later years were spent mainly on the continent. In 1798 he was imprisoned by the French at Milan, remaining in custody for 18 months. He died at Albano on July 8 1803, and was buried in Ickworth church. In 1752 he had married Elizabeth (d. 1800), daughter of Sir Jermyn Davers, Bart., by whom he had two sons and three daughters. His elder son, Augustus John, Lord Hervey (1757–96), had pre-deceased his father, and he was succeeded in the title by his younger son.

Frederick William Hervey, 5th earl and 1st marquis of Bristol (1769–1859), was born on Oct. 2, 1769, and died Feb. 15, 1859. He married Elizabeth Albana (d. 1844), daughter of Clotworthy, 1st Baron Templetown, by whom he had six sons and three daughters. In 1826 he was created marquis of Bristol and Earl Jermyn. He was succeeded by his son Frederick William (1800–64), M.P. for Bury St. Edmunds 1830–59, as 2nd marquis; and by the latter's son Frederick William John (1834–1907), M.P. for West Suffolk 1859–64, as 3rd marquis. The latter's nephew, Frederick William Fane Hervey (born 1863), who succeeded as 4th marquis, served with distinction in the royal navy; and was M.P. for Bury St. Edmunds from 1906 to 1907.

Bibliography.—*See* John, Lord Hervey, *Memoirs of the Reign of George II.*, edited by J. W. Croker (1884); John Hervey, 1st earl of Bristol, *Diary* (Wells, 1894); and *Letter Books of Bristol; with Sir T. Hervey's Letters during Courtship and Poems during Widowhood* (Wells, 1894). Also the articles in the *Dictionary of National Biography*, vol. xxvi. (1891).

BRISTOL, GEORGE DIGBY, 2nd Earl of (1612–1677), eldest son of John Digby, 1st earl (*see* below), was born in Oct. 1612. He entered Magdalen college, Oxford, in 1626, and after taking his M.A. degree in 1636, travelled abroad for some years. In 1638–39 he attacked Roman Catholicism in a series of letters to Sir Kenelm Digby. Elected member for Dorsetshire he supported Pym and Hampden in the parliaments of 1640, and was one of the committee for the impeachment of Strafford. But in 1641 he voted against the third Attainder bill, and defended episcopacy in the debates on the Root and Branch bill. To save him from the attacks of the Commons, the king raised him to the peerage, in his father's barony of Digby, and he became one of Charles's advisers. He urged on the arrest of the five members in Jan. 1642, and was soon after forced to escape impeachment by flying to Holland. From there he wrote letters discussing plans to win Dutch support, which were intercepted on their way to Charles. Digby fought at Edgehill, but threw down his commission in consequence of a quarrel with Prince Rupert. In 1643 he was made secretary of state and privy councillor, and in Oct. 1645 lieutenant general of the king's forces north of the Trent. On Oct. 15 he was defeated at Sherburn, his correspondence disclosing royal intrigues with Ireland and Scotland was captured and he was forced to escape to the Isle of Man and finally to France where he served in Louis XIV.'s troops in the Fronde. In 1656 Mazarin, who regarded Digby as a mere adventurer, had him expelled from France in accordance with the treaty with Cromwell, and he joined Charles II. at Bruges. Charles appointed him secretary of state in 1657, but on his becoming a Roman Catholic he had to resign office.

By the death of his father Digby succeeded, in 1653, to the peerage as 2nd earl of Bristol. He returned to England at the Restoration, but was excluded from office on account of his religion. He adopted an attitude of violent hostility to Clarendon, and on July 10, 1663, brought forward a charge of high treason against him. The charge was dismissed, and Clarendon expelled from court. On the fall of Clarendon, however, Bristol was again welcomed at court, and took his seat in the Lords, July 29, 1667. In March 1673, though still a Roman Catholic, he spoke in favour of the Test act, describing himself as a "Catholic of the Church of Rome, not a Catholic of the court of Rome." He died on March 20, 1677.

Bibliography.—*See* the article in *Dict. Nat. Biog.*; Wood's *Ath. Oxon.* (Bliss), iii. 1100–05; *Biographia Brit.* (Kippis), v. 210–238; H. Walpole's *Royal and Noble Authors* (Park, 1806), iii. 10[illegible]; *Roscius Anglicanus*, by J. Downes, pp. 31, 36 (1789); Cunningham's *Lives of Eminent Englishmen* (1837), iii. 20; *Somers Tracts* (1750), iii. (1809) iv.; *Harleian Miscellany* (1808), v., vi.; *Life* by T. H. Lister (1838); *State Papers.*

BRISTOL, JOHN DIGBY, 1st Earl of (1580–1653), English diplomatist, son of Sir George Digby of Coleshill, Warwickshire, was educated at Magdalen college, Oxford, and entered the Inner Temple in 1598. Between 1611 and 1624 he was constantly employed as ambassador of James I., notably in the negotiations for the Spanish marriage. During a short interval in 1622 he was sent to Brussels and Vienna to advocate the cause of the king's son-in-law, the elector palatine. In 1623, when the negotiations for the Spanish marriage were wrecked by the behaviour of Charles and Buckingham in Madrid, Digby incurred Buckingham's resentment by sending home an account of the true state of affairs. On his arrival at Dover in March 1624 he was forbidden to appear at court. On the death of James he was removed by Charles I. from the Privy Council, and ordered to absent himself from his first parliament. In March 1626, after the assembling of the second parliament, Digby applied to the Lords, who supported his rights, and Charles sent him his writ accompanied by a letter desiring him not to use it. Bristol however, took his seat and demanded justice against Buckingham. The king endeavoured to obstruct his attack by causing Bristol, on May 1, to be himself brought to the bar, on an accusation of high treason by the attorney-general. The Lords, however, ordered that both charges should be investigated simultaneously. Further proceedings were stopped by the dissolution of parliament on June 15, a prosecution was ordered by Charles in the Star Chamber, and Bristol was sent to the Tower, where he remained till March 17, 1628, when the peers, on the assembling of Charles's third parliament, insisted on his liberation and restoration to his seat in the Lords.

In the discussions upon the Petition of Right, Bristol supported the use of the king's prerogative in emergencies, but joined in the demand for a full acceptance of the petition by the king after the first unsatisfactory answer. He was now restored to favour, but took no part in politics till the outbreak of the Scottish rebellion, when he warned Charles of the danger of attacking with inadequate forces. He was the leader in the Great Council held at York, was a commissioner to treat with the Scots in Sept. 1640 at Ripon, and advised strongly the summoning of the parliament. In Feb. 1641 he advocated reforms in the Administration and received a seat in the council. Though no friend to Strafford, he endeavoured to save his life desiring only to see him excluded from office. On Dec. 27, he was declared an evil counsellor by the House of Commons, Cromwell on the 28th moving an address to the king to dismiss him from his councils, on the plea that he had advocated the bringing up of the northern army to overawe parliament in the preceding spring. There is no evidence to support the charge, but Digby was regarded by the parliamentary party with special hatred and distrust, of which the chief causes were probably his Spanish proclivities and his indifference on the great matter of religion. On March 28, 1642, he was sent to the Tower for having failed to disclose to parliament the Kentish petition. Liberated in April, he joined Charles at York, was present at Edgehill and accompanied him to Oxford. On Feb. 1, 1643, he was named with Lord Herbert of Raglan for removal from the court and public office for ever, and in the propositions of Nov. 1644 was one of those excepted from pardon. In January he had endeavoured to instigate a breach of the Independents with the Scots. Bristol, however, was not in favour of continuing the war, and withdrew to Sherborne, removing in the spring of 1644 to Exeter, and after the surrender of the city retiring abroad on July 11, by order of the Houses, passing the rest of his life in exile at Caen. In 1647 he printed *An Apology*, defending his support of the royal cause. This was reprinted in 1656 (Thomason Tracts, E 897, 6). He died in Paris on Jan. 16, 1653, and was succeeded by his son, George, as 2nd earl. Besides his *Apology*, he was the author of several printed speeches and poems, and translated *A Defence of the Catholic Faith* by Peter du Moulin (1610).

Bibliography.—Clarendon's *Hist. of the Rebellion*, esp. vi. 388; *Clarendon State Papers* and *Cal. of Cl. State Papers; Old Parliamentary History; Cabala* (1691; letters); Camden Soc., *Miscellany*, vol. vi. (1871); *Defence of his Spanish Negotiations*, edit. S. R. Gardiner (1847); *Somers Tracts*, ii. 501 (1809); *Thomason Tracts* in Brit. Museum; *Hardwicke State Papers*, i. 404. The mss at Sherborne castle, of which a selection was transcribed and deposited in the Public Record Office, were calendared by the Hist. MSS. Commission in *Rep.* viii. app. i. p. 213 and 10th *Rep.* app. i. p. 520. *See* also *Cal. of State Papers, Dom. Series; Harleian MSS.* Brit. Mus. 1580, art. 31–48, and *Add. MSS.* indexes and calendars.

BRISTOL, an industrial city of Hartford county, Connecticut, U.S.A., in the central part of the state, 16 m. S.W. of Hartford, on the Pequabuck river and served by the New York, New

Haven and Hartford railroad. It is coextensive with Bristol township and has an area of 27 sq mi. The population in 1920 was 20,620, of whom 5,638 were foreign-born white; and was 30,167 in 1940 federal census. Bristol has been noted for its clocks since the 18th century, and they are still one of its leading products. Other important products include ball bearings, springs, brass and sheet steel, fishing rods and golf clubs. The aggregate factory product in 1937 was valued at $38,367,935. Tobacco is grown in the vicinity.

Bristol was settled about 1727. Before and during the Revolution it had a strong Loyalist faction. The rector of the Protestant Episcopal church, the Rev. James Nichols, was tarred and feathered by the Whigs; and Moses Dunbar, a member of the church, was hanged for treason. Chippen's hill was a favourite rendezvous of the Loyalists, and a cave there is known as "the Tories' den."

BRISTOL, parliamentary and county borough, city and seaport of England, in Gloucestershire and Somersetshire, but also a separate county in itself with its own assizes, lying on both sides of the river Avon at the confluence of the rivers Avon and Frome, 118 mi. W. of London by rail. Population (1938) 415,500; area 38 sq mi. The Avon here forms the boundary between Gloucestershire and Somersetshire. Although entering the Bristol channel only 8 mi. below the city, it is confined between considerable hills, with a narrow valley-floor on which the nucleus of the city rests. Between Bristol and the channel the valley becomes a gorge, crossed by the famous Clifton Suspension bridge. Above Bristol the hills again close in at Keynsham, so that the city lies in a basin-like hollow some 4 mi. in diameter, and extends up the heights to the north. The G.W.R., striking into the Avon valley near Bath, serves Bristol from London, connects it with South Wales by the Severn tunnel, and with the southern and southwest counties of England. The G.W.R. express trains to London, however, are run on the line via Badminton. Local lines of this company encircle the city on the north and south, serving the outports of Avonmouth and Portishead on the Bristol channel. A trunk line of the L.M.S.R. connects Bristol with the north by way of Gloucester, Worcester, Birmingham and Derby. The central station, Temple Meads, is used by the G.W.R., and by the L.M.S. and L.N.E. Joint railways. An airport, 2½ mi. from the station, was opened in 1930.

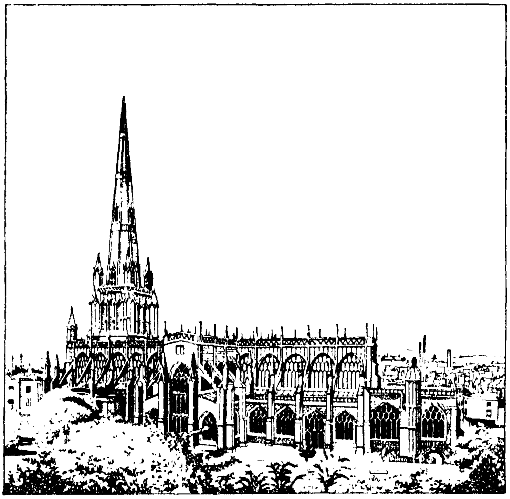
Early History.—Bristol (Brigstow, Bristou, Bristole) is one of the best examples of a town that has owed its greatness entirely to trade. It was the western limit of the Saxon invasion of Britain, and about the year 1000 a Saxon settlement began to grow up at the junction of the rivers Frome and Avon. Bristol owed much to Danish rule, and during the reign of Canute, when the wool trade with Ireland began, it became the market for English slaves. In Domesday it was already a royal borough, with a mint. One-third of the gold was paid to Geoffrey de Coutances, bishop of Exeter, who threw up the earthworks of the castle. Earl Robert of Gloucester still further strengthened the castle, probably with masonry, and involved Bristol in the rebellion against Stephen. A charter of 1172 granted the city of Dublin to the men of Bristol as a colony with the same liberties as their own town. As a result probably of the close connection between Bristol and Ireland the growth of the wool trade was maintained. About this time Bristol began to export wool to the Baltic, and had developed a wine trade with the south of France, while soapmaking and tanning were flourishing industries. Bristol was still organized manorially rather than municipally.

At some date after this a commune was established in Bristol on the French model, Robert FitzNichol, the first mayor of Bristol, taking the oath in 1200. The mayor was chosen by the merchants of Bristol who were members of the merchant gild.

In the reign of John, Bristol began the struggle to absorb the neighbouring manor of Bedminster, the eastern half of which was held by the Templars by gift of Earl Robert of Gloucester, while the western half, known as Redcliffe, had been sold to Robert FitzHardinge. The Templars acquiesced, but the wealthy owners of Redcliffe resisted for nearly 100 years. In 1247 a new course was cut for the river Frome, vastly improving the harbour, and a stone bridge was built over the Avon, bringing Temple and Redcliffe into closer touch with the city. About this time Brist seems to have become practically independent of the king. Tl exclusiveness of the merchant gild led to the insurrection 1312. During the reign of Edward III, cloth manufacture deve oped in Bristol. Thomas Blanket set up looms in 1337, employir many foreign workmen, and in 1353 Bristol was made one of tl staple towns.

The charter of 1373 extended the boundaries of the town t include Redcliffe (thus settling the long-standing dispute) ar the waters of the Avon and Severn up to the Steep and Fl Holmes, and made Bristol a county in itself, independent of tl county courts. It was the first city outside of London to receiv this honour. This charter (confirmed in 1377 and 1488) wa followed by the era of William Canynges, of the foundation of th Society of Merchant Venturers, and of the voyages of John an Sebastian Cabot. William Canynges (1399–1474) was five time mayor and twice represented Bristol in parliament; he carried o a huge cloth trade with the Baltic and rebuilt St. Mary Redcliff At the same time cloth was exported by Bristol merchants t France, Spain and the Levant. The records of the Society c Merchant Venturers began in 1467; by 1500 it directed all th foreign trade of the city and had a lease of the port dues. I was incorporated in 1552, and received other charters in 16 and 1662.

In the 16th century Bristol traded with Spain, the Canaries an the Spanish colonies in America, shared in the attempt to coloniz Newfoundland, and began the trade in African slaves which flour ished during the 17th century. A formal charter of incorporatio was granted in 1664. In the 18th century the cloth trade declin owing to the competition of Ireland and to general migration o manufactures to the northern coalfields, but prosperity was main tained by the introduction of manufactures of iron, brass, ti and copper, and by the flourishing West Indian trade, sugar bein taken in exchange for African slaves.



CHURCH OF ST. MARY REDCLIFFE, BRISTOL, ONE OF THE MOST BEAUTIFULLY PROPORTIONED PARISH CHURCHES IN ENGLAND, BUILT IN THE 14TH CENTURY

The hot wells became fashionable in the reign of Anne (wh granted a charter in 1710), and a little later Bristol was the centr of the Methodist revival of Whitfield and Wesley. The city wa small, densely populated and dirty, with dark, narrow streets, an the mob gained notoriety for violence in the riots of 1708, 1753 1767 and 1831. At the beginning of the 19th century prosperit was diminishing, comparatively if not actually, owing to (1) th rise of Liverpool, which had more natural facilities as a por than Bristol, (2) the abolition of the slave trade, which ruine the West Indian sugar trade, and (3) the extortionate rates levied by the Bristol Dock company, incorporated in 1803. The decline was checked by the efforts of the Bristol chamber of commerce (founded in 1823) and by the Municipal Reform Act of 1835. The new corporation bought the docks in 1848 and reduced the fees.

Modern Bristol.—Bristol, with its proud traditions, retains a remarkable collection of picturesque buildings. The ecclesiastical foundations are particularly noteworthy. This the city owes mainly to a few great baronial families, such as the earls of Gloucester and the Berkeleys, in its early history, and later to the great merchants, Canynges, Shipwards and Framptons.

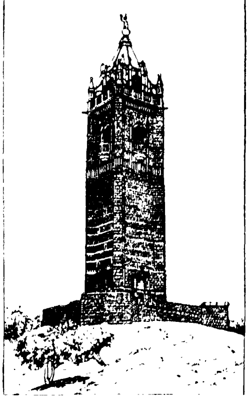
Bristol formed a special target for German air raids in World War II. Among those buildings seriously damaged or destroyed were the churches of St. Mary-le-Port (Perpendicular), the Temple church (Decorated and Perpendicular), whose leaning tower, however, escaped. St. Peter's (15th century) and St. Nicholas' (18th century), St. Peter's hospital (a gabled building mainly Jacobean, with a fine courtroom and beautiful carved timber front), the Dutch house (an early 17th century timbered building), the Merchant Venturers' almshouses (1699; the hall was destroyed), the remains of the castle, the museum, the art gallery (presented by Sir William Henry Wills and opened in 1905), and the new hall of the university.

The see of Bristol, founded by Henry VIII in 1542, was united to that of Gloucester in 1836, but again separated in 1896. The diocese covers the city, two deaneries in Gloucestershire, three in Wiltshire and a small but populous portion of Somerset. The cathedral is pleasantly situated on the south side of College Green. It was once the abbey of St. Augustine (1142) and there remain from Norman times the entrance gateway, the abbots' gateway and the chapter-house; the last mentioned among the finest of Norman chambers in Europe. On the north side of College Green is the small but beautiful Gothic St. Mark's, or the Lord Mayor's chapel. This building, restored in 1888, was founded in 1285. The long Early English nave is peculiar in standing nearly due north and south. The chantry chapel of Sir Robert Poyntz, with its fan tracery roof, is a perfect example of Tudor architecture. The chapel was purchased by the corporation from Henry VIII, and since 1722 has been devoted to the services of the mayor and corporation. Among conventual remains are the Dominican priory, St. Bartholomew's hospital, the small chapel of the Three Kings of Cologne, and Holy Trinity hospital. The following churches are noteworthy:—St. Stephen's (15th century); St. John's (15th century); St. James's (1130), which has a Norman nave and a 14th century tower; and St. Augustine the Less, which is Perpendicular. The church of St. Mary Redcliffe, for grandeur of proportion and elaboration of design and finish, is the first ecclesiastical building in Bristol, and takes high rank among the parish churches of England. It was built for the most part in the latter part of the 14th century by William Canynges (*q.v.*) or Canynge, but retains Early English work. The fine tower is Decorated but the spire, Decorated in style, is modern. The church exhibits the rare feature of transeptal aisles. Of St. Thomas's in the vicinity, only the tower (15th century) remains of the old structures. All Hallows' church is, in the main, of the 15th century, and is interesting from its connection with the ancient gild of calenders, whose office it was "to convert Jews, instruct youths," and to keep the archives of the town. Theirs was the first free library in the city, possibly in England. There are many good specimens of ancient domestic architecture—notably some arches of a grand Norman hall and some Tudor windows of Colston's house, Small street; and Canynges' house, with good Perpendicular oak roof. The public buildings are somewhat overshadowed in interest by the ecclesiastical. The council house, at the "Cross" of the four main thoroughfares, dates from 1827 and contains the city archives. The exchange (used as a corn market) is a noteworthy building by the famous architect of Bath, John Wood (1743). Edward Colston, citizen and benefactor of the city (d. 1721), is commemorated by name in several buildings and institutions, notably in Colston hall (bought by the city in 1919), used for concerts and meetings. A bank close by St. Stephen's church claims to have originated in the first savings bank established in England (1812). Similarly, the city free library (1613) is considered to be the original of its kind.

University college (1870) forms the nucleus of the University of Bristol (chartered 1909). The new buildings, designed by Sir George Oatley, and opened by King George in 1925, were the gift of Sir George Wills and Mr. H. H. Wills, as a memorial to their father, the first chancellor of the university. The Grammar school (1532), opposite the main university buildings, was enlarged in 1914. Clifton college, a modern public school, was founded in 1862. There is a technical college of the Company of Merchant Venturers (1885), where the university faculty of engineering is housed. The medical charities of Bristol are considerable in number and of various origins.

Of the open spaces in and near Bristol the most extensive are those bordering the river in the neighbourhood of the gorge, Durdham and Clifton downs (*see* CLIFTON). Others are Blaise castle (.3 sq mi.); Victoria park, south of the river; Eastville park by the Frome, N.E. of the city; St. Andrew's park to the north; and Brandon hill, west of the cathedral, an abrupt eminence commanding a fine view over the city, and crowned with a modern tower commemorating the "fourth centenary of the discovery of America by John Cabot, and sons, Lewis, Sebastian and Sanctus." But, like other places with a long history, Bristol is faced with the problem of slums. In 1919 there was an estimated shortage of 10,000 houses, but in 1919–43 well over 34,000 were built. Many slums were replaced and a large community centre was provided.

The Harbour.—Bristol harbour was formed in 1809 by the conversion of the Avon and a branch of the Frome into "the Float," by cutting a new channel for the Avon, and by the formation of two basins. Altogether, the water area, at fixed level, is about .1 sq mi. Four dry docks open into the floating harbour. In 1884 the Avonmouth and Portishead docks at the river entrance (constructed in 1877–80) were bought up by the city, and the port extends from Hanham Mills on the Avon to the mouth of the river, and for some distance down the estuary of the Severn. The city docks have a depth of 23 ft. at ordinary neap tides, while those at Avonmouth are accessible to the largest vessels. Revival of trade, rapid increase of population and enlargement of the city boundaries followed after 1884. In 1908 the Royal Edward dock at Avonmouth was opened by King Edward VII. It is entered by a lock 875 ft. long and 100 ft. wide, with a depth of water on the sill of 46 ft. at ordinary spring and 36 ft. at ordinary neap tides. The water area is about .1 sq.mi., the total area of the dock premises being 1.3 sq.mi. The length of wharfage amounts to 10,130 ft. Grain storage accommodation is provided for by three silo granaries and a transit silo granary, with a total capacity of 62,000 tons. Notable features are the Royal Edward cold stores (capacity 500,000 cu.ft.), the passenger station and the graving dock. The eastern arm extension provides six additional deepwater berths. The city docks, about seven miles up the Avon, have a water area of .1 sq mi. Portishead dock, on the Somerset shore, has an area of .03 sq.mi.



CABOT TOWER ERECTED ON BRANDON HILL, BRISTOL, IN COMMEMORATION OF JOHN CABOT AND HIS SONS

The port of Bristol has proved a convenient centre for the distribution of petroleum and its products, received in bulk from large ocean tankers. Avonmouth and Bristol are connected by the new "low-level road" which necessitated extensive blasting in the

Avon gorge. The port has a large trade with America, the West Indies and elsewhere.

Of the industries aircraft manufacturing is the most important. Between 1934 and 1938 the numbers employed in it increased from 4,000 to 14,000 and later they further increased. Other large industries are shipbuilding, chocolate factories, sugar refineries, tobacco mills, glass works, potteries, soaperies, chemical works, sawmills, breweries, ironworks and machine works. A coal field extending 16 mi. southeast to Radstock avails much for Bristol manufactures.

The parliamentary borough is divided into five divisions, each returning one member.

See W. Hunt, *Bristol*, in "Historic Towns" series (1887 and 1895); J. Latimer, *Annals of Bristol; The Little Red Book of Bristol* (1900), *Victoria County History, Gloucester;* D. Harvey, *Bristol—an historical and topographical account of the city; The Official Guide to the City of Bristol;* W. D. Bowman, *Bristol* (1927); H. A. Shannon and E. Grebenik, *The Population of Bristol* (Cambridge, 1943).

BRISTOL, a borough of Bucks county, Pa., U.S.A., on the Delaware river opposite Burlington, N.J., 20 mi. northeast of Philadelphia, and served by the Pennsylvania railroad. The population in 1920 was 10,273, of whom 2,453 were foreign-born white; and was 11,895 in 1940 federal census. Its manufactures include carpets, worsted and woollen yarns, boilers and machinery, patent leather, soap, chemicals, towels and aeroplanes. The factory product in 1937 was valued at $15,975,030. Bristol was settled soon after William Penn received his charter in 1681, and until 1725 was the seat of government of the county. It was incorporated in 1720.

BRISTOL, the shire town of Bristol county, R.I., U.S.A., 15 mi. S.E. of Providence, on a peninsula between Narragansett bay and Mount Hope bay. It is connected to the island of Rhode Island by the Mount Hope bridge. The population in 1940 was 11,159, federal census. The principal town Bristol has a deep and capacious harbour, which now has little commerce, but is used largely by yachts, and is headquarters for a fishing fleet of power boats. It is a renowned yacht-building centre, and has large manufactures of rubber and woollen goods. The manufactured products in 1940 were valued at $16,240,831. In the northeast part of the town is the Rhode Island Soldiers' home, which was established 1890.

The town is part of the land awarded to Plymouth Colony in 1676, at the close of "King Philip's War." It was incorporated by the Colony in 1681, and named after Bristol, England in anticipation of a commercial future. It became the shire town in 1685; came under the jurisdiction of Massachusetts in 1692; and in 1747 was annexed to Rhode Island. The village was bombarded by the British, Oct. 7, 1775, and partially destroyed by a British force, May 25, 1778. It has many places of historical interest and is noted for its scenic location.

BRISTOL, an urban unit on the Tennessee-Virginia (United States) boundary line, formed of two adjoining cities, one in Sullivan county, Tenn., the other in Washington county, Virginia. The state line runs through the main business street, and each city is necessarily a distinct political unit, though in other respects they are practically a single community. They are on federal highways 11 and 421 and are served by the Norfolk and Western and the Southern railways.

The combined population in 1920 was 14,776 (8,047 in Tennessee, 6,729 in Virginia), of whom 2,001 were Negroes; and in 1940, 23,772, in Tennessee 14,004, in Virginia 9,768.

Bristol is in the midst of beautiful mountain scenery, within 10 mi. of the Unaka national forest. The city has an elevation of about 1,800 ft. and neighbouring peaks range from 3,500 to 5,000 ft. above the sea. Its agricultural products are tobacco, poultry and dairy products, livestock and vegetables. Its manufactures include wood pulp and lumber, textiles, iron and steel products, pharmaceutical supplies and wood plastic aircraft. It is also an important retail centre. Among the educational institutions are Sullins college and Virginia Intermont colleges, both for women, and King college, coeducational. Bristol, Va., was known as Goodson before its incorporation as a city in 1890. It has a city-manager form of government, and is administratively independent of Washington county.

BRISTOW, BENJAMIN HELM (1832–1896), American lawyer and politician, was born in Elkton, Ky., on June 20, 1832. He graduated at Jefferson college, Cannonsburg, Pa., in 1851, studied law under his father, and was admitted to the Kentucky bar in 1853. During the Civil War he was lieutenant colonel of the 25th Kentucky infantry and helped to recruit the 8th Kentucky cavalry, of which he became lieutenant colonel and later colonel. Thereafter he was successively state senator, assistant U.S. district attorney, district attorney for the Louisville district, and the (first appointed) solicitor general of the United States. As secretary of the treasury (1874–76) he prosecuted with vigour the so-called "Whisky Ring," the headquarters of which was at St. Louis, and which, beginning in 1870 or 1871, had defrauded the federal government out of millions of dollars of its rightful revenue from the distillation of whisky. Distillers and revenue officers in various cities were implicated; and prominent among the ring's alleged accomplices at Washington was Orville E. Babcock, private secretary to President Grant, whose personal friendship for Babcock was unshaken.

Babcock was acquitted.

Through Bristow's efforts more than 200 men were indicted, a number of whom were convicted, but after some months' imprisonment pardoned.

Benjamin Bristow resigned his portfolio in June, 1876. As secretary of the treasury he advocated a resumption of specie payments and at least a partial withdrawal of "greenbacks." A prominent candidate for the Republican presidential nomination in 1876, he gave his support to Hayes when his own nomination was seen to be impossible.

After 1878 he practised law in New York city, where he died June 22, 1896.

Bibliography.—*Whiskey Frauds*, 44th Cong., 1st Sess., Mis. Doc. No. 186; John McDonald, *Secrets of the Great Whiskey Ring* (1880); David Willcox, *Memorial of Benjamin Helm Bristow* (Cambridge, Mass., 1897); E. P. Oberholtzer, *Since the Civil War* (vol. iii., 1926).

BRISTOW, a city among the oil and gas wells of Creek county, Okla., U.S.A., 82 mi. N.E. of Oklahoma City. It is on federal highway 66, state highways 16 and 56, and is served by the Frisco lines. The population in 1930 was 6,619; in 1940 it was 6,050 by the federal census. It is a supply point for the oil fields and has an oil refinery, cotton gins, cottonseed oil mills, a creamery and a peanut mill. The county ginned 24,500 bales of cotton in 1940.

Bristow was settled in 1901, incorporated as a town in 1902 and as a city of the first class in 1917.

BRITAIN, the anglicized form of the classical name of England, Wales and Scotland, sometimes extended to the British Isles as a whole (Gr. Πρετανικαί νῆσοι, Βρεττανία; Lat. *Britannia*, rarely *Brittania*). The Greek and Roman forms are doubtless attempts to reproduce a Celtic original, the exact form of which is still a matter of dispute. Brittany (Fr. *Bretagne*) in western France derived its name from Britain owing to migrations in the 5th and 6th century A.D.

In what follows, the archaeological interest of early Britain is dealt with, in connection with the history of Britain in pre-Roman, Roman, and Anglo-Saxon days; this account being supplementary to the articles England; English History; Scotland, etc.

PRE-ROMAN BRITAIN

Geologists are not yet agreed when and by whom Britain was first peopled. It used to be believed that the Palaeolithic men, who may or may not have been the earliest inhabitants, had died out or retired before their successors arrived. This view now requires modification in the light of the discovery of stray vestiges of "Mesolithic" cultures—Azilian, Tardenoisian, Maglemosian. During the Neolithic and Bronze ages we can dimly trace further immigrations. Real knowledge begins with two Celtic invasions, that of the Goidels in the later part of the Bronze age, and that of the Brythons and Belgae in the Iron age. These invaders brought Celtic civilization and dialects. It is uncertain how far they were themselves Celtic in blood and how far they were numerous enough to absorb or obliterate the races which they found in Britain. But it is not unreasonable to think that they were no mere conquering caste, and that they were of the same race as the Celtic-speaking peoples of the western continent. By the age of Julius Caesar all the inhabitants of Britain, except perhaps some tribes of the far north, were Celts in speech and customs. Politically they were divided into separate and generally warring tribes, each under its own princes. They dwelt in hill forts with walls of earth or rude stone, or in villages of round huts sunk into the ground and resembling those found in parts of northern Gaul, or in subterranean chambered houses, or in hamlets of pile-dwellings constructed among the marshes. But, at least in the south, market centres had sprung up, town life was beginning, houses of a better type were perhaps coming into use, and the southern tribes employed a gold coinage and also a currency of iron bars or ingots, attested by Caesar and by surviving examples, which weigh roughly, some ⅔ lb., some 2⅔ lb., but mostly 1⅓ lb. In religion, the chief feature was the priesthood of Druids, who here, as in Gaul, practised magical arts and barbarous rites of human sacrifice, taught a secret lore, wielded great influence, but, at all events as Druids, took ordinarily no part in politics. In art, these tribes possessed a native Late Celtic fashion, descended from far-off Mediterranean antecedents and more directly connected with the La-Tène culture of the continental Celts. Its characteristics were a flamboyant and fantastic treatment of plant and animal (though not of human) forms, a free use of the geometrical device called the "returning spiral," and much skill in enamelling. Its finest products were in bronze, but the artistic impulse spread to humbler work in wood and pottery. The late Celtic age was one which genuinely delighted in beauty of form and detail. In this it resembled the middle ages rather than the Roman empire or the present day, and it resembled them all the more in that its love of beauty, like theirs, was mixed with a feeling for the fantastic and the grotesque. The Roman conquest of northern Gaul (57–50 B.C.) brought Britain into definite relation with the Mediterranean. It was already closely connected with Gaul, and when Roman civilization and its products invaded Gallia Belgica, they passed on easily to Britain. The British coinage now begins to bear Latin legends, and after Caesar's two raids (55, 54 B.C.) the southern tribes were regarded at Rome, though they do not seem to have regarded themselves, as vassals. Actual conquest was, however, delayed. Augustus planned it. But both he and his successor Tiberius realized that the greater need was to consolidate the existing empire, and absorb the vast additions recently made to it by Pompey, Caesar and Augustus.

ROMAN BRITAIN

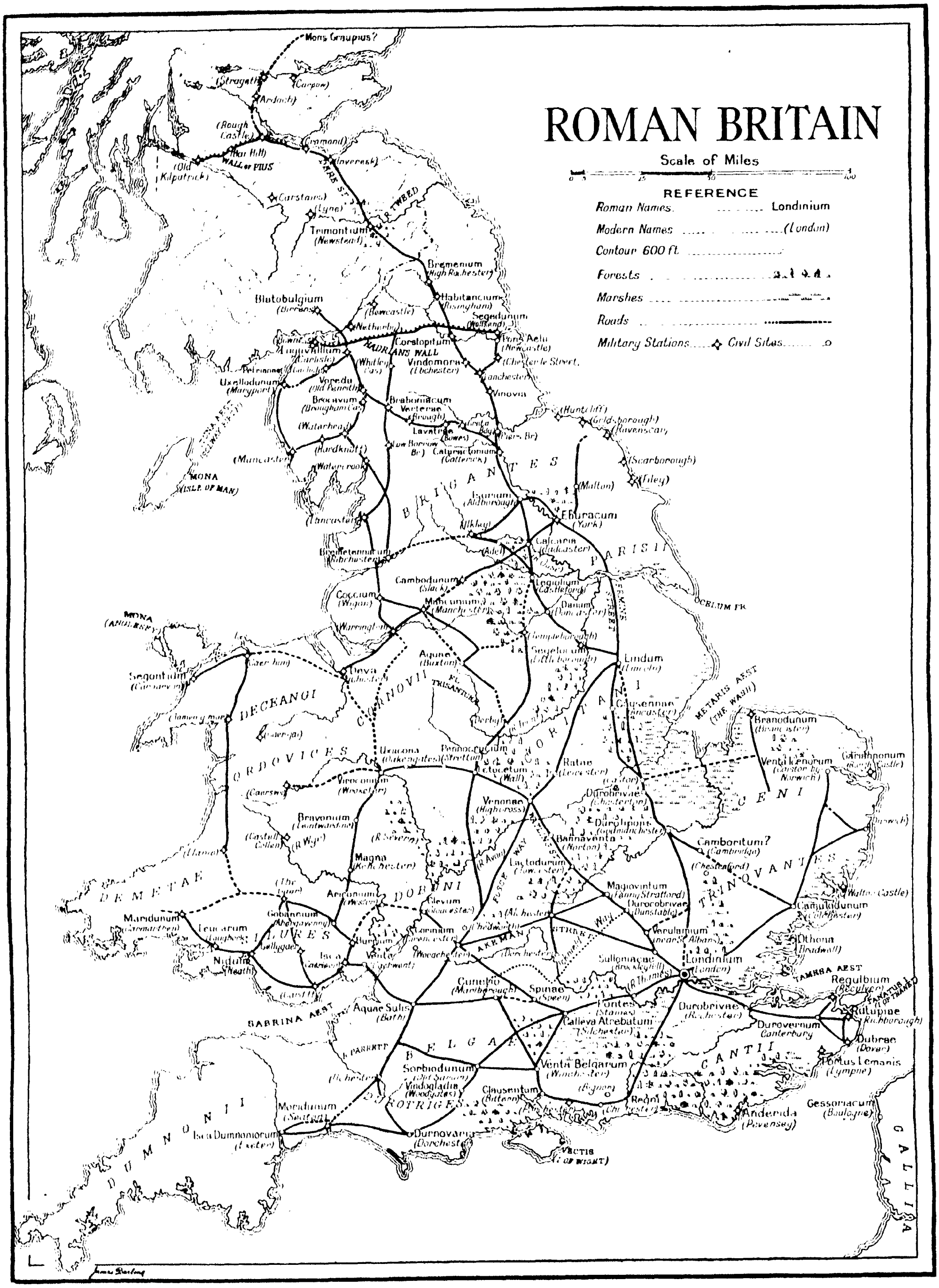
I. The Roman Conquest.—The conquest of Britain was undertaken by Claudius in A.D. 43. Two causes coincided to produce the step. On the one hand a forward policy then ruled at Rome, leading to annexations in various lands. On the other hand, a probably philo-Roman prince, Cunobelin (known to literature as Cymbeline), had just been succeeded by two sons, Caratăcus (*q.v.*) and Togodumnus, who were hostile to Rome. Caligula, the half-insane predecessor of Claudius, had made in respect to this event some blunder which we know only through a sensational exaggeration, but which doubtless had to be retrieved. An immediate reason for action was the appeal of a fugitive British prince, presumably a Roman partisan and victim of Cunobelin's sons. So Aulus Plautius with a singularly well equipped army of some 40,000 men landed in Kent and advanced on London. Here Claudius himself appeared—the one reigning emperor of the 1st century who crossed the waves of ocean—and the army, crossing the Thames, moved forward through Essex and captured the native capital, Camulodūnum, now Colchester. From the base of London and Colchester three corps continued the conquest. The left wing, the Second Legion (under Vespasian, afterwards emperor), subdued the south; the centre, the Fourteenth and Twentieth Legions, subdued the midlands, while the right wing, the Ninth Legion, advanced through the eastern part of the island. This strategy was at first triumphant. The lowlands of Britain, with their partly Romanized and partly scanty population and their easy physical features, presented no obstacle. Within three or four years everything south of the Humber and east of the Severn had been either directly annexed or entrusted, as protectorates, to native client-princes.

A more difficult task remained. The wild hills and wilder tribes of Wales and Yorkshire offered far fiercer resistance. There followed 30 years of intermittent hill fighting (A.D. 47–79). The precise details of the struggle are not known. Legionary fortresses were established at Wroxeter (for a time only), Caerleon (perhaps not till near the close of the period) and Chester, facing the Welsh hills, and at Lincoln in the north-east. The method of conquest was the erection and maintenance of small detached forts in strategic positions, each garrisoned by 500 or 1,000 men, and it was accompanied by a full share of those disasters which vigorous barbarians always inflict on civilized invaders. Progress was delayed too by the great revolt of Boadicea (*q.v.*) and a large part of the nominally conquered lowlands. Her rising was soon crushed, but the government was obviously afraid for a while to move its garrisons forward. Indeed, other needs of the empire caused the withdrawal of the Fourteenth Legion about 67. But the decade A.D. 70–80 was decisive. A series of three able generals commanded an army restored to its proper strength by the addition of Legio II. Adiutrix, and achieved the final subjugation of Wales and the first conquest of Yorkshire, where a legionary fortress at York was substituted for that at Lincoln.

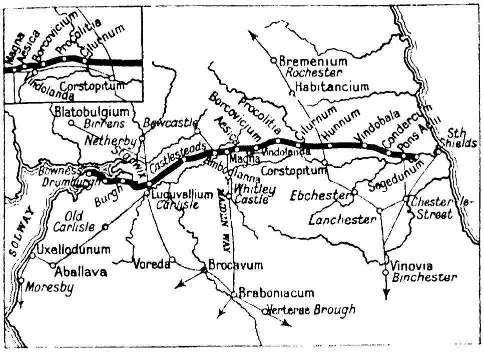
The third and best-known, if not the ablest, of these generals, Iulius Agricola, moved on in A.D. 79 or 80 to the conquest of the farther north. He built forts in Cumberland, constructed a road (the Stanegate) from Carlisle to Corbridge, and pushed on across Cheviot into Scotland, where he established between the Clyde and Forth a temporary frontier, guarded by a line of posts, the most certainly identifiable of which is that at Bar hill. Presently he advanced into Caledonia and won a "famous victory" at Mons Graupius (sometimes, but incorrectly, spelt Grampius), the site of which is doubtful, though it has given to the world the modern name of the Grampian hills. He dreamt even of invading Ireland, and thought it an easy task. The home government judged otherwise. Jealous possibly of a too brilliant general, certainly averse from costly and fruitless campaigns and needing the Legio II. Adiutrix for work elsewhere, it recalled both governor and legion, while it still endeavoured to cling to the ground that had been won (*see* CALEDONIA).

Precisely what happened after Agricola's departure, no one can tell. For 30 years (A.D. 85–115) the military history of Britain is little better than a blank; though we know that it was troubled. When the mists clear, we are in an altered world. About 115 or 120 the northern Britons rose in revolt and destroyed the Ninth Legion, posted at York, which would bear the brunt of any northern rebellions. The land beyond Cheviot was lost. In 122 the second reigning emperor who crossed the ocean, Hadrian, came himself to Britain, brought the Sixth Legion to replace the Ninth, and introduced the frontier policy of his age. For over 70m. from Tyne to Solway, more exactly from Wallsend to Bowness, he built a continuous rampart, with a ditch in front of it, a number of small forts along it, one or two outposts a few miles to the north of it, and some detached forts (the best-known is on the hill above Maryport) guarding the Cumberland coast beyond its western end; to move all these it must have been necessary to reduce the garrisons further south. The details of Hadrian's work are imperfectly known, for though many remains survive, it is hard to disentangle them. But that he has the best title to be regarded as the builder of the wall is proved alike by literature and by inscriptions. The meaning of the scheme is equally certain. It was to be, as it were, a Chinese wall, marking the definite limit of the Roman world. It was now declared, not by the secret resolutions of cabinets, but by the work of the spade marking the solid earth for ever, that the era of conquest was ended.

But empires move, though rulers bid them stand still. Whether the land beyond Hadrian's wall became temptingly peaceful or


ROMAN BRITAIN
Scale of Miles
0 5 25 50 100
REFERENCE
Roman Names .... Londinium
Modern Names .... (London)
Contour 600 ft. ....
Forests ....
Marshes ....
Roads ....
Military Stations .... Civil Sites ....
Mons Graupius?
(Stragath)
(Carpow)
(Ardoch)
(Rough Castle)
(Cramond)
(Bar Hill)
(Old Kilpatrick)
WALL of PIUS
(Inveresk)
(Carstairs)
(Lyne)
R. TWEED
Trimontium (Newstead)
Bremenium (High Rochester)
Habitancium (Risingham)
Blatobulgium (Birrens)
(Bewcastle)
(Netherby)
Segedunum (Wallsend)
Pons Aelii (Newcastle)
(Bowness)
Luguvallium (Carlisle)
Corstopitum
HADRIAN'S WALL
Vindomora (Ebchester)
Petrianae
(Whitley Cas)
(Chester le Street)
(Lanchester)
Uxellodunum (Maryport)
Voreda (Old Penrith)
Vinovia
Brocavum (Brougham Cas)
Brabonicacum
Verterae (Brough)
(Huntcliff)
(Goldsborough)
(Ravenscar)
(Watercrook)
Lavatrae (Bowes)
Greta Bdg
(Piers Br)
(Hardknott)
(Low Borrow Br)
Cataractonium (Catterick)
(Scarborough)
(Muncaster)
(Watercrook)
(Filey)
MONA (ISLE OF MAN)
B R I G A N T E S
(Malton)
Isurium (Aldborough)
Eburacum (York)
(Lancaster)
(Ilkley)
Bremetennacum (Ribchester)
(Adel)
Calcaria (Tadcaster)
P A R I S I I
(R Ouse)
Cambodunum (Slack)
Legiolium (Castleford)
OCELUM PR
Coccium (Wigan)
Mancunium (Manchester)
Danum (Doncaster)
ERMINE STREET
MONA (ANGLESEY)
(Warrington)
(Templeborough)
Aquae (Buxton)
Segelocum (Littleborough)
Lindum (Lincoln)
Segontium (Carnarvon)
(Caer hun)
Deva (Chester)
FL TRISANTONA
METARIS AEST (THE WASH)
C O R N O V I I
D E C E A N G I
(Tomen y mur)
(Derby)
Causennae (Ancaster)
Branodunum (Brancaster)
(Caer gai)
C O R I T A N I
Uriconium (Wroxeter)
Uxacona (Oakengates)
Pennocrucium (Stretton)
Letocetum (Wall)
Ratae (Leicester)
Venta Icenorum (Caistor by Norwich)
Gariannonum (Burgh Castle)
O R D O V I C E S
(Castor)
(Caersws)
Viroconium (Wroxeter)
Durobrivae (Chesterton)
I C E N I
Venonae (Highcross)
Bravonium (Leintwardine)
Durolipons (Godmanchester)
(Dunwich)
(Castell Collen)
(R Wye)
(R Severn)
(R Avon)
Bannaventa (Norton)
Camboritum? (Cambridge)
(Llanio)
Magna (Kenchester)
Lactodurum (Towcester)
(Chesterford)
T R I N O V A N T E S
D E M E T A E
(The Gaer)
Ariconium (Weston)
D O B U N I
Glevum (Gloucester)
FOSSE WAY
Magiovintum (Fenny Stratford)
Durocobrivae (Dunstable)
(Walton Castle)
Camulodunum (Colchester)
Maridunum (Carmarthen)
Gobannium (Abergavenny)
(Alchester)
(Chedworth)
Verulamium (near St Albans)
Leucarum (Loughor)
S I L U R E S
Burrium (Usk)
Corinium (Cirencester)
AKEMAN STREET
(Dorchester)
Icknield Way
Othona (Bradwell)
Nidum (Neath)
(Gelligaer)
Isca (Caerleon)
Venta (Caerwent)
(Woodchester)
Sulloniacae (Brockley Hill)
Londinium (London)
TAMESA AEST
(Cardiff)
(R Thames)
Regulbium (Reculver)
TANATUS I (I OF THANET)
Cunetio (Marlborough)
Spinae (Speen)
SABRINA AEST
Aquae Sulis (Bath)
Pontes (Staines)
Durobrivae (Rochester)
Rutupiae (Richborough)
Calleva Atrebatum (Silchester)
Durovernum Canterbury
Dubrae (Dover)
B E L G A E
R PARRETT
Portus Lemanis (Lympne)
C A N T I I
(Ilchester)
Sorbiodunum (Old Sarum)
Venta Belgarum (Winchester)
Vindogladia (Woodyates)
Clausentum (Bitterne)
(Bignor)
Regni (Chichester)
Gessoriacum (Boulogne)
D U R O T R I G E S
(Porchester)
Anderida (Pevensey)
D U M N O N I I
Moridunum (Seaton)
Isca Dumnoniorum (Exeter)
Durnovaria (Dorchester)
VECTIS (I OF WIGHT)
G A L L I A
James Darling

remained in vexing disorder, our authorities do not say. We know only that about 142 Hadrian's successor, Antoninus Pius, acting through his general Lollius Urbicus, advanced from the Tyne and Solway frontier to the narrower isthmus between Forth and Clyde, 36m. across, which Agricola had fortified before him. Here he reared a continuous rampart with a ditch in front—fair-sized forts, probably 19 in number, built, as a rule, so as to abut directly upon it—and a connecting road running from end to end. An ancient writer states that the rampart was made of regularly laid sods. Excavation has proved that this is true so far as the greater part of it is concerned, but that for 10m. at the eastern end the body of the structure consisted largely of clay. The work still survives visibly, though in varying preservation, except in the agricultural districts near its two ends. Occasionally, as or Croyhill (near Kilsyth), at Seabegs wood, and in the covers of Bonnyside (3m. west of Falkirk), wall and ditch and even road can be distinctly traced, while the sites of many of the forts are plain to practised eyes. Six of these forts have been excavated. All show the ordinary features of Roman *castella*, though they differ more than one would expect in forts built at one time by one general. In every case the barrack-rooms were of wood, and the headquarters buildings, the storehouses and the baths of stone. In size the enclosures range from just over one acre to just under seven. Nor was the character of the defences uniform. Balmuildy and Castlecary were walled with stone, whereas the ramparts of old Kilpatrick, Bar hill, and Rough castle were of sods, those of Mumrills of clay. Rough castle is remarkable for the astonishing strength of its ramparts and ravelins, as well as for a series of defensive pits, reminiscent of Caesar's *lilia* at Alesia, but which may belong to an earlier Agricolan fort. They were plainly intended to break an enemy's charge, and were either provided with stakes to impale the assailant or covered over with hurdles or the like to deceive him. Besides the 10 forts on the wall, one or two outposts seem to have been held at Ardoch and elsewhere along the natural route which runs by Stirling and Perth to the lowlands of the east coast.



FROM "SOCIAL ENGLAND" (CASSELL & CO.)

FIG. 1.—HADRIAN'S WALL, THE NORTHERN BOUNDARY OF ROMAN BRITAIN, BUILT BY THE EMPEROR HADRIAN, c. A.D. 122. IT WAS 70M IN LENGTH, EXTENDING FROM THE TYNE, ON THE NORTH SEA, TO SOLWAY FIRTH, ON THE IRISH SEA

The new frontier was reached from the south by two roads. One, known in mediaeval times as Dere street and misnamed Watling street by modern antiquaries, ran from Corbridge on the Tyne past Otterburn, crossed Cheviot near Makendon camps, and passed by an important fort at Newstead near Melrose, and others at Inveresk and Cramond (outside of Edinburgh), to the eastern end of the wall. The second starting from Carlisle, ran to Birrens, a Roman fort near Ecclefechan, and thence, by a line not yet explored and indeed not at all certain, to Carstairs and the west end of the wall. A fort at Lyne near Peebles suggests the existence of an intermediate link between them. There is nothing to indicate that the erection of the wall of Pius meant the abandonment of the wall of Hadrian. Rather, both barriers were held together, and the district between them was regarded as a military area, outside the range of civilization. The advance, however, entailed a heavy demand on the man-power available, and it is not surprising to find that just at this time many of the forts in Wales were dismantled, that part of the island being now completely subdued.

The work of Pius brought no long peace. Sixteen years later disorder broke out in north Britain, apparently in the district between the Cheviots and the Derbyshire hills, and was repressed with difficulty after four or five years' fighting. Eighteen or 20 years later still (180–185) another war broke out with a different issue. The Romans were driven south of Cheviot, and perhaps even farther. The government of Commodus, feeble in itself and vexed by many troubles, could not repair the loss, and the civil wars which soon raged in Europe (193–197) gave the Caledonians further chance. It was not till 208 that Septimius Severus could turn his attention to the island. He came thither in person, conducted a punitive expedition into Caledonia, set himself to consolidate the position once more, and then, in the fourth year of his operations, died at York. Amid much that is uncertain and even legendary about his work in Britain, this is plain, that he fixed on the line of Hadrian's wall as his substantive frontier. His successors, Caracalla and Severus Alexander (211–235), accepted the position, and many inscriptions refer to building or rebuilding executed by them for the greater efficiency of the frontier defences. The conquest of Britain was at last over. The wall of Hadrian remained for nearly 200 years more the northern limit of Roman power in the extreme west.

II. The Province of Britain and its Military System.—Geographically, Britain consists of two parts: (1) the comparatively flat lowlands of the south, east and midlands, suitable for agriculture and open to easy intercourse with the continent, *i.e.*, with the rest of the Roman empire; (2) the district consisting of the hills of Devon and Cornwall, of Wales and of northern England, regions lying more, and often very much more, than 1000ft. above the sea, scarred with gorges and deep valleys, mountainous in character, difficult for armies to traverse, ill fitted for peaceful pursuits. These two parts of the province differ also in their history. The lowlands, as we have seen, were conquered easily and quickly. The uplands were hardly subdued completely till the end of the 2nd century. They differ, thirdly, in the character of their Roman occupation. The lowlands were the scene of civil life. Towns, villages and country houses were their prominent features; troops were hardly seen in them save in some fortresses on the edge of the hills and in a chain of forts built in the 4th century to defend the south and south-east coast, the so-called Saxon shore. The uplands of Wales and the north presented another spectacle. Here civil life was almost wholly absent. No country town or country house has been found more than 20m. north of York or west of Monmouthshire. The hills were one extensive military frontier, covered with forts and strategic roads connecting them, and devoid of town life, country houses, farms or peaceful civilized industry. This geographical division was not reproduced by Rome in any administrative partition of the province. At first the whole was governed by one *legatus Augusti* of consular standing. Septimius Severus made it two provinces, superior and inferior, the former of which included Caerleon and Chester, the latter Lincoln, York,

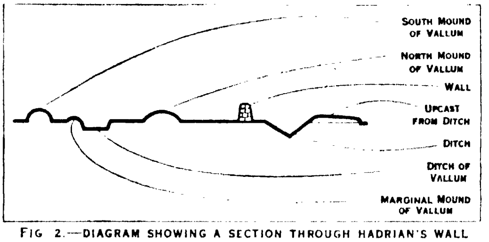


FIG. 2.—DIAGRAM SHOWING A SECTION THROUGH HADRIAN'S WALL

and apparently Hadrian's wall, but we do not know how long this arrangement lasted. In the 4th century there were five provinces, Britannia Prima and Secunda, Flavia and Maxima Caesariensis and (for a while) Valentia, ruled by *praesides* and *consulares* under a *vicarius*, but the only thing known of them is that Britannia Prima included Cirencester.

The army which guarded or coerced the province consisted, from the time of Hadrian onwards, of (1) three legions, the Second at Isca Silurum (Caerleon, *q.v.*), the Sixth at Eburācum (*q.v.*; now York), the Twentieth at Deva (*q.v.*; now Chester), a total of some 15,000 heavy infantry; and (2) a large but uncertain number of auxiliaries, troops of the second grade, organized in infantry cohorts or cavalry *alae*, each 500 or 1,000 strong and posted in *castella* nearer the frontiers than the legions. The legionary fortresses were large rectangular enclosures of 50 or 60 acres, surrounded by strong walls of which traces can still be seen in the lower courses of the north and east town-walls of Chester, in the abbey gardens and elsewhere at York, and on the south side of Caerleon. The auxiliary castella were likewise square or oblong in shape but were hardly a tenth of the size, varying generally from three to six acres according to the size of the regiment and the need for stabling. Of these about 100 are known. The internal arrangements follow one general plan, but in some cases the buildings within the walls are all of stone, while in others, principally (it seems) forts built before 150, wood is used freely and only the few principal buildings seem to have been constructed throughout of stone. Chief among these latter, and in the centre of the whole fort, was the headquarters, in Lat. *Principia* or *Praetorium*. This was a rectangular structure with only one entrance which gave access, first, to a small cloistered court, then to a second open court, and finally to a row of three, five, or even seven rooms containing the shrine for official worship, the treasury and other offices. Close by were officers' quarters, generally built round a tiny cloistered court, and substantially constructed storehouses with buttresses and dry basements. These filled the middle third of the fort. At the two ends were barracks for the soldiers. No space was allotted to private religion or domestic life. The shrines which voluntary worshippers might visit, the public bath-house (as a rule), and the cottages of the soldiers' wives, camp followers, etc., lay outside the walls. Such were nearly all the Roman forts in Britain. They differ somewhat from Roman forts in Germany or other provinces, though most of the differences arise from the different usage of wood and of stone in various places.

Forts of this kind were dotted all along the military roads of the Welsh and northern hill-districts. In Wales a road ran from Chester past a fort at Caer-hun (near Conway) to a fort at Carnarvon (Segontium). A similar road ran along the south coast from Caerleon-on-Usk past a fort at Cardiff and perhaps others to Carmarthen and beyond. A third, roughly parallel to the shore of Cardigan bay, with forts at Llanio, Pennal, Tomen-y-mur (near Festiniog), and Caer Llugwy, connected the northern and southern roads, while the interior was held by a system of roads and forts not yet fully understood but discernible at such points as Caer-gai on Bala lake, Caersws, Castell Collen near Llandrindod Wells, the Gaer near Brecon, Merthyr and Gellygaer. In the north of Britain we find three principal roads. One led due north from York past forts at Catterick bridge, Piercebridge, Binchester, Lanchester, Ebchester to the wall and to Scotland, while branches through Chester-le-Street reached the Tyne bridge (Pons Aelius) at Newcastle and the Tyne mouth at South Shields. A second road, turning north-west from Catterick bridge, mounted the Pennine chain by way of forts at Rokeby, Bowes and Brough-under-Stainmoor, descended into the Eden valley, where it joined the third route, reaching Hadrian's wall near Carlisle (Luguvallium) by way of Old Penrith (Voreda), and running on to Birrens. The third route, starting from Chester and passing up the western coast, is more complex, and exists in duplicate, the result perhaps of two different schemes of road-making. Forts in plenty can be detected along it, notably Manchester (Mancunium or Mamucium), Ribchester (Bremetennacum), Brougham castle (Brocavum), and on a western branch, Watercrook near Kendal, Waterhead near the hotel of that name on Ambleside, Hardknott above Eskdale, Ravenglass (probably Clanoventa), Maryport (Uxellodūnum), and Old Carlisle (possibly Petrianae). In addition, two or three cross roads, not yet sufficiently explored, maintained communication between the troops in Yorkshire and those in Cheshire and Lancashire. This road system bears plain marks of having been made at different times, and with different objectives, but we have no evidence that any one part was abandoned when any other was built. In general, however, it is clear that at no period were all the Roman forts in Britain simultaneously occupied. Garrisons were moved elsewhere as the country round them grew quieter. Thus, Gellygaer in South Wales and Hardknott in Cumberland have yielded nothing later than the opening of the 2nd century. On the other hand, forts which had been abandoned might be restored if circumstances changed. Thus, in Wales some of those which had been dismantled under Pius, were rebuilt by Severus, notably Segontium.

Besides these detached forts and their connecting roads, the north of Britain was defended by Hadrian's wall (figs. 1 and 2). The history of this wall has been given above. The actual works are threefold. First, there is that which to-day forms the most striking feature of the whole, the wall of stone 6–8ft. thick, and originally perhaps 14ft. high or a little higher, with a deep ditch in front, and forts (17 at very irregular intervals) and "mile castles" and turrets (both much more regularly spaced) and a connecting road behind it. On the high moors between Chollerford and Gilsland its traces are still plain, as it climbs from hill to hill and winds along perilous precipices. Secondly, there is, to the south of the wall, the so-called "Vallum," in reality no *vallum* at all, but a broad flat-bottomed ditch out of which the earth has been cast up on either side into regular and continuous mounds that resemble ramparts. Thirdly, to the west of Birdoswald fort there were discovered in 1895 the remains of a previously unknown wall, constructed of sods laid in regular courses, with a ditch in front. This turf wall can be traced for 1¾m., running roughly parallel to the stone wall, with the line of which its ends ultimately coincide. It is certainly older than the other and, as our ancient writers mention two wall-builders, Hadrian and Septimius Severus, it was at first inferred that Hadrian built his wall of turf and Severus reconstructed it in stone. Recent excavation has shown this attractive theory to be untenable by proving, first, that even in the section where both walls appear, the mile castles and turrets on the stone wall are of Hadrianic date and, second, that the ditch of the turf wall was deliberately filled up after it had been open for only a brief period.

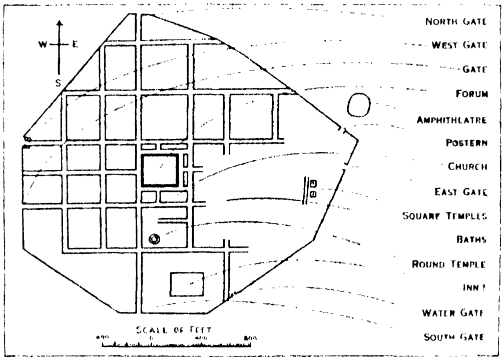
The meaning of the *vallum* has been much discussed. John Hodgson and Bruce, the local authorities of the 10th century, supposed that it was erected to defend the wall from southern insurgents. Others have ascribed it to Agricola, or have thought it to be the wall of Hadrian, or even assigned it to pre-Roman natives. It is now clear that it is a Roman work, no older than Hadrian, and that it was not intended, like the wall, for military defence, but merely as a line of civil or legal delimitation. It is undoubtedly not earlier than certain of the forts, since it swings to the south to avoid them, and at some time in its history it was branched by having a series of causeways laid across it, at intervals which seldom exceed 40 or 50 yards. Certain of the forts, on the other hand, are undoubtedly earlier than the stone wall, since this is built either wholly or partially over the north ends of their east and west ditches. Further, in at least two instances (Birdoswald and Chesters) the fort was practically doubled in size before the stone wall was erected. These *data* have suggested to the excavators the following provisional hypothesis as to the sequence of events, all of them compressed into a space of about seven years—(*a*) establishment of a line of small forts, with or without the *vallum*; (*b*) enlargement of some of the forts, and construction of the *vallum*, if not already in existence; (*c*) breaching of the *vallum*, and building of the stone wall as a link between the forts. The hypothesis accounts for many of the phenomena, but leaves others unexplained, notably (1) the turf wall and (2) a stone foundation 11ft. wide discovered in 1925, running for a mile west of the fort of Aesica (Great Chesters) immediately in front of the stone wall, beneath which it finally disappears. Much spade-work remains to be done before a completely satisfactory solution is in sight.

III. The Civilization of Roman Britain.—Behind these formidable garrisons, sheltered from barbarians and in easy contact with the Roman empire, stretched the lowlands of southern and eastern Britain. Here a civilized life grew up, and Roman culture spread. This part of Britain became Romanized. In the lands looking on to the Thames estuary (Kent, Essex, Middlesex) the process had perhaps begun before the Roman conquest. It was continued after that event, and in two ways. To some extent it was definitely encouraged by the Roman government, which here, as elsewhere, founded towns peopled with Roman citizens —generally discharged legionaries—and endowed them with franchise and constitution like those of the Italian municipalities. It developed still more by its own automatic growth. The coherent civilization of the Romans was accepted by the Britons, as it was by the Gauls, with something like enthusiasm. Encouraged perhaps by sympathetic Romans, spurred on still more by their own instincts, and led no doubt by their nobles, they began to speak Latin, to use the material resources of Roman civilized life, and in time to consider themselves not the unwilling subjects of a foreign empire, but the British members of the Roman state. The steps by which these results were reached can to some extent be dated. Within a few years of the Claudian invasion a *colonia*, or municipality of time-expired soldiers, had been planted in the old native capital of Colchester (Camulodunum), and, though it served at first mainly as a fortress and thus provoked British hatred, it soon came to exercise a civilizing influence. At the same time the British town of Verulamium (St. Albans) was thought sufficiently Romanized to deserve the municipal status of a *municipium*, which at this period differed little from that of a *colonia*. London became important. Romanized Britons must now have begun to be numerous. In the great revolt of Boadicea (61) the nationalist party seems to have massacred many thousands of them along with actual Romans. Fifteen or 20 years later, the movement increases. Towns spring up, such as Silchester, laid out in Roman fashion, furnished with public buildings of Roman type, and filled with houses which are Roman in fittings if not in plan. The baths of Bath (Aquae Sulis) are exploited. Another *colonia* is planted at Lincoln (Lindum), and a third at Gloucester (Glevum) in 96. A new "chief judge" is appointed for increasing civil business. The tax-gatherer and recruiting officer begin to make their way into the hills. During the 2nd century progress was perhaps slower, hindered doubtless by the repeated risings in the north. It was not till the 3rd century that country houses and farms became common in most parts of the civilized area. In the beginning of the 4th century the skilled artisans and builders, and the cloth and corn of Britain were equally famous on the continent. This probably was the age when the prosperity and Romanization of the province reached its height. By this time the town populations and the educated among the country-folk spoke Latin, and Britain regarded itself as a Roman land, inhabited by Romans and distinct from outer barbarism.

The civilization which had thus spread over half the island was genuinely Roman, identical in kind with that of the other western provinces of the empire, and in particular with that of northern Gaul. But it was defective in quantity. The elements which compose it are marked by smaller size, less wealth and less splendour than the same elements elsewhere. It was also uneven in its distribution. Large tracts, in particular Warwickshire and the adjoining midlands, were very thinly inhabited. Even densely peopled areas like north Kent, the Sussex coast, west Gloucestershire and east Somerset, immediately adjoin areas like the Weald of Kent and Sussex where Romano-British remains hardly occur.

The administration of the civilized part of the province, while subject to the governor of all Britain, was practically entrusted to local authorities. Each Roman municipality ruled itself and a territory, perhaps as large as a small county, which belonged to it. Some districts formed part of the Imperial domains, and were administered by agents of the emperor. The rest, by far the larger portion of the country, was divided up among the old native tribes or cantons, some ten or 12 in number, each grouped round some country town where its council (*ordo*) met for cantonal business. This cantonal system closely resembles that which we find in Gaul. It is an old native element recast in Roman form, and well illustrates the Roman principle of local government by devolution.

In the general framework of Romano-British life the two chief features were the town, and the *villa*. Apart from Luguvallium (Carlisle) and Corstopitum (Corbridge upon Tyne), which lay within the military area and were really of the nature of "bazaars" (as it were) for the soldiers of the frontier garrison, the towns of the province, as we have already implied, fall into two classes. Five modern cities, Colchester, Lincoln, York, Gloucester and St. Albans, stand on the sites, and in some fragmentary fashion bear the names of five Roman municipalities founded by the Roman government with special charters and constitutions. All of these reached a considerable measure of prosperity. None of them rivals the greater municipalities of other provinces. Besides them we trace a larger number of country towns, varying much in size, but all possessing in some degree the characteristics of a town. The chief of these seem to be cantonal capitals, probably developed out of the market centres or capitals of the Celtic tribes before the Roman conquest. Such are Isurium Brigantum (Aldborough), capital of the Brigantes, 12m. north-west of York and the most northerly Romano-British town; Ratae, now Leicester, capital of the Coritani; Viroconium, now Wroxeter, near Shrewsbury, capital of the Cornovii, Venta Silurum, now Caerwent, near Chepstow; Corinium, now Cirencester, capital of the Dobuni; Isca Dumnoniorum, now Exeter, the most westerly of these towns; Durnovaria, now Dorchester, in Dorset, capital of the Durotriges; Venta Belgarum, now Winchester; Calleva Atrebatum, now Silchester, 10m. south of Reading; Durovernum Cantiacorum, now Canterbury; and Venta Icenorum, now Caistor-by-Norwich. Besides these country towns, Londinium (London) was a rich and important trading town, as the remarkable objects discovered in it abundantly prove, centre of the road system, and the seat of the finance officials of the province, while Aquae Sulis (Bath) was a spa provided with splendid baths, and a richly adorned temple of the native patron deity, Sul or Sulis, whom the Romans called Minerva. Many smaller places, too, for example, Magnae or Kenchester near Hereford, Durobrivae or Rochester in Kent, another Durobrivae near Peterborough, a site of uncertain name near Cambridge, another of uncertain name near Chesterford, exhibited some measure of town life. London, one of the larger cities of the western empire, may well have had a character of its own, but direct evidence as to this is unfortunately lacking. Of the other towns we can form a good general idea through the excavations that have been carried out



GENERAL PLAN OF SILCHESTER (CALLEVA ATREBATUM)
Despite its irregular outline, Silchester furnishes a good example
chess-board system of planning introduced into the West by the Rom
had received it from the East, through the expedition of Alexander th

at Silchester, Caerwent and Wroxeter. Public life centred round the forum and the adjoining basilica. Here the local authorities had their offices, justice was administered, traders trafficked, citizens and idlers gathered. In fig. 3, though we cannot apportion the rooms to their precise uses, the great hall was plainly the basilica, for meetings and business; the rooms behind it were perhaps law courts, and some of the rooms on the other three sides of the quadrangle may have been shops. The temples might be either square or round, and at Silchester there was a small Christian church of the so-called "basilican" type, of which many examples have been found in other countries, especially in Roman Africa. A suite of public baths was always a prominent feature, and outside the walls there was usually an amphitheatre. The private houses were of two types. They consisted either of a row of rooms, with a corridor along them, and perhaps one or two additional rooms at one or both ends, or of three such corridors and rows of rooms, forming three sides of a large square open yard. They were detached houses, standing each in its own garden, and not forming terraces or rows. They differ widely from the town houses of Rome and Pompeii; they are less unlike some of the country houses of Italy and Roman Africa, but their real parallels occur in Gaul, and they may be Celtic types modified to Roman use—like Indian bungalows. Their internal fittings—hypocausts, frescoes, mosaics—are everywhere Roman. The largest Silchester house, with a special annex for baths, is usually taken to be a guest-house or inn for travellers between London and the west.

The streets vary in width. The intersect regularly at right angles, dividing the town into square blocks, like modern Mannheim or Turin, according to a Roman system usual in both Italy and the provinces, and derived ultimately from Babylon and the East through Alexander the Great and his successors. The walls are often later than the streets, having been erected when the peace of the province began to be seriously threatened by barbarian inroads. The inference suggested by the appearance of the chess-board system of town-planning is confirmed by the testimony of the numberless small objects recovered in the course of the excavations—coins, pottery, window and bottle and cup glass, bronze ornaments, iron tools, etc. Few of these are individually notable. Traces of late Celtic art are singularly absent; Roman fashions rule supreme, and inscriptions show that even the lower classes here spoke and wrote Latin. Outside the walls there are but slight traces of inhabitation, a fact which is significant of the economic position of the towns of Roman Britain. We may conclude that these towns were thoroughly Romanized, peopled with Roman-speaking citizens, furnished with Roman appurtenances, living in Roman ways, but not very large, not very rich, a humble witness to the assimilating power of the Roman civilization.

The country, as opposed to the towns, of Roman Britain seems to have been divided into estates, commonly (though perhaps incorrectly) known as "villas." Many examples survive, some of them large and luxurious country-houses, some mere farms, constructed usually on one of the two patterns described in the account of the towns above. The inhabitants were plainly as various—a few of them great nobles and wealthy landowners, others small farmers or possibly bailiffs. Some of these estates were worked on the true "villa" system, by which the lord occupied the "great house," and cultivated the land close round it by slaves, while he let the rest to half-free *coloni*. But other systems may have prevailed as well. Among the most important country houses are those of Bignor in west Sussex, and Woodchester and Chedworth in Gloucestershire. At the other extreme were the villages, whose remains can be detected in the Thames valley and elsewhere, and which housed the humbler members of the population.

The wealth of the country was principally agrarian, and the needs of the army of occupation must have helped to stimulate production. Wheat and wool were exported in the 4th century, when as we have said Britain was especially prosperous. But the details of the trade are unrecorded. More is known of the lead and iron mines which, at least in the first two centuries, were worked in many districts—lead (from which silver was extracted) in Somerset, Shropshire, Flintshire and Derbyshire; iron in the west Sussex Weald, the Forest of Dean, and (to a slight extent) elsewhere. Other minerals were less notable. The gold mentioned by Tacitus proved scanty, although there seem to be clear indications of Roman gold-mining in Wales. The Cornish tin, according to present evidence, was worked comparatively little, and perhaps most in the later Empire.

Lastly, the roads. Here we must put aside all idea of "four great roads." That category is probably the invention of antiquaries, and certainly unconnected with Roman Britain (*see* ERMINE STREET). Instead, we may distinguish four main groups of roads radiating from London, and a fifth which runs obliquely. One road ran south-east to Canterbury and the Kentish ports, of which Richborough (Rutupiae) was the most frequented. A second ran west to Silchester, and thence by various branches to Winchester, Exeter, Bath, Gloucester and South Wales. A third, known afterwards to the English as Watling street, ran by St. Albans wall and near Lichfield (Lectocetum) to Wroxeter and Chester. It also gave access by a branch to Leicester and Lincoln. A fourth served Colchester, the eastern counties, Lincoln and York. The fifth is that known to the English as the Fosse, which joins Lincoln and Leicester with Cirencester, Bath and Exeter. Besides these five groups, an obscure road, called by the Saxons Akeman Street, gave alternative access from London through Alchester (outside of Bicester) to Bath, while another obscure road winds south from near Sheffield, past Derby and Birmingham, and connects the lower Severn with the Humber. By these roads and their various branches the Romans provided adequate communications throughout the lowlands of Britain.

IV. The End of Roman Britain.—About 286 Carausius, admiral of the "Classis Britannica," quarrelled with the central government and proclaimed himself emperor. He remained in control of the island until 293, when he was murdered by one of his own officers, Allectus, who essayed to succeed him. By this time, however, the authorities at Rome had resolved on reconquest. An expedition under the personal command of the future emperor, Constantius Chlorus, successfully evaded the waiting ships of Allectus, and the usurper was slain in a land-battle. Extensive changes in the distribution of the garrison seem to have followed. Danger threatened, not only from the Picts beyond Hadrian's wall, but also from the sea. It may have been now that Caerleon was evacuated and the Second Legion sent elsewhere. At all events a special coast defence, reaching from the Wash to Spithead, was established against Saxon pirates: there were forts at Brancaster, Burgh Castle (near Yarmouth), Walton (near Felixstowe), Bradwell (at the mouth of the Colne and Blackwater), Reculver, Richborough, Dover and Lympne (all in Kent), Pevensey in Sussex, and Porchester near Portsmouth. The Irish (Scoti), too, were becoming increasingly aggressive. It is, therefore, not surprising that a new fort should have been erected at Cardiff and perhaps one on the Isle of Wight. For a time these measures were effective and the province prospered. But after about 350 the barbarian assaults became more frequent and more terrible. The building of a series of stone watch-towers along the Yorkshire coast, from the Tees to Flamborough head, is very significant.

At the end of the century Magnus Maximus, claiming to be emperor, withdrew many troops from Britain and a later pretender did the same. Early in the 5th century the Teutonic conquest of Gaul cut the island off from Rome. This does not mean that there was any great "departure of the Romans." The central government simply ceased to send the usual governors and high officers. The Romano-British were left to themselves. Their position was weak. Their fortresses lay in the north and west, while the Saxons attacked the east and south. Their trained troops, and even their own numbers, must have been few. It is intelligible that they followed a precedent set by Rome in that age, and hired Saxons to repel Saxons. But they could not command the fidelity of their mercenaries, and the Saxon peril only grew greater. It would seem as if the Romano-Britons were speedily driven from the east of the island, and as if the Saxons, though apparently unable to gain a hold on the western uplands, were able to prevent the natives from recovering the lowlands. Thus driven from the centres of Romanized life, from the region of walled cities and civilized houses, into the hills of Wales and the north-west, the provincials underwent an intelligible change. The Celtic element, never quite extinct in those hills and, like most forms of barbarism, reasserting itself in this wild age—not without reinforcement from Ireland—challenged the remnants of Roman civilization and in the end absorbed them. The Celtic language reappeared; the Celtic art emerged from its shelters in the west to develop in new and mediaeval fashions.

ANCIENT AUTHORITIES.—The principal references to early Britain in classical writers occur in Strabo, Diodorus, Julius Caesar, the elder Pliny, Tacitus, Ptolemy, Cassius Dio and Ammianus Marcellinus, and in the lists of the Antonine Itinerary (probably about A.D. 210–230; ed. Parthey, 1848), the *Notitia Dignitatum* (about A.D. 400; ed. Seeck, 1876), and the Ravennas (7th century *réchauffé*; ed. Parthey 1860). The chief passages are printed in Petrie's *Monumenta Hist. Britann.* (1848), and (alphabetically) in Holder's *Altceltischer Sprachschatz* (1896–1908). The Roman inscriptions have been collected in *Corpus Inscriptionum Latin.* vii. (1873), and in the periodical *Ephemeris epigraphica* (iii., iv., vii. and particularly ix.)

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(*b*) For late Celtic art: J. M. Kemble and A. W. Franks, *Horae Ferales* (1863); Arthur J. Evans in *Archaeologia*, vols. lii., lv.

(*c*) For Roman Britain *see*, in general, Prof. F. Haverfield, *The Romanization of Roman Britain* (1923), *The Roman Occupation of Britain* (1924), the latter containing a bibliography of the author's own writings, as well as references to all earlier works of importance; *Archaeologia*, and the Excavation Reports of the Society of Antiquaries of London, *Journal of Roman Studies*, which prints an annual survey of Romano British research, with list of new books and articles; *Arch. Aeliana* and *Trans. of the Cumberland and Westmorland Antiq. Soc.*, both indispensable for Hadrian's Wall and its forts; *Arch. Cambrensis* and the Cymmrodorim Society's publications, for reports on Welsh excavations; for Scotland, *see* CALEDONIA; *see* also, for all three countries, the reports of the respective Royal Commissions on Ancient and Historical Monuments. (F. J. H.; G. M.)

ANGLO-SAXON BRITAIN

History.—The history of Britain after the withdrawal of the Roman troops is extremely obscure, but there can be little doubt that for many years the inhabitants were exposed to devastating raids by the Picts and Scots. According to Gildas it was for protection against these incursions that the Britons decided to call in the Saxons. Their allies soon obtained a decisive victory, but subsequently turned their arms against the Britons themselves, alleging that they had not received sufficient payment for their services. A different account, probably of English origin, may be traced in the *Historia Brittonum*, according to which the first leaders of the Saxons, Hengest and Horsa, came as exiles, seeking the protection of the British king, Vortigern. Having embraced his service they quickly expelled the northern invaders. Eventually, however, they overcame the Britons through treachery, by inducing the king to allow them to send for large bodies of their own countrymen. It was to these adventurers, according to tradition, that the kingdom of Kent owed its origin. The story is in itself by no means improbable, while the dates assigned to the first invasion by various Welsh, Gaulish, and English authorities, with one exception, all fall within about a quarter of a century, viz., between the year 428 and the joint reign of Martian and Valentinian III. (450–455).

For the subsequent course of the invasion the information is most meagre and unsatisfactory. According to the Anglo-Saxon Chronicle the kingdom of Sussex was founded by a certain Ella or Aelle, who landed in 477, while Wessex owed its origin to Cerdic, who arrived some 18 years later. No value, however, can be attached to these dates; indeed, in the latter case the story itself is open to suspicion (*see* WESSEX). For the movements which led to the foundation of the more northern kingdoms we have no evidence worth consideration, nor do we know even approximately when they took place. But the view that the invasion was effected throughout by small bodies of adventurers acting independently of one another, and that each of Angli (*q.v.*) The peculiarities of social organization in Kent certainly tend to show that this kingdom had a different origin from the rest; but the evidence for the distinction between the Saxons and the Angli is much less satisfactory (*see* ANGLO-SAXONS). The royal family of Essex may have been of Saxon origin (*see* ESSEX), but on the other hand the West Saxon royal family claimed to be of the same stock as that of Bernicia, and their connections in the past seem to have lain with the Angli.

There is no doubt that the first invasion was followed by a long period of warfare between the natives and the invaders, in which the latter gradually strengthened their hold on the conquered territories. It is probable that by the end of the 5th century all the eastern part of Britain, at least as far as the Humber, was in their hands. The first important check was received at the siege of "Mons Badonicus" in the year 517 (*Ann. Cambr.*), or perhaps rather some 15 or 20 years earlier. According to Gildas this event was followed by a period of peace for at least 44 years. In the latter part of the 6th century, however, the territories occupied by the invaders seem to have been greatly extended. In the south the West Saxons are said to have conquered first Wiltshire and then all the upper part of the Thames valley, together with the country beyond as far as the Severn. The northern frontier also seems to have been pushed considerably farther forward, perhaps into what is now Scotland, and it is probable that the basin of the Trent, together with the central districts between the Trent and the Thames, was conquered about the same time, though of this there is no record. Again, the destruction of Chester about 615 was soon followed by the overthrow of the British kingdom of Elmet in south-west Yorkshire, and the occupation of Shropshire and the Lothians took place perhaps about the same period, that of Herefordshire probably somewhat later. In the south, Somerset is said to have been conquered by the West Saxons shortly after the middle of the 7th century. Dorset had probably been acquired by them before that time, while part of Devon seems to have come into their hands soon afterwards.

The area thus conquered was occupied by a number of separate kingdoms, each with a royal family of its own. The districts north of the Humber contained two kingdoms, Bernicia and Deira (*q.v.*), which were eventually united in Northumbria. South of the Humber, Lindsey seems to have had a dynasty of its own, though in historical times it was apparently always subject to the kings of Northumbria or Mercia. The upper basin of the Trent formed the nucleus of the kingdom of Mercia (*q.v.*), while farther down the east coast was the kingdom of East Anglia (*q.v.*). Between these two lay a territory called Middle Anglia, sometimes described as a kingdom, though whether it ever had a separate dynasty is not known. Essex, Kent, and Sussex (*see* articles on these kingdoms) preserve the names of ancient kingdoms, while the old diocese of Worcester grew out of the kingdom of the Hwicce (*q.v.*), with which it probably coincided in area. The south of England, between Sussex and "West Wales" (eventually reduced to Cornwall), was occupied by Wessex, which originally also possessed some territory to the north of the Thames. Lastly, even the Isle of Wight appears to have had a dynasty of its own. But these kingdoms were not always, or even normally, independent. When history begins, Aethelberht, king of Kent, was supreme over all the kings south of the Humber.

Government.—Internally the various states seem to have been organized on very similar lines. In every case we find kingly government from the time of the earliest records, and the institution certainly goes back to a date anterior to the invasion of Britain (*see* OFFA; WERMUND). The royal title, however, was frequently borne by more than one person. Sometimes we find one supreme king with a number of under-kings (*subreguli*); sometimes, especially in the smaller kingdoms, Essex, Sussex, and Hwicce, two or more kings, generally brothers, reign together apparently on equal terms. For most of the 8th century Kent seems to have been divided into two kingdoms; but as a rule such divisions did not last beyond the lifetime of the kings who made the arrangement. The kings were, with very rare exceptions, chosen from one particular family in each state, the ancestry of which was traced back not only to the founder of the kingdom but, in a remoter degree, to a god. The members of such families were entitled to special wergilds, apparently six times as great as those of the higher class of nobles (*see* below).

The only other central authority in the state was the king's council or court (*theod, witan, concilium*). This body was made up partly of young warriors in constant attendance on the king, and partly of senior officials whom he called together from time to time. The terms used for the two classes by Bede are *milites* (*ministri*) and *comites*, for which the Anglo-Saxon version has *thegnas* and *gesithas* respectively. Both classes consisted in part of members of the royal family. But they were not confined to such persons or even to born subjects of the king. Indeed, we are told that popular kings like Oswine attracted young nobles to their service from all quarters. The functions of the council have been much discussed, and it has been claimed that they had the right of electing and deposing kings. This view, however, seems to postulate a greater feeling for constitutionalism than is warranted by the information at our disposal. The incidents which have been brought forward as evidence may with equal probability be interpreted as cases of profession or transference of personal allegiance. In other respects the functions of the council seem to have been deliberative. It was customary for the king to seek their advice and moral support on important questions, but there is nothing to show that he had to abide by the opinion of the majority.

For administrative purposes, each kingdom was divided into a number of districts under the charge of royal reeves (*cyninges gerefa, praefectus, praepositus*). These officials seem to have been located in royal villages (*cyninges tun, villa regalis*) or fortresses (*cyninges burg, urbs regis*), which served as centres and meeting-places (markets, etc.) for the inhabitants of the district, and to which their dues, both in payments and services, had to be rendered. The usual size of such districts in early times seems to have been 300, 600, or 1,200 hides. Much larger divisions containing 2,000, 3,000, 5,000, or 7,000 hides are also mentioned. To this category belong the shires of Wessex (Hampshire, Wiltshire, Berkshire, etc.), each of which had an earl (*aldormon, princeps, dux*) of its own, at all events from the 8th century onwards. Many, if not all, of these persons were members of the royal family, and it is not unlikely that they originally bore the kingly title. At all events they are sometimes described as *subreguli*.

Social Organization.—The officials mentioned above, whether of royal birth or not, were probably drawn from the king's personal retinue. In Anglo-Saxon society, as in that of all Teutonic nations in early times, the two most important principles were those of kinship and personal allegiance. If a man suffered injury it was to his relations and his lord, rather than to any public official, that he applied first for protection and redress. If he was slain, a fixed sum (*wergild*), varying according to his station, had to be paid to his relations, while a further but smaller sum (*manbot*) was due to his lord. These principles applied to all classes of society, and though strife within the family was by no means unknown, at all events in royal families, the actual slaying of a kinsman was regarded as the most heinous of all offences. Much the same feeling applied to the slaying of a lord—an offence for which no compensation could be rendered. How far the armed followers of a lord were entitled to compensation when the latter was slain is uncertain, but in the case of a king they received an amount equal to the wergild. Another important development of the principle of allegiance is to be found in the custom of heriots. In later times this custom amounted practically to a system of death-duties, payable in horses and arms or in money to the lord of the deceased. There can be little doubt, however, that originally it was a restoration to the lord of the military outfit with which he had presented his man when he entered his service. The institution of thegnhood, *i.e.*, membership of the *comitatus* or retinue of a prince, offered the only opening by which public life could be entered. Hence it was probably adopted almost universally by young men of the highest classes. The thegn was expected to fight for his lord, and generally to place his services at his disposal in both war and peace. The lord, on the other hand, had to keep his thegns and reward them from time to time with arms and treasure.

The structure of society in England was of a somewhat peculiar type. In addition to slaves, who in early times seem to have been numerous, there were in Wessex and apparently also in Mercia three classes, described as *twelfhynde*, *sixhynde*, and *twihynde* from the amount of their wergilds, viz., 1,200, 600, and 200 shillings respectively. It is probable that similar classes existed also in Northumbria, though not under the same names. Besides these terms there were others which were probably in use everywhere, viz., *gesithcund* for the two higher classes and *ceorlisc* for the lowest. Indeed, these terms occur even in Kent, though the social system of that kingdom seems to have been essentially different. Here the wergild of the *ceorlisc* class amounted to 100 shillings, each containing 20 silver coins (*sceattas*), as against 200 shillings of four (in Wessex five) silver coins. Again, there was apparently but one *gesithcund* class in Kent, with a wergild of 300 shillings, while, on the other hand, below the *ceorlisc* class there were three classes of persons described as *laetas*, who probably corresponded to the *liti* or freedmen of the Continental laws, and possessed wergilds of 80, 60, and 40 shillings respectively. To these no analogy is found in the other kingdoms, though the poorer classes of Welsh freemen had wergilds varying from 120 to 60 shillings. This differential treatment of the various classes was not confined to the case of wergilds. It appears also in the compensations to which they were entitled for various injuries, in the fines to which they were liable, and in the value attached to their oaths. Generally, though not always, the proportions observed were the same as in the wergilds.

The nature of the distinction between the *gesithcund* and *ceorlisc* classes is nowhere clearly explained; but it was certainly hereditary and probably of considerable antiquity. We may perhaps define them as nobles and commons, though in view of the numbers of the higher classes it would probably be more correct to speak of gentry and peasants. The distinction between the *twelfhynde* and *sixhynde* classes was also in part at least hereditary, but there is good reason for believing that it arose out of the possession of land. The former consisted of persons who possessed, whether as individuals or families, at least five hides of land—which practically means a village—while the latter were landless, *i.e.*, probably without this amount of land. Within the *ceorlisc* class we find similar subdivisions, though they were not marked by a difference in wergild. The *gafolgelda* or *tributarius* (tribute-payer) seems to have been a ceorl who possessed at least a hide, while the *gebur* was without land of his own and received his outfit as a loan from his lord.

Payments and Services.—Reference has already been made to the dues rendered by different classes of the population, which the reeves in royal villages had to collect and superintend. The payments seem to have varied greatly according to the class from which they were due. Those rendered by landowners seem to have been known as *feorm* or *fostor*, and consisted of a fixed quantity of articles paid in kind. In Ine's Laws (cap. 70) there is a list of payments specified for a unit of ten hides, perhaps the normal holding of a *twelfhynde* man— though it may be nothing more than a mere fiscal unit in an aggregate of estates. The list consists of oxen, sheep, geese, hens, honey, ale, loaves, cheese, butter, fodder, salmon, and eels. Very similar specifications are found elsewhere. The payments rendered by the *gafolgelda* (*tributarius*) were known as *gafol* (*tributum*), as his name implies. Ine's Laws refer only to the *hwitel* or white cloak, which was to be of the value of sixpence per household (hide), and to barley, which was to be six pounds in weight for each worker. In later times many other payments occur both in money and in kind, some of which were doubtless in accordance with ancient custom. On the other hand the *gebur* seems not to have been liable to payments of this kind, presumably because the land which he cultivated formed part of the demesne (*inland*) of his lord. The term *gafol*, however, may have been applied to the payments which he rendered to the latter.

The services required of landowners were very manifold in character. Probably the most important were military service (*fird, expeditio*) and the repairing of fortifications and bridges. In addition to these we find reference in charters of the 9th century to the keeping of the king's hunters, horses, dogs, and hawks, and the entertaining of messengers and other persons in the king's service.

The duties of men of the *sixhynde* class, if they are to be identified with the *radcnihtas (radmanni)* of later times, probably consisted chiefly in riding on the king's (or their lord's) business. The services of the peasantry can only be conjectured from the custom of later times. Presumably their chief duty was to undertake a share in the cultivation of the demesne land. No doubt also the labour of repairing fortifications and bridges, though it was charged against the landowners, was in reality delegated by them to their dependents.

Warfare.—All classes are said to have been liable to the duty of military service. Hence, since the ceorls doubtless formed the bulk of the population, it has been thought that the Anglo-Saxon armies of early times were essentially peasant forces. The available evidence, however, gives little justification for such a view. The regulation that every five or six hides should supply a warrior was not a product of the Danish invasions, as is sometimes stated, but goes back at least to the beginning of the 9th century. Had the fighting material been drawn from the *ceorlisc* class a warrior would surely have been required from each hide, but for military service no such regulation is found. Again, the fird (*fyrd*) was composed of mounted warriors during the 9th century, though apparently they fought on foot, and there are indications that such was the case also in the 7th century. No doubt ceorls took part in military expeditions, but they may have gone as attendants and camp-followers rather than as warriors, their chief business being to make stockades and bridges, and especially to carry provisions. The serious fighting, however, was probably left to the *gesithcund* classes, who possessed horses and more or less effective weapons. Indeed, there is good reason for regarding these classes as essentially military.

The chief weapons were the sword and spear. The former were two-edged and on the average about 3ft. long. The hilts were often elaborately ornamented and sometimes these weapons were of considerable value. No definite line can be drawn between the spear proper and the javelin. The spear-heads which have been found in graves vary considerably in both form and size. Bows and arrows were certainly in use for sporting purposes, but there is no reason for believing that they were much used in warfare before the Danish invasions. They are very seldom met with in graves. The most common article of defensive armour was the shield, which was small and circular and apparently of quite thin lime-wood, the edge being formed probably by a thin band of iron. In the centre of the shield, in order to protect the hand which held it, was a strong iron boss, some 7in. in diameter and projecting about 3in. It is clear from literary evidence that the helmet (*helm*) and coat of chain mail (*byrne*) were also in common use. They are seldom found in graves, however, whether owing to the custom of heriots or to the fact that, on account of their relatively high value, they were frequently handed on from generation to generation as heirlooms. Greaves are not often mentioned. In later times the heriot of an "ordinary thegn" (*medema thegn*)—by which is meant, apparently not a king's thegn but a man of the *twelfhynde* class—consisted of his horse with its saddle, etc., and his arms, or two pounds of silver as an equivalent of the whole. The arms required were probably a sword, helmet, coat of mail and one or two spears and shields. There are distinct indications that a similar outfit was fairly common in Ine's time, and that its value was much the same. One would scarcely be justified, however, in supposing that it was anything like universal; for the purchasing power of such a sum was at that time considerable, representing as it did about 16–20 oxen or 100–120 sheep. It would hardly be safe to credit men of the *sixhynde* class in general with more than a horse, spear, and shield.

Agriculture and Village Life.—There is no doubt that a fairly advanced system of agriculture must have been known to the Anglo-Saxons before they settled in Britain. This is made clear above all by the representation of a plough drawn by two oxen in one of the very ancient rock-carvings at Tegneby in Bohuslän. In Domesday Book the heavy plough with eight oxen seems to be universal, and it can be traced back in Kent to the beginning of the 9th century. In this kingdom the system of agricultural terminology was based on it. The unit was the *sulung* (*aratrum*) or ploughland (from *sulh*, "plough"), the fourth part of which was the *geocled* or *geoc* (*jugum*), originally a yoke of oxen. An analogy is supplied by the *carucata* of the Danelagh, the eighth part of which was the *bovata* or "ox-land." In the 10th century the *sulung* seems to have been identified with the hide, but in earlier times it contained apparently two hides. The hide itself, which was the regular unit in the other kingdoms, usually contained 120ac. in later times and was divided into four *girda* (*virgitae*) or yardlands. But originally it seems to have meant simply the land pertaining to a household, and its area in early times is quite uncertain, though probably far less. For the acre also there was in later times a standard length and breadth, the former being called *furhlang* (furlong) and reckoned at one-eighth of a mile, while the *aecerbraedu* or "acre-breadth" (chain) was also a definite measure.

The husbandry was of a co-operative character. In the 11th century it was distinctly unusual for a peasant to possess a whole team of his own, and there is no reason for supposing the case to have been otherwise in early times; for though the peasant might then hold a hide, the hide itself was doubtless smaller and not commensurate with the ploughland. The holdings were probably not compact but consisted of scattered strips in common fields, changed perhaps from year to year, the choice being determined by lot or otherwise. For the method of cultivation there is little or no evidence. Both the "two-course system" and the "three-course system" may have been in use; but it is quite possible that in many cases the same ground was not sown more than once in three years. The prevalence of the co-operative principle was doubtless due in large measure to the fact that the greater part of England, especially towards the east, was settled not in scattered farms or hamlets but in compact villages with the cultivated lands lying around them.

The mill was another element which tended to promote the same principle. There can be little doubt that before the Anglo-Saxons came to Britain they possessed no instrument for grinding corn except the quern (*cweorn*), and in remote districts this continued in use until quite late times. The grinding seems to have been performed chiefly by female slaves, but occasionally we hear also of a donkey-mill (*esolcweorn*). The mill proper, however, which was derived from the Romans, as its name (*mylen*, from Lat. *molina*) indicates, must have come into use fairly early. In the 11th century every village of any size seems to have possessed one, while the earliest references go back to the 8th century. It is not unlikely that they were in use during the Roman occupation of Britain, and consequently that they became known to the invaders almost from the first. The mills were presumably driven for the most part by water, though there is a reference to a windmill as early as the year 833.

All the ordinary domestic animals were known. Cattle and sheep were pastured on the common lands appertaining to the village, while pigs, which (especially in Kent) seem to have been very numerous, were kept in the woods. Bee-keeping was also practised. In all these matters the invasion of Britain had brought about no change. The cultivation of fruit and vegetables on the other hand was probably almost entirely new. The names are almost all derived from Latin, though most of them seem to have been known soon after the invasion, at all events by the 7th century.

The question how far the villages were really new settlements is difficult to answer, for the terminations *-ham*, *-ton*, etc., cannot be regarded as conclusive evidence. Thus, according to the Anglo-Saxon Chronicle (ann. 571), Bensington and Eynsham were formerly British villages. Even if the first part of Egonesham is English—which is by no means certain—it is hardly sufficient reason for discrediting this statement, for Canterbury (*Cantwaraburg*) and Rochester (*Hrofes ceaster*) were without doubt Roman places in spite of their English names. On the whole it seems likely that the cultivation of the land was not generally interrupted for more than a very few years; hence the convenience of utilizing existing sites of villages would be obvious, even if the buildings themselves had been burnt.

Towns.—Most of the cities of Roman Britain were situated within the territories eventually occupied by the invaders, and re-appear as towns in later times. Their history in the intervening period is wrapped in obscurity. Chester appears to have been deserted for three centuries after its destruction early in the 7th century, and in most of the other cases there are features observable in the situation and plan of the mediaeval town which suggest that its occupation had not been continuous. Yet London and Canterbury must have recovered a certain amount of importance quite early, at all events within two centuries after the invasion, and the same is probably true of York, Lincoln, and a few other places. The term applied to both the cities and the fortresses of the Romans was *ceaster* [Lat. *castra*], less frequently the English word *burg*. There is little or no evidence for the existence of towns other than Roman in early times, for the word *urbs* is merely a translation of *burg*, which was used for any fortified dwelling place, and it is improbable that anything which could properly be called a town was known to the invaders before their arrival in Britain. The Danish settlements at the end of the 9th century and the defensive system initiated by King Alfred gave birth to a new series of fortified towns, from which the boroughs of the middle ages are mainly descended.

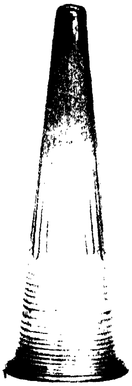
Houses.—Since houses were built entirely of perishable materials, wood and wattle, we are necessarily dependent almost wholly upon literary evidence for knowledge of this subject. Stone seems to have been used first for churches, but this was not before the 7th century, and we are told that at first masons were imported from Gaul. Indeed wood was used for many churches, as well as for most secular buildings, until a much later period. The walls were formed either of stout planks, laid together vertically or horizontally, or of posts at a short distance from one another, the interstices being filled up with wattlework daubed with clay. It is likely that the houses of wealthy persons were distinguished by ornamentation in carving and painting. The roof was high-pitched and covered with straw, hay, reeds, or tiles. The regular form of the buildings was rectangular, the gable sides probably being shorter than the others. There is little evidence of partitions inside, and in wealthy establishments the place of rooms seems to have been supplied by separate buildings within the same enclosure. The windows must have been mere openings in the walls or roof, for glass was not used for this purpose before the latter part of the 7th century. Stoves were known, but most commonly heat was obtained from an open fire in the centre of the building. Of the various buildings in a wealthy establishment the chief were the hall (*heall*), which was both a dining and reception room, and the "lady's bower" (*brydbur*), which served also as a bedroom for the master and mistress. To these must be added buildings for the attendants, kitchen, bakehouse, etc., and farm buildings. There is little or no evidence of the use of two-storeyed houses in early times, though in the 10th and 11th centuries they were common. The whole group of buildings stood in an enclosure (*tun*) surrounded by a stockade (*burg*), which perhaps rested on an earthwork, though this is disputed. Similarly the homestead of the peasant was surrounded by a fence (*edor*).

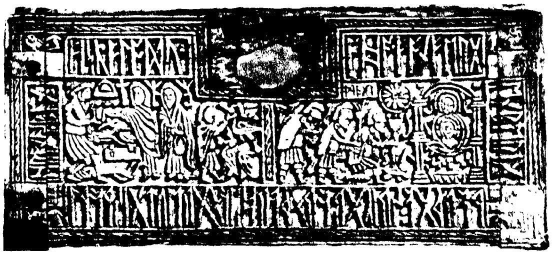
Clothes.—The chief material for clothing was at first no doubt wool, though linen must also have been used and later became fairly common. The chief garments were the coat (*roc*), the trousers (*brec*), and the cloak, for which there seem to have been a number of names (*hacele, sciccing, pad, hwitel*). To these we may add the hat (*haet*), belt (*gyrdel*), stockings (*hosa*), shoes (*scoh, rifeling*), and gloves (*glof*). The *crusene* was a fur coat, while the *serc* or *smoc* seems to have been an undergarment, probably sleeveless. The whole attire was of national origin and had probably been in use long before the invasion of Britain. In the great bog-deposit at Thorsbjaerg in Angel, which dates from about the 4th century, there were found a coat with long sleeves, a pair of long trousers with remains of socks attached, several shoes and portions of square cloaks, one of which had obviously been dyed green. The dress of the upper classes must have been somewhat gorgeous, especially when account is taken of the brooches and other ornaments which they wore. According to Jordanes the Swedes in the 6th century were splendidly dressed.

Trade.—The few notices of this subject which occur in the early laws seem to refer primarily to cattle-dealing. But there can be no doubt that a considerable import and export trade with the Continent had sprung up quite early. In Bede's time, if not before, London was resorted to by many merchants both by land and by sea. At first the chief export trade was probably in slaves. English slaves were to be obtained in Rome even before the end of the 6th century, as appears from the well-known story of Gregory the Great. Since the standard price of slaves on the Continent was in general three or four times as great as it was in England, the trade must have been very profitable. After the adoption of Christianity it was gradually prohibited by the laws. The nature of the imports during the heathen period may be learned chiefly from the graves, which contain many brooches and other ornaments of Continental origin, and also a certain number of silver, bronze and glass vessels. With the introduction of Christianity the ecclesiastical connection between England and the Continent brought about a large increase in the imports of secular as well as religious objects, and the frequency of pilgrimages by persons of high rank must have had the same effect. The use of silk (*seoluc*) and the adoption of the mancus (*see* below) point to communication, direct or indirect, with more distant countries. In the 8th century we hear frequently of tolls on merchant ships at various ports, especially London.

Coinage.—The earliest coins which can be identified with certainty are some silver pieces which bear in Runic letters the name of the Mercian king Aethelred (675–704). There are others, however, of the same type and standard (about 21 grains) which may be attributed with probability to his father Penda (d. 655). But it is clear from the laws of Aethelberht that a regular silver coinage was in use at least half a century earlier, and it is not unlikely that many unidentified coins may go back to the 6th century. These are fairly numerous and are either without inscriptions or, if they do bear letters at all, they seem to be mere corruptions of Roman legends. Their designs are derived from Roman or Frankish coins, especially the former, and their weight varies from about 10 to 21 grains, though the very light coins are rare. Anonymous gold coins, resembling Frankish trientes in type and standard (21 grains), are also fairly common, though they must have passed out of use very early, as the laws give no hint of their existence. Larger gold coins (solidi) are very rare. In the early laws the money actually in use appears to have been entirely silver. In Offa's time a new gold coin, the *mancus*, resembling in standard the Roman solidus (about 70 grains), was introduced from Mohammedan countries. The oldest extant specimen bears a faithfully copied Arabic inscription. In the same reign the silver coins underwent a considerable change in type, being made larger and thinner, while from this time onwards they always bore the name of the king (or queen or archbishop) for whom they were issued. The design and execution also became remarkably good. Their weight was at first unaffected, but probably towards the close of Offa's reign it was raised to about 23 grains, at which standard it seems to have remained, nominally at least, until the time of Alfred. It is to be observed that, with the exception of Burgred's coins and a few anonymous pieces, the silver was never adulterated. No bronze coins were current except in Northumbria, where they were extremely common in the 9th century.

Originally *scilling* ("shilling") and *sceatt* seem to have been the terms for gold and silver coins respectively. By the time of

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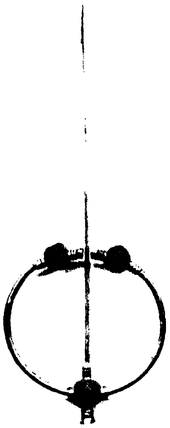
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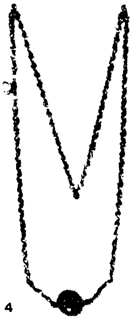
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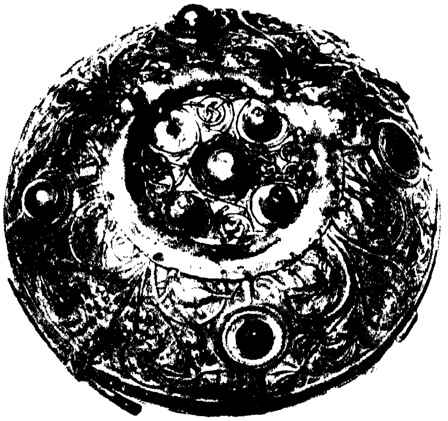
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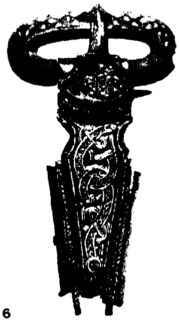
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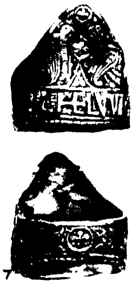
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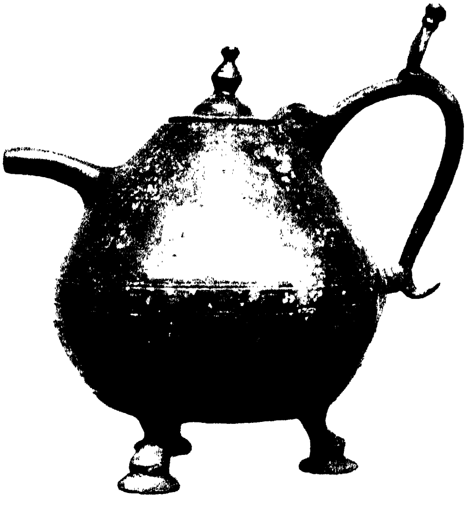
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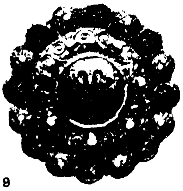
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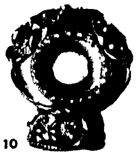
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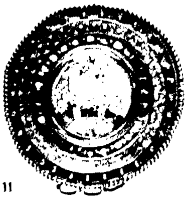
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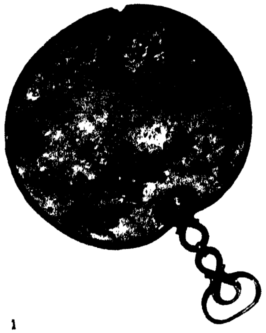
JEWELLERY AND METAL CRAFTSMANSHIP OF EARLY BRITAIN

1. Glass drinking horn found at Kempston, Bedfordshire. 2. The Franks casket of whale's bone, about 8th century. 3. Silver penannular brooch, about 10th century, found in Cumberland. 4. Gold neck-chain, probably 2nd century, found near Backworth, Northumberland. 5. Embossed Anglian bowl, found in Ormeside, Westmorland, England. 6. Gold ornament, found in Knight's Field, Faversham, Kent. 7. The ring of Aethelwulf, father of Alfred the Great. Front and back views. 8. Frankish bronze ewer, probably 7th century, found at Wheathampstead. 9, 11. Anglo-Saxon gold brooches, designed in enamel and precious stones. 10. Gold staff head, from Cairnmuir, Peebleshire, Scotland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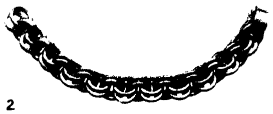
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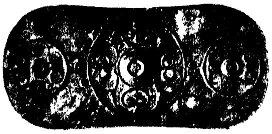
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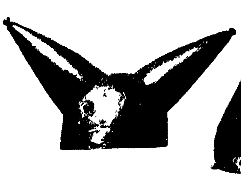
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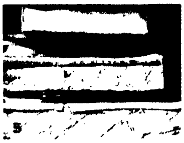
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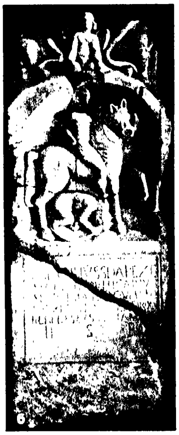
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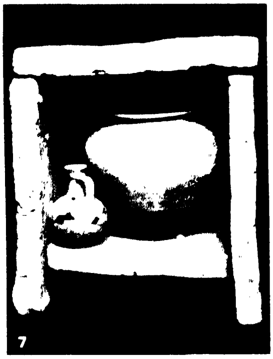
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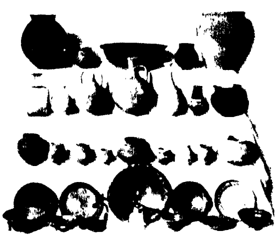

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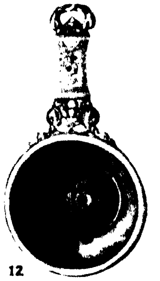
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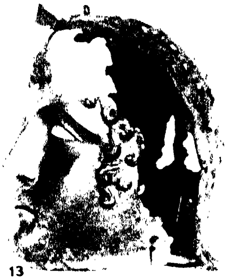
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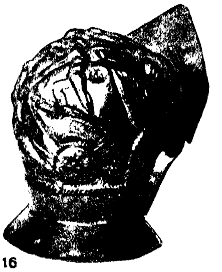
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ARCHAEOLOGICAL SPECIMENS OF ANCIENT BRITISH ART

1. Bronze mirror, found at Desborough, Northamptonshire, probably 1st century. Decorative curves and basket-pattern filling are late Celtic. 2. Silver chain found at Crawfordjohn, Lanarkshire, dating probably from the period of Celtic Christianity. The chain is 18 in. long and on the penannular link, at the end, are incised symbols. 3. Bronze shield, ornamented in red enamel, found in the Thames, near Battersea, London. It is an example of late Celtic decoration. 4. Celtic helmets of bronze (early period). Left, helmet with enamelled ornaments found in the Thames near Waterloo bridge, London. Right, helmet found in a chariot-burial at Gorgo-Meillet, Somme Tourbe, Marne. 5. Leaden coffins. These specimens are now in the Colchester Museum. 6. Tombstone of Roman cavalry soldier, Colchester. The inscription reads "Longinus, son of Sdapezmatucus duplicarius of the First Regiment of Thracian Cavalry; from the district of Sardica; aged 40; served 15 years. His heirs made this as directed by his will. He lies here." 7. Tiled tomb found at Old Windsor, dating from the Roman occupation of Britain. It contained an urn for ashes and a small jar of red pottery. 8. Bronze spear-head, in use in Britain before iron was introduced. 9. Burial urns, examples of castor ware. The centre urn is the "Colchester Vase" with a representation of a gladiatorial display. 10. Roman pottery and glass. The group shows thirty-three vessels of the 1st and 2nd centuries, found in a cemetery at Baldock, Hertfordshire. 11. Roman pottery, Rhenish ware, decorated with white or yellow ornament, first imported towards the end of the 2nd century A.D. 12. Bronze vessel for temple use found at Prickwillow, Isle of Ely, bearing the name of the maker, Boduogenus, apparently a Briton. 13. Wrought-iron helmet with visor-mask, found at the Roman fort of Newstead, Melrose, originally encrusted with silver and used in tournaments. 14. Statuette of Osiris Pethempamentes, found at Swanscombe, Kent, probably brought to England by the Romans. 15. Roman jug of pale olive-green glass, from a grave of Bayford-next-Sittingbourne, Kent, probably of 1st or 2nd century. 16. Brass helmet, found at the Roman fort of Newstead, Melrose. The embossed design shows a nude winged figure driving a leopard-drawn chariot

Ine, however, *pending*, *pen(n)ing* ("penny"), had already come into use for the latter, while, owing to the temporary disappearance of a gold coinage, *scilling* had come to denote a mere unit of account. It was, however, a variable unit, for the Kentish shilling contained 20 *sceattas* (pence), while the Mercian contained only four. The West Saxon shilling seems originally to have been identical with the Mercian, but later it contained five pence. Large payments were generally made by weight, 240-250 pence being reckoned to the pound, perhaps from the 7th century onwards. The mancus was equated with 30 pence, probably from the time of its introduction. This means that the value of gold relatively to silver was 10:1 from the end of Offa's reign. There is reason, however, for thinking that in earlier times it was as low as 6:1, or even 5:1. In Northumbria a totally different monetary system prevailed, the unit being the *tryms*, which contained three *sceattas* or pence. As to the value of the bronze coins we are without information.

The purchasing power of money was very great. The sheep was valued at a shilling in both Wessex and Mercia, from early times till the 11th century. One pound was the normal price of a slave and half a pound that of a horse. The price of a pig was twice, and that of an ox six times as great as that of a sheep.

Ornaments.—Of these the most interesting are the brooches which were worn by both sexes and of which large numbers have been found in heathen cemeteries. They may be classed under eight leading types: (1) circular or ring-shaped, (2) cruciform, (3) square-headed, (4) radiated, (5) S-shaped, (6) bird-shaped, (7) disk-shaped, (8) cupelliform or saucer-shaped. Of these Nos. 5 and 6 appear to be of Continental origin, and this is probably the case also with No. 4 and in part with No. 7. But the last-mentioned type varies greatly, from rude and almost plain disks of bronze to magnificent gold specimens studded with gems. No. 8 is believed to be peculiar to England and occurs chiefly in the southern Midlands, specimens being usually found in pairs. The interiors are gilt, often furnished with detachable plates and sometimes set with brilliants. The remaining types were probably brought over by the Anglo-Saxons at the time of the invasion.

Among other ornaments we may mention hairpins, rings and ear-rings, and especially buckles, which are often of elaborate workmanship. Bracelets and necklets are not very common, a fact which is rather surprising, as in early times, before the issuing of a coinage, these articles (*beagas*) took the place of money to a large extent. The glass vessels are finely made and of somewhat striking appearance, though they closely resemble contemporary Continental types. Since the art of glass-working was unknown, according to Bede, until nearly the end of the 7th century, it is probable that these were all of Continental or Roman-British origin.

Amusements.—It is clear from the frequent references to dogs and hawks in the charters that hunting and falconry were keenly pursued by the kings and their retinues. Games, whether indoor or outdoor, are much less frequently mentioned, but there is no doubt that the use of dice (*taefl*) was widespread. At court much time was given to poetic recitation, often accompanied by music, and accomplished poets received liberal rewards. The chief musical instrument was the harp (*hearpe*), which is often mentioned. Less frequently we hear of the flute (*pipe*) and later also of the fiddle (*fithele*). Trumpets (*horn, swegelhorn, byme*) appear to have been used chiefly as signals.

Writing.—The Runic alphabet seems to have been the only form of writing known to the Anglo-Saxons before the invasion of Britain, and indeed until the adoption of Christianity. In its earliest form, as it appears in inscriptions on various articles found in Schleswig and in Scandinavian countries, it consisted of 24 letters, all of which occur in abecedaria in England. In actual use, however, two letters soon became obsolete, but a number of others were added from time to time, some of which are found also on the Continent, while others are peculiar to certain parts of England. Originally the Runic alphabet seems to have been used for writing on wooden boards, though none of these has survived. The inscriptions which have come down to us are engraved partly on memorial stones, which are not uncommon in the north of England, and partly on various metal objects, ranging from swords to brooches. The adoption of Christianity brought about the introduction of the Roman alphabet; but the older form of writing did not immediately pass out of use, for almost all the extant inscriptions date from the 7th or following centuries. Coins with Runic legends were issued at least until the middle of the 8th century, and some of the memorial stones date probably even from the 9th. The most important of the latter are the column at Bewcastle, Cumberland, believed to commemorate Alhfrith, the son of Oswio, who died about 670 and the cross at Ruthwell, Dumfriesshire, which is probably about a century later. The Roman alphabet was very soon applied to the purpose of writing the native language, *e.g.*, in the publication of the laws of Aethelberht. Yet the type of character in which even the earliest surviving mss. are written is believed to be of Celtic origin. Most probably it was introduced by the Irish missionaries who evangelized the north of England, though Welsh influence is scarcely impossible. Eventually this alphabet was enlarged (probably before the end of the 7th century) by the inclusion of two Runic letters for *th* and *w*.

Marriage.—This is perhaps the subject on which our information is most inadequate. It is evident that the relationships which prohibited marriage were different from those recognized by the Church; but the only fact definitely known is that it was customary, at least in Kent, for a man to marry his stepmother. In the Kentish laws marriage is represented as hardly more than a matter of purchase; but whether this was the case in the other kingdoms also the evidence is insufficient to decide. It is known, however, that in addition to the sum paid to the bride's guardian, it was customary for the bridegroom to make a present (*morgengifu*) to the bride herself, which, in the case of queens, often consisted of a residence and considerable estates. Such persons also had retinues and fortified residences of their own. In the Kentish laws provision is made for widows to receive a proportionate share in their husbands' property.

Funeral Rites.—Both inhumation and cremation were practised in heathen times. The former seems to have prevailed everywhere; the latter, however, was much more common in the more northern counties than in the south, though cases are fairly numerous throughout the valley of the Thames. In *Beowulf* cremation is represented as the prevailing custom. There is no evidence that it was still practised when the Roman and Celtic missionaries arrived, but it is worth noting that according to the tradition given in the Anglo-Saxon Chronicle, Oxfordshire, where the custom seems to have been fairly common, was not conquered before the latter part of the 6th century. The burnt remains were generally, if not always, enclosed in urns and then buried. The urns are of clay, somewhat badly baked, and bear geometrical patterns applied with a punch. They vary considerably in size (from 4 to 12in. or more in diameter) and closely resemble those found in northern Germany. Inhumation graves are sometimes richly furnished. The skeleton is laid out at full length, generally with the head towards the west or north, a spear at one side and a sword and shield obliquely across the middle. Valuable brooches and other ornaments are often found. In many other cases, however, the grave contained nothing except a small knife and a simple brooch or a few beads. Usually both classes of graves lie below the natural surface of the ground without any perceptible trace of a barrow.

Religion.—Here again the information is very limited. There can be little doubt that the heathen Angli worshipped certain gods, among them Ti (Tig), Woden, Thunor, and a goddess Frigg, from whom the names Tuesday, Wednesday, Thursday, and Friday are derived. Ti was probably the god to whom early Roman writers refer under the name Mars (*see* TYR), while Thunor was doubtless the thunder-god (*see* THOR). From Woden (*q.v.*) most of the royal families traced their descent. Seaxneat, the ancestor of the East Saxon dynasty, was also in all probability a god (*see* ESSEX, KINGDOM OF). Of anthropomorphic representations of the gods we have no clear evidence, though we do hear of shrines in sacred enclosures, at which sacrifices were offered. It is clear also that there were persons specially set apart for the priesthood, who were not allowed to bear arms or to ride except on mares. Notices of sacred trees and groves, springs, stones, etc., are much more frequent than those referring to the gods. We hear also a good deal of witches and valkyries, and of charms and magic; as an instance may be cited the fact that certain (Runic) letters were credited, as in the North, with the power of loosening bonds. It is probable also that the belief in the spirit world and in a future life was of a somewhat similar kind to what is found in Scandinavian religion. (*See* TEUTONIC PEOPLES, *Religion*.)

The chief primary authorities are Gildas, *De Excidio Britanniae*, and Nennius, *Historia Britonum*, ed. Th. Mommsen in *Mon. Germ. Hist., Auct. Antiquiss.*, tom. xiii. (1898); Bede, *Hist. Eccl.* (ed. C. Plummer, Oxford, 1896); the *Saxon Chronicle* (ed. C. Plummer, Oxford, 1892–99); and the *Anglo-Saxon Laws* (ed. F. Liebermann, Halle, 1903), and Charters (Birch, *Cartularium Saxonicum*, 1885–93). Modern authorities: Sh. Turner, *History of the Anglo-Saxons* (1799–1805, 7th ed., 1852); Sir F. Palgrave, *Rise and Progress of the English Commonwealth* (1831–32, re-edited Cambridge, 1921); J. M. Kemble, *The Saxons in England* (1849; 2nd ed. 1876); K. Maurer, *Kritische Überschau d. deutschen Gesetzgebung u. Rechtswissenschaft*, vols. i. iii. (Munich, 1853–55); J. M. Lappenberg, *Geschichte von England* (Hamburg, 1834); F. Seebohm, *The English Village Community* (1883); A. Meitzen, *Siedelung und Agrarwesen d. Westgermanen, u. Ostgermanen* (1895); Sir F. Pollock and F. W. Maitland, *History of English Law* (Cambridge, 1895; 2nd ed., 1898); F. W. Maitland, *Domesday Book and Beyond* (Cambridge, 1897); F. Seebohm, *Tribal Custom in Anglo Saxon Law* (1903); P. Vinogradoff, *The Growth of the Manor* (1905); H. M. Chadwick, *Studies on Anglo-Saxon Institutions* (Cambridge, 1905); *The Origin of the English Nation* (ib., 1907); M. Heyne, *Über die Lage und Construction der Halle Heorot* (Paderborn, 1864); R. Henning, *Das deutsche Haus* (*Quellen u. Forschungen*, 47) (Strassburg, 1882); M. Heyne, *Deutsche Hausaltertumer*, i., ii., iii. (Leipzig, 1900–3); G. Baldwin Brown, *The Arts in Early England* (1903); C. F. Keary, *Catalogue of Anglo-Saxon Coins in the British Museum*, vol. i. (1887); C. Roach Smith, *Collectanea Antiqua* (1848–68); R. C. Neville, *Saxon Obsequies* (1852); J. Y. Akerman, *Remains of Pagan Saxondom* (1855); Baron J. de Baye, *Industrie anglo-saxonne* (1889); *The Industrial Arts of the Anglo Saxons* (1893); G. Stephens, *The Old Northern Runic Monuments* (1866–1901); W. Vietor, *Die northumbrischen Runensteine* (Marburg, 1895). Reference must also be made to the articles on Anglo-Saxon antiquities in the *Victoria County Histories*, and to various papers in *Archaeologia* and other antiquarian journals. (H. M. C.)

BRITANNIA METAL, a silvery white alloy with bluish tint, consisting essentially of tin and antimony, although copper is occasionally added. The best qualities of this alloy contain 90% of tin and 10% of antimony and may be regarded as tin hardened by antimony. Commoner grades of the alloy may contain 94% of tin, 5% of antimony and 1% of copper. The last mentioned metal increases the ductility and decreases the fusibility of britannia metal to which, however, it gives a yellowish tint. Britannia metal is employed in the manufacture of spoons, dish covers, tea pots and other hollow ware for table use. It is easily worked into complicated shapes by spinning or stamping and can then be silver plated. An increase in the proportion of antimony in the alloy raises the melting point, increases the hardness and diminishes the malleability.

A brilliant lustre is imparted to articles made from britannia metal by heating them for about 30 minutes in a bath containing water (120 parts), cream of tartar (12 parts), tartar emetic (one part), hydrochloric acid (16 parts), zinc (32 parts) and powdered antimony (8 parts). When the zinc of the foregoing bath is entirely replaced by antimony, warming for varying times produces diverse shades of bluish grey, copper red, gold and bluish or violet greys.

Britannia metal containing only tin and antimony is attacked but slightly by solutions of the chlorides of ammonium, magnesium, potassium and sodium, although aqueous caustic alkalis have a very appreciable corrosive action. (G. T. M.)

BRITANNICUS, son of the Roman emperor, Claudius, by Messalina, was born probably A.D. 41. He was originally called Claudius Tiberius Germanicus, and received the name Britannicus in honour of Claudius' expedition to Britain (A.D. 43). Till his mother's execution in 48 he was looked upon as the heir; but Agrippina, the new wife of Claudius, brought about the adoption of Nero, her own son by a former marriage. After the accession of Nero, Agrippina, by playing on his fears, induced him to poison Britannicus at a banquet (A.D. 55). Britannicus is the subject of a tragedy by Racine.

See Tacitus, *Annals*, xii. 25, 41, xiii. 14–16; Suetonius, *Nero*, 33; Dio Cassius lx. 32, 34; *see* also works quoted under NERO.

BRITISH CENTRAL AFRICA, a term sometimes used to describe the British possessions in central Africa, namely the Nyasaland Protectorate (*q.v.*) and Northern Rhodesia (*see* RHODESIA). Officially the term was used when the Nyasaland Protectorate was named "The British Central Africa Protectorate" in Feb. 1893. The old name was restored in Oct. 1907.

BRITISH COLUMBIA, the western province of the Dominion of Canada. It is bounded on the east by the watershed in the Rocky Mountains until this, in its north-westerly course, reaches the meridian 120° W., which is followed north to 60° N., thus including within the province a part of the Peace river country east of the mountains. The southern boundary is formed by 49° N. and the straits separating Vancouver Island from the State of Washington. The northern boundary is 60° N., the western the Pacific ocean, upon which the province fronts for about 600m., and the coast strip of Alaska for a further 400m. Vancouver Island and the Queen Charlotte Islands, as well as the smaller islands lying off the western coast of Canada, belong to the province of British Columbia.

Physical Features.—British Columbia is almost wholly mountainous. It comprises nearly the whole width of the western mountain-belt of North America, between the parallels of latitude above indicated, including the Rocky Mountains proper on the east and the coast range on the west. Between these are other ranges to which various local names have been given, as well as the interior plateau—a hilly country, with summits having an accordant elevation east of the Coast Range. The several ranges, having been produced by foldings parallel to the border of the Pacific ocean, have a common trend S.E. to N.W. Vancouver Island and the Queen Charlotte Islands are parts of still another fold parallel to the coast, but largely submerged.

The Rocky mountains are composed chiefly of palaeozoic sediments from Cambrian to Carboniferous, with subordinate infolded areas of Cretaceous which hold coal. The average height of the range along the United States boundary is 8,000 ft., but the range culminates between the latitudes of 51° and 53°, in Mt. Robson, 12,972ft., and Mt. Alberta, in Alberta province, 13,500ft.; Mt. Fairweather in south Alaska is 15,399ft. Passes include the South Kootenay or Boundary pass, 7,100ft.; the Crow's Nest pass, 5,500ft. (this is traversed by the Canadian Pacific railway and crosses great coal fields); the Kicking Horse or Wapta pass, 5,300ft. (traversed by the main line of the Canadian Pacific railway); the Athabasca pass, 6,025ft.; the Yellow Head pass, 3,733ft. (used by the Canadian National railway); the Pine River pass, 2,850ft.; and the Peace River pass, 2,000ft., through which the Peace river flows.

The Coast or Cascade Range borders the Pacific coast for 900m., and its partially submerged transverse valleys give excellent harbours and deep sounds and inlets of extraordinary beauty. At the head of Knight Inlet, Lat. 51° 22′ N., Long. 125° 16′ W., Mt. George Dawson is the highest point in British Columbia (13,260ft.). The coast is fringed with innumerable islands, of which Vancouver Island and the Queen Charlotte Islands are the largest. Along the south-west side of the Rocky Mountains is a very remarkable valley of considerable geological antiquity, in which run some seven of the great rivers of the Pacific slope, among them the Kootenay, Columbia, Fraser and Finlay. This valley, 1 to 6m. wide, can be traced continuously for at least 800m. The Fraser, rising in the Rocky Mountains, flows for a long distance to the north-west and then, turning south, eventually crosses the Coast Range by a deep canyon and empties into the Strait of Georgia, a few miles south of the city of Vancouver. The Columbia, which rises farther south in the same range, flows north for about 150m. and then, bending abruptly back upon its former course, flows south through the Arrow Lakes in the Kootenay country into the United States, emptying into the Pacific ocean at Astoria in the state of Oregon. In the north-western part of the province the Skeena flows south-west into the Pacific, and still farther to the north the Stikine rises in British Columbia, but before entering the Pacific crosses the coast strip of Alaska. The Liard, rising in the same district, flows eastwards and falls into the Mackenzie, which empties into the Arctic ocean. The headwaters of the Yukon are also situated in the northern part of the province. All these rivers are swift and frequently interrupted by rapids, so that, as means of communication, they are of little if any value; on the other hand there are in the province almost unlimited potentialities for water power.

At an early stage in the Glacial period British Columbia was covered by the Cordilleran ice-sheet, which moved south-east and north-west in correspondence with the ruling features of the country, from a gathering-ground about the 57th parallel. Ice poured through passes in the coast ranges, and to a lesser extent debouched upon the edge of the great plains, beyond the Rocky Mountain range. The great valley between the coast ranges and Vancouver island was also occupied by a glacier that moved in both directions from a central point in the vicinity of Valdez island. The effects of this glacial action have bearings on the distribution and character of the gold-bearing alluviums of the province.

Climate.—There are strong contrasts in respect both of rainfall and of temperature between the coast and the interior plateau, and, as regards rainfall on the coastlands, between places sheltered and unsheltered from wet westerly winds. Thus at Victoria, at the south end of Vancouver island, the mean annual rainfall amounts to 27·65in., but this place is sheltered by the heights of the island to the west. At Agassiz, on the narrow coastal plain of the Fraser river, the mean is 65·34in.: at both these stations the wettest months are in winter. At Kamloops in the south-central part of the province (1,193ft. above sea level) the main annual rainfall is barely over 10in.; the maximum is in June, but in the later summer this division is definitely dry, with vegetation, except along the waterways and at the higher elevations, characteristic of an almost arid region. The mean monthly temperature ranges from 39°F. in January to 60° in July and August at Victoria, 34° in December to 69° in July at Agassiz, and 22° in January to 63° in July and August at Kamloops. At Atlin in the far north, eastward of the Coast Range, there is a mean temperature range from 0° in January to 54° in July; and a mean annual rainfall similar to that of Kamloops (10·89in.); on the other hand in the Prince Rupert and coastal district, the rainfall reaches 95in. or more.

Fauna.—Among the larger mammals are the big-horn or mountain sheep (*Ovis canadensis*), the Rocky Mountain goat (*Mazama montana*), the grizzly bear, moose, woodland caribou, black-tailed or mule deer, and coyote. All these are to be found only on the mainland. The black and brown bears, wolves, lynx, wapiti and Columbian or coast deer occur on both mainland and islands. About 340 species of birds are known in the province, including the burrowing owl of the dry interior, the American magpie, Steller's jay and a true nut-cracker, Clark's crow (*Picicorvus Columbianus*). True jays and orioles are also well represented. The gallinaceous birds include the large blue grouse of the coast, replaced in the Rocky Mountains by the dusky grouse. The western form of the spruce partridge of eastern Canada is also abundant, together with several forms referred to the genus *Bonasa*, generally known as partridges or ruffed grouse. Ptarmigans also abound in many of the higher mountain regions. Geese, brant and many sorts of duck are numerous.

Area and Population.—The area of British Columbia is 359,279 sq.mi. and its population by the census of 1941 was 817,861. The population roughly trebled in the first quarter of this century, at first by the influx of miners and others, consequent upon the discovery of precious metals in the Kootenay, Boundary and Atlin districts; and later by the establishment of a settled population through the opening up of the valleys by railways and motor roads, and new lines of steamboats, mainly in the south. The population is predominantly white. There is a considerable Chinese population, and 61,302 entered the country between 1901 and 1934. Chinese immigration has, however, been forbidden by law since 1923, and was previously much reduced by the tax, rising in amount, imposed per head from 1885 onwards, owing to the objection felt by the white population to the entry of "Mongolians." Many Japanese have also come in they are engaged chiefly in lumbering and fishing, and do not appear to be so much disliked as the Chinese, as they adapt themselves to the ways of white men, but they are equally objected to on the score of cheap labour; and in 1907–08 considerable friction occurred with the Dominion Government over the anti-Japanese attitude of British Columbia, which was shown in some rather serious riots. Since that time Japanese immigration has been restricted by agreement with the Japanese Government. In the census of 1931 the Indian population was returned at 24,599, largely Christian. The Indians are divided into very many tribes, but fall naturally on linguistic grounds into a few large groups. There is no treaty with the Indians of British Columbia, as with those of the plains, for the relinquishment of their title to the land, but the government otherwise assists them. There is an Indian superintendent at Victoria, and under him are agencies throughout the province to attend to the Indians—relieving their sick and destitute, supplying them with seed and implements, settling their disputes and administering justice. The Indian fishing stations and burial grounds are reserved, and other land has been set apart for them for agricultural and pastoral purposes. A number of schools have been established for their education. The chief cities (with their 1941 populations) are Victoria, the capital (44,068), on Vancouver island; Vancouver (275,353) and North Vancouver (8,914) on the mainland, New Westminster (21,967) on the Fraser and Nanaimo (6,635) on Vancouver island, Nelson (5,912) in West Kootenay, Prince Rupert (6,714) at the mouth of the Skeena river; Kamloops (5,959) and Fernie (2,545) in East Kootenay are also places of importance.

Population in British Columbia is relatively huddled in the south with the north practically empty: 88% of the people occupy only 18% of the area. Census district No. 10 (northeast of the Rocky mountain summit) has an area of 82,535 sq.mi. and a population (1941) of 8,392. Yet this is an area two-thirds the size of Norway, with much the same climate, with very considerable resources and the whole of it south of Oslo. Stockholm, Sweden, would lie in the extreme north of it and all Finland beyond it. The Alaska military highway of 1942 traverses this territory. Census district No. 9 (between the Rocky mountain summit and Alaska) has 88,128 sq.mi. and 18,263 inhabitants.

Government and Finance.—The province is governed by a lieutenant-governor, appointed by the governor-general in council for five years, but subject to removal for cause an executive council (cabinet) of ministers, and a single legislative chamber. The ministers are appointed by the lieutenant-governor on the advice of the first minister, and the cabinet retains office so long as it enjoys the support of a majority of the legislature. The powers of the lieutenant-governor in regard to the provincial government are analogous to those of the governor-general in respect of the dominion government.

The British North America act (1867) confederating colonies, defines the jurisdiction of the provincial legislature as distinguished from that of the federal parliament, but within its own jurisdiction the province makes the laws for its own governance. The act of the legislature may be disallowed, within one year of its passage, by the governor-general in council, and is also subject to challenge as to its legality in the supreme court of Canada or on appeal to the juridical committee of the privy council of the United Kingdom. British Columbia sends 6 senators and 16 members to the lower house of the federal parliament at Ottawa (election of 1940).

Municipal government, as in all the provinces of Canada, rests under the B.N.A. act (Section 92) on provincial statute. Organized municipalities in British Columbia consist of cities, of which there are 33 in all, but of which eight have each less than a thousand inhabitants. There are no towns and no municipal counties and only 19 incorporated villages. There are 28 rural areas officially called districts, the rest of the province much of it empty (*see above*), being under provincial officials.

Public revenue in British Columbia as a province began in 1871 on a footing of $380,000 a year; in 1939 it stood at $35,908,899. In early years the main source of revenue was found in dominion subsidies which compensated the loss of the colonial customs and excise. These subsidies for some years before the war period of 1939 stood regularly at $874,561 with special grants for years of stringency. But early in the present century new and larger sources of revenue were found in succession duties, gasoline taxes, licences and the profits of liquor control. With these until the revision of the war period were corporation and income taxes. The gross bonded debt of the province in 1921 was $46,511,436, in 1939 $142,268,236, an increase largely due to public undertakings as, especially, highway construction.

Education.—Under the B N A act the province entirely controls education except for the right of remedial interference granted to the dominion (Section 93) in favour of denominational public schools. British Columbia has no public schools except non denominational, primary education being free of charge and compulsory Statistics of 1939–40 show an enrolment of 120,459 pupils in provincial day schools, 4,911 in private day schools, 1,975 in business colleges. Enrolment in regular university courses was 3,656.

The Dominion of Canada educates Indian children as part of its jurisdiction over Indians (British Columbia enrolment of 1939 40 4,067 pupils). Education is under a minister and department at Victoria, which carries on special summer schools, teachers' schools and organizes, since 1936 general and musical broadcasts. For isolated parts of the province the department teaches children by correspondence from mimeographed teachers' bulletins. The (provincial) University of British Columbia which began (1908) as affiliated for two years work with McGill, has now full courses of study in all faculties. Affiliated with the university is Victoria college.

Forests.—The province is rich in forests, and there is a steady demand for its lumber in the other parts of Canada, as well as abroad. Among the most important trees are Douglas fir, white and yellow pine, western hemlock, white spruce, Engellmann's spruce, giant cedar, yellow cypress or cedar and western larch The principal timbers of commerce are the Douglas fir and the spruces; the former is often found 300 ft high and from 8 to 10 ft in diameter The wood is tough and strong and is highly valued for ships' spars as well as for building purposes. White pine, hemlock and cedar are also much employed for various purposes. Owing to the scarcity of suitable streams for log-transport, the timber is conveyed mostly by special railways or motor tracks, and work is carried on all the year round.

The statistics here given of forestry as with other industries are those valid at the outbreak (1939) of war, which naturally altered all forms of economic activity either to expand or to curtail British Columbia presents a more balanced economic life than any other Canadian province. The total net value of production, $246,612,581 (or with the interconnected Yukon production, $253,642,048) in 1939 represented 7.85% of the Canadian total. Of this provincial production, forestry represents the largest net return with 24.8% of the total; general manufactures 21.5%; mining 20%; agriculture 12.5% and fisheries 5.5% with other scattered industries. But the number of persons occupied in each industry shows a different scale owing to the varying factor of machinery Thus, of males gainfully employed in British Columbia (*Canada Year Book 1937: Analysis of Census 1931*) only 8.3% were in fishing and lumbering, only 3.9% in mining and quarrying, with 16% in agriculture, 11% in manufacture, 12% in transportation and 13.7% in general labour outside of any of the above categories. But on the basis indicated, forestry ranks first. Prewar statistics (1939) show British Columbia with a cut of 2,270,033 M.ft b.m. of lumber. The province supplies annually well over 80% of the shingles of Canada, 95% of the British Columbia shingles being cut from fir wood.

Mining.—Mining is one of the chief industries of British Columbia The mining output increased from $4,225,717 in 1894 to $65,216,745 in 1939. Gold was at first the most important mineral. The greater part of the return is from lode mining. Rossland, Boundary and Kootenay districts are the chief centres of vein-mining yielding auriferous and cupriferous sulphide ores, as well as large quantities of silver-bearing lead ores. Gold has lately fallen to sixth place in annual value, the most valuable metals, in order of importance, being lead, copper, coal, zinc and silver. British Columbia has become the chief copper-producing state in Canada. The metal is worked largely in the coast districts, particularly on the Portland canal (Anyox) and Howe sound (Britannia), as well as in the inland areas already mentioned. Valuable discoveries of lead, silver and gold have been made in the coastal districts, and much gold and silver are produced near Stewart. There is also mining activity in the country behind Prince Rupert, and in recent years gold has again been recovered from the Cariboo and Cedar Creek areas where it was originally discovered. The mining laws are liberal, and, being based on the experience gained in the adjacent mining centres of the western states, are convenient and effective. Among the most important smelting and reducing plants are those at Trail in the West Kootenay country, and at Anyox. There are also numerous concentrating plants. The province contains enormous supplies of excellent coal, largely untouched. It is chiefly of cretaceous age. The producing collieries are chiefly on Vancouver island and on the western slope of the Rockies near the Crow's Nest pass. There are immense beds of high-grade bituminous coal and semi-anthracite in northern British Columbia (Skeena valley, etc) and mining is developing along the line of the railway to Prince Rupert.

Prewar (1939) statistics for British Columbia show a production of copper, 73,253,408 lb. ($7,392,734); gold, 626,970 fine oz; lead, 378,440,666 lb. ($11,902,784); silver, 10,648,031 fine oz. ($4,311,175); zinc, 279,041,497 lb ($8,563,784); coal, 1,537,905 tons ($5,464,061).

Fisheries.—A large percentage of the commerce is derived from the sea, the chief product being salmon. The halibut, herring and cod fisheries are also important, particularly the first, and whaling also is carried on. The chief centres of the salmon industry are the Fraser and Skeena rivers, Queen Charlotte islands and Vancouver island There are several varieties of salmon, the chief being called sock-eyes, chums, pinks, cohoes and springs; the coarse chum salmon are salted for export to the east. There are some 75 fish-curing and canning factories, employing largely Chinese labour, while many Japanese before the outbreak of war were engaged (as well as Indians) in the fisheries. Great Britain is the chief market for British Columbia salmon. Salmon hatcheries have been established on the chief rivers frequented by these fish. The value of the products of the British Columbia fisheries was computed in 1939 as $17,668,989, being 44% of the entire Canadian total.

Agriculture.—Although mountainous in character, the province contains many tracts of good farming land. These lie in the long valleys between the mountain ranges of the interior, as well as on the lower slopes of the mountains and on the deltas of the rivers on Vancouver island. Small mixed farming is predominant, and the chief crops raised are wheat, oats, clover, potatoes and other vegetables Some areas are specially suited for cattle- and sheep-raising, among which may be mentioned the Yale district and the country round Kamloops. The breeding of fur-bearing animals is a growing industry. From 123 silver- and black-fox pelts in 1921 the British Columbia farm production reached 3,328 in 1939 (value $413,000) *cf.* Canada. 310,693 pelts. Much attention has been given to fruit-growing, particularly in the Okanagan valley. Apples, plums and cherries are grown as well as pears, peaches, apricots and various small fruits, notably strawberries. Hops are also cultivated. Beef, dairy produce (especially from the Lower Mainland) and honey are important products. Agricultural statistics of 1939 show the acreage of field crops as 510,000 (*cf.* Saskatchewan 20,000,000); crop of spring wheat (ave 5 yrs 1935–39) 1,601,000 bu; oats 5,428,000 bu.; potatoes 18,000 ac (*cf.* Canada 516,000, P.E.I. 35,000); poultry 4,783 (*cf.* Canada 62,000). Butter and cheese are relatively unimportant, cheese, 791,000 lb. (*cf.* Ontario, 102,764,000). Commercial fruit (to include apples) a value of $7,006,900 (45% of all Canada).

Manufactures and Water Power.—The manufacturing industries of the province are chiefly those originating from the forests, the fisheries and the growing of fruit. Statistics for 1939 show a personnel of 42,554 employees (*cf.* Ontario 318,000), the largest group being the 12,603 in sawmills. The pulp and paper industry employed 2,555; fish processing, 1,658; sash and planing mills, 1,338; bread and bakery establishments, 1,928; fruit and vegetable canning, 1,212; printing and publishing, 1,628; with the balance in varied activities, all outside of the primary agricultural, fruit and mine work.

British Columbia has great natural sources of water power, much of it only partially explored and roughly estimated. It is based on the vast flow of waters from the mountains to the Pacific—the upper Columbia, the Thompson-Fraser, the Skeena, the Stikine and their numerous tributaries, together with the lesser known waters of the north moving to the Mackenzie and the Yukon systems. The official estimate for available 24-hour 80% efficiency at ordinary six months flow is 5,103,500 h.p. (*cf.* Canada 33,000,000). Of this the developed installation is 788,763 h.p. (*cf.* Canada 8,845,000 and U.S., as per geological survey, 1939, 18,000,000). It is estimated that within an area of 20,000 sq.mi. to include Vancouver and Victoria, 500,000 h.p. can be developed.

Communications and Shipping.—*Railways.* The Pacific division of the Canadian Pacific railway enters British Columbia through the Kicking Horse pass on the east and runs for about 500 mi. across the province before reaching the terminus at Vancouver, a line wonderfully engineered through some of the finest scenery in the dominion. A branch of the same railway leaves the main line at Medicine Hat, and running to the southwest, crosses the Rocky mountains through the Crow's Nest pass and thus enters British Columbia a short distance north of the United States boundary. This continues across the province, running approximately parallel to the boundary as far as Midway in what is known as the Boundary district. The line has opened up extensive coalfields and crosses a productive mining district. On Vancouver island there are two railways, the Esquimalt and Nanaimo railway (78 mi.) connecting the coalfields with the southern ports, and the Victoria and Sydney railway, about 16 mi. in length. The Canadian National railway enters British Columbia over the Yellowhead pass, and follows the upper valley of the Fraser river and then that of the Skeena to Prince Rupert. A line also runs from the Yellowhead pass to Vancouver down the Thompson and Fraser valleys. There is also a number of short lines in the southern portion of the province connecting with lines in the United States. In 1939 there were 3,884 mi. of railway in the province.

In addition to steam railways the province has 211 mi. of electric railways and 8,376 mi. of surfaced motor roads. The Alaska-Canada military highway constructed in 1942 crosses the northeastern section of the province from railhead at Dawson Creek to pass via the Yukon to railhead at Fairbanks, Alaska. The Trans-Canada (National) Airway began regular Montreal-Vancouver flights in 1938 with air mail and passenger service. Civil air traffic regularly connects Vancouver Victoria with Prince George, the Yukon, Seattle and the United States. Statistics (1940) showed: passengers, 20,040; freight, 548,000 lb.; mail, 258,000 lb.

Shipping.—The Canadian Pacific railway company has lines of steamers running from Vancouver and Victoria to (1) China and Japan, (2) Honolulu, New Zealand and Australia, and also to Alaskan ports. Grand Trunk Pacific railway steamers run from Prince Rupert to Seattle, Vancouver, Victoria, Queen Charlotte islands, Anyox, etc., and there are also boats to San Francisco and from Seattle to northern Alaska (Nome).

The number of sea-going vessels (foreign and international voyages) cleared from British Columbia ports in 1939 showed, out of Vancouver 2,967; Victoria 2,848; Prince Rupert 2,230; all ports 13,693. Total shipping arriving and departing to include foreign, international coastal and coastal, tonnage arrived (tons register) Vancouver 11,130,541; Victoria 6,913,567; Prince Rupert 833,742. A large and increasing traffic, to include a great export of western wheat passes from British Columbia, especially out of Vancouver, via the Panama canal. Total cargo tonnage of this sort, outwards, 1921, 125,000 long tons, 1939, 2,873,000.

History.—The discovery of British Columbia was made by the Spaniard Perez in 1774. With Cook's visit the geographical exploration of the coast began in 1778. Vancouver, in 1792–1794, surveyed almost the entire coast of British Columbia with much of that to the north and south, for the British government. The interior, about the same time, was entered by Alexander Mackenzie who crossed the Rockies and reached the Pacific in 1793. He was followed by other traders of the North-West company, which in 1821 became amalgamated with the Hudson's Bay company. For the next 28 years the Hudson's Bay company ruled this immense territory with beneficent despotism. In 1849 Vancouver island was proclaimed a British colony. In 1858, consequent on the discovery of gold on the Fraser river and in the Cariboo district, and the large influx of miners, the mainland territory was erected into a colony under the name of British Columbia, and in 1866 this was united with the colony of Vancouver island, under the same name. In 1871 British Columbia entered the confederation and became part of the dominion of Canada. One of the conditions under which the colony entered the dominion was the speedy construction of the Canadian Pacific railway, and in 1876 the nonfulfilment of this promise created strained relations. This was ameliorated when the construction of the road was begun.

Its completion in 1885 (through trains, 1886) led to the foundation of the seaport and city of Vancouver (incorporated 1886) and the initiation of oriental steamship trade. For several years after the opening of the 20th century, the question of oriental immigration dominated the political life of the province. Without direct power to exclude Asiatics the provincial legislature attempted indirect exclusion by statutes regulating labour, mines, etc., which were regularly disallowed by the dominion (see *Annual Reports*, department of justice). General public opinion in Canada at length brought about exclusion by prohibitive tax and later by absolute statute (*see* above). Japanese immigration, as apart from merchants, scholars, tourists, was practically terminated by a "gentlemen's agreement" in 1908.

After World War I transpacific shipping and the opening of the Panama canal led to a rapid development of Vancouver. The Grand Trunk Pacific (after 1919 Canadian National railways) opened a second transcontinental road via the Yellowhead pass, and a Pacific seaport at Prince Rupert. Prohibition, as throughout Canada, came with World War I and passed into provincial liquor control. The depression halted all immigration. Financial and economic difficulties led to a rapid alternation of Liberal and Conservative governments, with a Social Credit party in the background. The 22nd ministry gave way to war time coalition in 1941. (*See also* CANADA.)

BIBLIOGRAPHY.—*Census of Canada*; *Canada Year Book* (annual); *British Columbia* (a provincial official handbook); *Canada and Its Provinces* (23 vols., 1913); A. G. Brown, *British Columbia (History, etc.)* 1912. (S. LA.)

BRITISH COMMONWEALTH OF NATIONS, the aggregate of communities owing allegiance to the British crown. The term was first used in an official document in the Anglo-Irish treaty of Dec. 6, 1921, and in the Irish Free State Constitution act, 1922, of the parliament of the United Kingdom. The report of the inter-imperial relations committee of the imperial conference of 1926 described Great Britain and the dominions as "autonomous communities within the British empire, equal in status, in no way subordinate one to another, in any aspect of their domestic or external affairs, though united by a common allegiance to the crown, and freely associated as members of the British Commonwealth of Nations." It has come into both official and private use as a synonym for the British empire (*q.v.*).

BRITISH COTTON AND WOOL DYERS ASSOCIATION, LTD. This is the largest combination of yarn dyers in the world. Its chief business is to dye yarn or other raw material previous to its actual manufacture into cloth by the weaver or into web by the knitter. The company was floated early in 1900, to acquire and amalgamate 46 English and Scottish companies and firms. Additional works were afterwards acquired. The authorized capital in 1939 was 4,000,000 shares of 5s. each, of which 3,096,660 fully paid had been issued, amounting to £774,165. There was also an authorized 4% first mortgage debenture stock of £750,000, of which £620,000 had been issued. On March 31, 1939, the capital value of the operating works stood at £1,240,474. The central office was at Manchester.

BRITISH DYESTUFFS CORPORATION, LIMITED, now Imperial Chemical Industries Limited (*q.v.*), Dyestuffs Division. The first aniline dye was discovered by William Henry Perkin in 1856, during an attempt to produce quinine. He proceeded to erect a works near London, and, toward the end of 1857, the first synthetic dye was being manufactured.

For a brief period the infant industry, established by Perkin's discovery developed in England. The manufacture of aniline was taken up by Simpson, Maule & Nicholson, and to this firm is owed the first soluble blues and the beginning of the great range of azo dyestuffs. Read, Holliday of Huddersfield was founded in 1860, and Levinstein, Ltd., of Manchester in 1865. Brooke, Simpson & Spiller, founded in 1868, acquired Perkin's firm in 1874, ultimately selling its own goodwill to Clause & Rée, in 1906, which firm in turn was purchased by Levinstein in 1917.

After the first brilliant efforts, research in England languished. By 1885, the British dyestuffs industry had lost the greater part of its trade, and Germany became the chief supplier of synthetic dyestuffs to the whole world. On the outbreak of World War I, the colour-consuming trades found themselves cut off from what had become the chief source of supply, and a company called British Dyes, Limited was formed in 1915 with the backing of the government. It was upon the efforts of this company and of Levinstein, Ltd., that the colour users were very largely dependent for their supplies of dyestuffs during World War I.

It was decided toward the end of 1918 to effect a fusion of interests of British Dyes, Ltd., and Levinstein, Ltd. British Dyestuffs Corporation was incorporated for this purpose with government financial support. In 1926 British Dyestuffs Corporation became a constituent unit of I.C.I. The company changed its name to I.C.I. (Dyestuffs) Ltd. in 1940, and by Dec. 31, 1943, the following companies had been merged with I.C.I. (Dyestuffs) Ltd.: Oliver Wilkins and Co. (1928), Scottish Dyes (1928), Emco Dyestuffs (1928), The British Alizarine Co. (1931), British Synthetics (1931) and Leech Neal and Co. (1936).

The Dyestuffs Division of Imperial Chemical Industries, Ltd., comprise, therefore works at Huddersfield, Manchester, Grangemouth, Derby and Ellesmere Port; in these works is performed the manufacture from coal tar of the primaries, such as aniline, of dyestuff intermediates and of dyes of every class. In addition to these the chemically logical offshoots of such an industry (namely rubber chemicals, pharmaceutical products, synthetic resins and auxiliaries for the textile trade) are also manufactured.

BRITISH EAST AFRICA, in its narrower sense the name by which the East Africa Protectorate was generally known until in 1920 it became Kenya Colony and Protectorate (*see* KENYA COLONY). In its wider sense the term includes all the territories in East Central Africa under British administration, namely Uganda, Kenya, Tanganyika, Zanzibar, Nyasaland and Northern Rhodesia.

Since Tanganyika Territory (formerly German East Africa) came in 1919 under a British mandate these regions form a continuous block of country extending from the Zambezi to the Upper Nile. Their common interests led to co-operation in various economic spheres, and to a movement for political union or federation. The position in East Africa as a whole was studied on the spot by a parliamentary commission in 1924; in 1926 a conference was held in Nairobi of the governors of all the territories concerned, and in 1928 a commission appointed by the British Government further studied the question of federation. From time to time thereafter the East African governors continued to meet in conference. For example, in 1938 that body discussed organization of a new Makerere college at Kampala, Uganda, and such matters as soil conservation, centralization of medical and veterinary research, and the use of the cinema and broadcasting as instruments of native enlightenment.

For History *see* R. Coupland, *East Africa and its Invaders: From the Earliest Times to the Death of Seyyid Said in 1856* (1938), and *The Exploitation of East Africa, 1856–1890* (1939), and authorities cited under KENYA COLONY; TANGANYIKA TERRITORY, etc. *See* also A. Church, *East Africa: A New Dominion* (1927), F. S. Joelson, *Eastern Africa To-day* (1934), and the *Annual Reports* of the respective territories.

DEFENSE

The King's African Rifles, whose history dates from 1891, became the main defensive force in East Africa. The K.A.R. is a regular regiment, with native personnel drawn from numerous tribes, under officers seconded from the British army. In 1939 there were six battalions of infantry (one in Nyasaland, two in Kenya Colony, one in Uganda and two in Tanganyika Territory) and a camel corps (in British Somaliland). While the troops in each of these territories are under the orders of the governor, administration and training is superintended by the inspector-general, African Colonial forces, under the colonial office, with headquarters in London. Enlistment is for three years, with re-engagements for three years, up to nine years' service. The K.A.R. was much enlarged in both World Wars I and II; in the latter conflict the regiment, after serving through the East African campaigns against Italy, was sent to India, in 1943, for operations against Japan.

See also *Notes on the Land Forces of British Dominions, Colonies and Protectorates* (British War Office, 1934); League of Nations, *Armaments Year-Book* (1936), and *Army Estimates* (annual).

BRITISH ELECTRICAL MANUFACTURERS' ASSOCIATION. In administration two main principles have governed the development of the electrical industry in Great Britain—large-scale production and co-operation of manufacturers within a central trade association. Both principles are closely related, since effective co-operation can only take place in an industry when a certain degree of concentration has been effected between manufacturers. Thus, in British electrical engineering proper, some ten large firms have dominated the course of expansion and, in a great measure, determined the organization of the entire electrical industry. These ten firms are responsible for the major part of the British production.

In electrical and allied engineering, which includes steam turbines, boilers, condensing plant and other mechanical engineering products required for the equipment of generating stations, the British Electrical and Allied Manufacturers' association represents the producers, while the Cable Makers' association deals with cables and the Electric Lamp Manufacturers' association with lamps.

Of these associations, the first named is much the most important, since it includes practically all the members of the other two and generally acts on behalf of the entire industry. It was formed in 1911 with a view to creating: (1) A central organization for the discussion and treatment of all questions affecting the electrical industries; (2) a medium of communication between the manufacturers and the government and local authorities; (3) an organ for promoting trade in oversea markets; and (4) an economic and technical intelligence service. The association issues a quarterly trade survey giving essential statistics for the leading industrial countries, and from time to time special studies of electrical development. (H. Q.; X.)

BRITISH EMPIRE, the name given to the whole aggregate of territory, the inhabitants of which, under various forms of government, are linked together by a common ultimate allegiance to the British crown as their titular sovereign. This territory comprises the United Kingdom of Great Britain and Northern Ireland, the self-governing dominions, British India and the Indian states, and those territories collectively termed the colonial empire, still administered to a greater or less extent by the government of the United Kingdom. As a synonym for "empire," with its modern-day connotation of dominance, the term "commonwealth of nations" has come into general use to denote the British territories as a whole, since it expresses more appropriately the internal liberty in fact attained or in process of attainment by the components, which consist of sovereign states already equal and independent though voluntarily associated together, communities managing most of their internal affairs, and peoples in varying degrees of advancement toward eventual self-government.

The present article is divided into the following main topics:

I. Area and Population
II. Growth of the Empire
III. Political Development
IV. Trade and Commerce
V. Finance
VI. Communications
VII. Education

I. AREA AND POPULATION

The land surface of the earth is estimated to be about 52,500,000 sq.mi. Of this area the British empire occupies nearly 16,000,000 sq.mi. By far the greater portion lies within the temperate zones, and is suitable for white settlement. The notable exceptions are the southern half of India and Burma; West, Central and East Africa; the West Indian colonies; the northern portion of Australia; New Guinea; the British East Indies; and that portion of North America which extends into arctic regions. The area of the territory of the empire is divided almost equally between the southern and the northern hemispheres, those divisions in the southern hemisphere occupying 7,979,723 sq.mi., while those north of the equator cover between them 7,994,336 sq.mi. The alternation of the seasons is thus complete, one-half of the empire enjoying summer while the other half is in winter. The division of territory between the eastern and western hemispheres is less equal. Canada and other territories in the Americas occupying 3,967,005 sq.mi. in the western hemisphere, while the rest of the empire occupies in the eastern hemisphere 12,006,154 sq.mi. As a matter of fact, however, the eastern portions of Australasia border so nearly upon the western hemisphere that the distribution of day and night throughout the empire is, like the alternations of the seasons, almost complete, one-half enjoying daylight while the other half is in darkness. These alternations of time and of seasons, combined with the variety of soils and climates, have had important effect upon the material and industrial, as well as upon the social and political developments of the empire.

The white population includes the French, Dutch and Spanish peoples, but is mainly of the Anglo-Saxon race. The native population of the empire includes types of the principal black, yellow and brown races, classing with these the high-type races of the east, which may almost be called white. In Ceylon, the native population is mainly Sinhalese and Tamils, and in British Malaya and Borneo the natives are Malay. Chinese immigrants have settled among the Malays in almost equal numbers, and in Hong Kong the population is virtually all Chinese. In the West Indies the populations are made up largely of descendants of imported African Negro slaves, though there are also East Indians, some Chinese, aboriginal races (including American Indians of the mainland and Caribs), and mixed types having Spanish and Portuguese blood.

The Bushmen and Hottentots, the aboriginal races of South Africa, are rapidly diminishing in numbers, the former being nearly extinct and the pure stock of the latter also dying out, though the strain is preserved in the half-castes or "coloured people." The largest native population of South Africa comprises dark-skinned negroids of Bantu stock (in tribal groups known as Kaffir, Zulu, Bechuana and Damara), while within the union are also Malays, Indians and others. From east to west across Africa the aboriginal nations are mostly of the black Negroid type, though on the east coast are also found much higher types approaching to the Christian races of Abyssinia. There has been, too, a wide admixture of Arab blood, producing a light-brown type, while in Uganda and Nigeria a large proportion of the population is pure Arab and relatively light-skinned.

The aboriginal tribes of Australia are of a primitive pre-Dravidian black race. The natives of the islands east of Fiji are Malayo-Polynesians, tall, handsome and light-brown in colour. Their highest and lightest type is represented by the Maori of New Zealand. In the islands west of Fiji the natives are Melanesians, a darker and lower type, ranging from black to brown. The Fijians are a mixture of the two. The original natives of Papua are primitive and some of them are cannibals, but there is a substantial immigrant Melanesian stock in the territory.

According to the census reports and estimates available in 1946, the total population of the British empire, with its condominiums and mandates, amounted to 563,471,305, distributed over the globe as shown in Table I of the political divisions and their areas.

II. GROWTH OF THE EMPIRE

It is a matter of first importance in the geographical distribution of the empire that the five principal divisions, the British Isles, South Africa, India, Australia and Canada, are separated from each other by the three great oceans of the world. The distance, as usually calculated in nautical miles, from England to the Cape of Good Hope is 5,840 mi.; from the Cape of Good Hope to Bombay is 4,610 mi.; from Bombay to Melbourne is 5,630 mi., from Melbourne to Auckland is 1,830 mi., from Auckland to Vancouver is 6,210 mi.; from Halifax to Liverpool is 2,744 mi. From a British port direct to Bombay by way of the Mediterranean is 6,272 mi.; from a British port by the same route to Sydney 11,548 mi. These great distances necessitated the acquisition of intermediate ports suitable for coaling stations on the trade routes, and determined the position of many of the lesser colonies. Such are Gibraltar, Malta, Aden, Ceylon, the Straits Settlements, Labuan and Hong Kong, which complete the chain of connection on the eastern route, and such on other routes were the lesser West African stations, Ascension, St. Helena, the Mauritius and Seychelles, the Falklands, Tristan da Cunha and the groups of the western Pacific.

The spread of the empire over the oceans of the world is a matter of relatively modern history, and the modes of acquisition have been various. While the greater part has been acquired by the settlement overseas of British subjects, in certain cases territories were ceded by foreign powers. In many instances, peoples have placed themselves under British protection and in a few

TABLE I.—*Territories of the British Empire*

Territory	Area in sq mi	Population (census or estimate)
EUROPE:		
United Kingdom (incl. Channel Islands and Man)	94,066	48,332,700 (end '42)
Eire	26,601	2,989,700 (end '41)
Gibraltar	2	20,339 (end '38)
Malta	122	268,668 (end '38)
	120,791	51,611,407
ASIA:		
Cyprus	3,572	424,656 ('44)
Palestine Mandate	9,103	1,605,816 (mid '42)
Trans Jordan Mandate	34,740	300,000
Aden Colony and Protectorate	112,000	665,000 ('38)
Ceylon	25,332	6,134,000 ('43)
Maldive Islands	180	80,000 ('39)
Indian Empire		
British India	865,446	295,808,722 (Mar '41)
Indian States	715,964	93,189,233 (Mar. '41)
Burma	261,600	16,823,798 ('41)
Straits Settlements	1,356	1,435,895 (mid '41)
Federated Malay States	27,540	2,212,052 (mid '41)
Unfederated Malay States	22,100	1,912,407 ('40–'41)
North Borneo	31,106	304,000 (end '39)
Brunei	2,226	30,000 (end '39)
Sarawak	50,000	490,585 ('41)
Hong Kong	391	1,639,337 (mid '41)
	2,162,746	423,964,591
AFRICA:		
Gambia Colony and Protectorate	4,068	205,000 (mid '38)
Gold Coast Colony and Protectorate	91,843	3,722,685 (mid '42)
Togoland Mandate	13,041	412,619 (mid '42)
Sierra Leone Colony and Protectorate	27,925	1,070,000 (end '38)
Nigeria	338,593	19,773,177 ('39)
Cameroons Mandate	34,081	868,637 ('39)
Union of South Africa	472,550	10,521,700 (mid '41)
South-West Africa Mandate	317,725	365,000 ('38)
Basutoland	11,716	580,000 (end '38)
Bechuanaland Protectorate	275,000	275,000 (end '38)
Swaziland	6,705	160,000 (end '38)
Southern Rhodesia	150,333	1,453,475 (May '41)
Northern Rhodesia	290,323	1,381,829 (end '40)
Nyasaland Protectorate	36,829	2,050,051 (end '40)
Tanganyika Territory Mandate	362,688	5,321,203 ('42)
Kenya Colony and Protectorate	224,960	3,534,862 (end '40)
Uganda Protectorate	93,981	3,820,705 (end '40)
Zanzibar Protectorate	1,020	243,296 (end '41)
Somaliland Protectorate	68,000	350,000 (end '38)
Anglo-Egyptian Sudan Condominium	967,500	5,928,104 ('41)
Mauritius and dependencies	807	420,861 (end '40)
Seychelles	156	32,150 (end '40)
AFRICA—Continued		
St. Helena	47	4,710 ('40)
Ascension	34	169 (end '40)
Tristan da Cunha	40	188 ('38)
	3,789,074	65,404,421
AMERICA:		
Newfoundland	42,734	295,300 (end '40)
Labrador	112,000	5,000 (end '39)
Canada	3,694,863	11,506,655 (mid '41)
Bermuda	19	32,887 (end '42)
Bahamas	4,375	68,846 (Apr. '43)
Barbados	166	193,411 ('43)
Jamaica	4,450	1,237,063 (Jan. '43)
Cayman Islands	93	6,670 (Jan. '43)
Turks and Caicos Islands	202	6,138 (Jan. '43)
Cays	2	nil
Leeward Islands	423	99,379 (end '41)
Trinidad	1,862	490,094 (end '42)
Tobago	116	32,071 (end '42)
Windward Islands	821	257,180 (end '40)
Falkland Islands and dependencies	7,081	3,125 (end '39)
British Guiana	89,705	364,001 ('43 est.)
British Honduras	8,598	61,068 (end '41)
	3,959,220	14,677,534
AUSTRALASIA:		
Australian Commonwealth	2,974,581	7,220,864 ('43)
Antarctic Dependency	2,472,000	nil
Norfolk Island	13	806 (mid '40)
Papua (British New Guinea)	90,540	338,822 (mid '40)
New Guinea Mandate	93,000	675,389 (mid '40)
New Zealand	103,416	1,631,414 (end '41)
Outlying Islands	307	nil
Cook Islands	84	13,713 (Mar. '41)
Niue	100	4,424 (end '40)
Tokelau (or Union) Islands	4	1,380 (May '41)
Ross Dependency	175,000	nil
Kermadec Islands	13	9 ('42)
Western Samoa Mandate	1,133	62,287 (Apr. '41)
Fiji	7,135	220,787 (end '40)
Western Pacific High Commission:		
Gilbert and Ellice Islands	345	34,202 ('40)
British Solomon Islands	11,458	95,000 ('38)
Tonga	250	34,130 ('39)
New Hebrides Condominium	5,700	43,118 ('39)
Pitcairn, etc.	2	103 (mid '41)
Nauru Mandate	8	3,354 (end '40)
	5,035,380	10,388,980
Grand Total	15,068,120	563,156,953

cases a title rests on conquest The following is a list of major overseas components of the British empire, as well as areas held in condominium with a foreign state and those allotted in mandate to members of the British commonwealth. The date indicates in some instances only the first definite step toward settlement such as the building of a fort, the opening of a trading station, or other act, which led later to incorporation in the empire; in other instances, the date is that of institution of the existing form of government Reference should be made to the articles on the various parts of the empire

Name	*Date*	*Status*
Aden	1839	Colony and protectorate
Admiralty Islands	1920	Within Bismarck archipelago
Agra (*see* "United Province of Agra and Oudh" in this list, below)		
Aitutaki Island		Within Cook Islands group
Ajmere Merwara	1818	Commissioner's province of British India
Alberta	1870	Province of Canada
Andaman and Nicobar Islands	1858	Commissioner's province of British India
Anglo Egyptian Sudan	1898	Condominium
Anguilla Island		Within presidency of St Christopher and Nevis
Antigua	1632	Presidency of Leeward Islands, contains U S leased base
Ascension Island	1815	Dependency of colony of St Helena
Ashanti	1896	Dependency of colony of Gold Coast
Ashmore and Cartier Islands	1934	Territory of Commonwealth of Australia
Assam	1826	Province of British India
Atiu Island		Within Cook Islands group
Auckland Islands	1901	Within Dominion of New Zealand
Australia	1788	Dominion. Commonwealth comprises 6 states: New South Wales, Victoria, Queensland, South Australia, Western Australia and Tasmania, and Northern Territory, and Federal Capital Territory
Australian Antarctic Territory	1933	Administered by Commonwealth of Australia
Bahamas	1647	West Indian colony, U.S leased base on Mayaguana Island
Baker Island		Within Phoenix group
Baluchistan, British (*see* British Baluchistan, below)		
Banks Island		Attached to New Hebrides
Barbados	1627	West Indian colony
Barbuda		Dependency of Antigua
Baroda	1802	Indian state (protected)
Basutoland	1868	Colony within South Africa
Bechuanaland, British (*see* British Bechuanaland, below)		
Bechuanaland Protectorate	1885	Protectorate within South Africa
Behar (*see* Bihar, below)		
Bellona Island	1898	Within British Solomon Islands protectorate
Bengal	1633	Province of British India
Berar (*see* Central Provinces and Berar, below)		
Bermuda	1609	Colony of western Atlantic ocean; contains two U.S bases, given outright
Bihar	1765	Province of British India
Birnie Island		Within Phoenix group
Bismarck Archipelago	1920	Group within Territory of New Guinea
Bombay	1668	Province of British India
Borneo, British North (*see* British North Borneo, below)		
Bougainville Island	1922	Within Solomon Islands, Territory of New Guinea
British Baluchistan	1854	Commissioner's province of British India
British Bechuanaland	1895	Within province of Cape of Good Hope
British Columbia	1849	Province of Canada
British Cameroons (*see* Cameroons [British Sphere], below)		
British East Africa		Comprises Kenya, Uganda, Zanzibar and Tanganyika Territory
British Guiana	1732	Colony; contains U.S. leased base
British Honduras	1638	Colony
British India		Comprises 11 autonomous provinces—Assam, Bengal, Bihar, Bombay, Central Provinces and Berar, Madras, North West Frontier Province, Orissa, Punjab, Sind and United Provinces; and 6 commissioner's provinces – Ajmere Merwara, Andaman and Nicobar Islands, British Baluchistan, Coorg, Delhi and Panth Piploda
British New Guinea (*see* Papua, below)		
British North Borneo	1881	Protected state
British Solomon Islands Protectorate	1893	Protectorate
British Somaliland	1884	Protectorate
British Togoland (*see* Togoland [British Sphere], below)		
British West Africa		Comprises Gambia, Sierra Leone, Gold Coast and Nigeria; and Cameroons and Togoland mandates
British West Indies		Comprises Bahamas, Barbados, Jamaica (with Turks Islands) Leeward Islands, Trinidad (with Tobago), and Windward Islands
Brunei	1888	Protected state administered with Straits Settlements
Buka Island	1922	Within Solomon Islands, Territory of New Guinea
Burma	1824	Autonomous territory
Caicos (*see* Turks and Caicos Islands, below)		
Cameroons (British sphere)	1922	Mandate of United Kingdom administered with Nigeria
Canada	1763	Dominion comprising 9 provinces - Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba, Saskatchewan, Alberta and British Columbia; and Northwest Territories, and Yukon Territory
Canton Island		Within Phoenix group
Cape of Good Hope	1795	Province of Union of South Africa
Cartier (*see* Ashmore and Cartier Islands, above)		
Cayman Islands		Dependency of Jamaica
Central India Agency	1854	Group of Indian states (protected)
Central Provinces and Berar	1802	Province of British India
Ceylon	1796	Colony
Chatham Islands		Within Dominion of New Zealand
Choiseul Island	1900	Within British Solomon Islands protectorate
Christmas Island	1888	Within Singapore Settlement of Straits Settlements
Christmas Island	1888	Within colony of Gilbert and Ellice Islands
Cochin	1791	Indian state (protected)
Cocos (Keeling) Islands	1857	Within Singapore Settlement of Straits Settlements
Cook Islands Group	1888	Dependency of New Zealand
Coorg	1834	Commissioner's province of British India
Cyprus	1878	Colony
Delhi	1803	Commissioner's province of British India
D'Entrecasteaux		Island group of Papua
Diego Garcia		Dependency of Mauritius
Dindings	1874	Islands of Penang Settlement of Straits Settlements
Dominica	1756	Colony of Windward Islands
Ducie Island	1902	Within colony of Pitcairn Island
East Africa, British (*see* British East Africa, above)		
Eire	1921	Dominion
Ellice Islands (*see* Gilbert and Ellice Islands, below)		
Enderbury Island		Within Phoenix group
Falkland Islands	1833	Colony
Fanning Island		With Washington Island, of Gilbert and Ellice Islands colony
Federated Malay States	1895	Four protected states—Perak, Selangor, Negri Sembilan and Pahang
Fiji	1874	Colony
Friendly Islands (*see* Tonga Islands, below)		
Gambia	1618	Colony and protectorate
Gardner Islands		Within Phoenix group
Gibraltar	1704	Colony

Name	*Date*	*Status*
Gilbert and Ellice Islands	1877	Colony
Gold Coast	1821	Colony; with Ashanti and (protected) Northern Territories
Gozo		Dependency of Malta
Grenada	1762	Colony of Windward Islands
Grenadines		Island group half under St. Vincent, half under Grenada
Guadalcanal Island	1893	Within British Solomon Islands protectorate
Guiana, British (*see* British Guiana, above)		
Gwalior	1782	Indian state (protected)
Henderson Island	1902	Within Pitcairn Island colony
Honduras, British (*see* British Honduras, above)		
Hongkong	1841	Colony including Kowloon and New Territory
Howland Island		Within Phoenix group
Hull Island		Within Phoenix group
Hyderabad	1766	Indian state (protected)
Indian empire	1858	Comprises British India and Indian states
Indian States		562 protected states, including Baroda, Cochin, Gwalior, Hyderabad, Jammu and Kashmir, Mysore, Sikkim, and Travancore; others grouped in agencies Central India, Punjab States, Rajputana, and Western India States Agency
Indore	1818	State within Central India agency
Jamaica	1655	West Indian colony; dependencies Cayman Islands, and Turks and Caicos Islands, contains U.S. leased base
Jammu and Kashmir	1846	Indian state (protected)
Johore	1895	Protected (unfederated) Malay state
Kashmir (*see* Jammu and Kashmir, above)		
Kedah	1909	Protected (unfederated) Malay state
Keeling Islands (*see* Cocos Islands, above)		
Kelantan	1909	Protected (unfederated) Malay state
Kenya	1890	Colony and protectorate
Kermadec Islands	1887	Within Dominion of New Zealand
Kowloon	1860	Within Hongkong colony
Kuria Island		Within Gilbert Islands, Gilbert and Ellice Islands colony
Kuria Muria Islands		Within colony of Aden
Labrador	1750	Administered by Newfoundland
Labuan	1848	Settlement of colony of Straits Settlements
Laccadive Islands		Attached to Madras province of British India
Lavongai Islands		Within Bismarck archipelago
Leeward Islands		West Indian colony comprising 4 presidencies -- Antigua (with Barbuda and Redonda), St. Christopher (with Nevis and Anguilla), Montserrat, and Virgin Islands (with Sombrero)
Lord Howe Island		Dependency of New South Wales
Lord Howe Islands (*see* Ontong Java Group, below)		
Louisiade Islands		Group of Territory of Papua
Macaulay Island		Within Kermadec Islands
McKean Island		Within Phoenix group
Madras	1639	Province of British India
Mahé Island		Within Seychelles Islands
Malacca	1818	Settlement of colony of Straits Settlements
Malaita Island	1893	Within British Solomon Islands Protectorate
Malaya		Comprises Straits Settlements, Federated Malay States and Unfederated Malay States
Maldive Islands		Within colony of Ceylon
Malta	1800	Colony
Mangaia Island		Within Cook Islands group
Manihiki Island		Within Cook Islands group
Manitoba	1870	Province of Canada
Mauke Island		Within Cook Islands group
Mauritius	1810	Colony
Mayaguana Island		Within Bahamas; contains U.S. leased base
Merwara (*see* Ajmere-Merwara, above)		
Mitiaro Island		Within Cook Islands group
Montserrat	1632	Presidency of Leeward Islands
Mysore	1831	Indian state (protected)
Nassau Island		Within Cook Islands group
Natal	1842	Province of Union of South Africa
Nauru	1920	Mandate of British empire
Nawanagar		State within Western India States agency
Negri Sembilan	1874	Protected state of Federated Malay States
Nevis (*see* St. Christopher and Nevis, below)		
New Britain	1920	Within Bismarck archipelago
New Brunswick	1713	Province of Canada
Newfoundland	1623	Dominion government in commission; contains two U S bases, given outright
New Georgia Islands	1893	Within British Solomon Islands protectorate
New Guinea, British (*see* Papua, below)		
New Guinea, Territory of	1920	Mandate of Australia
New Hebrides	1902	Condominium with France
New Ireland	1920	Within Bismarck archipelago
New South Wales	1788	State of Commonwealth of Australia
New Territory	1898	Within colony of Hongkong
New Zealand	1840	Dominion
Nicobar (*see* Andaman and Nicobar Islands, above)		
Nigeria	1879	Colony and protectorate
Niue (or Savage) Island		Dependency of New Zealand
Norfolk Island	1788	Territory of Commonwealth of Australia
North Borneo, British (*see* British North Borneo, above)		
North Island	1840	Within Dominion of New Zealand
Northern Rhodesia	1889	Protectorate
Northern Territories	1897	Protectorate with Gold Coast
Northern Territory	1827	Within Commonwealth of Australia
North-West Frontier Province	1901	Province of British India
Northwest Territories	1905	Within Dominion of Canada
Nova Scotia	1714	Province of Canada
Nyasaland	1889	Protectorate
Ocean Island	1901	Within British Solomon Islands protectorate
Oeno Island	1902	Within Pitcairn Island colony
Ontario	1763	Province of Canada
Ontong Java (or Lord Howe) Group	1900	Within British Solomon Islands protectorate
Orange Free State	1900	Province of Union of South Africa
Orissa	1803	Province of British India
Oudh (*see* United Provinces of Agra and Oudh, below)		
Pahang	1887	Protected state of Federated Malay States
Palestine	1923	Mandate of United Kingdom
Panth Piploda		Commissioner's province of British India
Papua	1884	Territory of Australia
Pemba		Dependency of Zanzibar
Penang	1786	Settlement of colony of Straits Settlements
Penrhyn Island		Within Cook Islands group
Perak	1874	Protected state of Federated Malay States
Perim Island	1857	Dependency of colony of Aden
Perlis	1909	Protected (unfederated) Malay state
Phoenix Group		Within Gilbert and Ellice Islands colony
Pitcairn Island	1790	Colony
Prince Edward Island	1758	Province of Canada
Province Wellesley	1800	Within Penang Settlement of colony of Straits Settlements
Punjab	1849	Province of British India
Punjab States Agency		Group of Indian states (protected)
Quebec	1763	Province of Canada
Queensland	1824	State of Commonwealth of Australia
Rajputana Agency		Group of Indian states (protected)
Raoul (Sunday) Island		Within Kermadec Islands
Rarotonga Island		Within Cook Islands group
Redonda Island		Dependency of Antigua
Rennell Island	1898	Within British Solomon Islands protectorate
Rhodesias (*see* Northern Rhodesia, above, Southern Rhodesia, below)		
Rodrigues Island	1809	Dependency of Mauritius
Ross Dependency	1923	Dependency of New Zealand
Rotumah		Within colony of Fiji

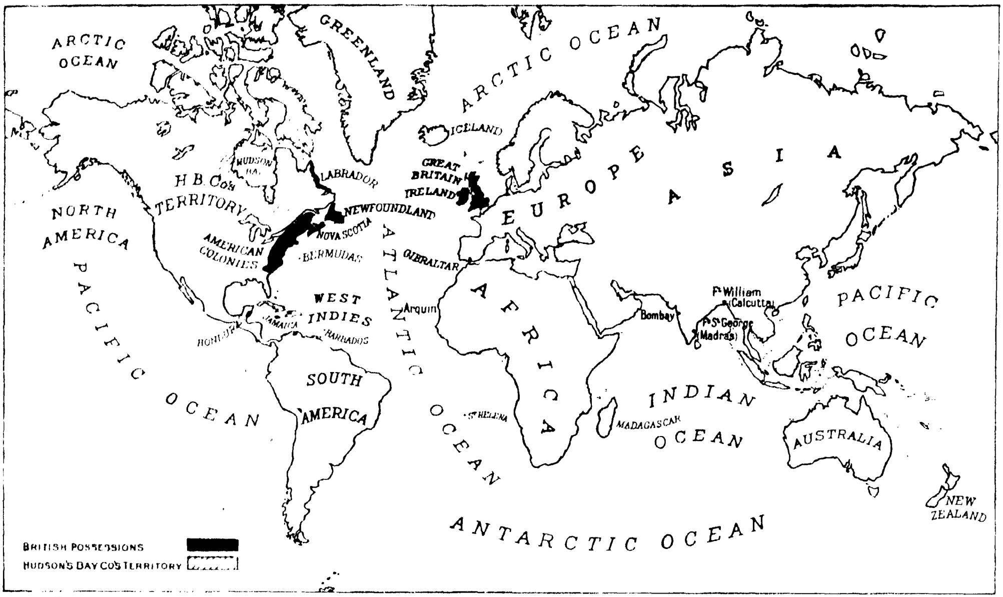

FIG 1—MAP OF THE BRITISH EMPIRE IN 1714, SHOWING (IN BLACK) BRITISH POSSESSIONS OF THAT TIME. THE HUDSON'S BAY COMPANY HOLDING SPECIAL TRADING RIGHTS, WERE NOMINAL RULERS IN THE NAME OF THE BRITISH SOVEREIGN, OVER THE TERRITORY (SHADED) ROUND HUDSON BAY

Name	*Date*	*Status*
St Christopher (St Kitts) and Nevis	1623	Presidency of Leeward Islands
St Helena	1673	Colony
St. Kitts (*see* St. Christopher and Nevis, above)		
St Lucia	1803	Colony of Windward Islands; contains U S leased base
St Vincent	1783	Colony of Windward Islands
Samoa, Western (*see* Western Samoa, below)		
San Cristoval Island	1893	Within British Solomon Islands protectorate
Santa Cruz Group	1898	Within British Solomon Islands protectorate
Sarawak	1842	Protected state
Saskatchewan	1870	Province of Canada
Savage Island (*see* Niue Island, above)		
Savo Island	1893	Within British Solomon Islands protectorate
Selangor	1874	Protected state of Federated Malay States
Seychelles Islands	1794	Colony
Sierra Leone	1788	Colony and protectorate
Sikkim	1816	Indian state (protected)
Sind	1843	Province of British India
Singapore	1819	Settlement of colony of Straits Settlements
Socotra Island	1876	Dependency of colony of Aden
Solomon Islands		Dependency of Mauritius
Solomon Islands	1920	Within (mandated) Territory of New Guinea
Solomon Islands Protectorate, British (*see* British Solomon Islands protectorate, above)		
Somaliland, British (*see* British Somaliland, above)		
Sombrero Island		Administered with Virgin Islands
South Australia	1836	State of Commonwealth of Australia
South Georgia		Dependency of Falkland Islands
South Island	1840	Within Dominion of New Zealand
South Shetland		Dependency of Falkland Islands
South West Africa	1920	Mandate of Union of South Africa
Southern Rhodesia	1888	Colony
Stewart Island	1840	Within Dominion of New Zealand
Straits Settlements	1786	Colony of 4 Settlements—Singapore (with Cocos Isls., Christmas Isl.), Penang (with Prov. Wellesley), Malacca, Labuan
Sunday Island (*see* Raoul Island, above)		
Suwarrow Island		Within Cook Islands group
Sverdrup Islands		Dependency of Canada
Swaziland	1888	Protectorate within South Africa
Sydney Island		Within Phoenix group
Takutea Island		Within Cook Islands group
Tanganyika Territory	1922	Mandate of United Kingdom
Tasmania	1803	State of Commonwealth of Australia
Tobago	1763	Colony (with Trinidad)
Togoland (British sphere)	1922	Mandate of United Kingdom—administered with Gold Coast
Tokelau (or Union) Group		Administered by New Zealand
Tonga (or Friendly) Islands	1890	Protected state
Tongaland	1890	Within Natal province
Torres Island		Attached to New Hebrides
Trans-Jordan	1922	Within mandate for Palestine
Transvaal	1900	Province of Union of South Africa
Travancore	1923	Indian state (protected)
Trengganu	1909	Protected (unfederated) Malay state
Trinidad	1797	West Indian colony (with Tobago); contains U.S. leased base
Tristan da Cunha		Dependency of St. Helena
Trobriand Islands		Group of Territory of Papua
Turks and Caicos Islands	1799	Dependency of Jamaica
Uganda	1894	Protectorate
Unfederated Malay States		5 protected states (not in federation)—Johore, Kedah, Perlis, Kelantan, and Trengganu
Union Group (*see* Tokelau Group, above)		
Union of South Africa	1910	Dominion comprising 4 provinces—Cape of Good Hope, Natal, Transvaal and Orange Free State
United Provinces of Agra and Oudh	1764	Province of British India
Vancouver Island	1849	Within province of British Columbia
Victoria	1788	State of Commonwealth of Australia
Virgin Islands	1773	Presidency of Leeward Islands
Walvis Bay	1878	Administered by Cape of Good Hope province

Name	*Date*	*Status*
Washington Island		With Fanning Island, within Gilbert and Ellice Islands colony
Wellesley, Province (*see* Province Wellesley, above)		
West Africa, British (*see* British West Africa, above)		
West Indies, British (*see* British West Indies, above)		
Western Australia	1791	State of Commonwealth of Australia
Western India States Agency	1924	Group of Indian states (protected)
Western Pacific Islands		Groups under high commissioner comprise Gilbert and Ellice Islands, British Solomon Islands protectorate, Tonga, New Hebrides, Phoenix group, and Pitcairn Island
Western Samoa	1920	Mandate of New Zealand
Windward Islands		4 West Indian colonies—Grenada, St. Vincent, St Lucia and Dominica; and the Grenadines, half under St. Vincent, half under Grenada
Ysabel Island	1900	Within British Solomon Islands protectorate
Yukon Territory	1898	Administered by Dominion of Canada
Zanzibar	1890	Protectorate
Zululand	1887	Within Natal province

British territories in the Pacific not listed above include Bird Island, Bramble Cay, Caroline Island, Danger Islands, Dudosa, Flint Island, Jarvis Island, Macquarie Island, Malden Island Palmerston Island, Palmyra Island, Purdy group, Raine Island, Rakahanga Island, Starbuck Island, Surprise Island, Vostock Island, Willis group and Wreck reef. In the Indian ocean there are, besides the territories already mentioned, Amirante Islands, Aldabra Islands, Farquhar Islands, Praslin, St. Brandon Islands, Six Islands, and some other small groups.

Egypt was a British protectorate during 1912–22; British military forces, which had occupied the country since 1882, were withdrawn in 1936, though a treaty of alliance permitted their retention in the vicinity of the Suez canal. Iraq was a League of Nations mandate entrusted to the United Kingdom from 1920 until the country became an independent state in 1927. Wei-hai-wei, leased from China in 1898, was relinquished by Britain in 1930, and Kuling, a small hill resort, was restored to Chinese sovereignty in 1936. The Phoenix group of Pacific islands was included as part of the Gilbert and Ellice Islands colony in 1937; when claims of sovereignty over Canton and Enderbury, of the Phoenix group, were put forward by the United States in 1938, an agreement was reached to make the islands available to both powers for aviation and communications purposes. Simultaneously with relinquishment of her extraterritorial rights in China in 1943, Great Britain gave up her concessions in Shanghai and Amoy.

In 1937 the external relations of the Indian states were vested in a crown representative, as the person holding the office of governor-general of British India. The Government of India act, 1935, made provision for the federalization of the Indian states with the provinces of British India, should the former so decide. Between the northwest frontier of British India and that of Afghanistan there are districts known as the North-West Frontier Agencies and Tribal Areas, over which the government of India exercises surveillance though interfering as little as possible with the rule of the tribal chiefs. Nepal is a wholly independent kingdom, with respect to both internal and external affairs, a status confirmed by treaty in 1923; after 1934 there was a British legation in Nepal, and a Nepalese minister in London. Bhutan, between Tibet and British India, is likewise an independent state.

III. POLITICAL DEVELOPMENT

This vast congeries of communities, widely varying in character and absorbed within the empire by varying methods, is governed, under the supreme headship of the British crown, in several different forms. These forms of government are the outcome of a process of development which is continually at work. Underlying the great diversity of forms is the basic principle that the populations should have as great a degree of responsibility for the management of their own affairs as their circumstances permit, and that the various peoples are encouraged and actively assisted to progress stage by stage towards the eventual goal of self-government.

The empire, with its condominiums and mandates, may be divided into the following political classes:—

(1) The United Kingdom of Great Britain and Northern Ireland, consisting of England, Wales, Scotland and Northern Ireland. It possesses full sovereignty, external and internal. Northern Ireland, besides having a parliament and a government responsible to it for local matters, sends members to the parliament of the United Kingdom. The Channel Islands and the Isle of Man are in an anomalous position, inasmuch as they have independent legislatures and semi-independent executives, subject to the supremacy of the British parliament.

(2) Self-governing dominions. These countries were defined by the Balfour committee of the imperial conference of 1926 as "autonomous communities within the British empire, equal in status, in no way subordinate one to another in any aspect of their domestic or external affairs, though united by a common allegiance to the crown, and freely associated as members of the British Commonwealth of Nations." The Statute of Westminster, 1931, legislation of the parliament of the United Kingdom gave legal effect to this declaration. The countries holding dominion status comprise the dominion of Canada, the commonwealth of Australia, the dominion of New Zealand, the Union of South Africa, Eire (formerly the Irish Free State) and Newfoundland; the autonomy of the last named was suspended, however, in 1934. While Eire has equal status with these other countries and the crown is accepted as an instrument for the discharge of certain external functions, all references to the crown were removed from the Eire constitution. Newfoundland, owing to financial difficulties, temporarily relinquished dominion status at her own request in 1934, administration then being assumed by a commission responsible to the government of the United Kingdom. All the dominions (except Newfoundland), and the United Kingdom, became members of the League of Nations.

(3) The Indian empire. It comprises two types of territory (i) British India (consisting of 11 provinces and 6 commissioner's provinces) and (ii) the Indian states, ruled by hereditary princes and varying in size from a state such as Hyderabad (of about the same area as England and Wales) to small states of a few square miles. Pending federalization as envisaged in the Government of India act, 1935, British India is administered through a central government (consisting of the viceroy, an executive council, an upper chamber known as the council of state, and a legislative assembly), each province being entitled to an elected legislature enjoying complete self-government in provincial affairs; the Indian states possess various degrees of internal autonomy, external relations being in British hands. The Indian empire became a member of the League of Nations and had an Indian representative at imperial conferences.

(4) Territories with autonomy less than that of dominions but greater than that possessed by most parts of the colonial empire comprise Southern Rhodesia and Burma. Ceylon, too, has a measure of restricted autonomy, though less than that of Southern Rhodesia and Burma, while Cyprus and Malta, which had attained a considerable degree of self-government, experienced setbacks in their political evolution.

(5) Other colonies, and the protectorates, are in varying degrees dependent upon the United Kingdom. Except in the Bahamas, Barbados, Bermuda, Jamaica and the Leeward Islands, the crown has the power of legislating by order in council

i. Territories with an elected house of assembly and a nominated legislative council: Bahamas; Barbados; Bermuda. A new constitution for Jamaica approved in 1943 provided for like legislative powers.

ii Territories with partly elected legislatures: British Guiana; British Honduras; Fiji; Gold Coast; Kenya (colony's legislative council also legislating for the protectorate); Leeward Islands (one body for whole federation,

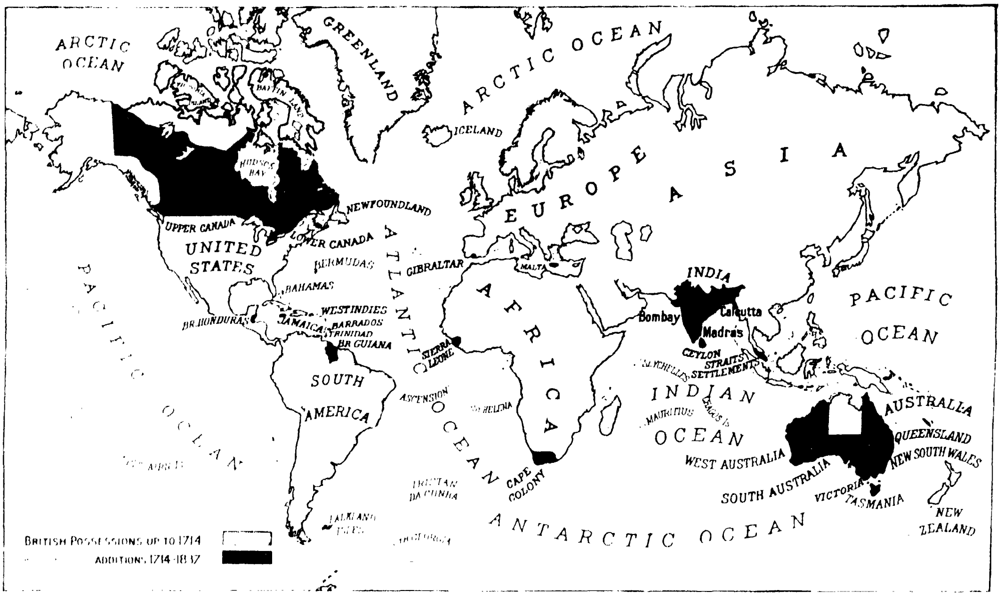

FIG. 2 MAP OF THE BRITISH EMPIRE IN 1837. SINCE 1714, INDIA AND THE GREATER PART OF CANADA AND AUSTRALIA HAD BEEN ADDED WHILE SUB-ARCTIC CANADA, INCLUDING VICTORIA ISLAND AND BAFFIN LAND, ALTHOUGH NOT COLONIZED, WAS CLAIMED BY THE CROWN. CAPE COLONY WAS ALSO ANNEXED DURING THIS PERIOD, AS WERE THE STRAITS SETTLEMENTS

and others for each of 4 presidencies, the governor alone legislating for the Virgin Islands); Mauritius; Nigeria; Northern Rhodesia; Sierra Leone; Straits Settlements; Trinidad, Windward Islands (separate legislatures for each colony—Dominica, Grenada, St. Lucia and St. Vincent).

iii. Territories with legislatures wholly nominated: Falkland Islands; Gambia (colony's legislative council also legislating for the protectorate); Hongkong; Nyasaland protectorate, Seychelles; Turks and Caicos Islands (dependency of Jamaica); Uganda protectorate; Zanzibar.

iv. Territories having no legislatures: Aden; Ashanti; Basutoland; Bechuanaland protectorate; British Solomon Islands protectorate; Gibraltar; Gilbert and Ellice Islands; Northern Territories (Gold Coast); Pitcairn Island; St Helena; Somaliland; Swaziland.

(6) Protected states, which in some cases possess internal autonomy, while in others administration is carried on by British officials in the names of their rulers. They comprise Brunei, which is administered by the government of the Straits Settlements, British North Borneo, which conducts its own internal affairs, Federated Malay States, which possesses a federal legislative council and also a legislature in each state; Sarawak, in which the legislature is termed council of Negri; Tonga, which has an elected legislative assembly; and the Unfederated Malay States, each of which has a legislature.

(7) Dependencies of dominions. Australia administers Papua (having a nominated legislative council) and Norfolk Island (having an advisory council); Australian Antarctic Territory; and the Territory of Ashmore and Cartier Islands. New Zealand administers Tokelau Islands; Ross Dependency; Auckland Islands; Cook and other Pacific islands; Kermadec Islands; and Niue (or Savage) Island. Newfoundland administers Labrador.

(8) Territories held under condominium comprise the Anglo-Egyptian Sudan (with Egypt) and the New Hebrides (with France)

(9) Mandates of the League of Nations:

i. Held by the British empire: Nauru, administered by the Commonwealth of Australia, by agreement between that dominion, New Zealand and the United Kingdom.

ii. Held by the United Kingdom: Palestine (the mandate also covering Trans-Jordan); Tanganyika Territory; Cameroons (British sphere), administered with Nigeria; and Togoland (British sphere), administered with the Gold Coast.

iii. Held by dominions: Territory of New Guinea (by the commonwealth of Australia); South-West Africa (by the Union of South Africa); and Western Samoa (by New Zealand).

In Sept. 1940, at a time when the empire was confronted with the difficulty of conducting war alone against both Germany and Italy, the British government concluded agreements with the United States whereby, in exchange for the delivery to the former of 50 20-year-old destroyers, the latter acquired on 99-year lease naval and air bases and facilities in the Bahamas, Jamaica, St Lucia, Trinidad, Antigua and British Guiana. At the same time the United States was granted freely and without consideration like leases for bases in Newfoundland and Bermuda.

All the bases were free from rent and charges other than compensation to be paid by the United States to owners of private property for loss by expropriation or damage; the American government accepted the British offer in 1943 to assume these costs.

The Japanese, in World War II, overran many British territories during 1941–42. The principal portions of the empire occupied comprised Hongkong, Burma, Malaya, the British sphere of Borneo, the Gilbert Islands, and portions of Papua, the Territory of New Guinea and the British Solomon Islands protectorate.

The political classes into which components of the empire, its condominiums and mandates have been divided above fall into four main groups: (a) self-governing communities (nos. 1 and 2 above); (b) the Indian empire (no. 3); (c) territories with restricted autonomy (no. 4); and (d) nonself-governing areas (nos. 5 to 9).

A. SELF-GOVERNING COMMUNITIES

The political development of the United Kingdom is dealt with in other articles (*see* ENGLISH HISTORY, etc.). The political development of the dominions has proceeded on the same lines. In fact it is best described as a process of assimilation by which British citizens in the oversea territories occupied by the dominions have acquired in course of time, stage by stage, the same political status as British citizens in the mother country. The keynote of this process has been equality. It was inequality which at root brought about the secession of the old American colonies.

The American Colonies.—The isolation of the first colonists on the North American coast made it impossible for these pioneers to be represented in the English parliament. But in the conduct of their own local affairs they possessed from the first a certain measure of equality. In each colony, soon after its foundation, a representative assembly was established, on the model of the house of commons, which enacted legislation for the colony, including taxation to meet the cost of its administration. But the executive was independent of the legislature; for, whereas in England the principle of responsible government, *i.e.*, that the executive should be responsible to the legislature, began to be established in the course of the 18th century, the colonial executive, the governor and other officials, was responsible in most colonies only to the crown or the minister who advised the crown. Otherwise the American colonies were virtually independent in their local concerns, in which the British government in those days took little interest. Externally, however, they were quite subordinate. Their trade was controlled by a system of navigation acts and other legislation, enacted by the British parliament as part of a "commercial system" applied to the whole empire. Despite occasional friction between executive and legislature, the colonists felt themselves sufficiently free and self-governing internally; and the external restrictions of the trade laws did not seem burdensome because on the whole it was economically profitable, and, if need be, it could be, and was, evaded by smuggling. But the system was bound to seem less tolerable as soon as anything occurred to emphasize the inequality of status it involved; and when the British government attempted to raise money for the cost of maintaining troops in America, partly by direct taxation and partly by stiffening up the administration of the trade laws, the colonists revolted and the system collapsed.

The Crisis in Canada.—Fifty years after the American revolution, British statesmen were confronted with a similar crisis in those colonies in North America which had survived the schism or had been established since. Except for the decision never again to tax the colonies for revenue, the new political system was much the same as the old. The colonies possessed local representative government and nothing more, and in 1837 a period of increasing tension in Upper and Lower Canada culminated in rebellions. Lord Durham (*q.v.*), sent from England to investigate, declared in his famous *Report* that the only cure was to give the colonists the same kind of self-government in all their internal affairs as that enjoyed by Englishmen at home. The result was that responsible government was established in the North American colonies in 1846–49 and in Australia and New Zealand a few years later. It was delayed in South Africa owing to the native problem.

Once it had been conceded that the people of a colony had the same right as the people of the mother country entirely to control their local affairs, it was difficult to refuse their claim for a wider measure of equality. In 1859, after a brief controversy, the demand of the province of Canada to be free to set up protective tariffs not only against foreign goods but also against British was conceded.

Unification of the Dominions.—The most important stage in this advance was the change from colonies into dominions, *i.e.*, the unification of contiguous groups of colonies into national entities. By this means colonies, which in their separate existence had been small and weak, attained a size and strength which made them at least potentially comparable with the mother country. Unification also made possible the steady growth of a distinctive national spirit. In 1867 the four chief North American provinces, on their own initiative but with full consent in Britain, constituted themselves a federation under the title of the "Dominion of Canada"; the other provinces, existing or created later, all joined the federation in due course. Newfoundland chose to remain separate.

For various local reasons the other groups of colonies were slow to follow Canada's lead. The commonwealth of Australia was not proclaimed till 1901 and the Union of South Africa did not become a reality till 1910. New Zealand, which had never been divided into separate colonies, obtained a unitary constitution in 1870, but did not receive the official designation of "dominion" till 1907. Southern Ireland secured dominion status in 1921 under the title of the Irish Free State and the Government of India act, 1935, made provision for dominion status for the Indian empire as soon as its components, British India and the Indian states, agreed upon the form of a federal union.

Dominion Constitutions.—Both Canada and Australia have federal constitutions, in some respects analogous to that of the United States. In Canada, the federal legislature is bicameral, members of the senate being appointed for life by the governor-general in council and members of the house of commons being elected by the people for the duration of parliament. Eight of the nine provinces have unicameral legislatures, Quebec having in addition to an elected legislative assembly, a legislative council with nominated membership. Lieutenant-governors, who represent the crown in the provinces, are appointed by the dominion government, whereas in Australia like appointments (termed governorships) are made by the British government. The federal government of Canada can disallow provincial acts, but that of Australia lacks that power. The dominion government exercises all power not expressly assigned to the provinces, in contrast to Australia, where the states are free to legislate in all matters not specifically allotted to the commonwealth. The Australian federal legislature is bicameral, members of both senate and house of representatives being elected. Queensland has a unicameral (elected) legislature, and the other five states two houses each, both having membership elected by the people (except in the case of New South Wales, where members of the upper chamber are elected in joint sittings of the two houses).

Until suspension of its constitution in 1934, Newfoundland had a nominated legislative council and an elected house of assembly, these bodies constituting the sole legislature. It is similar, too, in New Zealand, the only legislature of the dominion being a nominated upper house, the legislative council, and an elected lower house, the house of representatives. Likewise, the Union of South Africa has a single legislature, with a senate (mainly elected) and an elected house of assembly; the four provincial councils have strictly subordinate and delegated powers.

Defense Forces Prior to World War I.—The self-governing colonies, predecessors of the dominions, were free from almost every obligation of contributing either by personal service or money payment towards their own defense. Imperial policy changed after 1862, when the British house of commons resolved that "colonies exercising the right of self-government ought to undertake the main responsibility of providing for their own internal order and security, and ought to assist in their own external defense." As a result, imperial troops were gradually withdrawn from the self-governing colonies, and encouragement was given to the development of local military systems. In 1868 the Canadian government began to organize local forces, and British troops were withdrawn from New Zealand in that year, and from Australia in 1870. The last British troops (save naval station garrisons) left Canada in 1871; and naval forces left Halifax and Esquimalt in 1905. Colonial military forces were relatively weak and mainly composed of militia and volunteers until compulsory military training was established in Australia and New Zealand in 1909. South Africa introduced compulsory military service three years later.

The Colonial Naval Defence act, 1865, empowered self-governing colonies to provide ships of war for their own defense and in

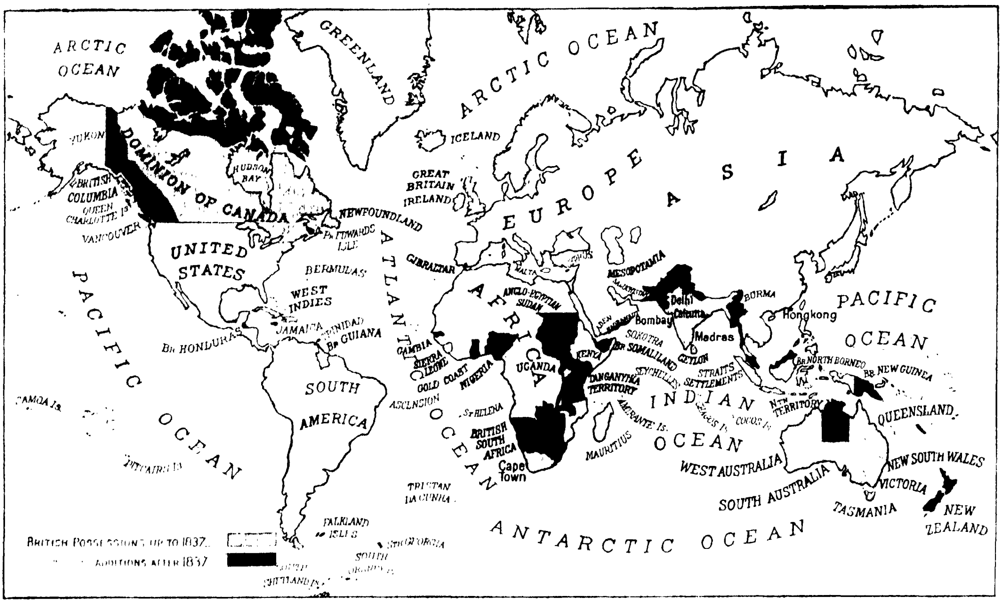

FIG. 3.—THE BRITISH EMPIRE AT THE START OF WORLD WAR II, COVERING NEARLY 16 MILLION SQUARE MILES OF THE EARTH'S SURFACE

case of need to place them at the disposal of the British government for imperial purposes. After 1887 the Australasian squadron of the royal navy was increased, and Australia and New Zealand contributed toward naval expenditure of the United Kingdom. After 1897 Cape Colony, Natal and Newfoundland contributed smaller sums. While the Australian-New Zealand and South African contributions were increased in 1902, Canada declared that she preferred to create a local navy rather than contribute to the British treasury. Australia began in 1909 to build a commonwealth navy of first-class vessels; New Zealand presented a battleship to the British navy but adopted the "local navy" policy in 1913. Canada began a local navy policy by buying two small cruisers in 1910, while South Africa continued its contribution for the time.

The first Colonial conference, held in 1887, met mainly to discuss defense. The committee of imperial defense was set up in 1901–02 with dominion representatives, and it became the supreme consultative body on the question. Troops from the self-governing parts of the empire, meanwhile, had begun to take part in imperial wars. Contingents from Canada and New South Wales served on the Sudan expedition of 1885; and 30,000 men from Canada and Australasia fought in the South African War, 1899–1902. Subsequent policies and actions of the dominions with respect to local and imperial defense are discussed later in this article.

The Dominions and Foreign Policy.—It was not till the eve of World War I that the dominions began to concern themselves directly with foreign policy, having been content previously to leave the issues of war and peace in the hands of the British government. At the imperial conference of 1911 (the term "colonial" was discontinued at the 1907 meeting), dominion prime ministers were, for the first time, admitted into the secrets of foreign policy, though the British government was still unwilling to share with the dominions responsibility for it. The dominion governments being more concerned at that time with confirming and advancing their separate national status than with devising methods of united action, in 1912 they succeeded for the first time in having their own representatives at an international conference—a meeting on the subject of radiotelegraphy. This recognition for external purposes of a distinction long familiar in matters of internal sovereignty was followed once more in 1913–14 in the Conference on the Safety of Life at Sea.

The Dominions in World War I.—The outbreak of hostilities came so swiftly on Aug. 4, 1914, that it was impossible to consult the dominions, who, under the relationship then existing, became belligerents automatically when the United Kingdom declared war. Co-operating willingly, they placed their naval forces (the Australian fleet and the units belonging to the other dominions) under admiralty orders, and troops, specially raised for imperial service, under British command; only in the last year of the war did the Canadian expeditionary force have some independence. At the time war began the populations of Canada, Australia, New Zealand and South Africa together numbered some 22,000,000 persons. These dominions raised a total of 1,460,321 men for their armed forces which, besides participating in the great campaigns in Europe and the near east, served in Pacific areas and throughout Africa. Their total casualties amounted to 503,751, of whom 139,212 were killed in action or died of disease.

In the earlier period of the war the governments were too busy to hold the imperial conference, due under its constitution to meet in 1915. However, when David Lloyd George succeeded Asquith in 1916 as British prime minister, the determination to secure greater efficiency in the conduct of the war, and the more complete mobilization of the strength of the empire, led to the summoning of representatives of the dominions and, for the first time, of India, for discussions with the British government. Meetings in 1917 and 1918 took a double form; on the one hand, the immediate issues affecting the war and the conditions on which peace might be made were debated at sessions of the imperial war cabinet, while matters of secondary importance were dealt with by the imperial war conference.

Representatives of each dominion, India and the United Kingdom served on the imperial war cabinet, the British prime minister presiding merely as *primus inter pares*. Although the dominion representatives agreed to cabinet resolutions (there was no joint responsibility) only on the understanding that they must be approved by their colleagues and parliaments, they were able to express their views and thus, in some measure, to share in the supreme direction of the forces of the empire. However, final responsibility necessarily rested with the British government in view of the preponderant share of the burden of the war borne by British resources. Nevertheless, the war effort and sacrifices of the dominions developed a high sense of responsibility and brought recognition of the fact that the constitutional relations of the empire would have to be reconsidered at a conference to be summoned after peace was achieved. Repudiating the federal idea, the members of the 1917 session of the imperial war conference resolved in the famous "Borden resolution" that any new system must maintain "all existing powers of self-government" enjoyed by the dominions, and recognize them as "autonomous nations of an imperial commonwealth."

The Versailles Peace Conference.—Although the dominions were not recognized by foreign powers as independent nations, their contribution to victory was such that their claim to individual representation at the peace conference of 1919 could not be ignored. A compromise was, accordingly, reached. Under this, in addition to the British empire delegation on which the dominions might be represented from time to time on a panel system, Canada, Australia, South Africa, New Zealand and India were also recognized, in their own right, as "belligerent powers with special interests"—*i.e.*, the status of small states, as contrasted with the major powers, who had "general interests." Newfoundland was omitted in view of her small population. The influence of the dominion representatives was of greater importance, however, within the British empire delegation. They helped decide what attitude should be adopted by that body, or, when matters were left to the heads of the delegations of the five great powers, by Prime Minister Lloyd George.

Further confirmation of "dominion status" (as it was now called) was marked by the form in which the treaty of Versailles was concluded. Thus the dominion delegates received their full powers to negotiate and sign separately from the crown on the separate advice of their respective governments; and, while the British delegates signed the treaty for the British empire generally, the dominion delegates signed each for his own dominion. Similarly, the dominions insisted that the ratification of the treaty should not be carried out until approval of it had been expressed by their parliaments, and, after demur on the ground of delay, this demand was conceded by the British government. The same procedure was adopted in the international negotiations on seapower in the Pacific at Washington in 1921–22. A similar British delegation attended the conference, and the treaty was signed and ratified separately by dominion representatives as was the case with the treaty of Versailles.

Membership in the League of Nations.—Still more important was the decision taken at the request of the dominions to secure them an independent position in the League of Nations as created by the treaty of Versailles. This was done by including the British empire in the list of original members, followed immediately by the dominions and India, ignoring the United Kingdom altogether. The effect was to confer on the dominions and India for all purposes of the League of Nations an international status apart from the British empire, which was to be represented by delegates appointed by the British government. It was ruled, too, that the dominions were eligible for election to nonpermanent seats on the council of the League, despite the fact that the British empire as such had a permanent place on the council. Further recognition of the independent status of the dominions came in conferment of mandates directly on Australia, New Zealand and South Africa, besides those conferred separately on the British empire and on the United Kingdom.

Imperial Conferences after World War I.—Although the sense of "nationhood" had been greatly stimulated during the conflict, the conference of 1921 declared itself satisfied that no reconstruction of imperial relations was desirable. The value of the plan of conference, however, was strikingly confirmed at this meeting, for it was found possible to adjust the discordant views of Great Britain and the dominions regarding the renewal of the Japanese alliance by adopting the policy which culminated in the Washington conference and the treaties of 1922.

The Irish Free State was represented for the first time at the meeting of the imperial conference in 1923. There it was agreed that treaties should normally be negotiated and signed by representatives of parts of the empire affected, and that it should be the duty of the government primarily concerned to see that any other government which was affected should be invited to take part in the negotiations. Discussion at the conference of the terms of peace to be made with Turkey (the treaty of Lausanne) led to an unfortunate misunderstanding, for only representatives of the United Kingdom had participated in the negotiations prior to the peace settlement. This failure to abide by the precedents set in negotiating the treaty of Versailles and the Washington treaties was due solely to the attitude of other interested powers, not to an omission on the part of the British government, but great exception was taken to it by the dominion representatives. In 1924 Canada made it clear that, while she did not object to ratification of the treaty, the responsibility for it, and for the obligations which might be imposed on the empire under its terms, must rest with the British government only. The doctrine was thus established that the dominions would accept active obligations only when they had taken part in the negotiations and agreed to their results.

In confirmation of the fact that the dominions were now equal with the older and larger Britain "in status, though not in stature," a new office of secretary of state for dominion affairs was created in 1925, the colonial office in London henceforth being concerned only with the nonself-governing crown colonies. In addition to business connected with the dominions, the dominions office also dealt with that of the self-governing colony of Southern Rhodesia and the South African territories (Basutoland, Bechuanaland protectorate and Swaziland), and business relating to the imperial conference.

The imperial conference of 1926 was one of the most memorable held, for there the "position and mutual relation" of Great Britain and the dominions was discussed and a doctrine of equality and freedom defined as follows: "They are autonomous communities within the British empire, equal in status, in no way subordinate one to another in any aspect of their domestic or external affairs, though united by a common allegiance to the crown, and freely associated as members of the British Commonwealth of Nations." The conference also decided that the old customs of "disallowance" or "reservation" of dominion legislation by the king on the advice of his British ministers—customs which had fallen into disuse—were no longer constitutional since the king, being advised on dominion matters by dominion governments, could not properly be advised against these governments' views by the British government.

The imperial conference of 1930 adopted the report of the committee which, since the meeting of 1926, had studied proposals for giving legal effect to the fact that all limitations on the freedom of the dominions within the empire had been removed. The next step was enactment by the British parliament of the statute of Westminster (*see below*). The conference also resolved that henceforth the king should appoint governors-general only in consultation with the government of the dominion concerned (rather than, as heretofore, on the advice of the British government) and extended existing tariff preferences within the empire for another three years, pending further discussion of the subject at a special conference.

The last imperial conference to meet before outbreak of World War II was that of 1937. No representative was sent to it by Eire (the name adopted that year by the Irish Free State) nor by Newfoundland (whose dominion status had been temporarily suspended in 1934), but Southern Rhodesia and Burma were separately represented for the first time. In view of the unsettled state of world affairs, more attention was devoted to considerations of empire defense than to such subjects as dominion status and autonomy. For the first time, too, representatives of dominion legislatures met in London prior to an imperial conference at a conference of parliaments convened by the Empire Parliamentary association.

The Position of Ireland.—The aspect of the British empire as an informal alliance of autonomous states was emphasized by the signing in 1921 of a document entitled "Articles of Agreement for a Treaty between Great Britain and Ireland." It was provided that the status of the Irish Free State (therein recognized) within the British empire should be the same as that of Canada, Australia, New Zealand and South Africa, and that its position in relation to the imperial parliament and government should be that of the Dominion of Canada. In 1933 the parliament of the Irish Free State enacted abolition of the requirement that members of the legislature should swear an oath of allegiance to the crown, and ended appeals to the judicial committee of the privy council. The office of governor-general the representative of the crown in the Irish constitution, was done away with in 1936, and after the abdication of Edward VIII in that year the office of the crown was restricted to "external association." The name of "Eire" was adopted in place of "Irish Free State" when a new constitution went into effect in 1937, at which time the British government stated that "they are prepared to treat the new constitution as *not* affecting a fundamental alteration" in the position of the country as a member of the British commonwealth of nations. In commercial relations Eire retained her dominion status, in 1938 concluding with the United Kingdom a trade agreement, involving tariff preferences, along the lines of those reached at Ottawa by other dominions in 1932.

In Eire there is a "representative" of the government of the United Kingdom, holding a position analogous to that of a high commissioner in other dominions, and likewise, Eire has a high commissioner in London, transactions being conducted through the dominions office. Eire appointed diplomatic representatives in the United States, Spain, France and Belgium, Italy, the Vatican, Germany, Portugal and Switzerland, these bearing letters of credence from the king; in countries where Eire does not have a legation, British ambassadors or ministers are responsible for Irish business.

When Great Britain went to war with Germany in 1939, Eire declared herself neutral, and German and Italian ministers remained in Dublin after the conflict developed into World War II. The fact that Eire's decision to remain neutral was fully accepted by the rest of the member states of the British commonwealth was a drastic demonstration of the reality of independent nationhood which dominion status conferred. Protection of shipping of the United Nations in the Atlantic was seriously hampered by lack of the use of the Irish ports of Cobh, Berehaven and Lough Swilly. The treaty of 1921 had provided that the United Kingdom should maintain forces for the protection of those ports, but by an agreement made in 1938 the ports and their defenses had been transferred to Eire.

Statute of Westminster.—The equal status of the dominions within the British commonwealth of nations, as defined at the imperial conference of 1926 and expressed in a draft of legislation accepted by the conference of 1930, was formally acknowledged by the British parliament in 1931, when it enacted the statute of Westminster. Thus, for the first time, the fact that no acts of the British parliament could extend to a dominion except with its own consent was given formal expression, and the dominions were empowered to make laws with extra-territorial effect. Australia, New Zealand and Newfoundland reserved the right of ratification of the statute of Westminster by their own parliaments, and in 1942 Australia took this step because of practical difficulties in the drafting of legislation.

By 1931 the dominions had become in law quite independent states, though having a common allegiance to the British crown and in practice being loosely allied with each other. They made their own laws, maintained their own armed forces, devised their own tariffs (which frequently harmed British trade), restricted immigration severely (often to the exclusion of British subjects), appointed their own foreign representatives, and governed their own colonies and dependencies, as well as mandates of the League of Nations. The United Kingdom, by this time, was governing only a relatively small and diminishing part of the British empire—which could by this time be described more fittingly as the British commonwealth of nations.

Migration.—The sparseness of population in the dominions affected detrimentally not only the rate of economic development but also the potentialities for self-defense against aggressors. After eliminating those areas unsuitable for permanent white settlement, the average density of population in Australia was found in 1933 to be 3.75 persons per sq.mi., in Canada 7.25 persons and in New Zealand 13 to the sq.mi., as compared with 483 in the United Kingdom and 701 in England proper. Added to the fact that dominions discouraged migration when conditions were bad with them, potential emigrants from Britain were loath to abandon advantages secured to them by provisions of national insurance. Nevertheless, young unmarried women and children were aided in emigrating from Britain to the dominions by several voluntary societies; notably, a successful type of farm school for migrant children was initiated in Australia and Canada by Kingsley Fairbridge (1885–1924), a former Rhodes scholar, who devoted his life to the work of the Child Emigration society.

The British government afforded some financial assistance to the Selkirk scheme for settlement in Canada early in the 19th century and to the New Zealand Colonization company in the 1840s, and soon after conclusion of World War I it aided the 1820 Memorial Settlers association, which sent colonists to South Africa. In 1922 it went further, by the Empire Settlement act authorizing the subsidizing of schemes for facilitating emigration within the empire up to a maximum sum of £3,000,000 a year; half the cost in each instance was met by dominion governments or by public or private organizations. In 1937 the provisions of the act were extended for a further 15 years and, though the annual sum was reduced to £1,500,000, state aid to co-operating agencies was increased from 50% to 75%. In order to remove a deterrent to migration which had become increasingly serious, Australia passed the State Insurance act, 1938, which enabled immigrants from Great Britain to retain their health insurance and pension rights.

Relationship to Great Britain.—While the British parliament has ceased to exercise any sort of sovereignty over the dominions, the crown continued to be, in the words of the statute of Westminster, "the symbol of the free association of the members of the British commonwealth of nations." This unity under one crown did not, however, imply any subordination on the part of the dominions to the ministers of the crown in Westminster. The personality of the sovereign, too, was considered to be secondary to the importance of the institution of monarchy, as was evidenced at the time of the abdication of Edward VIII in 1936, when all dominion governments gave their support to the policy of the British government. At the coronation of George VI, the following year, the monarch's oath, for the first time, mentioned separately Canada, Australia, New Zealand and South Africa, for he had become, in law, the king of each of the dominions individually.

Appeals to the Privy Council.—Since the days of colonial government, there had existed a right of appeal from British courts of law overseas to the judicial committee of the privy council (*q.v.*). In addition to judges of the United Kingdom, dominion judges became in time eligible for appointment to the committee, and they sat from time to time. Gradually the right of such appeal came to be retained only in so far as the dominions so desired. Eire abrogated appeals of all kinds in 1933, and that same year Canada forbade appeals in criminal cases, though preserving that recourse in civil suits. In the case of Australia, appeals lie to the privy council in all matters not concerned with the powers *inter se* of the states and the commonwealth. While New Zealand and Newfoundland retained the right of appeal in all cases, appeals from South Africa (which are most rare) lie only from the appellate division of the Union's supreme court.

Intra-Empire Representation of the Dominions.—The governor-general of a dominion occupies the same position in the dominion as the king in Great Britain, though prior to 1926 he was also the representative, or agent, of the British government. As the representative of the crown he can act only in the role of a constitutional monarch, and in consequence he does not serve as the channel of communication between the dominion

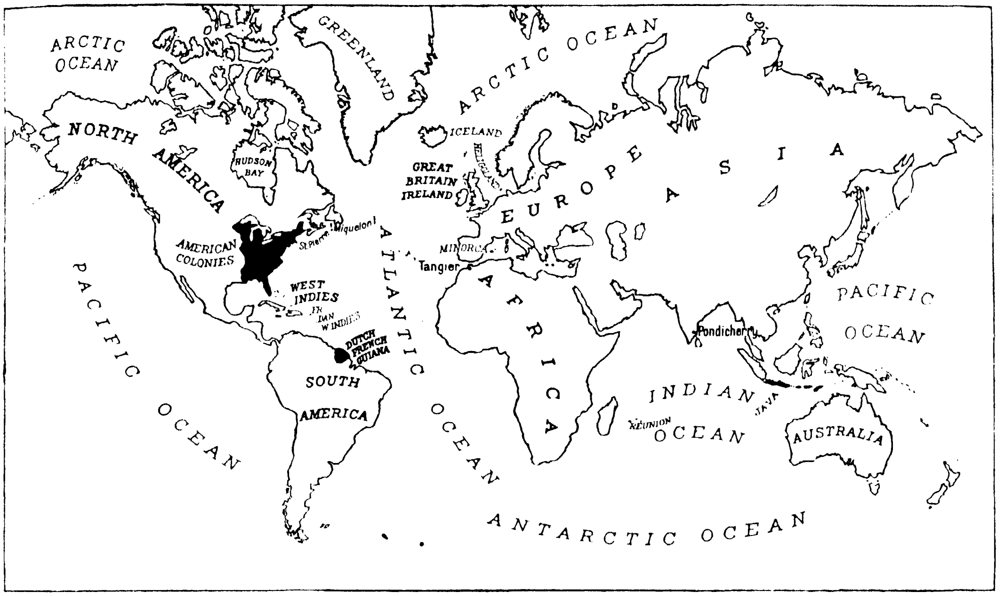

FIG. 4.—MAP SHOWING TERRITORIES (IN BLACK) CEDED BY GREAT BRITAIN FROM 1714 TO WORLD WAR II. THE 13 STATES FORMING THE AMERICAN COLONIES DECLARED THEIR INDEPENDENCE ON JULY 4, 1776, AND THIS WAS ACKNOWLEDGED BY GRLAT BRITAIN ON NOV. 30, 1782. JAVA, GUIANA, REUNION, PONDICHERRY, HELIGOLAND, ST. PIERRE AND MIQUELON WERE GIVEN UP OR EXCHANGED AS A RESULT OF VARIOUS TREATIES BOTH POLITICAL AND ECONOMIC

government and that of Great Britain. Under normal circumstances, the government of the United Kingdom is represented in each of the dominions by a high commissioner (in Eire he is styled "representative"), and likewise the dominions (including Eire) have their own high commissioners in London. The latter have almost daily meetings with the secretary of state for the dominions, and they also deal with the dominions intelligence department of the British foreign office. The respective dominions also have high commissioners or trade commissioners in their fellow dominions, concerned primarily with questions of trade but also with other matters as occasion may arise.

Foreign Relations of the Dominions.—Canada, largest and second strongest state in the Americas, was not represented at Pan-American conferences (nor were other British territories in that region). However, the recognition of the dominions as distinct entities conceded in the treaty of Versailles led to the claim by Canada for separate diplomatic representation where that was desirable in her own interests—and primarily in the United States. For various reasons, a Canadian legation in Washington was not established for some years, and in the meantime, in 1924, the crown accredited a minister of the Irish Free State to the U.S. The first Canadian minister to Washington was appointed in 1926, and subsequently the other dominions established their own legations in Washington (where India was represented by an agent-general), as well as in other foreign capitals where their respective interests were of major importance. Where they did not have their own diplomatic agents, the dominions acted through British diplomatic channels. In only a few instances do dominions maintain consular offices in foreign countries. The first dominion consulate general established abroad was that opened in New York city in 1943 by Canada, its jurisdiction covering New York state, Connecticut and northern New Jersey; it co-ordinated the work of the existing trade commissioner's office and wartime information board. In 1943 the Canadian legation in Washington was raised to an embassy, the first such status to be accorded to a British dominion in a foreign country.

Treaty Relations of the Dominions.—In accordance with a rule laid down by Lord Ripon in 1805 and reaffirmed in 1907 by Sir Edward (later Earl) Grey, any political treaty involving a dominion was signed not only by a dominion but also by a British representative. However, the recognition of virtual dominion sovereignty during and after World War I had created a new situation of considerable importance. In 1923 Canada contended that her representative alone should sign a treaty with the United States regarding preservation of the halibut fisheries in the northern Pacific ocean, for this would conform to the practice adopted in the case of the treaty of Versailles, in which acknowledgment was first made of the treaty-making powers of the dominions. The British government demurred, recognizing that such an act would constitute a precedent in the case of a bi-lateral treaty, but eventually accepted the contention.

In dealing with the Geneva protocol of 1924 and the Locarno pact of 1925, the British government consulted with the dominions mainly by telegram; and, since no *ad hoc* conference could be held nor empire delegation formed, a clause was inserted in the Locarno treaty exempting the dominions from their obligation unless expressly accepted by them. Not one of them acceded to the treaty, which included a British guarantee for the protection of France and Belgium and, in certain eventualities, of Germany also.

In 1928 the general act for the Pacific Settlement of International Disputes (the Paris, or Kellogg, pact) was signed and ratified by the dominions as a group, as was also the London Naval treaty of 1930; ratifications of the latter were deposited in October on behalf of the United Kingdom and all dominions except the Irish Free State, and on behalf of the latter in December of that year. Neither South Africa nor the Irish Free State were parties to the 1936 London Naval treaty; in this instance the other dominions did not sign as a group, Canada, Australia and New Zealand, as well as India, signing separately as individual treaty-making powers. While the dominions did not express opposition to the policy of appeasement toward Germany which culminated in the Munich pact of 1938, they were not expressly involved in the terms of the latter, or in those of the subsequent obligations toward Poland.

Dominion Defense Policies between the World Wars.—Although the dominions maintained only small defense forces after World War I, plans were prepared for rapid expansion in the event that they might become once more involved in war. Senior military, naval and air officers from all the dominions (except Eire), and from India, were sent to England for advanced training at the Imperial Defence college, which had been established in 1927. Australia made her own military training facilities available to the New Zealand forces. The Australian (nonpermanent) militia was maintained on a compulsory service basis until 1929, thereafter enlistment being voluntary, and a like change was made in 1930 with respect to the New Zealand territorial force. The Canadian militia was continued as a voluntary organization after World War I, but all male citizens of South Africa were liable to undergo a four-year course of peacetime training (though only about half of those liable were in fact called annually).

All dominions had small air forces, and their naval strengths were in some instances substantial. The royal Australian navy provided and maintained a squadron of ships, and in order to ensure close co-operation with the royal navy, ships and officers were normally exchanged. From 1920 New Zealand had her own sea-going naval forces, officers being trained in the royal navy. The Canadian navy, which had been in existence since 1910, possessed six destroyers prior to World War II and had permanent, reserve and volunteer reserve personnel. South Africa had a Seaward Defence force for protection of Union territorial waters with permanent and volunteer personnel.

The Dominions in World War II.—Unlike the situation which obtained at the outbreak of World War I, the dominions were not brought into the conflict automatically when Great Britain declared war on Germany on Sept. 3, 1939, for since enactment of the statute of Westminster they had possessed in law the discretionary power of electing to participate or of remaining neutral. Their actions left no room for doubt as to where they stood. Without waiting for approval by their parliaments, the governments of Australia and New Zealand went to war with Germany within a few hours of Britain's declaration. Both Canada and South Africa acted similarly after their legislatures had taken the decision. Only Eire exercised her untrammelled discretion in remaining neutral. The dominions exerted unstinted efforts, and in the dark days after France surrendered in 1940 Prime Minister Winston Churchill was able to announce that "we have received from all [dominion] prime ministers messages couched in the most moving terms, in which they endorse our decision [to continue the war alone] and declare themselves ready to share our fortunes and persevere to the end." Clearly, the British commonwealth of nations was stronger and more unified than it had ever been, affording an example without parallel of the fruits of voluntary co-operation stemming from complete self-government.

An Australian Imperial force (of volunteers) fought in North Africa, Greece, Crete and Malaya; compulsory military training was reinstituted in 1939 for defense of the commonwealth and territories under its authority, and the Defence act, 1903, was amended in 1943 to permit the use of militia alongside the volunteer units anywhere in the southwest Pacific area. New Zealand also resumed compulsory service for home defense in 1940, and supplied volunteer troops for service in all campaigns in the Mediterranean region. South African volunteer forces, raised for service "anywhere in Africa," played a major role in the East African campaigns before joining the British armies in North Africa. After amending legislation enacted in 1943 had permitted South African troops to volunteer for service in non-African theatres of war, forces of the Union participated in the Sicilian campaign. Canada supplied troops on a voluntary basis for service in Great Britain as well as in Iceland, Gibraltar, the West Indies and Hongkong, and Canadians also fought in Sicily and on the Italian mainland.

The naval forces of the dominions, greatly augmented, were operated with those of the royal navy, fighting in all parts of the world. The royal Canadian navy had more than 400 vessels, employed largely in the Atlantic, and in 1942 Canada instituted its first destroyer-building program. In 1939 Australia, New Zealand and Canada joined Great Britain in a co-operative British Commonwealth Air Training plan to train airmen in Canada, this scheme supplementing programs also in effect in the respective dominions. South Africa did not participate, electing to conduct air training exclusively in her own country.

The dominions shared in the aid which the United States congress provided through the lend-lease act for those countries whose defense was considered by the president essential to American interests. Much necessary equipment was sent from the United States to dominion forces in all parts of the world, and in return the dominions, in common with the United Kingdom, provided supplies and foodstuffs in great variety to American troops and vessels. Australia and New Zealand, as well as the United Kingdom, signed in 1942 "master agreements" with the United States on the principles applying to mutual aid, which was intended to "promote mutually advantageous economic relations" and "the betterment of world-wide economic relations."

The four dominions at war, Canada, Australia, New Zealand and South Africa, raised during 1939–42 well over 1,000,000 men for their armies serving overseas (in addition to home-defense forces), their combined white populations at that time being about 33,000,000 persons of both sexes and of all ages. During the first three years of war—the period ending Sept. 3, 1942—the dominions incurred battle casualties of 106,341 (the British empire as a whole having 514,093). Of this number, 13,992 were known killed, 42,461 missing, 27,464 wounded and 22,424 taken prisoner. These figures of casualties were inexact in the breakdown owing to the failure of the Japanese government to notify the names and condition of those who had fallen into their hands, as required by international law. Casualties of the United Kingdom through the first three years of war numbered 378,778 (275,844 among the armed forces and a further 102,934 among civilians), excluding the losses of the merchant navy.

Although no imperial war cabinet was created in World War II, dominion prime ministers and other accredited representatives visiting London had the right to be heard in the British war cabinet in the formulation and direction of policy. Dominion high commissioners in London were members of the Commonwealth Supply council (an outgrowth of the Empire Clearing house), which co-operated with the Combined Raw Materials board in Washington, and also of the Pacific War council, set up in London in 1942. In Washington, ministers of the dominions directly concerned served on the Pacific War council, counterpart of the body in London, and special liaison officers from the dominions were members of other organizations of the United Nations. A Canadian-American Defense commission was set up in 1940 to plan for mutual defense of the hemisphere and Canada also co-operated with the United States in construction of a highway for military purposes through the dominion to Alaska.

The trade and commerce, finance and educational progress of the dominions are discussed later in this article.

B. THE INDIAN EMPIRE

The services rendered by the people of India in World War I and the emphasis laid by the Allied and associated powers on the principle of self-government hastened measures for further Indian autonomy. Accordingly the Government of India act, 1919, with the declared intention of leading up by gradual stages to responsible government, introduced a constitutional system known as dyarchy, by which the field of government in the provinces was divided into "reserved" and "transferred" subjects; the former was to be controlled by the governor of a province and a nominated executive council, the latter by the governor acting with Indian ministers responsible to elected legislative councils. At the same time a mainly elected legislature was created for all British India; but the all-India executive (the governor-general and council), while acting as far as possible in harmony with this legislature, was not to be responsible to it but only to the British government and parliament.

Government of India Act, 1935.—In 1927, two years before it was required by the act of 1919, a statutory commission (under Sir John Simon) was appointed to report on what further progress could be made. Following its recommendation in 1930 that dyarchy and "gradualness" should be abandoned, three round table conferences of Indian representatives met in London to discuss further legislation. A new constitution was embodied in the Government of India Act, 1935, separating Burma from India and giving full responsible government to the provinces of British India (then increased from 9 to 11). Also, for the first time it provided (with the reservation of defense and foreign affairs) for a federal government of India responsible to a federal legislature composed of representatives of both British India and the Indian states. Since Hindus constitute the vast majority of the electorate in British India, the federal constitution was disliked by the Congress party (largest and best organized political party) because seats in the federal legislature were reserved for representatives of minority races and creeds. Likewise, the Moslem league, second largest political organization, feared that their community of 90,000,000 persons would become a permanent minority if all seats were open to the election of any candidate, whatever his creed, and urged creation of a Moslem state, termed "Pakistan."

The provincial portion of the act (that part applicable to British India) came into force in 1937, the federal portion awaiting acceptance by a prescribed number of Indian states, and ministries were formed in all provinces. In eight of these, after some hesitation, office was taken by members of the Congress party, but the Congress ministries resigned in Sept. 1939 in protest against Britain's alleged inadequate statement of her post-war intentions towards India. Administration was carried on by the governors in seven provinces (an alternative ministry taking office in Assam), and elected ministries continued to function in the other three provinces; ministerial government was also resumed in Orissa in 1941 and in the North-West Frontier province in 1943. When the Viceroy's Executive council was expanded in 1941 from 7 to 12 members, it contained for the first time a majority of Indian nonofficial members—who held 8 of the portfolios. The number was increased to 15 in 1942, and one Indian member of the enlarged council without portfolio was appointed that body's representative with the British war cabinet; another member also went to London as representative of the Indian states.

The Cripps Mission.—In 1942 Sir Stafford Cripps, lord privy seal in the British cabinet, visited New Delhi to discuss with leaders of the main parties and interests of India proposals put forward by his government with a view to a final solution of political differences affecting adversely Anglo-Indian relations. The British proposed that immediately following conclusion of World War II there should be created, through a constitution-making body elected by provincial assemblies and containing also representatives of the Indian states, a new Indian union which would constitute a dominion equal in every respect to the United Kingdom and other dominions. The constitution thus framed would be accepted by the British government subject only to two provisions: (1) any province which did not accept the new constitution might remain outside the union; and (2) a treaty would be negotiated between the British government and the constitution-making body covering all matters arising out of the complete transfer of responsibility from British to Indian hands, and in particular the protection of minorities, but not restricting the power of the union "to decide its relationship" to the rest of the British empire (*i.e.*, the power to secede if it wished). The British also proposed that, pending termination of hostilities, provision be made for "immediate and effective participation of the leaders of the principal sections of the Indian people" in the government of India, under the existing constitution, for the organizing to the full of the resources of India for India's defense, and the continuation, for the period of the war only, of "control and direction of the defense of India." These proposals were not found acceptable by the various Indian groups and were withdrawn then by the British government, but the latter subsequently stated that they would continue to stand by the broad intention of their offer.

The Indian States and Federation.—The position of the Indian states in a post war Indian union required the voluntary consent of the ruling princes. Their territories, one-half the area of India, are not part of British India but autonomous entities under British protection, and they are not subject to British authority. The leading states, having one-fourth of India's population, are comparable with many of the nations of Europe and the Americas in size, resources and the progressive character of their administrations. Their rulers, speaking through the representative chamber of princes, made it clear beyond the possibility of doubt that they did not desire to stand in the way of India's political freedom. However, as integral parts of India they claimed that they, no less than British India, were entitled to a full share in political power without annulment or modification of their rights and authority unless by their free consent. When Sir Stafford Cripps visited India in 1942 the chamber of princes reiterated to him the desire to co-operate in framing a new constitution for India, but claimed that states not finding it feasible to adhere should have the right to form a union of their own with full sovereign status.

India's Part in World War II.—Despite efforts made by some Indian politicians to dissuade soldiers from fighting and war workers from working, Indians willingly took their part. The strength of the military forces was increased from less than 200,000 to nearly 2,000,000 men entirely by voluntary enlistment, three-quarters of the added cost being borne by the British government. The Indian army was increasingly officered by Indians, who were trained at Dehra Dun military academy and at an additional institution opened at Mhow during the war. Except for a few technical instructors, the Indian air force, greatly expanded, was composed entirely of Indian personnel. The contribution of the Indian states to the successful prosecution of the war was particularly notable, all states devoting their entire resources and energy to furthering measures for defense of the country.

Besides serving in many parts of Asia, Indian troops, including those of the Indian states, fought in France and, particularly, in East Africa and the middle east. Indians performed brilliantly in Eritrea and Abyssinia, and participated in operations in Iraq and Syria, while for long they formed the main bulwark of the defense of Egypt against aggression from Libya. Indian pilots served with the royal air force in Britain, and the Indian air force defended the land and sea frontiers of their own country. The royal Indian navy (until 1934 known as the royal Indian marine) was employed in operations on the coasts of Italian East Africa, fought in the engagements off Java and performed much escort and patrol work in Asiatic and western Pacific waters. During the three years ending Sept. 3, 1942, Indian casualties totalled 101,979, comprising 3,286 known killed, 86,289 missing, 9,168 wounded, and 3,236 known prisoners; Japanese failure to notify the names of those in their hands rendered detailed classification of casualties uncertain.

India's contribution to the war effort in the economic field was of the utmost importance. Besides supplying nine-tenths of the military equipment needed at home, India sent to the imperial forces in Africa and the middle east a large proportion of their war materials and supplies, while Indian technicians were trained in Britain for work in India's expanded munition factories. An Eastern Group supply council, set up in Delhi in 1941, comprised representatives, besides Indian, of the United Kingdom, Australia, New Zealand and South Africa.

India's International Position.—Internationally, India enjoys, in form, the status of a dominion. Its representatives, in common with dominion prime ministers, were members of the imperial war cabinet in World War I and attended meetings of the British war cabinet in World War II, and like the dominions, India became an original member of the League of Nations. As was the case, too, with the dominions, India had a high commissioner in the United Kingdom and trade commissioners at several places abroad. In 1941 India sent to Washington its first minister, designated agent-general, and a like first diplomatic envoy of the United States in India was termed U.S. commissioner; an Indian also headed the Indian Purchasing commission in Washington

The British Position.—For varying reasons, leaders of most political parties in British India rejected the Cripps proposals for an Indian federal union. The Congress party, declining to enter a national government for prosecution of the war, resolved in 1942 to start "a mass struggle on non-violent lines on the widest possible scale," and this at a time when Japanese forces were gathered on the frontiers of India, resulted in the internment of Mohandas Gandhi and many other Congress party leaders. The British government continued to stand by its undertaking to accept and implement any constitution framed immediately after cessation of hostilities by an elected body of Indians; should any province of British India not agree to the proposed constitution, India's independence need not to be impeded thereby, because that province's independence would be recognized separately. In offering full self-government after the war, no reservation was made by the British government as to India remaining a member of the British commonwealth of nations.

The trade and commerce, finance and educational progress of India are discussed later in this article, and *see*, also, the article INDIA

C. TERRITORIES WITH LIMITED AUTONOMY

In addition to Newfoundland, whose dominion status was temporarily replaced in 1934 by a government in commission, certain components of the empire have degrees of autonomy less than that of a dominion but greater than that of most colonies. Southern Rhodesia, till 1923, was administered on the lines of a colony by the British South Africa company; but in that year, after the financial claims of the company had been met by agreement with the British government, the territory was annexed to the crown and responsible government was instituted. The powers of the unicameral legislature were limited touching the interests of the natives, and the crown maintained the right of disallowing bills and assumed direction of Southern Rhodesia's external affairs. The government of Burma, separated from that of British India in 1937, became analogous to that of the 11 Indian provinces. With certain very limited reservations, domestic affairs were placed in the hands of ministers responsible to an elected bicameral legislature. After 1931 the governor of Ceylon acted on the advice of a legislature elected for the greater part by adults of both sexes and a ministry chosen by that body; the British government undertook to grant full self-government under the crown, in all matters of internal administration, on conclusion of World War II While Southern Rhodesia deals with the dominions office in London, there is a separate Burma office (conducted in conjunction with the India office), and the colonial office handles the affairs of Ceylon.

The constitution granted to Cyprus in 1882 was suspended in 1931 after serious disorders had occurred, and pending restoration of the legislative council, in which elected members were in a majority, nominated Cypriots assisted in the task of administration. Full constitutional government on parliamentary lines was enjoyed in Malta until 1930, when active pro-Italian propaganda led to dissension and resulted in its suspension Half of the members of a council of government created early in 1939 were elected, and the British government later gave its promise that complete self-government would be restored after cessation of hostilities in recognition of the heroism of the Maltese in the face of Italian attacks in World War II.

D. NONSELF-GOVERNING AREAS

These many diverse units with varying constitutions can be grouped because none of them enjoys full responsible government, and in all of them (except the Bahamas, Barbados, Bermuda, Jamaica and the Leeward Islands) the executive can control the legislatures in those instances where they exist In some cases the governor alone has power to legislate because, as at Gibraltar, the colony is little else than a fortress or naval station, but more often because the population consists almost entirely of politically backward peoples. In other cases a legislative council or assembly exists, sometimes wholly nominated; sometimes partly elected, but always (except in the case of those territories with restricted autonomy discussed above) with a majority of official or nominated members through whom the executive can keep control. These diverse stages in political evolution illustrate a complexity which exists, too, in other aspects of what is increasingly referred to as the "colonial empire." There are fundamental distinctions between, for instance, the concepts of British colonial trusteeship and partnership, between protectorates and protected states, between direct and indirect rule, and between mandate and dual mandate. These differences in the theory of imperial relationship, in the status of certain components of the empire, and in methods of administration are considered below.

Types of Administration.—As is the case respecting colonies, the supreme government of a protectorate is vested in the crown, though, unlike colonies, the territory is not annexed to the British realm and the inhabitants are not British subjects but "protected persons." By contrast, protected states, those in which the framework of the state survives intact, are administered in the names of their rulers by British officials in some cases, though others possess internal autonomy. The area and population of protectorates and protected states are far greater in the aggregate than those of colonies. Throughout the colonial empire the taxes raised in a territory are spent in that territory and are not paid to the United Kingdom; in fact, the latter makes considerable contributions from its own exchequer, raised by taxes in Britain, to meet the expenses of administration and development—as is later related. Executive government is controlled in the cases of colonies and protectorates, and that of autonomous protected states is supervised, through the secretary of state for the colonies, with the exception of Basutoland, Bechuanaland protectorate and Swaziland, whose affairs (and those of Southern Rhodesia) are dealt with through the dominions office. The form the government takes in any given instance depends upon such circumstances as the size of the territory and its population, and the cultural level and political experience of the inhabitants.

Methods of administration of individual territories are differentiated by the terms "direct rule" and "indirect rule." Under the system of direct rule the inhabitants of a small territory or of a district of a large one are supervised directly by British officials living in close contact with them, usually exercising both executive and judicial functions and frequently being local representatives of all departments of the central government of the unit. In the case of indirect rule, local government, administrative, judicial and legislative, is mainly in the hands of tribal authorities, British officials confining themselves, for the most part, to instilling sound principles of government. The best and most suitable in indigenous culture is preserved wherever an advanced social state renders indirect rule practicable, and in order to prepare the community for eventual self-government schools for training in administration have been established for the sons of chiefs and others destined to become leaders among their peoples.

Trusteeship and Partnership.—From the close of the 19th century Great Britain recognized the principle of moral responsibility for the welfare of backward peoples, and in the application of this trusteeship millions of people in the colonial empire have obtained security of life and property, and an even-handed justice, such as they had never known before. From this acknowledgment of trust grew a concept of the "dual mandate" (*i.e.*, the "twofold requirement"), a principle described by its chief exponent, Lord Lugard, as implying (i) responsibility for the moral and material development of the inhabitants of colonial territories, and (ii) responsibility for the development of colonial resources for the benefit of the world as a whole. At that stage in colonial administration the British government fulfilled its function as trustee by preventing the exploitation of colonial peoples and by building up native responsibility for native government; but it limited its financial aid in that period to the guaranteeing of loans for the building of ports, harbours, railways and similar valuable assets. For other internal developments the colonies were to all intents and purposes dependent on their own individual resources.

An innovation in constitutional usage was introduced by the creation after World War I of the mandates system, under which concept of trusteeship the administration and development of certain conquered territories were entrusted by the League of Nations to individual victorious powers (*see* MANDATE). The terms of mandates assigned variously to the British empire, to the United Kingdom, and to certain of the dominions, authorized the administration of Nauru, Togoland, the Cameroons, New Guinea, Western Samoa and South-West Africa as portions of the territory of the mandatory, subject to the observation of certain principles in the interest of the inhabitants, and under obligation to report annually to the League. Togoland and the Cameroons were respectively attached for administration to the Gold Coast and Nigeria, the others, in practice, having separate administrations; Tanganyika, another mandate, was given a constitution of the usual protectorate type. In the case of Palestine the mandate was granted subject to the obligation, voluntarily assumed by Great Britain, of furthering the establishment of a home for the Jews; efforts to carry this out were defeated by the irreconcilable attitude of the leaders of both the Arabs (who were in a majority) and the Jews. On the eve of World War II the British government submitted to the League's permanent commission on mandates a proposal for the establishment within ten years of an independent Palestine state, under treaty obligations with Great Britain, but consideration of the plan was interrupted when the conflict broke out. The clauses of the Palestine mandate relating to the establishment of a national home for the Jews do not operate beyond the Jordan, and with the approval of the League of Nations the British government recognized the independence of Trans-Jordan.

From the concept of a trusteeship for territories not yet fitted for self-government, Britain came in the course of years to view the relationship rather as that of a partnership Whereas the former envisaged private initiative and not state action as the primary agency in improving material and social conditions the latter is a recognition of the fact that it is a function of the state (in addition to such responsibilities as maintenance of law and order) to promote economic welfare, safeguard standards of living and fit the people to govern themselves. In advanced communities having restricted self-government there is practically no recruitment from Britain for executive services, and in other territories, particularly in Africa, a large number of the indigenous inhabitants have been equipped to hold important posts in the administration and in the judicial and medical services. Throughout the colonial empire only 5,000–6,000 of those in public service have been recruited in the British Isles, all others of the 250,000 so employed having been born in the countries in which they serve. The administrative experience thus gained has proved as valuable as, though less spectacular than, any in the political field.

Economic and Social Development.—Colonial agricultural departments afford instruction in scientific farming, officials recruited in Britain training thousands of native subordinates in modern methods. The progress in agricultural vocational training was the subject of a special survey published in 1937 (H.M.S.O., Colonial No. 124). Extensive research to counteract soil deterioration in the colonial empire is carried on in London by the Imperial Bureau of Soil Science, and in Trinidad by the Imperial College of Tropical Agriculture, and like foundations were established at Anabi, East Africa, and Kuala Lumpur, Malaya. Steps to check cattle disease are rigorously enforced, and anti-locust measures are subject to a central control, planning and information services operating in affected territories.

The vast majority of indigenous inhabitants are not wage-earners, and no form of compulsion is applied to the recruitment of labour for private employment. Among the 30 labour conventions of the International Labour office ratified by Great Britain are the Forced Labour convention of 1929 and the Recruitment of Labour convention, 1936. The colonial office in London employs a labour adviser, and a social services department deals with labour and other questions. Labour departments exist in all territories where much of the population is privately employed (labour officers being engaged, in some instances, from the ranks of British trade unionists), as well as labour advisory boards composed equally of employers and workers. Children under 14 years of age may not be employed, and protective legislation ensures other wage-earners adequate pay and housing, safeguards for health and against accidents, and workmen's compensation. A Colonial Labour Advisory committee, in London, the members of which include representatives of British trade unions, constantly reviews labour conditions in all territories associated with the colonial office.

Despite much ignorance and sometimes prejudice, public health and sanitation measures raised the general standards of life in the colonial empire. In addition to unending research into the causes of tropical and subtropical diseases, nutritional surveys in the individual territories were undertaken prior to outbreak of World War II. Medical instruction was instituted in all large centres, in some instances up to the doctoral standard and in others for the training of nurses, midwives, pharmacists, health inspectors and hospital assistants. Town residents were provided with improved housing, pure water supplies and drainage and sewerage works, while in many cases rural communities received instruction in agricultural, medical and educational subjects through radio broadcasting and mobile cinema units.

Financial Assistance.—Since the total resources available to many territories from their own revenues were insufficient to afford adequate expenditure on social and economic services, it became necessary that, as the principle of partnership evolved, the burden be assumed by the British taxpayer. The first permanent financial assistance to colonial territories (earlier, there had been piecemeal "grants-in-aid") was initiated in 1929 by the Colonial Development fund, authorizing expenditures up to £1,000,000 a year on schemes of local administrations within the colonial empire for the development of agriculture and industry. Loans and grants under this measure were limited to capital expenditure for services which the territories could maintain subsequently from their own funds, but this restriction was swept away by the Colonial Development and Welfare act, 1940. This legislation, enacted just after France's surrender had left Britain alone in the war against Germany and Italy, enabled money to be spent on recurring expenditure, thus rejecting the condition that the territories must be financially self-sufficient. The British exchequer was authorized to expend, on schemes of social welfare in the colonies, protectorates, protected states and mandates, up to £5,000,000 per year for ten years, and allotted an additional annual sum of £500,000 for research; if experience should prove that either the total sum or the period was insufficient, parliament could at any time increase them.

Despite limitations imposed by war conditions, 167 schemes were being sponsored under the act two and one-quarter years after its passage, the largest comprising: rinderpest control in Tanganyika; a veterinary training school in Nigeria; reafforestation and establishment of village fuel supplies in Cyprus; roadmaking in British Honduras; and land reclamation, forestry development and equipment of schools in Jamaica. The largest number of schemes undertaken were in the West Indies, under the direction of a comptroller, sent from Britain, who was also British co-chairman of the Anglo-American Caribbean commission.

The Anglo-American Caribbean Commission.—Acquisition by the United States of bases in the British West Indies and elsewhere off her Atlantic seaboard in 1940, and her entry into World War II the following year, brought the need for close co-operation in measures related to the common war effort. Associated with matters of protection in the Caribbean area were such subjects as economics, transport, health and communications, and with a view to mutual solution of these common problems the British and United States governments jointly announced on March 2, 1942, the creation of the Anglo-American

Caribbean commission. Though lacking administrative powers, the commission was in a position to facilitate intergovernmental and interisland agreement on basic matters. On the commission each country had three members, one of whom was a co-chairman; and a permanent secretariat, with British and American co-secretaries, was established in Washington. Besides dealing with the part of the Caribbean islands in the war, the commission undertook long-term studies relating to such matters as the prevailing one-crop economy, public health and educational questions, and the greater utilization of fishery resources.

The Colonial Empire in World War II.—Colonial forces served on all battlefronts of the empire. Nearly 100,000 Africans participated in the East African and Madagascar campaigns during 1941, troops coming from West and East Africa, Northern Rhodesia, the Anglo-Egyptian Sudan and British Somaliland. In 1943 East African forces sailed for India. Many officers in both the British army and the royal air force were Africans. West Indians served with the armies in Britain and in the R.A.F., and also with the Indian army and the Canadian forces, and Fijians fought brilliantly at Guadalcanal. The royal navy and merchant navy, too, drew personnel from many parts of the colonial empire. During the three years ending Sept. 3, 1942, troops of the colonial empire suffered 30,829 casualties, this figure comprising 1,334 killed, 22,566 missing, 1,499 wounded and 5,430 taken prisoner.

The colonial empire rendered even greater service in the war, however, as a source of foodstuffs and raw materials, several bodies being set up to ensure a correlation of supply. While such circumstances as size and number of population made it impossible for all areas to be self-supporting, immense efforts were made in order that territories should not only supply their own needs but also be in a position to export large quantities of food and other supplies. With the loss of Burma and Malaya the output of rubber was intensified in Ceylon, and sources of wild rubber were greatly developed in British African territories, British Honduras and British Guiana. Many new industrial plants were built in various parts of the colonial empire, and the output of mines was much increased, in particular the mining of tin in Nigeria, copper in Northern Rhodesia and manganese in the Gold Coast.

Evolution in the Colonial Empire.—As has been illustrated above, it became the central purpose of British colonial administration to guide the peoples along the road to self-government within the framework of the empire, building up their social and economic institutions and developing their natural resources. Some territories of the colonial empire obtained increased though still restricted autonomy even during the course of World War II, and continual smaller changes elsewhere tended towards the same goal of eventual self-government. Communities were able to gain experience not only in administration, as already mentioned, but also in local self-government, and that in territories under direct rule no less than in those ruled directly. Notably was this the case in West Africa, where, in colonies ruled directly, many municipalities had majorities of elected Africans. In the stimulation of social consciousness colonial governments encouraged establishment of co-operative societies and other organizations developing qualities of leadership, and with colonial office endorsement the British Trades Union congress began to foster trade unionism in the colonies (where, in 1943, the number of unions exceeded 300). The over-all direction of economic development was considered, too, of major importance. A Colonial Products Research council, set up in London in 1943, concerned itself with the procurement of raw materials for industry, and pure and applied research in that direction, and a Colonial Research Advisory committee assisted the colonial office with regard to postwar problems of the colonies.

The policy of the British government regarding the future of the colonial empire was that, as stated in 1943, while responsibility for the economic and political welfare of the territories must remain ultimately with Great Britain and that country alone, close co-operation with neighbouring and friendly nations would be welcomed. The government suggested creation after the war of regional commissions to promote the well-being of colonial territories, such commissions comprising not only the states with colonial territories in the region but also other states which have in the region a major strategic or economic interest. Each state would remain responsible for the administration of its own colonial territory, the peoples of which would be associated with the work of the commissions.

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IV. TRADE AND COMMERCE

The British empire is responsible for over a quarter of the world's food supply. Its economic resources are the greatest that have ever come under the control of any single political system. The exports and imports of its several constituents totalled £2,324,000,000 in 1938. While the outbreak of World War II in Sept. 1939 did not greatly affect the trade figures for the year as a whole, its influence should be kept in mind in any analysis of trade with European countries involved. The distribution of empire trade as between inter-imperial and that with foreign countries during the three years ending with the close of 1938 is shown in Table II.

Table II.—*Distribution of Empire Trade, Inter-Imperial and Foreign*

Year	Total Inter-Imperial Trade	Total Trade with Foreign Countries	Percentage Proportions	
			Inter Imperial Trade	With Foreign Countries
1936	£667,000,000	£1,513,000,000	30.6	69.4
1937	£851,000,000	£1,810,000,000	31.5	68.5
1938	£772,000,000	£1,552,000,000	33.2	66.8

The total value, over the same period, of the imports, exports and re-exports of the United Kingdom and of the rest of the empire in three classifications, is given in Table III.

Table III.—*Value of Imports, Exports and Re-exports of British Empire*

		1936 £'000	1937 £'000	1938 £'000
United Kingdom	Imports Exports Re-exports	847,752 440,605 60,769	1,027,824 521,301 75,134	910,500 470,755 61,525
Dominions, British India and Burma	Imports Exports Re-exports	482,907 510,817 11,215	603,221 601,044 13,551	566,087 541,700 12,507
Colonies and protectorates	Imports Exports Re-exports	183,822 130,122 55,801	238,400 204,414 59,231	211,117 112,768 57,311
Mandated territories and territories under condominium	Imports Exports Re-exports	26,108 18,175 1,831	30,457 24,600 1,631	28,588 10,100 1,559

Tariff Preferences.—Although most self-governing colonies had accorded preferential tariffs to the mother country after 1907, Great Britain did not accord like treatment to the dominions, as they had become, until 1919. A comprehensive system of tariff preferences in favour of the dominions became possible after Great Britain abandoned her historic free trade policy by legislating the Abnormal Importations act, 1931, and the Import Duties act, 1932. An Imperial Economic conference met at Ottawa in 1932, and the "Ottawa agreements" which were reached marked a new phase in interimperial economic relations. Great Britain made agreements with all the dominions except the Irish Free State, and with India and Southern Rhodesia, the term in each instance being for five years. They guaranteed the entry free of duty into Great Britain of nearly all produce from the dominions concerned, though the right was retained to impose duties on dominion eggs, poultry, butter, cheese and other milk products after three years. Britain also undertook to impose new duties on certain foreign goods, and to regulate quantitively the imports of meat from foreign countries. The dominions, on their part, gave increased preferential margins to Great Britain over a range of products, and they also undertook that their tariffs should "be based on the principle that protective duties shall not exceed such a level as will give United Kingdom producers full opportunity of reasonable competition on the basis of the relative cost of economical and efficient production." The agreements also widened the area of preferences accorded by the dominions to British colonies. These arrangements between Great Britain and other parts of the empire met with little favour in foreign countries, where they were considered a violation of the unconditional most-favoured-nation principle. However, in the view of the British commonwealth the several countries constituted a single economic group, the trade relations of which could be determined without affecting commercial treaties already concluded with foreign countries.

India denounced her treaty in 1936 but retained its provisions until 1939, when a new one was concluded, and on expiry of all Ottawa agreements in 1937 they were temporarily extended. Canada, however, made a new agreement with Great Britain to replace the former one, and in 1938 Eire came within the provisions of imperial preferences. Other trade treaties of importance to empire trade were also negotiated by Great Britain with foreign countries, principally with certain European industrial countries and with the United States. In view of negotiations with the latter, British and Australian representatives met in London in 1938 and decided that "while strongly adhering to the principle of preferential trade within the empire, it was desirable that each country should from time to time enter into trade agreements with foreign countries in order to make an effective contribution to the expansion of international trade." After the United States and Great Britain concluded an agreement in Nov. 1938, it became necessary for the other dominions, and India, to assent to modification of certain of the Ottawa agreements as then existing. The terms of the agreement with the United States, which were applicable both to the United Kingdom and to the colonial empire, provided that quantitaive regulation of imports should not be imposed on any of a specified list of goods except in connection with a government measure to raise the domestic price or labour costs of the article. While the United Kingdom abolished the duties on foreign wheat and lard, increased the quota for hams of the United States and lowered other duties, the United States made substantial reductions on cotton piece and linen goods, and high grade linens. These tariff concessions made by the United Kingdom were highly important as marking a reversal of the tariff policy initiated in the early 1930s.

Even after adoption of imperial preference, wide areas of the colonial empire continued the system of free trade, including those subject to the Congo Basin treaties, in parts of West Africa, and the mandated territories. Imperial preference had not proved in practice to be wholly satisfactory to many of the parties concerned. Manufacturers in the dominions and India disliked the preferential duties accorded to British products while they were endeavouring to build up domestic markets of their own, and British farmers were discouraged by the free importation of dominion meat and dairy produce. The British government, too, as well as the dominions, finding that imperial preference did not succeed in providing a sufficient market within the empire for their home products, were unable to make most-favoured-nation trade treaties with foreign countries without first securing the assent of those other members of the commonwealth whose preferential positions would be affected.

GREAT BRITAIN'S TRADE WITH THE BRITISH EMPIRE

From the middle of the 19th century, manufacturing activity became the distinguishing mark of the economic life of a constantly growing number of nations. The greatly increased output from the world's factories during World War I was still further augmented in the succeeding years, when Great Britain found herself faced with increasingly serious competition in all the markets of the world. As a result, those countries which took Great Britain's manufactures and sent in exchange raw materials for her industries and foodstuffs for her urban population became essential to her welfare. Thus the most important aspect of empire trade was its complementary nature, as opposed to the competitive trade which characterized the exchange between Great Britain and those countries which were her industrial rivals.

Composition of British Exports to the Empire.—British external trade is officially classified under three main heads:

(1) Food, drink and tobacco.
(2) Raw materials and articles mainly unmanufactured.
(3) Articles wholly or mainly manufactured.

Great Britain, as a predominantly manufacturing nation, with most of her skill and capital locked up in highly specialized industries, must be especially interested in the extent of markets overseas for the articles wholly or mainly manufactured. From the standpoint of national social welfare, it is the output of highly manufactured goods requiring the employment of the highest degree of national skill which must be encouraged. The value and proportion of the main classes of the export trade and the principal groups of manufactured goods exported to the empire in 1938 is shown in Table IV

TABLE IV *Value of Great Britain's Main Classes of Exports and Value of Exports to Empire, 1938*

Class of export	Total £000,000	To empire £000,000	% Exported to empire
I Food, drink and tobacco	[illegible]	[illegible]	[illegible]
II Raw materials and articles mainly unmanufactured	[illegible]	[illegible]	15.5
III Articles wholly or mainly manufactured	[illegible]	[illegible]	51.8
Iron and steel	41.5	26.4	63.6
Electrical goods and apparatus	13.4	[illegible]	68.2
Machinery	57.8	[illegible]	55.8
Cotton yarns and manufactures	49.6	[illegible]	50.1
Wool yarns and manufactures	26.8	[illegible]	37.3
Vehicles	14.6	[illegible]	[illegible]
Cutlery and hardware	9.0	[illegible]	61.2
Apparel	[illegible]	6	70.6

Composition of British Imports from the Empire.—Table V gives the value and proportion of the main groups of commodities imported from the empire in 1938. Nearly half the total imports of Class I, food, drink and tobacco were obtained from the empire, and in the case of a number of essential goods the proportion was considerably higher—wheat and flour two-thirds, mutton and lamb four-fifths, butter just over one-half, and sugar two-thirds. The empire supplied two-fifths of imports

TABLE V *Value of Great Britain's Main Classes of Imports and Value of Imports from Empire, 1938*

Class of imports	Total £000,000	From empire £000,000	% Imported from empire
I Food, drink and tobacco	[illegible]	[illegible]	[illegible]
of which:			
Grain and flour	74.1	37.9	[illegible]
Meat	90.6	[illegible]	[illegible]
Dairy products	80.0	38.4	48.0
II Raw materials and articles mainly manufactured	247.0	103.0	41.7
of which:			
Wool	[illegible]	34.8	81.6
Hides and skins	18.2	[illegible]	34.2
Non ferrous metals	16.3	9.3	57.4
Wood and timber	42.8	9.5	22.3
Seeds and nuts for oils	[illegible]	[illegible]	53.4
Rubber	[illegible]	9.6	83.8
III Articles wholly or mainly manufactured	235.8	[illegible]	22.5
of which:			
Non-ferrous metals	40.8	[illegible]	60.0

of Class II, raw materials and articles mainly unmanufactured, and here also in the case of a number of key commodities the proportion was even higher—wool and rubber over four-fifths, and non-ferrous metals and seeds and nuts for oil over one half. Even in Class III, manufactured goods, a significant amount, £52,500,000 or 22.5% of the total was obtained from the empire, principally non-ferrous metals for further manufacture in British factories, paper, and other metal goods.

While Britain's trade has always been far more with non-empire than with empire countries, the dominions, India, and what is conveniently known as the colonial empire likewise trade less with the United Kingdom than with other countries. The only exception as a purchaser is Eire, rather more than half of whose imports come from Great Britain. Almost all Eire's products, too, are sold to Great Britain and in addition to Eire, New Zealand and Australia have an export trade with the United Kingdom greater than that with the rest of the world. Based on the figures for 1938, or for 1938–39, the percentages of trade of the components of the empire between the United Kingdom and other countries is as indicated in Table VI.

TABLE VI. *Percentage of Trade Between Parts of Empire and United Kingdom and Between Empire and Other Countries, 1938 or 1938–39*

Country	Imports % from		Exports % to	
	United Kingdom	Other Countries	United Kingdom	Other Countries
Canada	17.5	82.5	39.1	60.9
Australia	41.6	58.4	54.5	45.5
South Africa	43.3	56.7	38.1	61.9
New Zealand	47.8	52.2	84.5	15.5
India	31.4	68.6	34.2	65.8
Eire	50.5	49.5	92.6	7.4
Colonies and protectorates	26.6	73.4	35.4	64.6
Mandated territories	26.7	73.3	37.5	62.5

TABLE VII. *Import Trade of Components of the British Empire*

	Principal Imports	Chief Countries of Origin		Value of all Imports				
		British	Foreign	Year	Total	Whole Empire	United Kingdom	United States
					£'000	£'000	£'000	£'000
United Kingdom	Meat, dairy products; grain, flour, oil, fats, non-ferrous metals, wool	Canada, India, Ceylon, Australia, New Zealand, S. Africa	U.S., Argentina; Denmark, Germany, Netherlands, Sweden	1936 1937 1938	847,752 1,027,824 919,509	335,36[illegible] 401,224 371,532		93,227 111,105 117,980
Canada	Machinery, coal, petroleum, motor car parts, rolling mill products	U.K., Malaya; Australia, India, British Guiana	U.S., Germany, France; Belgium, Japan	1936–37 1937–38 1938–39	137,674 163,909 135,121	40,561 47,877 37,099	26,476 29,751 23,728	80,054 99,077 81,057
Australia	Machinery; textiles, oils, fats, paper, stationery, drugs, chemicals	U.K., Canada, India, New Zealand; Ceylon	U.S., Neth. Indies, Japan, Germany, France	1935–36 1936–37 1937–38	8[illegible],521 96,592 111,733	40,008 [illegible],082 6[illegible],628	33,836 38,559 46,236	13,001 12,050 17,759
New Zealand	Machinery, textiles, oils, fats, waxes, paper, stationery, drugs, chemicals	U.K., Australia, Canada, Ceylon, India	U.S., Neth. Indies, Japan; Germany, Belgium	1936 1937 1938	38,515 45,105 44,512	2[illegible],85[illegible] [illegible],2[illegible]6 [illegible],74[illegible]	17,850 22,577 21,310	4,501 5,501 5,506
Union of South Africa (and S. W. Africa)	Tea, beverages, machinery, textiles, rice, dried fish, motor vehicles, oil	U.K.; Canada, India, Ceylon, South West Africa	U.S.; Germany, Japan, Belgium, France	1936 1937 1938	88,1[illegible] 105,71[illegible] 98,[illegible]20	40,[illegible] 5[illegible],106 [illegible],[illegible]50	40,546 44,784 4[illegible],176	16,140 20,523 16,601
Eire	Textiles, grains, flour, coal, machinery, iron, steel	U.K.; India, Canada, Australia, South Africa	U.S., Germany, Argentina, Belgium, France	1936 1937 1938	39,013 44,105 41,314	26,769 28,067 26,317	21,255 22,069 20,803	3,050 2,007 4,706
Newfoundland	Flour, apparel, machinery, meat, coal	Canada, U.K., British West Indies; Ceylon	U.S., Denmark; Germany	1936–37 1937–38 1938–39	4,249 4,913 5,279	2,741 [illegible],080 [illegible],106	1,075 1,165 1,395	1,274 1,550 1,033
India (private account only)	Oil, grain, pulse, cotton goods, metals, ores, machinery	U.K., Burma, Malaya, Kenya, Australia	U.S., Japan, Germany, Neth. Indies; Iran	1935–36 1936–37 1937–38	93,035 130,537 114,256	36,272 74,117 65,149	36,070 38,069 34,875	6,110 9,658 7,333
Burma (private account only)	Cotton goods, machinery, jute gunny bags, cigarettes, tobacco	India, U.K.; Malaya, Hongkong	Japan, U.S.; Netherlands; Germany, Belgium	1936–37 1937–38 1938–39	(Included with figure for India) 17,860 15,584	 13,777 13,205	 3,504 2,903	 775 556
Southern Rhodesia	Metals, fibres, yarns, foodstuffs, oils, waxes, drugs, chemicals	U.K., South Africa, Canada, India, Northern Rhodesia	U.S., Germany; Japan, Belgium, Iran	1936 1937 1938	6,850 8,421 9,607	4,069 6,085 7,118	3,741 5,088 4,845	685 820 850
Mediterranean territories	Machinery, timber, wheat, flour, mineral oils, textiles	U.K.; Australia; India, Canada, Burma	Germany; Rumania, U.S., Syria; Italy	1936 1937 1938	18,005 22,141 20,353	5,580 5,745 7,376	4,274 4,210 6,040	1,124 1,282 1,228
West Africa	Cotton goods, machinery, oils, petroleum, tobacco, dried fish, metals	U.K.; India; Burma, Canada, South Africa	Germany; U.S., Japan, Netherlands; Norway	1936 1937 1938	21,510 20,606 18,265	13,840 17,894 11,004	12,188 15,530 10,000	1,531 2,408 1,503
East Africa	Machinery, petroleum oils; textiles, metals, grains, flour	U.K., India, South Africa, Burma, Canada	Japan; U.S.; Germany; Iran, Netherlands	1936 1937 1938	27,407 34,615 34,200	13,080 17,031 18,701	7,537 9,506 10,558	1,441 2,128 2,020
Eastern dependencies	Grains, flour; petroleum oils, vehicles, machinery, iron, steel	U.K., Australia, India, Burma, South Africa	Neth. Indies; China; Thailand, Japan; U.S.	1936 1937 1938	100,150 141,115 125,020	33,677 35,178 42,830	14,319 19,150 19,231	3,054 5,691 6,111
Western Pacific	Machinery, iron, steel, grains, flour, petroleum oils, vehicles	Australia, U.K., Canada, New Zealand, India, Burma	U.S.; France and colonies, New Zealand, India, Burma	1936 1937 1938	2,040 2,253 2,198	1,502 1,825 1,708	540 616 652	110 152 165
West Indies and America	Grains, flour, cotton goods, iron, steel, metal goods, machinery, apparel	U.K., Canada, Burma, Australia, India	U.S.; South America, Germany; Japan; Netherlands	1936 1937 1938	19,075 24,590 23,857	12,872 15,042 11,348	7,781 8,810 8,364	3,043 5,213 5,376

Much the greater part of Britain's oversea capital investments has not gone to the building up of the empire but to foreign countries. As of 1943, only 15% of the total capital invested in Canada, for instance, had come from Great Britain, and of £3,240,000,000 nominal capital from Great Britain invested abroad in 1936, no less than £372,000,000 was invested in one foreign country alone—Argentina. British investments in the colonial empire amounted to only £253,399,000, less than 8% of the total sum invested.

Besides Eire, Australia, New Zealand and South Africa maintain particularly close trading connections with Great Britain, and constitute the largest empire market. At one time India had been Britain's largest customer, while in later years there was a considerable increase in the British export trade to Malaya and Ceylon. Owing to the immense economic influence of the United States upon neighbouring countries, the American group of empire countries, particularly Canada, was somewhat less affected by the imperial aspect of trade than other parts of the empire. Canada remained, however, an important market for Great Britain, buying per head of population eleven times the value of British goods purchased by her more powerful neighbour. Though the territories of British East Africa cover a larger area than those in West Africa, the development of this group did not proceed so far, and the volume of exports of Great Britain by the time of World War II was only two-fifths that of West Africa.

TRADE OF THE OVERSEAS EMPIRE

Australia maintains a larger volume of imports and exports than either New Zealand or South Africa, and the commonwealth's trade with empire countries, apart from Britain, amounts to about one-tenth of the total. After World War I, Australian

TABLE VIII—*Export Trade of Components of the British Empire*

	Principal Exports	Chief Countries of Destination		Value of all Exports				
		British	Foreign	Year	Total	Whole Empire	United Kingdom	United States
					£'000	£'000	£'000	£'000
United Kingdom	Cotton goods, machinery; vehicles, mining products, manufactured iron, steel	Australia, S. Africa, India, Canada; New Zealand	U.S., Argentina, France; Germany, Denmark	1936 1937 1938	440,605 521,391 470,755	216,868 254,040 231,738		27,676 31,310 20,484
Canada	Newsprint, wheat, planks, boards, meats, wood pulp	U.K., Australia, S. Africa, Newfoundland, Br. West Indies	U.S.; Japan, Belgium, Germany, Scandinavia	1936–37 1937–38 1938–39	197,591 196,512 171,430	99,427 103,376 88,383	81,263 81,693 62,163	71,806 67,088 57,780
Australia	Meat, vegetable foodstuffs, beverages, metals, machinery; stones, minerals	U.K., New Zealand, Canada, India; Malaya	France, Japan, Belgium, Germany, U.S.	1936–37 1937–38 1938–39	96,500 115,297 110,733	51,067 70,136 75,774	48,350 57,847 62,784	4,430 8,665 2,028
New Zealand	Butter, cheese, meats, wool, hides, skins, gold	U.K.; Australia, Canada; India, Fiji	U.S.; France, Germany, Japan, Egypt	1936 1937 1938	55,959 61,026 45,401	37,591 45,571 41,017	33,493 39,737 38,374	2,274 3,833 1,138
Union of South Africa (and S.-W. Africa)	Gold, sugar, wool, hides, skins, cereals, diamonds	U.K., N. and S. Rhodesia, South West Africa, Canada	Germany, U.S., France, Belgium, Italy	1936 1937 1938	30,616 35,119 31,665	16,968 22,085 17,331	12,986 16,414 12,397	1,054 1,330 755
Eire	Cattle, bacon, beverages, butter, horses	U.K., South Africa, India, Canada; Australia	Germany, U.S.; Belgium, France; U.S.S.R.	1936 1937 1938	21,969 22,244 23,877	20,382 20,450 22,316	20,101 20,166 22,109	274 137 114
Newfoundland	Paper, iron ore, dried cod, zinc concentrates; lead concentrates	U.K., Canada, British West Indies	U.S.; Brazil, Portugal, Belgium, Germany	1935–36 1936–37 1937–38	5,711 5,507 6,900	3,035 3,848 3,303	2,961 2,499 2,630	1,225 1,259 1,025
India (private account only)	Jute, cotton, tea, oil seeds, hides, skins	U.K., Burma, Ceylon, Australia, Malaya	U.S.; Japan, China, France, South America	1936–37 1937–38 1938–39	147,001 135,693 132,101	67,096 69,412 64,203	47,619 45,113 41,876	13,874 13,69[illegible] 10,406
Burma (private account only)	Rice; petroleum oils; wood, timber, lead, wolfram	India; U.K., Malaya, Ceylon, British West Indies	Germany, Japan, Neth. Indies, Belgium, Netherlands	1936–37 1937–38 1938–39	(Included with figures for India) 37,411 35,857	 31,069 31,286	 6,373 5,551	
Southern Rhodesia	Metals, tobacco, minerals, foodstuffs, agricultural products	U.K.; N. Rhodesia, South Africa; Bechuanaland	U.S.; Germany, France, Belgium; Belgian Congo	1936 1937 1938	3,613 5,075 4,866	2,458 3,293 3,396	1,343 1,815 2,026	377 651 378
Mediterranean territories	Citrus fruits, copper, hides, skins; grains; asbestos	United Kingdom	Germany; Netherlands, Syria, Egypt, France	1936 1937 1938	5,335 8,157 7,622	2,653 4,048 3,423	2,454 3,785 3,159	108 214 87
West Africa	Gold; palm kernels, oil, cacao, ground nuts, diamonds; tin ore	U.K.; Canada, Australia; South Africa	Germany, Netherlands, U.S., France; Italy	1936 1937 1938	26,740 33,853 18,341	11,411 14,071 8,996	10,566 13,045 8,526	3,083 6,049 2,061
East Africa	Copper, cotton, tobacco, sugar, coffee	U.K.; India, South Africa; Canada; Southern Rhodesia	Germany, Belgium, Italy; U.S., France	1936 1937 1938	30,845 41,350 33,508	18,527 25,500 20,502	12,409 16,332 12,729	1,413 1,431 1,207
Eastern dependencies	Rubber, tin, tea, copra, gold	U.K.; Australia, India; Burma; Canada	U.S.; Japan, China; Neth. Indies; Germany	1936 1937 1938	119,100 164,443 115,852	34,840 47,691 40,368	16,368 25,809 21,564	30,113 52,735 25,660
Western Pacific	Sugar; gold; copra, phosphates, bananas	U.K.; Australia; Canada; New Zealand	France; French colonies; Japan, U.S.	1936 1937 1938	3,954 3,035 2,608	2,080 2,154 2,026	780 764 755	125 151 82
West Indies and America	Petroleum oils, sugar, molasses; bananas, cacao, bauxite	U.K.; Canada; Newfoundland	U.S.; Netherlands; Germany; Canary Islands; France	1936 1937 1938	14,627 17,311 17,291	11,399 13,108 13,676	6,641 8,507 8,417	1,208 1,465 1,114

imports from Britain and the empire as a whole declined, partly owing to a postwar increase of noncompetitive imports from the United States, such as petroleum products, and partly to the expansion of Australian factory production, especially textiles, and iron and steel, certain classes of which inevitably competed with British export trade. Before World War II Australia drew from Great Britain the following proportions of her major imports: machinery (not electrical), 42½%; car-chassis, 32½%; art silk piece goods, 25%; and paper, 41%.

Though the value of its trade is not as great as that of either Australia or South Africa, New Zealand maintains the closest touch with the trade of Great Britain and other empire countries. After the beginning of the 20th century New Zealand's export trade grew very considerably in volume, next to Britain Australia being her largest empire customer. Of her principal imports, 40% of the machinery (not electrical), 50% of the drugs and chemicals, 25% of printing paper and 40% of silk and art silk came from Great Britain.

In 1938–39 Great Britain held a rather smaller share of South Africa's trade than did New Zealand, and a considerably less share of the union's export trade. After World War I there was some decline in the proportion of South African exports going to countries within the empire owing to a diversion of South African produce from the United Kingdom to European countries, particularly France and Germany. Only 10% of the motor cars imported into the union in the years immediately prior to World War II came from Great Britain, and less than 30% of her paper supplies, but she drew from the mother country almost 60% of her iron and steel requirements and 55% of her imported clothing.

The remarkable expansion of Canada's exports after World War I was based on the exploitation of her vast resources of softwood timber, nonferrous metals, and hydroelectric power on the processing of which large factories manufacturing for export were built up. Canada sold to Britain more than she bought from her, and bought more from the United States than she sold, and her exports to markets of the British empire as a whole were approximately twice her imports from the empire. A marked feature of Canadian exporting in the years immediately preceding World War II was the great increase of trade with Australia. During the latter conflict Canada bought from the United States twice as much as before, and paid cash for it, and supplied Britain, without payment, twice as much as she formerly sold to her.

A considerable proportion of Canada's exports to overseas countries is shipped by way of the United States. Canadian grains, for example, are frequently routed through the United States in bond, most of them leaving Canada with the United Kingdom as the stated destination, and at the same time United States grain is routed through Canada and shipped from Montreal. Large quantities of grain shipped to Great Britain by way of the United States are, however, later diverted to other European or overseas countries, and some is taken out of bond for consumption in the United States. Purchases in bonded markets in Great Britain, Germany, Belgium and France are included in Canadian imports from those countries, but are not included by those countries in exports to Canada. The practices illustrated above are not, of course, restricted to Canadian trade, and for such reasons the respective countries' statistics of the origin and destination of products are frequently wholly at variance. These facts have a bearing on the figures in Tables VII and VIII, which show the external trade of components of the British empire—principal articles, countries of origin or destination, and value—as recorded in the *Statistical Abstract for the British Empire, 1920–38* (H.M.S.O., 1939).

After adoption of a protectionist policy in British India in 1921, British producers, who had formerly supplied the bulk of India's manufactured goods, were the chief sufferers as India's industries were built up behind tariff walls. Between 1914 and 1930 the Indian import of Lancashire cotton goods dropped to less than one-twelfth of the total of a quarter of a century earlier. Other British exports to India declined similarly, and with the aid afforded by tariffs, India created a great steel industry and the largest single unit manufacturing steel in the British empire (the Tata Steel works). In 1938–39 Britain took 34% of all India's exports, and was by that period buying more goods from India than she sold to her. While Great Britain remained India's best customer and supplier, the United States reached second place, obtaining one-fifth of India's total trade in 1941–42 as compared with only 7½% in 1938–39 (exports rising from 8.4% to 20%, and imports from 6.4% to 20%). These figures do not take into account large quantities of goods, such as motor vehicles, plant and machinery, imported from the United States for the purpose of military operations in World War II.

During the 19th century governments of the colonial empire were concerned primarily with the securing of order and justice, leaving economic development to private enterprise. While the West Indian territories lost their prosperity as the sugar industry declined, such areas as Malaya and Ceylon prospered through the development of the tin, rubber and tea industries, while elsewhere, and notably in tropical Africa, cocoa cultivation and mining brought prosperity. Prior to World War II only 27% of the imports of the colonial empire came from Great Britain, and that country took only 36% of the exports. The United States was by far the best customer of the colonial empire, which was brought within the scope of the trade agreement of 1938 between the United Kingdom and the United States for the promotion of mutual trade. The natural resources of large areas still remained undeveloped, however, and therefore provision was made in the Colonial Development and Welfare act, 1940, for funds from the British treasury to stimulate, *inter alia*, industrial expansion in the Colonial empire.

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V. FINANCE

Before considering each dominion, India and the colonial empire separately, certain broad facts must be stated. Each unit of the empire imposes and collects its own taxes, and is free to use the proceeds for its own needs. No taxes collected in overseas territories go to the British exchequer. The dominions and India are free to borrow money where they like, but are encouraged to go to London by the fact that their loans rank as "trustee securities" in Great Britain, and so command a better price. These countries are free to maintain such tariffs as are thought to be necessary, subject to the terms of the Ottawa agreements, even against Great Britain. While the dominions take their share in the burden of imperial defense, the apportionment of the cost as between them and the United Kingdom is a matter of informal arrangement rather than rigid law.

Canada.—The unit of currency is the Canadian dollar, which weighs 25.8 grains, nine-tenths fine gold, and thus contains 23.22 grains of gold. British and United States gold coin are legal tender, but in practice never emerge from the banks.

On March 11, 1935, the Bank of Canada, established by an act passed in 1934, began business as a central or banker's bank. The capital was $10,100,000, and all of its stock was vested in the dominion government. It regulates the statutory cash reserves of the chartered banks, which are required to maintain not less than 5% of their deposit liabilities payable in Canadian dollars in the form of deposits with, and notes of, the Bank of Canada. The bank also acts as the fiscal agent of the dominion of Canada. Bank of Canada notes, which are legal tender, are the main source of paper money in Canada and were intended to become increasingly so since the chartered banks (which formerly issued their own notes) gradually had to reduce their note issues to 25% of their paid-up capital.

The commercial banking system originated from the needs of Montreal traders in the first half of the 19th century. Unlike that of the United States, it is based upon the branch banks; the 10 chartered banks, most of them possessing their head offices in the east, between them cover the country. No attempt is made to segregate the country into districts, as is done by the federal reserve system in the United States. The Canadian banks have been compared, with some justice, to the Scottish banks. In 1943 there were 32 bankers' clearing houses in the dominion.

Geographical influences and the Canadian tariff led to the investment of large quantities of American capital in Canada, and many industrial undertakings passed under American control. After 1930 there was a reduction in the value of U.S. investments in Canada, as a result of the redemption of Canadian securities owned in the United States, changes in the values of equity investments in Canada, and other factors. In 1937, British and foreign capital invested in Canada amounted to $6,765,000,000, of which $3,932,400,000 was invested by residents of the United States, $2,684,800,000 by residents of the United Kingdom and $147,800,000 by residents of other countries. For 1937, Canadian capital in other countries was estimated at $1,757,900,000; the largest part of this, about $1,097,600,000, was invested in the United States, $40,900,000 in the United Kingdom, and $619,400,000 in other countries.

The total estimated national wealth according to the dominion bureau of statistics at Ottawa was $31,276,000,000 in 1929, and $25,768,000,000 in 1933. The 1929 estimate presents a picture at the peak of prosperity, whereas that of 1933 reflects the writing down of values resulting from the prevailing financial depression. No further estimate was published between 1933 and the outbreak of World War II. A Foreign Exchange Control board, set up in Sept. 1939, had the power to licence imports and exports of goods, currency and capital. The net national debt for the year ended 1939 was $3,152,559,314, equal to a net debt per capita of $317.09. The cost of Canada's financial part in World War II is reflected in the comparable figures for 1942, which were $4,045,221,161 and $351.55 respectively.

Australia.—An important factor in Australian finance is that the country is new and rapidly developing. There is a certain division of powers between federal government and state government. Customs and excise are reserved to the commonwealth government, though individual states have definite powers in regard to other forms of taxation. Both governments impose income tax.

Until the world economic depression of 1930 there was virtual parity between the Australian pound and the pound sterling. Subsequently the value of the Australian £ depreciated steadily until at the end of 1931 it stood at 30% below the old sterling parity. Later it rose slightly and was stabilized at 25% below its former par value.

The Commonwealth bank, which controls the note issue, undertakes the responsibility of regulating the sterling exchange. The statutory note reserve is 25% held in gold or English sterling. English sterling was defined in an amendment to the Commonwealth Bank act in 1932 as "currency which is legal tender in the United Kingdom," and includes, *inter alia*, bills of exchange, and secured advances maturing in not more than three months.

Rapid development and the burden of Australia's share in World War I necessitated the frequent raising of loans, many on the London market, and during the postwar years there was an impression in London that Australia was overborrowing, largely because at that time the commonwealth and each separate state had independent borrowing powers. In 1927 the Federal Loan council was created to co-ordinate Australian loan finances, and two years later the federal government assumed the liability of states to their bondholders. On June 30, 1940, the aggregate debt of the commonwealth and federal states was officially given as £1,341,054 (£750,763 borrowed internally, £546,406 in London and £43,795 in New York). Much of this money was represented by remunerative assets such as railways, harbours and other public works, so that the total debt could not be called excessive; nor was it fruitful to compare it with the national debts of old countries, which often represent past and unremunerative expenditure.

Australia is well provided with banks. Besides the Commonwealth bank there were, in 1943, 16 other banks, including two state government institutions, most of which operate in all the states of the commonwealth and in addition maintain London branches. The Commonwealth Savings bank, created a separate department in 1928, conducts all savings bank business in New South Wales, Queensland and Western Australia. Elsewhere there are private savings banking institutions. On June 30, 1940, the total savings banks deposits in the commonwealth amounted to £236,953,542, representing £33.7 per head of the population.

Although Australia has a substantial industry, she depends on her primary export industries whose chief outlet is Great Britain, and the maintenance of adequate sterling funds in London is a prime concern of the financial authorities.

New Zealand.—Prior to Dec. 1929, no distinction was made between the currency of New Zealand and sterling, for exchange was conducted on a basis of virtual parity. The £N.Z. depreciated gradually after that date until £110 N.Z. was worth £100 sterling, and it remained at that level till Jan. 1933, when the government fixed the rate at that figure. With the establishment of the Reserve Bank of New Zealand, which began to function on Aug. 1, 1934, the control of the note issue was transferred from the trading banks to the reserve bank, and that institution maintained the exchange rate at £125 N.Z. to £100 sterling In 1936 an amendment to the act creating the reserve bank abolished the subscribed private share capital of the institution, which became state-owned, and further important changes were made in 1939.

The trading banks, of which there were six in 1943 (four of them predominantly Australian institutions) are required to maintain with the reserve bank a balance of not less than 7% of their demand liabilities and 3% of their time liabilities in New Zealand. Reserve bank notes are legal tender up to any amount, and the reserve bank is required to maintain a minimum reserve of not less than 25% of the aggregate amount of its notes in circulation and other demand liabilities, though the minister of finance is empowered to vary or suspend this requirement The term "reserve" includes gold coin and bullion, sterling exchange, comprising deposits at the Bank of England, British treasury bills of not more than three months unexpired currency, bills of exchange bearing at least two good signatures and of not more than three months unexpired currency and net exchange.

New Zealand's prosperity depends on her primary industries, whose chief outlet is the export market of Great Britain. New Zealand's financial problem is briefly the adjustment of her internal price structure as circumstances demand so as to permit her exports to meet the cost of imports and the charges of the overseas debt, the bulk of which is domiciled in London. On March 31, 1941, the amount of New Zealand's public debt domiciled in London stood at £158,371,589 (45.32% of the total), while the debt held internally was £190,176,386 (54.43%), with £879,600 (0.25%) domiciled in London.

Fluctuations in the prices of such primary products as butter, cheese, wool and meat impose at times considerable strain on the reserves of sterling funds, the level of which constitutes an important financial and economic barometer for the country. This became apparent at the end of 1938, when New Zealand's overseas assets fell to £N.Z. 7,000,000, and New Zealand had to institute a system of exchange control and drastic import restrictions. Twelve months later net overseas funds had increased to nearly £N.Z. 16,000,000, and in Dec. 1942 reached over £N.Z. 40,000,000.

South Africa.—From the standpoint of pure finance, South Africa is sharply distinguished from the rest of the empire. Since the bulk of the world's gold is produced in the union, gold shipments possess a different significance. Gold, in fact, must be regarded as one of the staple products of the country, and its relation to the money and exchange markets judged accordingly.

One of the most important events in South Africa's financial history after the date of the union (1910) was the foundation of the South African Reserve bank, which was set up in 1921. It resembles in many respects the American Federal Reserve bank. It is principally a bank of issue and was given the sole right for 25 years, subject to renewal, to issue notes. The bank has a capital of £1,000,000. Every bank transacting business in the union is required to hold reserves balances in the reserve bank equal to at least 10% of its demand liabilities in the union, other than notes, and 3% of its time liabilities to the public of the union. The reserve fund having reached the statutory maximum of £1,000,000, declared net profits in excess of a 10% dividend to shareholders are paid over to the government.

The unit of currency is the pound (South African), and from the restoration of the gold standard in Great Britain up to Sept. 1931, the exchange was at par. South Africa maintained gold parity up to the end of 1932. This caused the pound sterling to depreciate until, at the end of 1931, £100 sterling was worth only £72 S.A. This damaged export trade, stimulated imports and also caused a flight of funds to London. Worse still, the South African gold producer received only 85*s*. per ounce of gold in his own currency, although the sterling price was up to 120*s*. At the end of 1932, South Africa re-established parity with sterling at £100 stg. for £100 S.A. The relief was immediate. The fact that gold producers got the full price (which, by Sept. 1939, had risen to 150*s*.) made it profitable to mine low-grade ore, and so increased the total gold output and added to the union's income.

When World War II broke out in 1939, and sterling depreciated against the dollar, the price of gold rose to 168*s*. per ounce. The South African government impounded as special taxation the margin between 150*s*. and 168*s*. per ounce. In 1940 the "Gold Mines Special Contribution," yielding approximately the same revenue, was substituted for this special taxation. As a consequence, by amendment to the Emergency Finance regulations, dated Aug. 31, 1940, producers were paid the full market value of the gold on the day of sale, though they had to bear the realization charges. Gold production reached a new peak in 1940, with 14,046,502 fine ounces.

Even before the foundation of the reserve bank, banking in the union was well developed. The leading commercial banks are the Standard Bank of South Africa and Barclays (Dominion, Colonial and Overseas), whose head offices are in London, and the Netherlands Bank of South Africa. The head offices of the latter were established at Amsterdam, but after the occupation of the Netherlands by the Germans in 1940, a controller exercising the powers of the directorate functioned temporarily in South Africa, having been appointed by the union treasury.

Like the other dominions, South Africa used to be a well-known borrower in London, where South African loans commanded a high reputation. At the end of March 1941 the national public debt stood at £335,097,215, of which £98,141,579 (29.2%) had been raised externally, almost exclusively in London. In 1938, however, the union government discontinued borrowing in the London market, and as a result of certain vesting operations in 1942 the London debt of the union government was reduced to a very low figure. The total funded debt at the end of March 1941 amounted to £301,265,502 and the floating debt was £34,731,713, the average rate of interest for all loans being £3 9*s*. 6*d*.

Under the emergency finance regulations promulgated in Sept. 1939, dealings in foreign exchange were subjected to the control of the union treasury. The three principal commercial banks were appointed as authorized dealers in exchange, and the South African Reserve bank undertook general supervision of exchange transactions.

India.—Financial conditions in India are governed by several imponderable factors. The first is the fact that India is not one homogeneous nation, but consists of 20 or 30 peoples. Another is that gold and silver are the traditional form of wealth, and their accumulation is stimulated by definite religious beliefs and ceremonies; hence the absorption of the precious metals by the Indian population. Superimposed on these is the influence of London as the chief financial and trading link between India and the outer world. Thus in India the modern complexities of trade and exchange exist side by side with the most primitive methods, and the banking, currency and financial system has to take account of both.

The unit of currency is the rupee. A lakh is 100,000 rupees, written Rs. 1,00,000; and a crore is 100 lakhs or Rs. 10,000,000, written Rs. 1,00,00,000. The silver rupee weighs one tola (180 grains), and its fineness is one-half silver and one-half alloy. It was reduced from a fineness of eleven-twelfths silver and one-twelfth alloy by an ordinance dated Dec. 20, 1940. Silver rupees of eleven-twelfths fineness were demonetized, the last ceasing to be legal tender on Nov. 1, 1943. Government of India one-rupee notes were put into circulation in 1940; they are legal tender in India for the payment of any amount, and are deemed to be included in the expression "rupee coin" for the purposes of the Reserve Bank of India act. Reserve bank notes of denominations up to Rs. 10,000 are also legal tender in India.

Until 1893 India was on a silver standard, the exchange rate of the rupee being dependent on the price of silver. To avoid the embarrassing fluctuations in the rate of exchange with gold standard countries, which were caused by the fall in the price of silver, it was decided to close the Indian mints to the free coinage of silver. From then until World War I the rupee was maintained at 1*s*. 4*d*. gold, or Rs. 15 to the sovereign, by the offer of the secretary of state for India to sell bills on India without limit of amount at 1*s*. $4\frac{1}{8}$*d*. per rupee and by the sale of drafts on the secretary of state, when the need arose, at a price just below 1*s*. $3\frac{29}{32}$*d*. The standard thus evolved was known as the gold exchange standard.

While this standard was in operation the people of India were gradually being educated to the use of paper currency, which led to a steady increase in the note circulation. The first issue of government currency notes dates back to 1861, but the note issue remained small until the last decade of the 19th century. Government currency notes were freely convertible into silver rupees and, for this purpose, a "paper currency reserve" was maintained. The Indian currency system was put to a severe test in World War I. When the price of silver rose to unprecedented heights it became profitable to melt down rupees for sale as bullion (a practice which is not illegal in India). There was a keen demand for Indian exports, and there were exceptional disbursements on behalf of the British government. Confronted with the difficulties, the authorities allowed the rupee to break loose from its anchorage at 1*s*. 4*d*. and to rise in value as the price of silver rose. The rate of exchange rose rapidly and reached 2*s*. 4*d*. (sterling) in Dec. 1919.

An attempt was made in 1920 to fix the rate of exchange at 2*s*. 0*d*. gold and then at 2*s*. 0*d*. sterling, but the forces that had driven the rupee upwards were now operating in the reverse direction: silver prices were falling, government could not contract the currency fast enough to keep pace with the fall in world prices, and the trade balance had turned against India. Control was abandoned in the autumn of 1920 and the rupee was left to find its own level. After a descent to 1*s*. 3*d*. in 1921 it gradually recovered to 1*s*. 6*d*. and was stabilized at that level by the Currency act of 1927. As the United Kingdom had, by then, returned to the gold standard, the rupee was again virtually linked to gold.

The Reserve Bank of India was established in 1935 as a central bank with the sole right to issue bank notes in British India. The bank holds the cash balances of the central and provincial governments and transacts their money, remittance, exchange and banking business; and the scheduled banks, consisting of the more important commercial banks, must maintain minimum balances with it. The bank is responsible for maintaining the exchange value of the rupee, and for making remittances to meet government disbursements in sterling, and is under an obligation to deliver "rupee coin" in exchange for its notes, and vice versa. For the maintenance of the exchange rate the bank is required to buy sterling at 1*s.* $6\frac{3}{16}$*d.* per rupee and sell sterling at 1*s.* $5\frac{49}{64}$*d.* per rupee. Thus the rupee is linked to sterling, and variations in the sterling or rupee price of gold do not directly affect the rate of exchange.

Banking in India is a complicated matter. On the one hand there are many small indigenous banks, and, on the other, the big exchange and other well-known banks, centred chiefly in Bombay and Calcutta, but by no means confining their activities to those cities. Dealings in foreign exchange are conducted mainly by the European and American exchange banks and by the Imperial Bank of India, these virtually forming the Bombay and Calcutta markets. Foreign trade is mainly financed through London, by sterling or rupee bills and telegraphic transfers.

Originally, most of India's capital needs were provided for in London, but with the growth of industry India began to provide for her own capital needs. India's former position as a debtor country was profoundly affected by World War II. The demand for Indian exports and her industrial expansion to provide war equipment for the allied forces in the middle east and elsewhere, coupled with restrictions on her imports of manufactured goods, resulted in heavy acquisitions of sterling, both by purchases in the market and by the recovery of cost of war expenditure in India on behalf of the British government.

Part of the sterling resources thus accumulated was utilized for the repatriation of India's sterling debt. This was achieved by purchase of securities in the market for cancellation; by requisitioning by the British treasury of British residents' holdings of India sterling stocks and railway debenture stocks and their sale to the government of India for cancellation; and by repayment of loans after due notice. Also, in return for a capital payment, the British treasury undertook to provide the annual sums required for the service of the several Indian sterling railway annuities, which, however, remained a liability of the government of India. By these means the government of India's sterling market debt which, on March 31, 1936, stood at £360,000,000, was reduced to about £13,000,000, exclusive of the railway annuities. This residue consisted of stock not subject to the requisitioning orders mentioned above. The cancellation of sterling debt was, of necessity, accompanied by a considerable increase in rupee debt. On Dec. 31, 1942, the government of India's rupee debt, including floating and unfunded debt, was Rs. 1042¾ crores (Rs. 10,427 millions).

Colonial Empire.—As is the case with the dominions and India, each component of the colonial empire manages its own finance, collects its own taxation and pays it into its own exchequer, and so long as it pays its way it is financially independent of the British treasury. To quote a leading example, the proceeds of the export duties upon rubber go to swell the revenues of the colonies concerned, and not those of Great Britain. Moreover, in instances where local revenues do not permit adequate expenditure for needed improvements, the British treasury was authorized by the Colonial Development and Welfare act, 1940, to provide necessary sums at the expense of the British taxpayer.

As regards currency, too, each unit is independent, being sometimes administered by local currency boards. Singapore and Hongkong have each their own dollars; Tanganyika has its shilling, and so on. Kenya, in particular, has had a checkered currency history. Immediately after conclusion of World War I the Indian rupee was in circulation, and so Kenya shared in the attempt to raise the rupee from 15 to the pound to 10 to the gold sovereign. Next a florin was introduced, and held at 10 to the pound even after the new rupee parity had been tacitly abandoned. For a time this gave rise to serious inequities, and it was only when the shilling was made the standard coin instead of the florin that an equilibrium was established. Besides British India, the rupee is the local currency of Burma, Somaliland Protectorate, Mauritius, Seychelles, Aden and Ceylon. The local currencies of other territories are shown in Table IX.

Most of the units of the colonial empire are too small to need a central bank of their own, and to a large extent they are served by branches or subsidiaries of banks domiciled in Great Britain or one of the dominions. Instances of this are Barclays Bank (Dominion, Colonial and Overseas), the Standard Bank of South Africa and the Bank of British West Africa; while the far eastern territories, such as Hongkong and Singapore, are served by the big eastern exchange banks.

TABLE IX. *Local Currencies and Sterling Equivalents of Certain Parts of the British Empire*

Countries	Local currency	Sterling equivalents (at par of exchange)
Zanzibar Protectorate Tanganyika Territory Kenya Uganda Protectorate	Shilling	1*s.* 0*d.*
Straits Settlements Federated Malay States Unfederated Malay States British North Borneo Brunei Sarawak	Dollar (Silver)	2*s.* 4*d.*
Hongkong	Dollar (Silver)	*
Fiji	£ Fiji	£111 Fiji = £100 stg.
Trinidad	Dollar (Gold)	4*s.* 2*d.*
British Honduras		4*s.* $1\frac{1}{3}$*d.*
British Guiana		4*s.* 2*d.*
Palestine	£ Palestinian	£1 0*s.* 0*d.*
Cyprus	Piastre	0*s.* $1\frac{1}{3}$*d.*

*Rate varies, *e.g.*, in 1931 1*s.* $0\frac{9}{16}$*d.*, and in 1938 1*s.* $2\frac{7}{32}$*d.* per dollar.

VI. COMMUNICATIONS

The first line of communication of the empire is by sea. Until the outbreak of World War I the great majority of ships serving empire ports were owned by companies operating from the British Isles, but during the war and the immediate postwar period the dominions, notably Canada and Australia, developed mercantile marines which largely operated on empire routes. But while they assisted in trade development they were also a cause of substantial losses. The losses became so serious that Australia disposed of her fleets within a few years, and in 1936 Canada sold the 10 last remaining vessels of her government-owned merchant marine; after World War II began the latter resumed operations in order to make use of certain Danish, French, German and Italian ships, and also provided direct steamship services to the West Indies. While the coasting trade of Australia in passengers and cargo was reserved to ships licensed to engage in that trade, from 1935 unlicensed British ships of not less than 10,000 tons and a sea speed of not less than 14 knots were permitted to carry passengers between any two ports in Australia not connected by rail.

By 1939 there were 550 to 600 liner routes operating from the British Isles. Not all were empire routes, but there was at least one, and frequently more than one, liner route connecting Great Britain with each of the dominions and colonies; there was also a marked development in the organization of lines working directly between the overseas dominions.

Freights were, however, subject to considerable variation, because of changes in the balance of cargoes on the routes at different times and seasons. The serious drop in coal exports from Great Britain during the 1920s caused British shipping to be less remunerative and kept up freights for the carriage of raw products to Britain. The Australian trade was, from a shipping standpoint, unusually well balanced. The worst balanced route was that across the Atlantic to Newfoundland and Canada, for the United Kingdom exported to those countries mainly manufactured goods, occupying moderate cargo space in relation to their value, and imported grain, timber, pulp, flour and other comparatively bulky goods.

With the growth in the size of ships the need for deep water ports and for dock equipment which would provide for a rapid turn round of the ship was emphasized. Taken as a whole, the empire is well provided with ports having a depth of water of 35 ft. upwards, or with ports which can readily be deepened as soon as the necessity arises. The tendency has been to develop a large number of ports, and this often compels ships to call at several to ensure a full cargo. New Zealand perhaps suffered more from this than any other part of the empire, which accounted for freights being relatively high.

Great changes in the oriental trade occurred during the half-dozen years preceding World War II. However, despite great competition, by 1939 British shipping was still maintaining its long lead in the trade to the far east from ports of the United Kingdom, with between two-fifths and one-half of the tonnage and of the cargo and passengers carried. While all the principal territories of the empire, with the exception of the United Kingdom, have seafronts within the orient, or facing the orient across the Indian and Pacific oceans, they own very few ocean-going ships, despite the fact that they are large importing and exporting countries. This trade went principally to British shipowners, but the interests of these latter were harmed by various fiscal measures elsewhere, notably the virtual cessation of importation of sugar into India from the Netherlands Indies because of Indian customs duties and the complete stoppage of rice exportation from Siam (Thailand) and French Indo-China to the Netherlands Indies because of the embargo imposed by the government of the last named country. Moreover, while the development of Japanese industries caused a great expansion of Japanese foreign trade in both directions, British shippers reaped no benefit, for sea carriage was conducted by the Japanese mercantile marine which, because of government subsidies, was modernized with fast and efficient vessels. The United Kingdom and Japan were the two great carriers in the trades within the North Pacific ocean and through the Panama canal, something like one-third to two-fifths of all freight being transported under each of the two flags.

Railways.—The railway systems of the various parts of the empire differ very much in their adequacy. In the majority of cases they are in the hands of the state and, while in some instances they are worked to cover all expenses, in others there is an annual deficiency incurred for national development. The system of the government of the Union of South Africa comprised 13,238 mi. of line in 1940, and that of the dominion of Canada in 1941 amounted to 22,586 mi. (exclusive of mileages owned by provincial governments, municipalities and private companies). In 1939 the commonwealth or state governments of Australia owned and controlled 27,234 mi. of line, while railways open in all India in 1939–40 totalled 41,156 mi. All but 180 mi. of a total of 3,570 mi. operated in New Zealand in 1941 were owned by the government.

In the colonial empire, the prospects of improving the supplies of raw materials largely depend upon railway development. Whereas in the dominions the construction of transcontinental lines proved remunerative as settlers developed agricultural areas, such a policy was impracticable in the colonies, even on the continent of Africa. There, railways were built to convey raw produce to the coast, but operation was expensive because of the long distances and the sparseness of populations, and branch lines were seldom profitable because of the small quantities and small value of crops available.

Roads.—The importance of road transport increased rapidly with the widespread use of motor vehicles. With the development of six-wheeled and trackless vehicles, it became possible also to carry on transport for moderate distances over tracks and earth roads. In Canada, roads suitable for motor traffic are built by the provincial administrations, the government of the dominion constructing only those in national parks and in the territories. The trans-Canada highway was completed in 1943, when the section between Hearst and Geraldton, in northern Ontario, was opened. In 1942, U.S. engineer troops built the Alaska highway, a 1,600-mi. roadway across Canada from Fort St. John, British Columbia, through Whitehorse to Fairbanks, Alaska; the U.S. government was under agreement to maintain it for six months after conclusion of World War II, and then to return to Canadian jurisdiction all sections of the highway in Canada.

Local authorities construct and maintain all roads in Australia, except in New South Wales and South Australia, where these duties are undertaken by the state governments. In the Union of South Africa, the government railways administration was operating in 1940 16,491 route miles of road motor services. Roads outside municipal areas in British India are maintained by public authorities, those fit for motor traffic in 1938 totalling 200,000 mi. in length. New Zealand had 50,000 mi. of roads.

Air Services.—The Cairo-Baghdad mail route, opened by the royal air force in 1921, was the first main link in an empire service; it was taken over in 1926 by Imperial Airways, a private company in receipt of government subsidies. By 1929 the route had reached Karachi, India, and by 1936 Brisbane, Australia, was accessible in 10 days by regular services from London; the next year a branch line was instituted from Singapore to Hongkong, where it later linked up with the service to the United States operated by Pan American Airways. In 1931–32 Imperial Airways began a regular service through Africa from Egypt, first to Kenya, East Africa, and then, in conjunction with South African Airways (operated by the union railways administration) to Cape Town; from South Africa there was a further service to Calcutta, India. The British Overseas Airways corporation, formed in 1939 and wholly owned by the government of the United Kingdom, took over in 1940 both Imperial Airways and British Airways, the latter operating air routes to many parts of Europe. During World War II the new corporation was engaged exclusively in military transportation.

Meanwhile, Australia had developed, with the aid of government subsidies, a regular aerial network circumnavigating the continent, connecting with Tasmania and New Guinea, and linking Sydney, Melbourne and Adelaide with Oodnadatta, Alice Springs and Port Darwin—covering some of the most desert sections of the commonwealth. Pan American Airways commenced operation in 1940 of a route from San Francisco to Auckland, New Zealand, and that dominion, Australia and the United Kingdom became joint owners of Tasman Empire Airways, Ltd., their shares of the capital being 39%, 23% and 38% respectively. Canada had, by 1937, the world's highest aerial ton-mileage, with the possible exception of the U.S.S.R. The trans-Canada airway system operated from Vancouver to Toronto, Montreal, Moncton and Halifax.

Air services were extensively developed in the colonial empire prior to World War II. The local air service established in Malaya in 1937 traversed the entire peninsula, and Ceylon was linked with the Indian services, while African aerial systems formed in 1938 included those of Rhodesian and Nyasaland Airways and of Elders Colonial Airways, the latter on the west coast of Africa. Palestine Airways and associated services maintained connection with Iraq, Iran, Turkey and Egypt.

The empire air mail scheme was inaugurated in 1938, all first-class mail to East and South Africa, India, Australia and intermediate points being carried by air without surcharge.

Wireless and Radio Services.—In 1925 the only direct wireless service of an empire character was that between the United Kingdom and Canada, which had been in existence since 1907, though a limited service with India was maintained by way of Egypt. The first suggestion for an empire wireless scheme was made in 1911 but World War I caused its postponement until 1926, when the scheme was developed on the short-wave beam system. Both telegraph cables and radio are worked by the Cables and Wireless Company of Great Britain. A scheme for all-empire flat rates of charges for certain classes of telegrams was introduced in 1938, and the following year the reduced rates for inter-empire traffic were extended to telegrams exchanged between British ships and radio stations in empire countries. In 1939 a maximum rate of 2½*d.* per word for press telegrams within the empire was also introduced, this reduced rate applying to almost all empire countries.

Airgraph Services.—A new development in the speeding of transoceanic mail during World War II was the airgraph service. Letters written on special forms were reduced to miniature film and forwarded by plane across the sea; at the country of destination the letters were enlarged to readable size and delivered. A small roll of film contained 1,600 airgraph letters and weighed but 5 oz., as against over 70 lb. for a similar number of ordinary letters. Each negative of an airgraph letter was kept for about six weeks, until news was received of the safe arrival of the batch in which it was despatched; the originals then became "confidential salvage" and were destroyed in bundles. At first introduced for the use of troops, the service was later made available for correspondence between civilians. An airgraph service employed for correspondence with the armed forces of the United States was termed V-mail.

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VII. EDUCATION

Imperial Education Conference.—In 1907 a number of educational administrators from parts of the British empire, who were attending in London an educational congress convened by the League of the Empire, met representatives of the home government and suggested that an official Imperial Education conference should be convened periodically by the British government. The government of the day adopted this suggestion and through the board of education convened the first such conference in 1911. The delegates were nominated by the several governments of the empire, being either heads of education departments or persons officially connected with their educational administration. The conference recommended that meetings should be held at intervals of four years but the second meeting was held in 1923; the third in 1927; later, the meetings were in abeyance. At each conference there were delegates from the self-governing dominions, India, and the colonial empire. In 1927 the mandated territories were also represented.

The work of the conference may be divided into two parts. First, the movements of teachers and students about the empire gave rise to a number of rather technical problems best solved after personal discussion between responsible officials. Thus when a teacher migrates it is necessary to determine his professional status, his salary, etc., in his new country. Migrant students bring with them problems as to the equivalence of examinations for the purpose of admission to training colleges, universities and other institutions for higher education. The conferences endeavoured to devise principles to be applied in the solution of such problems. Their recommendations resulted in legislation directed to the facilitation of movement and thus to the promotion of imperial unity.

Second, attention was given at each meeting to educational problems of the moment on which the experiences of each country were likely to be helpful to all.

The 1911 conference established an advisory committee to carry on its work between successive conferences. It consisted of the accredited agents in London of the several governments concerned, presided over by the secretary of the board of education. This committee made the arrangements for the later conferences and advised on questions referred to it by the education departments at home and overseas. It conducted, for example, certain inquiries into the working of the scheme for the temporary exchange of teaching posts at home and in the dominions, and investigated the possibility of a common form for the display of the fundamental statistics of public education in all the countries of the empire.

An official report of the proceedings of each conference was published by H.M. Stationery office.

CANADA

By sec. 93 of the British North America act, 1867, the control of education in the dominion was exclusively entrusted to the provinces, and a special safeguard was added that no law passed should prejudicially affect any right or privilege with respect to denominational schools that was legally possessed by any class of persons in the provinces at the time of confederation. The safeguard involved a principle of great importance, for Canadian educational systems derive from two separate ancestries and there is much opportunity for difference over religious matters. The undenominational system of English-speaking Canada was founded on English and Scottish precedents modified by American experience, while the system of the Roman Catholic Church, in which religious instruction, according to its tenets, forms a vital part, prevails in French-speaking Quebec.

The supreme education authority for the province of Quebec is a council of public instruction with two sides supervising the Roman Catholic and Protestant schools respectively. Each committee has independent jurisdiction over the schools of its own faith, but questions of common interest are decided by the council as a whole. The cost of education is defrayed from three sources: provincial grants, local rates assessed on all property within the school district, and fees paid by parents having children of school age. Secondary education in the province of Quebec is divided upon more sharply marked denominational lines than primary. The most distinctive institutions on the French side are the residential classical colleges with almost wholly clerical staffs. There are also Roman Catholic nonresidential secondary schools provided by local school boards and supported by government grants, local rates and fees, in the same way as the primary schools.

The educational system of English-speaking Canada finds its fullest development in Ontario, but in its essentials it is the same in all the provinces. The primary schools are organized in "grades" corresponding roughly to English "standards," and education is free and compulsory for all children between the ages of 8 and 14. In Ontario, either full or part-time attendance is required up to 16, and in some cases up to 18, a requirement that greatly increased the attendance in the secondary schools of the province. Secondary education in government-aided schools is free throughout English-speaking Canada, but there are, in addition, certain boarding schools of high reputation modelled on the lines of an English public school. In the larger cities, industrial, technical and art schools have been established, and everywhere throughout Canada great attention is paid to agricultural education in schools and colleges, ranging upwards from farm schools to elaborately equipped and staffed agricultural colleges with experimental farms attached. Certain of the Canadian agricultural colleges rank among the best in the world.

In 1941 a total of 370 Indian schools were in operation, including 77 residential schools for Indians (enrolment 8,774 pupils), 282 day schools for Indians (enrolment 8,427 pupils) and 11 combined public and Indian schools (enrolment 224). Continuation and high-school work is taught in several of the day and residential schools.

The two leading universities—Toronto and McGill (Montreal)—represent different types in the organization of their finances, the first being supported by public funds, as are the state universities in the United States, and the second depending upon its endowments, as do the British universities. They differ little, however, in their academic organization or curricula. To the first type belong the universities of the west: Manitoba, Saskatchewan, Alberta and British Columbia, while in the east most of the universities belong to the second type, the best known of them being Queen's (Kingston, Ontario) and Dalhousie (Halifax, Nova Scotia). Laval (Quebec) and the University of Montreal, however, differ considerably from other Canadian universities in organization and curricula, methods of instruction deriving from the precedents of the ancient University of Paris. (*See* Universities.)

AUSTRALIA

Education in Australia is administered and controlled separately by the six states. At the cost of the federal government, schools in the Northern Territory are conducted by the education department of Queensland, and those in the Australian Capital Territory by that of New South Wales. Primary education is free and compulsory in all states, in most instances between the ages of 6 and 14; the commencing age is 7 in South Australia, and the leaving age is 15 in New South Wales. In some states, where any child is living outside stated distances from a state school, the age at which the child must commence school is increased. Free kindergartens are in operation in all states. There exists in all states a more or less liberal provision of scholarships and bursaries to higher state schools, to the secondary schools and to the universities.

One of the foremost problems in every state is that of the "out-back" children, the families of settlers in sparsely populated districts. The efforts to meet their needs are various. There are "provisional schools" where about a dozen children can be assembled, and "half-time schools" for a lesser number, a teacher visiting on alternate days. In still more sparsely settled districts an itinerant teacher goes from house to house, and in some states parents are allowed to club together and build a school, which receives a government subsidy and a grant of school material. In New South Wales are "travelling schools," a teacher having a van with a tent for himself and one for use as a school; South Australia has attractive portable schools; and Queensland operates three travelling housecraft schools and a travelling manual training school for boys. Railway camp schools are found in some states on the sites of extensive railway works. For children not reached by any of the above methods, all states provide education by correspondence, and super-primary education by correspondence is afforded many children attending small one-teacher schools. A movement for centralization of schools developed with improvement of transport facilities, travelling allowances being provided for the children.

Agricultural training receives varying degrees of attention in the various states. There are two residential agricultural schools in New South Wales, and agricultural high schools in Victoria. The study of agriculture and kindred subjects in state schools in Queensland is encouraged by a government grant, and in the remaining states agriculture is taught in many of the academic schools. The progress of evening schools in several of the states was uncertain, and the expenditure on technical education for the whole of the commonwealth comparatively small.

The pupil-teacher system was largely abolished as the result of a strong movement, and the condition of admission to the teachers' training colleges is a minimum standard of secondary education. The outlying country schools suffered from insufficiently trained teachers, but some States made a term of service in the country a condition of promotion in the city schools. There are two teachers' training colleges in New South Wales and three in Victoria, while Queensland, South Australia and Western Australia have one each. In Tasmania, practise-teaching is provided in practising schools and in small model schools.

The universities of Sydney and Melbourne (*see* also UNIVERSITIES) stand very high among the universities of the empire and have faculties of world-wide reputation. They have considerable endowments and receive governmental aid, but without control. Universities in other states (also government-aided) comprise the University of Queensland, at Brisbane; the University of Adelaide, South Australia; the University of Western Australia, at Perth; and the University of Tasmania, at Hobart. Canberra University college, governed by the University of Melbourne, commenced operation in 1930. New England University college, affiliated with the University of Sydney, opened in 1938 at Armidale, New South Wales. The Workers' Educational association, aided by state grants, brings the universities into closer relationship with the masses of the people.

According to the census of 1933, the numbers of students receiving instruction were as follows:

Government school .	904,383	University	8,525
Private school . .	224,004	Home . . .	33,126
		Total	1,171,028

A relatively small proportion of Roman Catholics attend state schools—34.66 were attending state schools in 1933 as compared with 86.84 for the rest of the community

NEW ZEALAND

The first mission school in New Zealand was established in 1816. An ordinance of 1847 recognized and allotted financial assistance to religious schools for both whites and Maoris, but this remained inoperative as regards whites. The act of 1871 established village Maori schools with local committees on which both races might serve.

The act of 1877 made education free, compulsory and secular. This statute became the keystone of the educational system. Though education is secular, the door is opened to religious instruction for those who desire it by the fact that permission may be given to use school buildings for other purposes out of school hours. Under this act the country was divided into districts, each with an education board to administer grants, establish and maintain schools and training colleges, and appoint teachers. School committees for small areas are elected by the householders, and these committees in turn elect the boards, besides managing their own schools under the board. Each secondary school, however, is managed by its own governing body. The whole system is placed under the control of a central department of education, over which the minister of education, a member of the cabinet, presides. Later acts made the registration of private schools compulsory, set up a teachers' register, and obliged all teachers, in public and private schools, to take the oath of allegiance.

Primary Education.—At the age of three a child may enter a free kindergarten, and at the age of five he may enter, and at seven he must enter, either a primary school organized under one of the nine education boards, or a registered private primary school. This schooling is compulsory until the age of 15 (and was planned in 1943 to extend until the child reached 16). All state primary schools are co-educational. In addition to primary schools proper, there are so-called district high schools, established where there are not enough children for a separate secondary school, and these unite primary and postprimary departments. New Zealand, like the other dominions, has its problem of the isolated rural child, and provides correspondence classes as well as free conveyance to school where this may be possible. Itinerant and organizing teachers are sometimes employed to staff the small "back block" schools, and the consolidated school became popular wherever established. The educational broadcasts from New Zealand broadcasting stations have been of great value to the rural schools. In sparsely populated areas there are part-time schools, so that one teacher can take charge of two schools.

The Maori child has the same right to a free education, primary and secondary, as the non-Maori. Approximately one-half are educated in the public schools, others attend mission schools, and the government also reserves free places for Maori at certain denominational boarding schools. While the language of instruction is English, the native schools are not completely English in outlook, for Maori arts and crafts, song, legend and history are taught.

In 1936 free postprimary education to the end of the year in which he is 19 was first offered to every child completing a primary-school course or attaining the age of 14 years. District schools, as already stated, combine primary and secondary departments. Technical high schools, as well as providing for normal postprimary needs, also specialize in vocational training for both full and part-time students.

The University of New Zealand was recognized in 1876 as an examining body, and an act of 1926 made it a teaching body. It is constituted of university colleges in Auckland, Wellington, Canterbury and Dunedin (*see* also UNIVERSITIES). The school of agriculture, consisting of Massey and Lincoln agricultural colleges, is open to students specializing in farming studies. The Workers' Educational association co-operates with the university and receives a government grant.

The four teachers' training colleges are subject to the control of the state education department. They provide a two-years' course, or one year for university graduates.

SOUTH AFRICA

The history of education in South Africa has been a checkered one, owing to the long political troubles that delayed union. In Cape Colony and Natal, English precedents were generally followed, while in the Orange Free State and the Transvaal the educational system was largely influenced by the pastors of the Dutch Reformed Church. After 1902, however, the systems of primary education approximated more closely, and development in all four provinces of the union proceeded on parallel lines. Since both English and Afrikaans are recognized as official languages, there has sometimes been acute language difficulty in the schools. The questions raised by the education of the native and coloured population differ widely from those in connection with the education of the white population (*see* below, *Non-European Education*).

The South African act of 1909 (of the parliament of the United Kingdom) made higher education a matter for the union government, which might subsequently take over other branches left, for the time being, under the provincial governments. Successively, the union took over from the provinces industrial, vocational, technical and special education (and also child welfare), but agricultural schools on a postprimary level, which the union government had instituted in 1925, were handed over in 1938 to the provincial administrations. Agricultural colleges dealing with students beyond the secondary school age fall within the purview of the union government.

With these exceptions, primary and secondary education is administered by the provinces, although about 70% of the cost is borne by the union government; and the provincial departments of education also train their own teachers. While the provinces obtain from the union about £15 per pupil in subsidy, they actually spend about £21 per pupil per annum on European primary and secondary education. Approximately 94% of the European children attend public (state) schools. Afrikaans (*i.e.*, South African Dutch) and English are equally recognized. Children are taught at the outset in their mother tongue, but learn the second language at a later stage.

Primary education is separately managed in the four provinces, and is everywhere free. In the Cape, Orange Free State and Transvaal, it is compulsory for white children from 7 to 16 (though to 15 on the Witwatersrand), and in Natal from 7 to 15. But there are regulations allowing children to leave younger if they have completed standard VI (in the Transvaal, standard VIII), and are in regular employment. All four provinces have school medical services.

Throughout the union undenominational religious teaching is given, subject to a conscience clause, but only in the Cape is denominational teaching allowed in state schools under certain conditions.

Like other dominions, South Africa has its problems of children living in such isolation that school attendance is difficult. When necessary, provision is made for the transport or boarding of children, or grants are made to "farm schools," that is, groups of children gathered at a farm under the guidance of a governess or tutor.

In the Transvaal and (with some exceptions) the Orange Free State, secondary education is free; in the Cape it is free at most schools up to the age of 15; but fees are charged for secondary education in Natal, though bursaries may help to meet the cost. Grants are also made to private secondary schools. The needs of the country children are met by attaching secondary standards to some of the primary schools, and by the provision of hostels and transport.

South Africa has four universities of the unitary type, all the outgrowth of earlier institutions: University of Cape Town (incorporated in 1918), University of Stellenbosch (1918), University of the Witwatersrand (1922) and the University of Pretoria (1930). The University of South Africa, at Pretoria, successor in 1918 to the University of the Cape of Good Hope, embraces five constituent colleges, the first four of older foundation: University college of the Orange Free State, Bloemfontein; Huguenot University college, Wellington; Natal University college, Pietermaritzburg and Durban; Rhodes University college, Grahamstown; and the Potchefstroomse Universiteitskollege vir Christelike Hoër Onderwys (until 1933, Potchefstroom University college).

Non-European Education.—For South African census purposes, racial groups besides Europeans (persons of pure European descent) comprise natives (pure blooded aboriginals of the Bantu race), Asiatics (natives of Asia and their descendants, mainly Indians) and coloured (chiefly Cape coloured, and also Cape Malays, Bushmen, Hottentots and all persons of mixed race). European and non-European children do not attend the same schools. The overwhelming majority of native schools throughout the union are state-aided mission schools. In the Cape, schools for coloured children are mostly of the mission-aided type; in Natal, most coloured children attend government schools, and in the Orange Free State all of them do so; and coloured children in the Transvaal are in undenominational public schools. Only in Natal is a distinction made between the administration of coloured and Asiatic education; in the other three provinces, Asiatics are comparatively few and are treated as part of the coloured school population. In 1930 there were in the four provinces 5,131 schools and training colleges for non-European scholars, and 303 training institutions for non-European teachers.

While native students are not barred from following courses at the European university institutions, very few actually do study there. The only *ad hoc* native institution doing work of a university standard is the South African Native college, at Fort Hare, opened in 1916, students sitting for the examinations of the University of South Africa; a government grant is the college's chief source of income.

INDIA

The problems of education in India are immense with the immensity of that vast peninsula. There is, moreover, this perplexity, that whereas in most countries education is linked continuously through all grades and stages, in India a deep rift divides higher education from primary. Higher education uses English as its language-medium: education for cultivators and artisans is necessarily in the mother-tongue, and India's millions speak in many languages. Further, higher education is relatively widespread and advanced, while 88% of the whole population are illiterate.

History.—For about 40 years after Warren Hastings founded the Calcutta Madrassa (1781), British interest in Indian education was confined to the encouragement of the traditional Islamic and Hindu learning, and the funds first assigned to education in 1813 were devoted to that purpose. A definite change in policy came in 1835, the date of Lord William Bentinck's "resolution" and Macaulay's "minute," which together determined that from that time on the main line of educational advance should be through "English education." But the beginnings of English education go back 20 years earlier, and came, in effect, in answer to a popular demand, and out of the belief that a true revival of learning in India could most effectually be brought about by means of the English language. The Hindu college, Calcutta, was founded in 1817 under the inspiration of this belief. In 1854 the "despatch" of Sir Charles Wood formulated a comprehensive scheme of education for all India, the groundwork of the present system. Progress after that time was continuous. There have been three principal epochs, each following the appointment of an educational commission. The first of these was in 1882 and resulted in an immense extension of high school and college education. The second, the Universities commission of 1902, was occupied with university reform, at that time much needed. The third, in 1917, remembered as the Sadler commission, dealt exhaustively with the problems of higher education in Bengal, including schools. A central advisory board of education was created in 1920 on lines recommended by the Sadler commission, but that body was abolished in 1923 as a measure of retrenchment. It was revived in 1935 on the recommendation of the auxiliary committee on education of the Simon commission, and became engaged in advising the central and provincial governments as to the lines which educational reorganization should follow.

The aims of the education fostered under British control in India were from the first philanthropic, looking to the hope of intellectual and moral renewal. They were criticized as too narrowly practical—the training of useful subordinates for the public services. They were also criticized as misdirected and unpractical. To the diffusion of western learning through English there was reasoned opposition from the first, because of the inevitable conflict between modern thought and Indian life and tradition. The bitterest and most damaging attacks on the educational system came from men who owed the effectiveness of their weapons largely to the system which they denounced. For these critics the ground of quarrel was that English education in India demoralized and denationalized. Whatever truth there was in these criticisms, it remained beyond dispute that the great educational experiment launched by the despatch of 1854 was well-intentioned, and that its results were on the whole beneficent. One striking result was the attainment by the Indian peoples of a common language in which to express their political aspirations.

But the strongest title of the system of education to favourable judgment is that it was the effective cause and motive power of a true Indian renascence. This revival permeated Indian society very widely. It took three main forms: (1) the revival of vernacular literatures and of Indian art; (2) social reform; (3) political developments. One of the political developments was that the control and guidance of educational policy passed from the British into Indian hands—the really salient feature of the system. Some of the short-comings in the system were the tendency of the prevalent type of secondary education to encourage the drift of unsuitable pupils toward higher literary education, the huge wastage in primary schools which retarded progress toward the attainment of literacy, the too frequent lack of adequate control by provincial governments over the educational activities of local bodies, and finally, the absence of effective co-ordination of educational activities.

Educational Administration.—In 1920 the control of primary and secondary education in British India passed to Indian ministers, responsible to their own legislatures. The European official element in the administration of education had almost disappeared by the time of World War II. In the early days of educational development, the Indian Educational service was largely responsible for educational administration but as Indians were trained up to take the place of Europeans, this service lost its original character and was abolished with the advent of the 1919 constitution. Primary and secondary education are both under the supervision of inspectors responsible to the provincial governments. Schools are staffed and equipped by missionary agency or private enterprise, largely with the help of governmental grants-in-aid. The provincial governments also maintain and manage directly key schools of all types, to set the standard. Total expenditure on education in British India amounted to Rs. 29,09 lakhs in 1939–40, compared with Rs. 27,18 lakhs in 1931–32. Of the former amount, Rs. 17,23 lakhs was provided from public funds, the remainder accruing from fees and other sources.

Primary and Secondary Education.—Pupils in primary schools number only about one-fifth of the children who might have been at school. Nominally, the principle of compulsory primary education (usually from 6 to 11 years) has been accepted in British India, but its application is dependent upon local option. Areas of the provinces imposing compulsory attendance upon children in 1938–39 were as follows: urban areas, 175; rural areas, 3,333; and villages in rural areas, 13,537. The proportion between enrolment and regular attendance is very low. This failure does not come from want of recognition of the greatness of the need. It has been affirmed again and again in government declarations of policy. The hindering causes have been the absence of any popular demand, scarcity of teachers, want of money, and unwillingness of the provincial governments to impose special taxation to provide it. In 1917, the total school-going population of British India attending primary schools was 6,500,000. By 1927 it had risen to 9,250,000, and in 1939–40 it numbered nearly 11,500,000

Secondary education is widely diffused, and the demand for it does not slacken. The true use and value of the school as an institution, however, are imperfectly recognized, though strenuous efforts have been made in the right direction. Even among high English schools, which lead to the universities, there are few in which school life is as full and vivid as it may be, for these schools prepare candidates for university matriculation rather than educate for life. In 1938–39, the total scholars attending the 12,177 secondary schools for boys in British India amounted to 2,210,181.

Education of Women.—Although custom and prejudice still seriously obstruct efforts to advance the education of India's womanhood, figures for female education are by no means negligible. Institutions provided for the education of women and girls in British India in 1938–39 comprised 483 special schools, 28,482 primary schools, 1,093 middle schools (476 English and 617 vernacular), and 417 high schools. At that period, there were also 8 professional colleges for women and 33 colleges (including intermediate and second-grade colleges). Two women's medical colleges affiliated to Punjab university are the Lady Hardinge, at New Delhi, and the Women's Christian, at Ludhiana, and a private institution of higher education where the mother tongue is the medium of instruction is the Shreemati Nathibai Damodar Thackersey Indian Women's university; the last-named was founded at Poona in 1916 and was transferred to Bombay 20 years later.

Technical Education.—Engineering colleges at Benares, Guindy (Madras), Mughalpura, Patna, Poona and Sibpur are affiliated to universities, while another of importance is situated at Roorkee. Benares Hindu university has faculties of mining and metallurgy, and there is a mining school at Dhanbad, and technical institutes at Bombay, Bangalore and Cawnpore, to mention but a few. Notable success has attended the schools of forestry at Dehra Dun and Coimbatore, and the Research Institute in Agriculture, the last transferred in 1934 from Pusa, in Bihar, to New Delhi.

University Education.—In British India there are eight federal universities—Calcutta (founded in 1857), Madras (1857), Bombay (1857), Punjab (1882), Patna (1917), Nagpur (1923), Andhra (1926) and Agra (1927); five unitary teaching and residential universities—Allahabad (1887), Lucknow (1920), Dacca (1921), Delhi (1922) and Annamalai (1929); and two denominational universities—the Benares Hindu university (1916) and the Aligarh Muslim university (1920). The three universities in the Indian states are Mysore (1916), Osmania, at Hyderabad (1918) and Travancore (1937). The greater part of the teaching for the first degree (B.A.) is done in university colleges nominally under university supervision but in reality practically autonomous. There is a great preponderance of men in all these institutions. In 1939–40, the total number of scholars attending all institutions up to university standard numbered 15,250,000, as compared with 12,750,000 in 1931–32.

THE COLONIAL EMPIRE

In its first stage, development of education in the colonies sted entirely, as it had done in the mother country, with the churches and their great missionary agencies. This early period of purely missionary development was followed by the stage at which the governments of the various colonies in which native peoples redominated began to realize that the problem of securing order and justice produced in turn the problem of means of developing the peaceful pursuits of the people. Thus it was that colonial governments began to take an interest in the educational work of missions. Besides money grants from colonial revenues, following emancipation of the slaves in the colonies in 1833 the imperial parliament began to vote grants-in-aid for education in the colonies. In 1847 the British government prepared a memorandum outlining a scheme of education in the colonies, and gradually colonial administrations came to take a more active and direct interest in educational development.

The second stage in the educational history of the colonial empire had been reached by the close of the 19th century, at which period administrative educational machinery had been expanded, with inspectors of education functioning in many territories. The hird stage in educational development commenced early in the 20th century, when education had come to be recognized as one of the most important factors contributing to the general advance of the people as a whole, and not merely a means for providing clerical staffs for governments and traders. The vastly increased world demand for colonial products at this time had brought increased revenue, and thus increased colonial expenditures became possible for the improvement and development of education. Moreover, the growth of transport facilities and expanding use of machinery produced in the colonial empire a demand for skilled artisans of all types, and so new avenues for employment were opened to those who had a wider training than had been available to the preceding generation.

Educational Policies.—By this period educational policy as affecting the components of the colonial empire had assumed a definite pattern which had seven aspects: (*a*) co-operation between Government and voluntary educational agencies—missions, Moslem and other native authorities, and private groups; co-operation in administration by the formation of local advisory committees, the membership of which included natives; and co-operation in actual school work by encouraging nongovernmental bodies to continue to develop their schools with the assistance of government grants; (*b*) insistence upon education having a definitely religious or ethical background, whether Christian or non-Christian; (*c*) conservation through school activities of the best elements in native life; (*d*) provision of technical and vocational training according to local needs; (*e*) education for girls; (*f*) educational programs directed toward the advancement of the peoples as a whole; and (*g*) development of higher education for the training of potential leaders for eventual self-government.

The need for co-ordinating the educational policies of the various colonial territories led to the appointment by the secretary of state for the colonies, in 1923, of an Advisory Committee on Native Education. In a command paper (2374) published two years later, this body pointed out that since the first task of education was to raise the standard and efficiency of the bulk of the people, government schools should be established (supplementing the state-aided mission institutions) with an educational staff of the highest qualifications. The committee's scope, at first restricted to tropical Africa, was extended in 1929 to embrace the colonial empire as a whole, and in 1935 the committee further developed its conception of education as a community service in an important memorandum concerning African communities. While stressing the need for real popular interest in education, the memorandum urged increased co-operation between all the services making for social improvement, particularly the administrative, medical, agricultural and educational agencies.

Education for Girls.—Because in many parts of the empire, particularly in Africa, society is organized on a family economy, and each person has to play a part in it, the education of girls proceeded slowly. To send the boys away to school disturbs this economy; to send the girls as well complicates the division of labour to an incalculable extent. Then, again, in some areas religious and social sanctions demand close family supervision of girls. Despite these difficulties, both mission and government schools for girls have become well attended in such areas of Africa as Kenya, Uganda, Tanganyika Territory and Nigeria. In some territories women have done invaluable work as assistant directors of education and inspectors of domestic science.

Preservation of Native Cultures.—Although the gradual spread of the use of the English language is regarded as inevitable for economic reasons, local cultures and languages are deliberately encouraged, in the primary stages, at least, because of their value in the preservation of social pride. Owing to the great multiplicity of vernaculars, and to the fact that many have no script, certain ones in groups of allied languages have been selected for standardization and use in education; official committees in all territories are charged with the production of vernacular publications and textbooks. With the financial support of the Carnegie foundation and the Phelps-Stokes fund, "Jeanes schools," patterned on like institutions in the United States, have been established in the Rhodesias, Nyasaland and Kenya. At these schools natives were trained as visiting teachers to develop community work in groups of schools placed under their supervision. This program, which proved highly successful, was subsequently expanded to afford instruction in community welfare work, also, to native chiefs and other authorities, and to subordinate technical officers. The movement thus initiated in Africa later spread to many other parts of the colonial empire.

Expenditure on Education.—Since many educational institutions in colonial territories are controlled and maintained by departments of government other than education departments, and a considerable amount of educational work is also carried on by missions and others outside the direct purview of the administrations concerned, figures for expenditure on education can be only partial and approximate. The expenditure from funds voted directly for the services of the education departments in the territories directly under the control of the colonial office was, in 1937, about £3,500,000, this figure representing about 6.6% of the total expenditures of the colonial governments in that year. The number of pupils in all institutions under the direct supervision of the education departments in 1938 was about 3,300,000. The estimated number of children of school age (between 6 and 14) at that period was approximately between 10,000,000 and 10,500,000. These figures indicate that about 30% of the children of school-going age were in receipt of education. The percentage varied greatly in different colonies. In Hongkong nearly 80%, and in Ceylon over 75%, of the school population were in school, while in other areas, particularly in Africa (outside Nyasaland), the figure was below 20%. About 73% of the pupils were in schools maintained or aided from public funds (most of the latter category being mission schools), and more than 95% of those under instruction were at the elementary stage; pupils receiving secondary and vocational instruction were about 4½% of the total.

Higher Education.—The increase in social and economic services in colonial territories, and the policy of developing local leadership, resulted in a greatly increased need for trained professionals. This served to stimulate the expansion of colonial universities and colleges. Besides numerous collegiate institutions of university status, there are four full ranking universities within the colonial empire. The first founded was Malta university (1769); an independent body, it established a chair of archaeology in 1938 as its seventh faculty. Hongkong university (1912) received an annual government grant; its third faculty, that of medicine, was created by means of a grant from the Rockefeller foundation. Another body independent of public funds is the Hebrew university (1925), at Jerusalem; besides faculties of humanities and science, and a pre-faculty of medicine, it contains several institutes and departments. Ceylon university (1942) is a merger of the Royal University college and the Ceylon Medical college; the license of the latter had long been recognized by the General Medical council.

Oldest of collegiate institutions in tropical Africa is Fourah Bay college (1827), in Sierra Leone, which is affiliated with Durham university. At the outbreak of World War II it had been planned to constitute a university for Malaya with the consolidation of two earlier institutions in Singapore, King Edward VII College of Medicine (1904) and Raffles college (1928). The Imperial College of Tropical Agriculture (1921), at Trinidad, provides additional training to scientific agriculturists and pursues research work. An independent institution (though in receipt of government grants), and one of the best known of the colonial empire, is the Prince of Wales college (1927), at Achimota, Gold Coast, half the managing council of which are Africans; the instruction for both sexes from kindergarten to university standard, and the training in agriculture, engineering and the arts and crafts, are planned throughout to conserve and strengthen the cultural heritage of West Africa. Post-secondary vocational training (including medical) is given at Yaba Higher college (1933) near Lagos, Nigeria, and post-primary vocational work at Makerere college (1922), at Kampala, Uganda; the status of several courses at the latter has been raised to secondary standard, and higher education courses have been transferred to a new university college. Codrington college, in Barbados, affiliated with Durham university, offers a limited number of university courses. At Tabora school, in Tanganyika Territory, boys, many of them the sons of chiefs, take a four-year course which includes both academic and vocational instruction.

The Advisory Committee on Native Education instituted in 1942 an examination of the subject of the mass education of communities, and the following year the colonial secretary created a commission to consider the best means of ensuring closer co-operation between higher education institutions in the territories under his jurisdiction and British universities. The coordination of higher education in west Africa presented numerous special difficulties, for there were great contrasts between the widely separated dependencies in their educational standards and programs, and in their economic, social and political development. Therefore in 1943, at the same time that a commission commenced inquiry into the general problem of the relations of the universities, there was set up a separate commission of inquiry into higher education in British West Africa.

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BRITISH EMPIRE EXHIBITION: *see* Exhibition and Trade Fair.

BRITISH GUIANA: *see* Guiana

BRITISH HONDURAS, formerly called *Belize*, or *Balize*, a British crown colony, bounded N. and N.W. by the Mexican Territory of Quintana Roo, N.E. and E. by the Bay of Honduras; S. and W. by Guatemala. The area, including about 212 sq.mi. of cays, is 8,598 sq.mi. The Guatemalan frontier had long been regarded as definitively settled under a convention made in 1859, but in 1938 Guatemala reopened the entire question on the ground that British noncompliance with other provisions had invalidated the entire convention. As defined in 1859, the boundary follows the Sarstoon from the Bay of Honduras to Gracias á Dios falls, runs northward in a straight line to Garbutt's falls on the Belize and from there due north to the Mexican frontier, which follows Blue creek and the Río Hondo to its mouth in Chetumal bay.

Approach to the coast is through the islets known as cays, and through coral reefs, and is both difficult and dangerous. For some miles inland the ground is low and swampy, with mangroves and tropical jungle. Next succeeds a belt of rich alluvial land, seldom more than a mile in width, beyond which, and parallel to the rivers, are extensive tracts of sandy, arid land called "pine ridges," from the trees (*Pinus cubensis*) with which they are clothed. Further inland comes the less elevated "broken ridge" country, of mixed scrub. These tracts are intersected by what is called "Cohune ridges," with a deep rich soil covered with myriads of palm trees and broad savannas, studded with clumps of trees which are threaded by streams from the mountains. The latter rise in a succession of ridges parallel to the coast. Nearest to Belize (the capital) are the Manatee hills, from 800 to 1,000 ft. high; beyond these the Cockscomb mountains rise to 3,700 ft. Fifteen streams, large enough to be called rivers, descend from these mountains to the sea, between the Hondo and the Sarstoon. The uninhabited country between Garbutt's rapids and the coast south of the Cockscomb mountains consists of pine ridge and open grasslands, with fine pasturage in the west and valuable forests in the east. Its elevation varies from 1,200 to 3,300 ft. Auriferous quartz and traces of other minerals have been discovered, but not in workable quantity. The geology, fauna, and flora resemble those of Central America (*q.v.*). Although within the tropics, the climate is subtropical. The highest shade temperature recorded is 98°F., the lowest 50°. Easterly sea winds prevail most of the year. The dry season lasts from mid-Feb. to mid-May; rain occurs at intervals during the other months, and almost continuously from October through December. At Belize the annual rainfall average is 80–85 in. (1933–39: 77·58 in.). It is lower in the north and higher in the south, where as much as 193 in. has been recorded for a single year. Malaria fever is endemic, and other tropical diseases occur sporadically, but, compared with the West Indies and the Central American states, the country is not unhealthy.

Inhabitants.—British Honduras is a little larger than Wales, and has a population of about 61,068 (official est., 1941). Purebred white inhabitants number less than 1 in 25; the remainder are of mixed descent. The majority are hybrids of Negro slaves, native Indians, and white settlers. There are (1) Maya Indians, chiefly in forest villages in the west and north, away from the sea; (2) descendants of English buccaneers, mixed with Scottish and German traders; (3) the woodcutting class known as "Belize creoles," of more or less pure descent from African slaves or labourers, from the West Indies; (4) the Caribs of the south, descendants of the population deported in 1796 from St. Vincent, of mixed African and Carib origin; (5) in the south, a Spanish-Indian population, from Guatemala and Honduras; and (6) in the north, a Spanish-Indian group which came from Yucatan in 1849. The population increases steadily; about 45% of the births are illegitimate and males are more numerous than females. Many tracts of uninhabited land and forest were once thickly populated. The country abounds in ruins of the ancient Maya civilization.

Natural Products.—British Honduras has long depended on timber, especially mahogany, logwood, cedar, and dyewoods and cabinet woods, such as lignum vitae, fustic, bulletwood, santamaria, ironwood and rosewood. The Negro inhabitants are superb woodsmen. Agriculture, prohibited in the 18th century by treaties with Spain, has never been adequately developed, and at most 100,000 ac., or less than 2% of the whole area, is tilled. The Stann creek district, centre of grapefruit cultivation, has undergone considerable agricultural expansion, and several groups of government-sponsored colonists, including 82 European refugee families in 1940, were settled in the interior. Sugar cane, coco-nut palms, bananas, plantains and citrus fruits are cultivated. Vanilla, sarsaparilla, sapodilla (from which chicle is obtained), rubber, and the cohune or coyol palm, valuable for its oil, grow wild. The government maintains a forest department (founded in 1922) which is charged with conserving and replanting valuable timber, and also maintains a department of agriculture (founded in 1928).

Chief Towns and Communication.—Belize (*q.v.*), with a population (1941 est.) of 17,289, is the capital and chief seaport. Stann Creek also has a deepwater port (at Commerce Bight). The towns of Stann Creek, Corozal, Orange Walk, Punta Gorda, Cayo, Monkey River, Mullins River and Benque Viejo have their own town boards and considerable local self-government.

The Belize river is navigable by shallow boats for 180 mi., the Chetumal for 70 mi., the Sarstoon, the Sibun and other rivers for shorter distances. There are no railways, the 25-mi. Stann Creek valley railway having been converted into an all-weather motor road. While most of the main centres are connected by all-weather roads, land communication is on the whole inadequate. Under the provisions of the Colonial Development and Welfare act, 1940, the British government allotted £187,500 for modernization of the Belize-Cayo road. The Central American airways (TACA) links Belize by air with the main interior towns and with the outside. Steamers from New Orleans, Liverpool, Jamaica, Colón and Puerto Cortés (Honduras) regularly visit Belize.

Commerce and Finance.—The colony's principal imports are foodstuffs, cotton goods, hardware, beer, wine and spirits. The leading exports are mahogany, cedar, chicle, coco-nuts and copra, grapefruit and bananas. Goods in transit to and from Quintana Roo territory (Mexico) make up a considerable portion of the colony's external trade, accounting for somewhat over half of the exports in 1939. The external trade in 1939 (with corresponding figures for 1938 in parentheses) was: imports, $3,532,059 ($4,004,091), of which the United States supplied 32.44% (30.78%), Mexico 27.55% (24.6%), Great Britain 15.8% (19.06%), Canada 7.18% (8.06%), other parts of the British Empire 4.73% (4.79%), other countries 12.3% (12.71%); exports, $2,519,674 ($3,263,384), of which the United States took 69.19% (72.84%), Great Britain 15.25% (12.72%), and Canada 2.16% (3.4%). Mahogany logs and lumber aggregated 42.19% of the total export value (57.32% in 1938).

In 1894 the British Honduras dollar became the standard of currency, and all financial transactions are reported in it. It is normally equal to the U.S. dollar. The pound sterling is legal tender at $4.86. The colony issues its own notes and subsidiary coins. There is a government savings bank, and the Royal Bank of Canada has a branch at Belize. In 1939 revenues, exclusive of $721,489 advanced from the colonial development fund, were $1,246,173 (1938: $1,258,099); expenditures, exclusive of imperial grants and loans, were $1,539,187 (1938: $1,337,868).

Constitution and Administration.—From 1638 to 1786 the colonists were completely independent and their customs were codified as "Burnaby's laws," after the visit of Admiral Sir W. Burnaby in 1765, and recognized by the crown. In 1786 a superintendent was appointed by the crown, and although this office was vacant from 1790 to 1797, it was revived until 1862. An executive council was established in 1839, and a legislative assembly in 1853. British Honduras was declared a colony in 1862, with a lieutenant governor, subject to the governor of Jamaica, as its chief magistrate. In 1870 the legislative assembly was abolished and a legislative council substituted. In 1884 the lieutenant governor was created governor and commander-in-chief and the colony rendered independent of Jamaica. Reorganized (1936, 1938), the legislative council consisted of five official and eight unofficial (six elected) members. English common law and all imperial statutes affecting it passed before 1899 are valid, subject to modification by colonial ordinance. Appeals from decisions of the supreme court of British Honduras go to the privy council.

Religion and Education.—The churches represented are Roman Catholic, Anglican, Methodist, Baptist and Presbyterian; but none of them receives assistance from public funds. The bishopric of British Honduras is part of the West Indian province of the Church of England. Almost all schools are denominational. School fees are charged, and grants-in-aid are made to elementary and secondary schools. Most of these are under control of a board, on which the religious bodies managing the schools are represented. Slightly over half the population is Roman Catholic.

HISTORY

British settlement in Honduras, the scene of the ancient Maya civilization, begins with the coming of shipwrecked sailors or buccaneers in 1638. The first regular establishment followed in 1662, when settlers were attracted from Jamaica by the logwood and mahogany which soon became an important product of the bay. The woodcutters covered an area wider than Honduras, but for a century Spain did not admit their title, and English settlers tended to concentrate more and more on the Belize river, which gave an alternative name to the colony. In the 18th century they increased greatly in number, and African slaves were imported. The hostility of their Spanish rivals was keen and not unprovoked; and it was only after resisting formidable attacks that the English "baymen" were recognized by the treaty of Paris in 1763, and gained Spanish consent, at the price of destroying their fortifications, "not to be disturbed or molested, under any pretext whatever, in their said places of cutting and loading logwood." This agreement did not lead to friendly relations, and in 1779 the Spaniards made a grand attack which destroyed the settlement at Belize, the inhabitants being taken to Yucatan and Havana, where most of them died. In 1783 the survivors returned with new adventurers and resumed the cutting of timber, and by the treaties made in that year and in 1786 between England and Spain, they were recognized as having the right to cut both logwood and mahogany in the northern half of what later became British Honduras; but they were not to erect fortifications. In compensation, England gave up her claims to the Mosquito Coast. When war broke out again the Spaniards prepared another great attack on Belize, but this was repulsed, and after 1798 the British were left in peace

The successful resistance to Spain has been regarded as establishing British sovereignty over Honduras; but it is probably more correct to attribute the title to undisturbed possession than to conquest, as Spanish sovereignty appears to have been tacitly admitted in 1814, when the provisions of the earlier treaty were revived. With the breakup of Spanish power in Central America, any rights she might have were inherited by Mexico and Guatemala. The provisions of 1786 relating to this "settlement, for certain purposes, under the protection of his Majesty" were incorporated in a treaty with Mexico in 1826, and in the drafts of other treaties; and British authority over the greater area claimed in 1836 was later confirmed by the exception of Belize from the provision of the Clayton-Bulwer treaty (1850) which forbade the contracting nations to fortify points on the Central American mainland, and by the boundary settlement with Guatemala (1859). The country progressed peacefully under British rule, although the northern borders were occasionally attacked by rebel bands in the second half of the century. In 1849 an influx of Spanish-Mexicans in flight from the Indians of Yucatan did much to populate the desert areas of the colony.

While the status of British Honduras was in dispute, government was by public meeting of the free inhabitants, who elected an unpaid magistracy of about seven, one being superintendent. The crown granted a similar constitution in 1765. From this time gradual modifications were introduced, until in 1862 British Honduras became a colony with a lieutenant governor under the governor of Jamaica. In 1871 it became a crown colony and was separated from Jamaica in 1884. In 1890–92 a dispute, in which the minority of unofficial members resigned from the council, led to the reconstitution of that body, with a majority of unofficial members, the historical outcome of the colony's democratic origin.

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(L. W. BE.; X.)

BRITISH INDUSTRIES FAIR. The British Industries fair, held each year for eleven days from the third Monday in February until the Friday of the following week in London and Birmingham simultaneously, is an outstanding example of an organized trade fair. It is a national display of the quality and range of a large number of British products and plays its part in assisting the trade of the United Kingdom.

The Fair was first held in 1915 for the purpose of encouraging the manufacture in the United Kingdom of articles which had previously been entirely or almost entirely purchased from foreign sources. In 1920 the Birmingham Chamber of Commerce organized for the first time the heavy industries section, which is now known as the Engineering and Hardware section of the Fair. The London section of the Fair is organized by the Department of Overseas Trade which, in order that the policy of the two sections of the Fair may be co-ordinated in keeping with the national aspect of the Fair as a whole, works in close collaboration with the Birmingham Chamber of Commerce, and also conducts annually on behalf of the Fair in general a world-wide publicity campaign. In 1915, when the Fair was held in the Royal Agricultural Hall, the total occupied exhibiting area amounted to 88,714 sq.ft., the exhibitors numbering 591. During the other War years the Fair was much smaller, owing to the transference of much industrial activity to the manufacture of munitions, while even in 1919 the occupied exhibiting area totalled only 80,207 sq.ft., and the number of exhibitors was 23 fewer than in 1915. In 1920, with the inauguration of the Birmingham section, London and Birmingham together accounted for a total stand area of 315,088 sq.ft., which increased in the following year to 332,425 sq.ft., or nearly four times the area in 1915, and the exhibitors rose to 1,689 in number. In 1928 the total occupied exhibiting area increased sharply to 434,707 sq.ft., while the exhibitors numbered 2,119. Two years later the Fair moved to Olympia and in the following year, 1931, when the Fair was held for the first time at all three centres, Olympia and White City, London, and Castle Bromwich, Birmingham, the number of exhibitors increased to 2,202 and the total occupied exhibiting space to 552,044 sq. feet. In 1939, when the Fair was held at Olympia and Earls Court, London, and Castle Bromwich, Birmingham, the number of exhibitors was 2,338, while the exhibits occupied an area of 826,433 sq.ft. or more than nine times that of the original Fair.

The Fair is unique in two major aspects. In the first place it is entirely national in character and only goods produced in the United Kingdom or in any other part of the British Empire may be shown. In the second place participation in it, with the single exception of one trade group, is restricted to the actual manufacturers of the articles exhibited. The only exception is the Textiles section where, owing to the many stages of manufacture which are carried out independently of the industry, difficulty would be experienced in confining participation to manufacturers, and merchant firms are, therefore, permitted to exhibit in this one section of the Fair. Products of the lighter industries including chemicals, jewellery and electro-plate, watches and clocks, leather and leather goods, paper and stationery, pottery and glassware, scientific, optical and photographic goods, plastics, fancy goods, toys, games and sports goods, etc., as well as the textiles and furniture trades are shown in London, which in addition is the venue of the Empire section, while the Birmingham section comprises exhibits of the products of the hardware, metal and engineering industries. The two schedules of trade have been arranged so as to avoid the necessity for the buyer of any particular class of commodities to visit more than one section of the Fair. Equally, in both London and Birmingham, the various trade sections are grouped as completely as possible, again to facilitate the work of the buyer, who is thus able to inspect in the shortest possible time all exhibits of the class or classes of goods in which he is most interested.

The Fair is the subject of an annual world-wide publicity campaign. In addition to editorial publicity both home and overseas, a series of letters couched in appropriate language is sent to over 100,000 trade buyers throughout the world, while in the United Kingdom a special mailing campaign is undertaken with a view to encouraging home buyers to attend the Fair. Overseas officers of the Department of Overseas Trade, who comprise within the Empire His Majesty's Trade Commissioners and Imperial Trade Correspondents, and the Commercial Diplomatic and Consular Officers in foreign countries, work successfully to make the Fair widely known in their areas. Active support is also given by British Chambers of Commerce both at home and overseas.

The London section of the Fair, for which the Department of Overseas Trade is wholly responsible, is self-supporting, the receipts from exhibitors being balanced against expenditure. The Birmingham section is also on a self-supporting basis, the Birmingham Chamber of Commerce being responsible for the finance of the enterprise. (C. TA., X.)

BRITISH ISLES: *see* GREAT BRITAIN; IRELAND; SCOTLAND; WALES; etc.

BRITISH LEGION. The British Legion was established in 1921, under the late Field-Marshal Earl Haig, its first president, for the purpose of uniting in one national organization the various existing associations of ex-service men. These were the Comrades of the Great War, the National Association of Discharged Sailors and Soldiers, the National Federation of Discharged and Demobilized Sailors and Soldiers, and the Officers' Association. In April 1925 the Legion was incorporated by royal charter.

The principles and policy of the Legion are non-political and non-sectarian, and its membership is open to all British or naturalized British men and women who have served with the forces of the Crown, including men and women of the Red Cross and similar organizations.

The activities of the Legion are administered through various departments dealing with legal and financial aid, appointments and employment, assistance of various kinds to families, including educational assistance and the after-care of children, as well as a business branch for setting up ex-service men in business. A Legion industrial village settlement has been established at Preston Hall, near Aylesford, Kent, where tubercular cases are received. It comprises a sanatorium with park grounds and cottages covering in all 450ac., where the patients, who in some cases have their families with them, when fit to work, are taught to pursue a great variety of suitable occupations, including carpentry, printing, fibre and leather case manufacture, etc. With the aid of the National (Prince of Wales') Relief Fund, as well as through private generosity, the Legion has also acquired a factory fully equipped for the manufacture of handwoven Welsh tweeds by disabled ex-service men, and in the Ex-service Industries, Ltd., at Warminster, has financed another similar undertaking for the manufacture of furniture.

Another of the Legion's practical activities is the poppy factory, where over 400 disabled men are employed all the year round making the "Flanders" poppies and wreaths in anticipation of the demands for Remembrance Day (Nov. 11). The sale of these poppies throughout the country on that day has been recognized as constituting a special appeal in aid of the funds of the Legion, and the total contribution from all sources made on "Poppy Day" is now the main source of income for its work, and in 1938 realized the sum of £578,188. The co-ordination of this and other appeals and funds, such as the United Services, the British Red Cross and others, for the relief of distress among ex-service men and their families, is made through the national executive council. Further a representative of the Legion serves on every committee in the country that has to do with pensions.

The organization of the Legion, whose headquarters are in London, is based on the establishment of over 4,412 branches throughout the country, as well as a number of branches abroad, including Geneva, Lima, Mexico City, etc. The branches are grouped into administrative areas, each with its own elected council, the national executive council being also elected annually at the conference of branch delegates. Through its membership of the British Empire Services League and association with the *Fédération Interalliée des Anciens Combattants*, the British Legion also maintains its contact, and serves as a connecting link, with the other ex-service organizations of the British Dominions and allied nations in the World War.

BRITISH MUSIC SOCIETY. This was a body which was formed in 1918, on the initiation of Dr. Eaglefield Hull and under the presidency of Lord Howard de Walden, to further the interests of British music and of music in general in Great Britain. The society aimed at stimulating the musical life of the nation, alike by developing and co-ordinating the work of existing organizations and by its own activities carried on through the agency of its various provincial centres and local branches throughout the country. At the same time, in virtue of its relations with the International Society for Contemporary Music, of which it constituted the British section, the society was in close touch with Continental music. It has, however, ceased to exist.

BRITISH NATIONAL OPERA CO., THE, came into existence in 1922 when it was formed on so-called "commonwealth," or profit sharing, lines by some of the leading artists who had found their occupation gone on the cessation of Sir Thomas Beecham's managerial activities, a company of notable strength and efficiency resulting. The company's activities are confined mainly to the provinces, but it has also given seasons in London. Operas of all schools were comprised in its repertory. In 1929 the company was compelled to go into bankruptcy.

BRITISH SOUTH AFRICA COMPANY, THE. This company owes its existence mainly to the creative genius of the late Mr. Cecil Rhodes, who in the early 'eighties of the last century saw that, unless Great Britain bestirred herself, large tracts of valuable country ruled by savage native chiefs in the interior of Africa would pass into the hand of the continental Powers then engaged in a scramble for new colonies. The reports of explorers had convinced him that the high lands north and south of the Zambesi river not only provided favourable fields for colonization and agricultural development but contained the promise of great mineral wealth. Upon these tracts the eyes of Transvaal Boers and Germans were already fixed, while Portugal, after centuries of apathy, was beginning to assert historical claims to their ownership.

Rhodes first tackled the problem of acquiring a foothold in the Matabele and Mashona country, and with that object secured the despatch to King Lobengula of a diplomatic mission to establish an understanding between him and the Government of Queen Victoria. This, being successful, was followed in 1888 by a more special mission which succeeded in obtaining from Lobengula a concession of mineral rights over the whole of what is now Southern Rhodesia. Other financial groups which claimed to have secured local mineral concessions and trading rights were persuaded to throw in their lot with Rhodes, and he was thus enabled to approach the British Government with a petition for a charter authorizing him to undertake the development and administration of all that part of the interior of south Central Africa not definitely appropriated by Belgians, Germans, and Portuguese.

Royal Charter, 1889.—The Royal charter was granted on Oct. 29, 1889. By adroit handling Lobengula was next induced to permit the entry of an expedition composed of settlers and police. This arrived on Sept. 12, 1890, at the site of the modern town of Salisbury, which thereafter became the headquarters of the Chartered Company's government and the focus of its activities. Simultaneously Rhodes despatched expeditions to various regions north of the Zambesi and obtained land and mineral concessions over Barotseland, and, in concert with the late Sir Harry Johnston, over a great part of the territory lying between Lakes Nyasa, Tanganyika, Mweru, and Bangweulu, which districts were afterwards administered by the British South Africa Company under the names of north-western and north-eastern Rhodesia respectively.

During the years immediately following the occupation of Mashonaland the European settlers, as was almost inevitable, had to encounter opposition from the savage Matabele on their borders, who were loth to abandon their traditional practice of raiding and plundering the weaker tribes whom the company had taken under their protection. To this cause was due the Matabele War of 1893, which resulted in the defeat of Lobengula's army by a small body of the settlers headed by the Company's administrator, Dr. L. S. Jameson, and the flight, followed by the death, of the chief himself. The Crown then consented to extend the administration of the Chartered Company over Matabeleland and gave effect to this by an Order in Council dated July 1894.

For some years the fortunes of the new settlements fluctuated. A determined rebellion broke out in Matabeleland in March 1896 and was immediately followed by a rising of most of the tribes in Mashonaland. In both provinces a large number of isolated settlers were trapped and murdered in cold blood. In Matabeleland, after some months of indecisive fighting, Rhodes, with great courage, went almost alone into the rebel stronghold and arranged terms of peace with the leaders. In Mashonaland the hostilities were more protracted, but were finally brought to an end by the surrender of the rebels in Oct. 1897. Thenceforward the record of the country is one of unbroken progress. A legislative council was instituted and the principle of popular representation was introduced, agricultural industries established, and mining for gold and other minerals actively carried on.

Rhodes successfully financed the construction of a trunk line of railway connecting the Cape system with the north, and Mashonaland with the more convenient port of Beira in Portuguese East Africa. The Chartered Company was thus the parent of the Rhodesia railway system, which now extends from Vryburg in Bechuanaland to the borders of the Belgian Congo, and from Bulawayo to the east coast of Africa—some 2,500 miles of railway line in all.

The whole expense of the Chartered Company's operations, including the cost of quelling the various native disturbances, was borne by its shareholders without assistance from the British taxpayers.

Southern Rhodesia and Self-Government.—In 1923 the settlers of Southern Rhodesia felt themselves strong enough to demand self-government. An alternative proposal that the territory should become incorporated in the Union of South Africa was submitted to a referendum and rejected by a large majority. Southern Rhodesia was granted self-government in 1923, and in the following year the territories lying north of the Zambesi were given the status of a protectorate of the Crown. In both cases the company was relieved of the administrative obligations which it had faithfully carried out for 33 years. During that period, besides developing the agricultural and mineral resources of the countries embraced within its charter, the company succeeded in completely eradicating the slave trade, which from time immemorial had been carried on by many of the native chiefs encouraged by Arabs from Zanzibar and other parts of East Africa; it had strangled the traffic in alcoholic liquor, prohibiting its sale to the natives under the most rigid penalties; it had established a system of native education and had set aside reserves whereon the natives could continue to live under tribal conditions, and had given facilities to Christian missionaries of all creeds to carry on their civilizing work in every part of the territory.

At the termination of the Chartered Company's administration the Imperial Government arranged to refund to it a portion of the heavy expenditure which it had incurred in discharging the obligations of the charter, and the Southern Rhodesia Government assumed its share of this expenditure as a public debt. The Chartered Company was also allowed to retain such areas of land as it had appropriated for agricultural and ranching purposes and the benefit of extensive land concessions in Northern Rhodesia and Nyasaland. It retained also the mineral rights originally acquired from native chiefs, which cover the whole of Rhodesia north and south, but it has since sold these rights in Southern Rhodesia, though not in Northern Rhodesia, to the local government. As holding the great majority of the shares in the companies operating the various sections of the railways it is virtually the proprietor of the whole system.

During the period of administration the financial burdens imposed upon the company were too heavy to permit of any return to the shareholders, but within a year of being relieved of these burdens the directors were able to refund 5s. on every £1 share, and since that date dividends have also been regularly paid. The capital of the company, originally £1,000,000, has been raised to £6,750,000. Its president is Sir Dougal Malcolm, K.C.M.G.

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BRITISH THERMAL UNIT, the amount of heat required to raise one pound of water through one degree Fahrenheit, denoted by the abbreviation B.Th.U. (*See* PHYSICAL UNITS.)

BRITOMARTIS, "sweet maiden" an old Cretan goddess, later identified with Artemis, whose favourite companion she is said to have been. Being pursued by Minos, king of Crete, who was enamoured of her, she sprang from a rock into the sea, but was saved from drowning by falling into some fishermen's nets. Made a goddess by Artemis as *Dictynna* (δίκτυον, net), she was the patroness of hunters, fishermen and sailors, and also a goddess of birth and health. The centre of her worship was Cydonia, whence it extended to Sparta and Aegina (where she was known as Aphaea) and the islands of the Mediterranean. By some she is considered to have been a moon-goddess, her flight from Minos and her leap into the sea signifying the revolution and disappearance of the moon.

BRITON-FERRY, former urban district, Glamorganshire, Wales, east bank, estuary of Neath river in Swansea bay. Pop. (1931) 9,383. The name La Brittone was given by the Norman settlers of the 12th century to its ferry across the estuary of the Neath, but the Welsh name of the town, at least from the 16th century has been Llansawel. The district was formerly celebrated for its scenery, but this has been marred by industrial developments. The Vale of Neath canal built in 1797 has its terminus at Briton-Ferry, which became the port for the rapidly developing Neath valley. The construction in 1861 of a large dock by the G.W.R. and the opening up about the same time of the mining districts of Glyncorrwg and Maesteg by means of the South Wales Mineral railway made the town a leading exporting centre of the coal field. The development of metallurgical industries in the south Wales coast towns brought further prosperity to Briton-Ferry. Steel, tin-plate and galvanized goods are manufactured on a large scale. Trade depression after 1918 severely affected all aspects of the town's trade. The town has stations on the G.W.R. main line and on the old Rhondda and Swansea Bay line (now G.W.R.). It is a ward in the municipal borough of Neath.

BRITTANY or **BRITANNY,** an ancient province and duchy of France (Fr. *Bretagne*), known as Armorica (*q.v.*) until the influx of Celts from Britain. It consists of the northwest peninsula, nearly corresponding to the departments of Finistère, Côtes-du-Nord, Morbihan, Ille-et-Vilaine Lower and Loire. It is popularly divided into Upper or Western, and Lower or Eastern Brittany. Its greatest length between the English channel and the Atlantic ocean is 250 km. (about 155 English miles), and its area is 30,000 sq.km. (about 18,630 English sq.mi.).

OLD WOMEN
BRITTANY

It comprises two distinct zones, a maritime zone and an inland zone. In the centre there are two plateaus, partly covered with *landes*, unproductive moorland; the southern plateau is continued by the Montagnes Noires, and the northern is dominated by the Monts d'Arrée. The waterways of Brittany are for the most part of little value owing to their torrent-like character. The only river basin of any importance is that of the Vilaine, which flows through Rennes. The coast is very much indented, especially along the English channel, and is rocky and lined with reefs and islets. The mouths of the rivers form deep estuaries. In the 19th century the development of new means of communications drew Brittany from its isolation, and agriculture developed in a remarkable manner. Many of the *landes* were cleared and converted into excellent pasturage, and on the coast market-gardening made great progress. In the fertile districts cereals are cultivated. Industrial pursuits, except in a few seaport towns, which are rather French than Breton, have hitherto received but little attention. The Celtic language is still spoken in Lower Brittany. Four dialects are clearly marked (*see* CELTIC LANGUAGES). (X.)

HISTORY

The earliest inhabitants of whom we have a record were Celtic tribes, probably mixed with remnants of the earlier race whose monuments are the cromlechs and stone circles. The Roman name of the country—Armorica—is Celtic. Caesar invaded it in 56 B.C., and the Bretons took part in the unsuccessful rising against him in 52–51 B.C. Roman rule then lasted till the 5th century A.D.

After the withdrawal of the Romans, there came, in the 5th and 6th centuries, a considerable immigration of the Celts of Britain, taking refuge among their continental kinsmen from the Saxon invasion. Till then, the rural population had still been mostly pagan, but now for 300 years Breton history and tradition are largely occupied with records and legends of the Celtic missionaries from Britain and Ireland, who gradually converted the whole country and gave their names to towns and villages (such as St. Malo, St. Brieuc, St. Tugdual, and St. Pol). Until a national hero, Nominoë, united its people against the Norse raiders of the 9th century, Brittany was divided into a number of petty lordships. Nominoë accepted the suzerainty of the French king, Louis the Pious, but revolted in 846 against Charles the Bald, and restored Breton independence.

The raids of the Norsemen continued into the 10th century. In its second half, Conan of Rennes became paramount in Brittany. His son Geoffrey took the title of duke. Breton adventurers fought under William of Normandy at Hastings, but the Breton dukes successfully opposed his attempts to add their country to his conquests. The line of Conan ended in the 12th century. Duke Conan IV, hard pressed by rebellious nobles, sought the help of Henry II of England and gave his daughter Constance in marriage to Henry's son, Geoffrey Plantagenet, who succeeded to the dukedom. His heir, Arthur, was murdered by John Lackland, but Arthur's sister married a French noble, Pierre de Dreux, who became duke of Brittany in 1212. A line of French dukes ruled at Rennes until, on the death of the childless Jean III in 1341, civil war began between the partisans of two indirect heirs, Jean de Montfort and Charles de Blois. The defeat and death of Charles at Auray (1364) secured the dukedom for the house of Montfort. The Breton hero, Bertrand Duguesclin, won his first honours in this "war of succession." Later, as constable of France, he fought against the English invaders. Tales of his prowess in battle and tourney are traditional in Brittany.

Brittany's independence practically ended in 1491, when Duke Francis I died without a son, and his daughter, the duchess Anne, married Charles VIII of France. Her daughter, Claude, became the queen of Francis I, under whom the treaty of 1532 was concluded, annexing Brittany to France, with guarantees for its local liberties. Until the revolution this provincial autonomy survived, local patriotism opposing the attempts at centralization made by Bourbon absolutism. The mass of the people had remained unaffected by the Reformation. During the war of the league there were conflicts with the Huguenots. The peace of 1593 was followed by local troubles arising from the duke de Mercoeur's attempt to make himself duke of Brittany. The province then had a long period of peace interrupted only by an unsuccessful rising in 1675 against new taxation—the "revolt of the stamped paper." Many Bretons distinguished themselves in seafaring enterprise—men like Cartier, the maker of French Canada, and the naval heroes, Surcouf and Duguay Trouin.

The revolution at its outset found support in Brittany, but the abolition of the monarchy and the new church laws led to risings, which began in the winter of 1792. The last shots were fired in 1799. The disembarkation of an *emigré* force at Quiberon in 1795 ended in tragic disaster, 1,000 disarmed royalists being massacred by the republicans. The last stage of the resistance was the guerrilla warfare of the "Chouans." Brittany was long after royalist, republicanism being associated with memories of these tragic years and of the anti-religious campaign of the Jacobins. Later there has been a notable movement toward conservative republicanism. In World War I, Breton regiments were among the best soldiers of France, and the Breton Admiral Ronarc'h held a critical position on the Yser in 1914. In World War II, German troops occupied Brittany in June 1940.

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BRITTLE STARS, the popular name for star-fish (*q.v.*) of the class Ophiuroidea (*see* ECHINODERMA). The name refers to the habit of most of the commoner species of breaking off their arms (autotomy, *q.v.*) when alarmed

BRITTON, JOHN (1771–1857), English antiquary, was born on July 7, 1771, at Kington-St.-Michael, near Chippenham, Wilts. Along with his friend Edward Wedlake Brayley, Britton produced *The Beauties of Wiltshire*, 2 vols. (1801; a third added in 1825), the first of the series *The Beauties of England and Wales*, nine volumes of which Britton and his friend wrote. Britton created the taste for popular books on topography. His numerous works include: *Architectural Antiquities of Great Britain*, 9 vols. (1805–1814); and *Cathedral Antiquities of England*, 14 vols. (1814–1835). He died in London on Jan. 1, 1857. His *Autobiography*, which brings the account of his life down to about 1825, was published in 1850. The best notice of Britton is by Digby Wyatt, *Papers* of the Royal Institute of British Architects (1856–57).

BRITTON, NATHANIEL LORD (1859–1934), American botanist, was born at New Dorp, Staten Island, New York, on Jan 15, 1859. He graduated in 1879 at Columbia university from which in 1881 he received the degree of doctor of philosophy. After serving as instructor in geology in 1879–87 and as instructor and adjunct professor of botany in 1886–91, he was made professor of botany in Columbia university. He occupied this chair until 1896 when he became director-in-chief of the New York Botanical Garden, created as the result of his efforts and which under his guidance became one of the leading institutions for the advancement of botanical science. He rose to front rank among American systematic botanists, specializing in the North American flora, notably in the Crassulaceae, Cactaceae and Cyperaceae, and in the flora of the West Indies, Bolivia and Paraguay. Besides writing numerous botanical papers and editing the *Bulletin of the Torrey Botanical Club*, 1888–97, he was the author of important botanical works among which are: *Illustrated Flora of the Northern United States and Canada*, with Addison Brown (1896–98, 2nd ed., 1913); *Flora of Bermuda* (1918); *The Bahama Flora*, with C. F. Millspaugh (1920); *The Cactaceae*, with J. N. Rose (1919–23), and various portions of the monumental *North American Flora*. He died in New York city on June 25, 1934.

See E. D. Merrill, *Biographical Memoir of Nathaniel Lord Britton* (1938).

BRITTON, the title of the first great treatise of the law of England in the French tongue, which purports to have been written by command of King Edward I. The author is probably either John le Breton, a justice for the county of Norfolk, or a royal clerk of the same name. The probable date of the book is 1291–92. It was based upon the treatise of Henry de Bracton (*q.v.*), which it brought up to date. The work is entitled in an early ms. of the 14th century, which was once in the possession of Selden, and is now in the Cambridge university library, *Summa de legibus Anglie que vocatur Bretone;* and it is described as "a book called Bretoun" in the will of Andrew Horn, the learned chamberlain of the City of London, who bequeathed it to the chamber of the Guildhall in 1329, together with another book called *Mirroir des Justices*. *Britton* was first printed in London by Robert Redman, without a date, probably about 1530. Another edition of it was printed in 1640, corrected by E. Wingate A third edition, with English translation, was published at the University Press, Oxford, 1865, by F. M. Nichol. An English translation without the Latin text had been previously published by R. Kelham in 1762.

BRIVE or **BRIVE-LA-GAILLARDE,** a town of France, capital of an arrondissement, department of Corrèze, 62 mi. S S E. of Limoges on the main line of the Orleans railway from Paris to Montauban. Pop. (1936) 27,124. It lies on the left bank of the Corrèze in a fertile plain where important roads and railways meet, and where the high Plateau Central grades down to the south-western plain. Rock caves give local evidence of man in early prehistoric times and great stone monuments show later occupation. Known to the Romans as Briva Curretiae (bridge of the Corrèze), in the middle ages it was the capital of lower Limousin, and St Anthony of Padua founded a Franciscan monastery here in 1226 The *enceinte* which formerly surrounded the town has been replaced by boulevards. Outside the boulevards lie the modern quarters. A fine bridge leads over the Corrèze to suburbs on its right bank. The church of St. Martin in the heart of the old town is a building of the 12th century in the Romanesque style of Limousin, with three narrow naves of almost equal height. The ecclesiastical seminary occupies a graceful mansion of the 16th century, with movable façade, staircase and fireplaces. Brive's position makes it a market of importance with large trade in the early vegetables, nuts and fruit of the Corrèze valley, and in live stock, liqueurs and truffles. Table delicacies, paper, wooden shoes, hats, candles, and earthenware are made, and there are slate and millstone workings and dye works Brive is the seat of a sub-prefect and has a tribunal of first instance, a tribunal of commerce, and a school of industry.

BRIXEN (town, North Italy). *see* BRESSANONE.

BRIXHAM, seaport and urban district, Devonshire, England, 33 mi. S. of Exeter, on a branch of the G.W. railway. Pop (1938) 8,178. The town is irregularly built on the cliffs to the south of Torbay, and its harbour is sheltered by a breakwater. Early in the 19th century it had important fortified barracks on Berry Head The former chief industry of fishing declined, but Brixham became an important coaling station and gasoline depot, while paint making and yacht building are also carried on. Brixham is in favour as a seaside resort. St. Mary's, the ancient parish church, has an elaborate 14th century font and some monuments of interest. At the British Seamen's Orphans' home, boys are fed, clothed and trained as apprentices for the merchant service. A statue commemorates the landing in 1688 of William of Orange. Area of urban district 8.8 sq.mi.

Brixham Cave, called also Windmill Hill Cavern, is a well-known ossiferous cave situated near Brixham, with a fauna closely resembling that of Kent's Hole. The implements are of a roughly-chipped type. The formation of the cave was carried on simultaneously with the excavation of the valley; the small streams, flowing down the upper ramifications of the valley, entered the western opening of the cave, and traversing the fissures in the limestones, escaped by the lower openings in the chief valley.

BRIXTON, a district with railway station (S.R.) in the south of London, England, included in the metropolitan borough of Lambeth (*q.v.*). Pop. of parl. district (1931) 74,536.

BRIZEUX, JULIEN AUGUSTE PÉLAGE (1803–1858), French poet, was born at Lorient (Morbihan). In 1827 he produced at the Théâtre Français a one-act verse comedy, *Racine*, in collaboration with Philippe Busoni. Brizeux's second visit to Italy in 1834 resulted in the publication of a complete translation of the *Divina Commedia* in *terza rima* (1841). With *Primel et Nola* (1852) he included poems written under Italian influence, entitled *Les Ternaires* (1841), but in the rustic idyll of *Marie* (1836) he turned to Breton country life; in *Les Bretons* (1845) he found his inspiration in the folk-lore and legends of his native province, and in *Telen-Aroor* (1844) he used the Breton dialect. His *Histoires Poétiques* (1855) was crowned by the French Academy. His work is small in bulk but is characterized by simplicity and sincerity.

See C. Lecigne, *Brizeux, sa vie et ses oeuvres* (1898).

BRIZO, an ancient goddess, long worshipped in Delos. She delivered oracles in dreams to those who consulted her about fishery and seafaring. The women of Delos offered her presents consisting of little boats filled with all kinds of eatables (except fish) in order to obtain her protection for those engaged on the sea.

BRNO (Ger. Brünn), capital of Moravia, Czechoslovakia, after 1938 part of the German "protectorate;" at the confluence of the Svratka and the Svitava, between two hills, one of which, the Spielberg (945 ft.), is crowned by a fortress which formerly was an Austrian political prison. In this capacity it was rendered famous by the narrative of Silvio Pellico who was confined there from 1822 to 1830. On the lower hill lies the cathedral of St. Peter dominating the old town, which, though small and traversed by narrow, crooked streets, contains most of the important civic and ecclesiastic buildings, many of them, *e.g.* the Rathaus (1511), and the 15th century church of St. Jacob, rich in interesting antiquities. Around the old town fine gardens and well-built streets have replaced the fortifications and connect old and new; 9th century Brno gives place here to the busy manufacturing suburbs of the 19th and 20th centuries. The town is the headquarters of the Czechoslovak cloth and woollen manufactures which, as well as the manufacture of machinery, are based upon the neighbouring Rosice-Oslavany coalfield. Brewing, distilling, milling, sugar-refining, etc., reflect the fertility of the territory in which Brno lies. It is the seat of the supreme court, and the establishment of the Masarykova university (1918) revived the spirit of its mediaeval predecessor and enabled Brno once more to make its full contribution to civilization. Population 264,925, of whom 70% are Czechs and 25% German.

BROACH, or BARUCH **AND PANCH MAHALS,** an ancient city and modern district of British India, in the northern division of Bombay. The city is on the right bank of the Nerbudda, about 30 mi. from the sea, and 203 mi. N. of Bombay. The area, including suburbs, occupies 2⅛ sq.mi. Pop. (1941) 55,810. The sea borne trade is confined to a few coasting vessels. There is a considerable cotton industry; flour milling and handicrafts are also carried on. The fort containing the civil courts, the gaol, church, municipal offices, etc., stands on a hill above the river. Broach is the Barakacheva of the Chinese traveller Hsüan Tsang and the Barygaza of Ptolemy and Arrian. Upon the conquest of Gujarat by the Mohammedans, and the formation of the state of that name, Broach formed part of the new kingdom. On its overthrow by Akbar in 1572, it was annexed to the Mogul empire and governed by a nawab. The Mahrattas became its masters in 1685, from which period it was held in subordination to the Peshwa until 1772, when it was captured by a force under Gen. Wedderburn, who was killed in the assault. In 1783 it was ceded by the British to Sindhia in acknowledgment of certain services, but was stormed in 1803 by a detachment commanded by Col. Woodington, and finally ceded to the East India company by Sindhia.

The district of Broach and Panch Mahals contains an area of 3,198 sq.mi. It includes Champaner, the old Hindu capital of Gujarat, now a ruin; it became British territory in 1861 by a transfer from Sindhia. Consisting chiefly of the alluvial plain at the mouth of the river Nerbudda, the land is rich and highly cultivated, and though it is without forests it is not wanting in trees. The district is well supplied with rivers, having in addition to the Nerbudda the Mahi in the north and the Kim in the south. Pop. (1941) 924,527, comprises several distinct races or castes, who, while speaking a common dialect, Gujarati, inhabit separate villages. The principal crops are cotton, millet and pulse. There is extensive dealing in cotton, the dealers being organized in a guild. Besides the cotton mills in Broach city there are several factories for ginning and pressing cotton, some of them on a very large scale. There are rich mineral deposits, and there is extensive mining of manganese. The district is traversed by the Bombay and Baroda railway, which crosses the Nerbudda opposite Broach city on an iron-girder bridge of 67 spans.

BROACH, a word used for any one of many forms of pointed instruments, such as bodkins, wooden needles used in tapestry, roasting spits and even the tools (also called "rimers" or "reamers") employed for enlarging or smoothing holes. Hence comes the expression "to broach" for "to tap" a cask. In architecture, the term is used specifically to designate a triangular surface inserted in the corners of a square or cube to make the upper face an octagon, especially at the junction of a square tower and an octagonal spire, in which case the slope of the broached surface is usually less than that of the spire sides. The word is also used for any means of adjusting a polygonal spire to a square base and even as synonymous with squinch (*q.v.*).

BROADBENT, SIR WILLIAM HENRY, 1ST BARONET, (cr. 1893) (1835–1907), English physician, was born at Lindley, near Huddersfield, on Jan. 23, 1835, the son of a woollen manufacturer. He studied at Owens college, Manchester, and Manchester Royal School of Medicine, and then in Paris under Trousseau, Ricord, Reyer and others. He became resident medical officer of St. Mary's hospital, London, in 1859, and in 1860, pathologist and lecturer on physiology and zoology in the medical school there. From 1860–79 he was physician at the London Fever hospital, but he retained his association with St. Mary's hospital in various capacities until 1896, and after that date remained an honorary consulting physician. He attended the Duke of Clarence (1892) during his fatal illness, and in that year became physician in ordinary to the Prince of Wales (Edward VII), and in 1896 physician extraordinary to Queen Victoria. He was physician in ordinary to King Edward VII and the Prince of Wales (George V).

Broadbent did much important work in connection with paralysis and his name is associated with "Broadbent's hypothesis" explaining its unequal distribution in various parts of the body in the ordinary form of hemiplegia. His memoir "On the Cerebral Mechanism of Speech and Thought" (*Trans. Roy. Med. Chir. Soc.*, 1872) and later papers, are important contributions to the literature on the brain. Many of his papers on clinical questions were collected by his son, Dr. Walter Broadbent (1908).

Broadbent held many offices in connection with medical societies, and took an active part in public health work, particularly in promoting (1899) the National Association for the Prevention of Consumption, and in the organization (1901) of the British Congress on Tuberculosis, and received many academic honours; he was elected F.R.S. in 1897. He died in London on July 10, 1907.

BROAD-BOTTOM MINISTRY, in English political history a term applied to the wide coalition ministry formed after the fall of Carteret in 1744, between the existing ministry under the Pelhams and the opposition led by Lord Chesterfield. The name is said to have been first coined at the formation of the ministry of 1742; but it was universally applied to the ministry of 1744, which has since been known to history as the Broad-Bottom administration. Chesterfield was its real leader, and the nickname receives an extra significance from the fact that he had recently published a series of letters in the *Constitutional Journal* under the pseudonym of "Jeffrey Broadbottom." The opposition of the king at first excluded Pitt; but early in 1746 he was admitted to a subordinate post. With some changes the ministry survived until the death of Henry Pelham in 1754.

BROADCASTING. Broadcasting, as distinct from wireless communication, may be said to have come into being about 1920. It may be defined as the systematic diffusion, by radio telephony, of music, lectures, drama, humour, news and information bulletins, speeches and ceremonies, pictures and other matter susceptible of appreciation by a scattered audience, individually or in groups, with appropriate receiving apparatus. The expression "appropriate apparatus" must be taken as applying not only to technical and artistic suitability but to qualities such as cheapness and ease of management.

Whether broadcasting is conducted as a public service as in Great Britain and in most other countries, or also as a means of attracting commercial goodwill as in the United States of America and elsewhere, the results tend to become unexpectedly similar, and the material that is acceptable from the point of view of commercial goodwill differs only by fine shades from what is suitable from the point of view of the non-commercial broad-

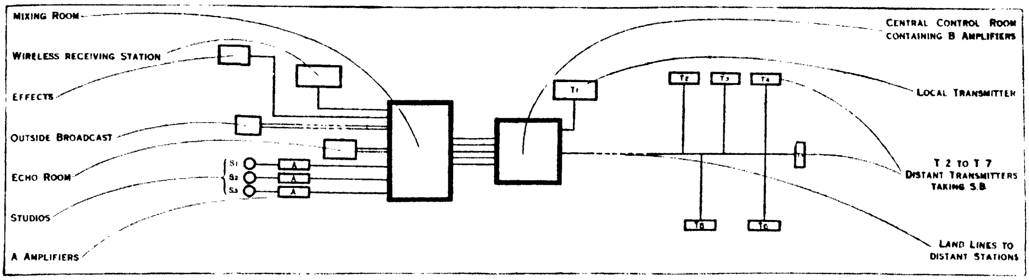

Mixing Room
Wireless Receiving Station
Effects
Outside Broadcast
Echo Room
Studios
A Amplifiers
S1
S2
S3
A
A
A
T1
T2
T3
T4
T5
T6
Central Control Room containing B Amplifiers
Local Transmitter
T 2 to T 7 Distant Transmitters taking S.B.
Land Lines to Distant Stations

Fig 1—Schematic Diagram of a Broadcasting System

caster animated by a sense of his public mission. Even the successful acquisition of commercial goodwill depends more and more upon the interested party assuming the rôle of public benefactor. Quantitatively, as to numbers reached, there seems to be little to choose between the two systems.

From 1919 onward, amateur wireless experimenters, who were numerous even before the war, worked more and more in telephony in preference to Morse telegraphy, and in England and several other European countries broadcasting began spontaneously with transmissions of gramophone records and amateur performances. At the same time the radio industry began to foresee and prepare for a future of evidently great but unknown possibilities. Experimental work was undertaken for the improvement of microphones, and for the development of listening apparatus which could be operated with a minimum of technical knowledge. Arrangements began to be made (in some cases under considerable difficulties due to the claims of vested interests) for the regular transmission of programmes. Thus, an innovation, comparable in cultural importance to the introduction of printing, was launched tentatively upon a responsive Europe, before either the financial organization of broadcasting services or their relations with the theatre, the musical profession, the press, the wireless industry, or existing wireless services had been properly settled, and while the conditions for good broadcasting were unexplored. The nations of Europe pushed on with the organization of regular broadcasting services so fast that by the end of 1925 more than 90, and by the end of 1935 practically 300 stations, were in operation.

The first result of this rapid growth was an imminent danger of chaos, and it was the first task of the International Broadcasting Union (headquarters Geneva), formed in April 1925, at a conference of European broadcasters held at the headquarters of the British Broadcasting Company, to remedy this situation. The task was one of extreme difficulty, as the conflicts to be adjusted were those of perfectly legitimate interests, and the character of the union as an unofficial body left its decisions open to ratification or reversal by the several national governments. but a tentative pan-European scheme was largely in operation by Nov. 1926. In 1929 the union was recognized as expert adviser to the official Telecommunication union of Berne; its activities also concern copyright law, exchange of experience and consideration of common policy *vis-à-vis* performers, authors, press, concert and theatrical interests, etc., international transmissions of programmes for terminal broadcast by telephone lines, and generally the promotion of international smooth working and good feeling.

PROGRAMMES

As a broad classification, programme elements may be divided into music and speech. For broadcasting purposes, music, whether concerted or solo, instrumental or vocal, is best classified according to character and appeal; viz., as serious, popular and dance music. The proportions of each that are included in any day's or week's programmes vary according to the conceptions of the programme authorities, their resources in artists from day to day and the demands of the public.

Broadcast speech includes (a) informative and practical utility matter such as news, market prices, weather reports, time signals, agricultural bulletins and notices of various sorts (*e.g.*, appeals for charity, police notices, club or association bulletins and notifications of dangerous illness to relatives whose address is unknown); (b) "talks," *i.e.*, short lectures or series of lectures on all sorts of subjects, critiques of literature, drama, music and films, courses of education addressed to schools in school hours or to adults, and debates; (c) important public speeches, ceremonies, matches and events taken by a microphone on the spot; (d) religious services, either specially arranged for broadcasting, or taken by a microphone from church or chapel; (e) radio drama, a form of dramatic presentation in which all effects other than vocal have to be conveyed to the ear or suggested to the imagination, and which calls, therefore, for a special technique in playwriting and acting; (f) short programmes of entertainment and instruction for children; (g) humorous entertainment; (h) advertisement; and (i) political or other propaganda. To these must be added the possibilities of television. Further, there are miscellaneous special broadcasts, such as words of command for physical exercises performed by listeners at home, or messages from an explorer in the heart of a distant country.

The Principles of Selection.—The mere catalogue of these activities is enough to indicate the immense social importance of broadcasting. So far, it is only under the headings (e) and (f) above that radio has created expression forms peculiar to itself, and in all other respects programme-building is creative only in the sense that the programme-builders can build combinations of suitable music and speech round one or another central idea. More generally, too, they can create (or evoke and nurse) a mass-disposition towards certain aims and preferences. Practically, then, their power is no more and no less than the power of selection, which is qualified by the need of balancing the character of successive or simultaneous programmes so as to give a fair measure to all reasonable tastes or to ensure a fair field to speakers of all points of view. Here and there constitutional limitations or police instructions limit the scope. Established interests such as the press, the theatre and the musical industry, have in many cases safeguarded their special fields in various ways; and technical requirements also operate to a certain, though rapidly diminishing, extent as a check.

It is coming to be recognized also that, from the social standpoint, it is vitally important that programme-builders should be governed by ideals and standards defined by themselves as a rule of conduct. This question affects every aspect of a programme service. A well-developed national broadcast system has the ear of far more people than any two or three newspapers, and this, coupled with the fact that the microphone is the most intimate of all known vehicles of general communication, makes it perhaps more potent for good or evil than any other social influence.

Alternative Programmes.—As no one is entitled to dictate that the public shall hear only what he himself would care to hear, as the available programme material exceeds the capacity for dealing with it, and as the listener's temporary mood must be catered to no less than his settled tastes, programme policy must seek to provide (technical and financial limitations permitting) for more than one programme to be available at any given time for any given listener. The U.S. system of unrestricted competition was expected to provide this very freedom of choice, but in practice the alternatives simultaneously transmitted are apt to be simultaneously received also. The prevention of mutual interference thus becomes a keynote of technical policy. This interference depends on many factors, chiefly (a) the number of wave lengths regionally available, limited because every musical transmission requires not a mere "spot" frequency but a fairly wide band of frequencies, and (b) the fact that every station possesses both a "primary" or direct ray service area and a "secondary" or indirect ray service area, the secondary service area of one station overlapping and thus being capable of causing interference in the primary service area of another station. Remedies are complex, the chief are (a) careful regional planning in the allocation of frequencies (b) extreme working accuracy of stations, and (c) the useful but delicate technique of "synchronization," which enables different stations to employ the same wave with minimal interference in each other's zones. And the application of these expedients is more complicated still. Populations may be dense or widespread; districts flat or mountainous, the admissable power rating may be more than 150kw. here and less than 5kw. there; wave-lengths vary widely in service value; the applicability of synchronization differs according to whether the programmes concerned are different or identical; and in the particular case of the European "region" account must be taken of the diversity of authorities, cultures and tongues, and even the shapes of the states. The problem of programme material on the contrary is simpler—it is possible and even customary to separate studios (or other places of performance) from transmitters in such a way that artistic resources can be tapped wherever they exist, while the actual emission takes place from points chosen for geographical and demographical reasons.

THE PROCESS OF BROADCASTING

The actual process of broadcasting, though complicated in detail by the variety of the items broadcast and by their volume (which amounts for instance to about 74,000 transmission hours annually for the British broadcasting system), is simple enough in outline. Most of the performances take place in a studio, which is carefully arranged so as to give, for the necessarily small room, an acoustical condition that is pleasing to a musical judgment as applied to the receiver. This requires a certain amount of echo elimination, by drapery and otherwise (in British practice a fixed amount of natural echo with partial superposition of a controllable "artificial echo"). Speakers, singers and players address themselves to the microphone, and an expert operator in a control-room, following closely the speech or music, continuously makes fine adjustments of the amount of electrical impulse modulating the transmitter to allow for changes of original sound volume, an operation necessitated by the fact that the transmitter is of fixed and limited power. The transmitting gear proper is usually separate from the studio, and may be as far away as 70 or 80 miles, connected with the studio by a special line. Another class of broadcast which is of growing importance is the picking-up at the place of origin of public concerts, operas, plays and public speeches, as well as of ceremonies, crowd noises, sporting events, etc. This is done by a portable microphone gear connected, not necessarily by wire, to the control-room; the special interest of these broadcasts to the listener is that they enable him to feel himself as a participant or member of the audience. In the case of music, large scale performances are often, for psychological as well as acoustic reasons, more successful as "outside" than as studio broadcasts; but, of course, public halls, churches, theatres, and opera stages, open spaces and so on, all present special acoustic problems which have to be solved according to the special circumstances.

Of outstanding importance in the organization of broadcasting is the *simultaneous broadcast*, or "S.B." This involves a system of interconnected telephone lines by which a studio or other place of performance can be connected to as many transmitters as may be desirable or possible. Thus the London microphone may be connected to all stations of the British system for a news bulletin, and immediately afterwards all, or some, stations (London included) may be similarly connected to a microphone installed in a Manchester concert hall; or, again, the sound of the sea taken up by microphone on the shore at Plymouth may provide a background for a drama performed before the London microphone and broadcast by Plymouth, London and all other transmitters.

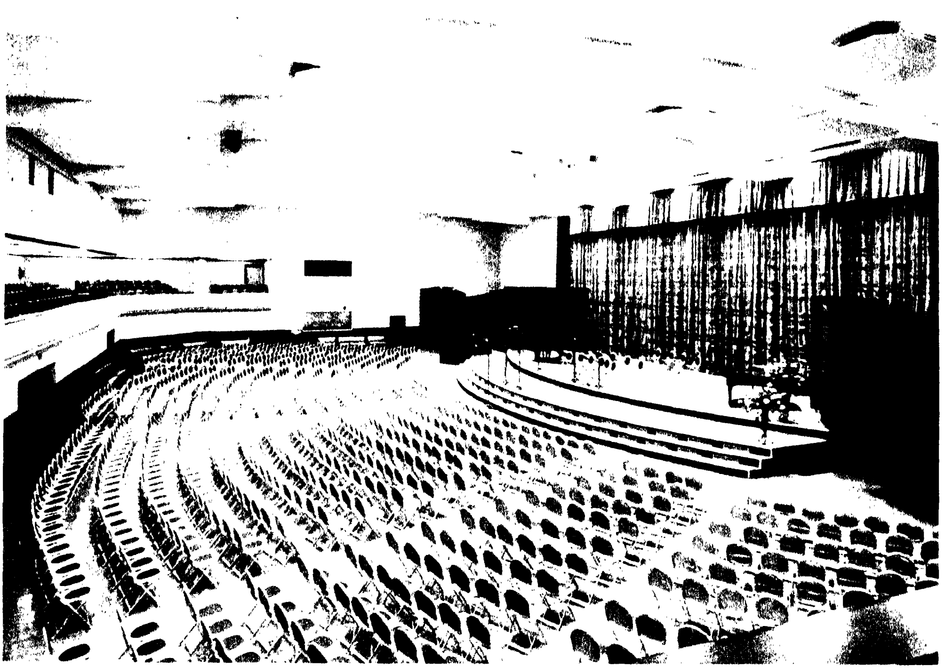
Needless to say, S.B. requires the closest timing and co-ordination over the whole system, and it is carried out most completely and successfully when all the stations of a country are under one management, as in Great Britain. In the United States and Canada the method is practised wherever a distributed network of stations happens to be controlled by a large corporation. In Germany, until the unifying policy of the National-Socialist regime made itself felt, *simultaneous broadcast* was usually practised only between a main station and its relay stations considered as a group. The "wireless link" (*i.e.*, the substitution of the telephone wire by a wireless telephone system) is sometimes employed in broadcasting where land line facilities are either unavailable or unsuitable.

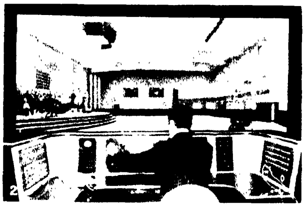
Listening Problems.—The listener's end of the transmission system presents problems of its own. Private receiving sets are divided, conventionally rather than scientifically, into "crystal" and "valve" (vacuum tube) sets. The sounds that they generate in response to the excitation of their aerials are heard from either headphones or loud-speakers, the latter varying in power from small drawing-room instruments to large-scale installations capable of reaching crowds assembled in halls and open spaces. The receiving sets themselves vary in sensitiveness, selectivity and other qualities, according to design, workmanship, nature of aerial and earth employed. The crucial distinction in the nature of sets, though roughly coinciding with that between "crystal" and "valve," really turns upon the distance at which a station can be heard without extraneous interferences. The crystal set may now be regarded as obsolete.

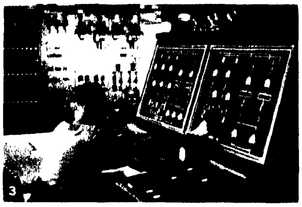
There are two distinct conceptions of "listening," from the listener's point of view. On the one hand, there is the desire—which may arise from technical interest or from dissatisfaction with the local programme—to listen to far-away stations. This has produced the long-distance set, which is so sensitive as to be able to pick up 1.5kw. stations as much as 1,000 or 2,000 miles away, but which, from the very fact of this sensitivity, is more or less open both to local and remote electrical disturbances, such as those caused by "oscillation" (re-radiation from a nearby receiving set which, when mishandled, acts as a small transmitter), by heterodyning between stations, by "atmospherics," by harmonics emitted by powerful W.T. stations, by the spark transmitters still largely used by ships, and by industrial and domestic electrical appliances.

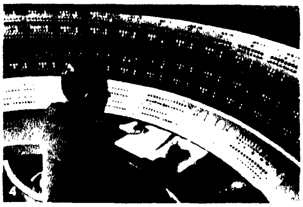
On the other hand, there are the listeners who are content with the programmes of the nearest station (which, as we have seen, do not in the least depend on that station's own artistic resources) either because they have little or no interest in the technical side of wireless telephony, or because the local programmes are artistically and otherwise satisfying. The interest of such listeners is concentrated upon the programme. The receiving apparatus that they need is simple, easily manageable, and owing to the nearness of the station and the consequent strength of its signals free from extraneous interference (other than purely local troubles, such as are apt to affect "all mains" receivers).

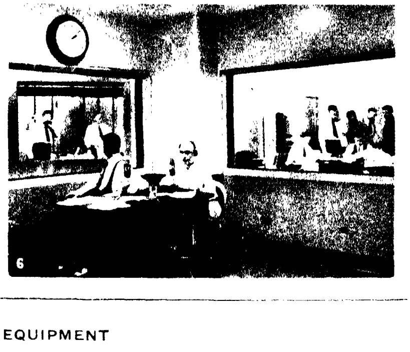
International Relay.—Public interest in the broadcast movement tends to centre itself more and more on the programmes rather than on the means of receiving them. This brings forward new problems and prospects of extending, by co-operation between national, as well as by co-ordination of local and regional, broadcasting stations, the field whence material for alternative programmes can be taken and locally re-broadcast. So far as Europe is concerned, this has been rendered possible by the rapid extension of modern long-distance telephony cables; and, given certain technical conditions and pre-arrangements, there has been ample proof that it is not difficult to carry out multiple relays involving a number of countries. Such relays have, in fact, become a habitual feature in the broadcasting programmes of many European transmitting stations.











BY COURTESY OF (1-5) THE NATIONAL BROADCASTING COMPANY, (6) COLUMBIA BROADCASTING SYSTEM

BROADCASTING STUDIO AND EQUIPMENT

1. World's largest broadcasting studio, the auditorium studio in the National Broadcasting Company's Radio City home, New York city
2. Looking from the studio monitoring booth into the NBC studio during a rehearsal
3. Controlling radio's power. A section of the control board for the power room in NBC's new studios in Radio City. From this panel are controlled the huge motors and dynamos, which energize the equipment of Radio City, the world's largest studio plant
4. A section of the main control desk of the National Broadcasting Company's headquarters in Radio City. The lights represent the different studios and stations on the coast-to-coast networks, which the operator controls
5. Nerve centre of a network. The master control room of the National Broadcasting Company's Radio City headquarters
6. Studio of the Columbia Broadcasting System built especially for news broadcasts shortly before the outbreak of war in Europe in 1939

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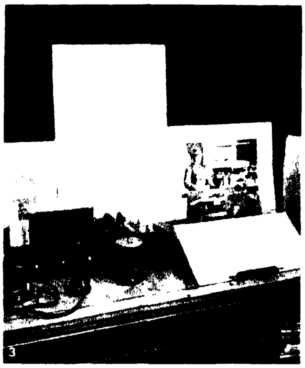

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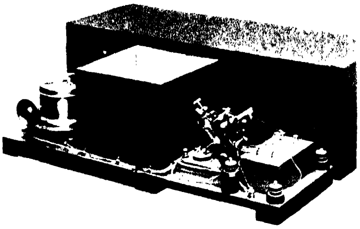

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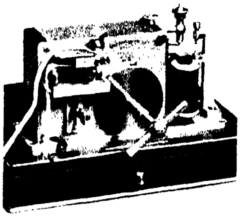

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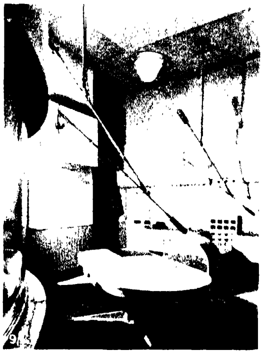

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BY COURTESY OF (1, 2, 4, 8, 9) THE BRITISH BROADCASTING CORPORATION, (3, 5, 6, 7) THE MARCONI WIRELESS COMPANY

BROADCASTING EQUIPMENT

1. Military Band Studio, London, by Architect Serge Chermayeff, F.R.I.B.A.
2. The Droitwich Transmitting Station showing two 700 ft. masts which support the single wire 'T' aerial
3. Early transatlantic wireless receiving instrument on exhibition at Marconi house, London
4. The Transmitter Hall, Droitwich Transmitting Station, showing the five cubicles containing the long-wave National transmitter and the motor-generators which supply filament current and grid-bias voltages to the transmitters
5. Senatore Marconi's self-designed coherer, used in early experiments
6. Early type of Morse inker for recording wireless signals on paper tape
7. The transmitter at Poldhu, Cornwall, by which the first transatlantic wireless signal was sent, in December, 1901
8. Main Control Room of the British Broadcasting system, London. All other control rooms and transmitters in Great Britain are connected to it via the simultaneous broadcast landline network
9. Sound effects studio of the British Broadcasting Corporation

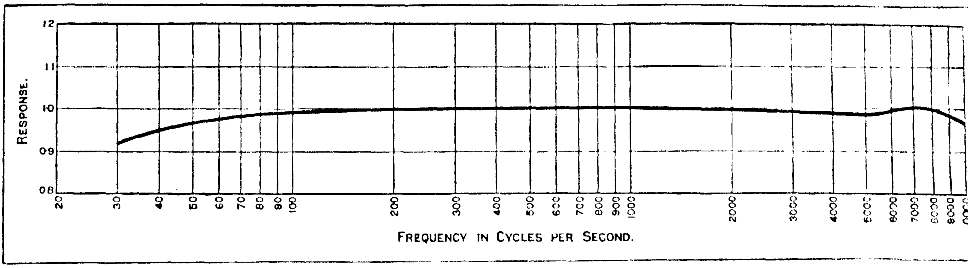


FIG. 2—FREQUENCY RESPONSE CURVE OF AN "A" AMPLIFIER

World-wide broadcasting, on the contrary, involves either an enormous development of telephony lines of the highest grade over regions where maintenance is difficult if not impossible, or the use of the wireless link. Now the waves used in ordinary regional broadcasting, none too reliable even over continental distances, are useless over world-distances, but fortunately, another line of attack on the problem, namely the use of "short" waves (lengths 50-10m., frequencies 6000–30000kc/s) has proved increasingly successful. Most civilized countries have now set up world broadcasting services, and though these cannot as yet claim the certainty and the high quality of transmission of local services, the extension of the field of broadcast over the whole globe is bound to have important social, political and economic consequences. A further technical development, as yet embryonic, is the use of 'ultra-short' waves (lengths below 10 m., frequencies above 30000kc/s) with precisely the opposite object, namely, to increase the possibilities of very localized service and in particular, television.

Communal Listening.—Although in civilized countries of the European type the great majority of listeners are individuals and families grouped round their own hearths, this is not the only form in which the broadcaster's output reaches the public. Another is the so-called 'wireless exchange,' which in essence consists of a central receiving set connected by wire to subscribers in their houses, inmates of hospitals and institutions, etc., who listen on their telephones or loudspeakers, as the case may be. A variant of the same scheme—which is, in fact, older than radio broadcasting—is the direct connection of such subscribers, institutions, etc., to the source of performance without the intervention of wireless transmission at all. Yet another form of collective listening is the loud-speaker in hotels, cafés, cinema theatres, open squares etc.; here the audience is practically a public assembly, and hence this practice of "re-diffusion," if carried on without permission, has been held in many countries, Great Britain included, to constitute an infringement of performing right.

Organized communal listening promoted and controlled by the broadcasters or by local or national administrations is likely to have a considerable future, especially for populations of predominantly rural type. In Russia, for example, it may be said to be the most important branch of broadcasting as practised, the individual listener being of much less account. The loud-speaker may operate in or in front of churches, mairies, schools or the like. A special type of communal listening is the religious service in which the sermon, or sometimes the service itself, is received and diffused in the smaller and scattered places of worship, many of which have only visiting clergy. Loud-speakers as such are frequently used to convey the voice of the officiating clergy.

ADMINISTRATIVE ORGANIZATION OF BROADCASTING

It has been indicated that there are two main types of organization handling public broadcasting; the commercial and competitive type and the centralized public-service type; and that the former type tends steadily to approximate to the latter so far as concerns its relation with the public. The same may be said, to a certain extent, of the administration and public-relation side of broadcasting. Given the immense cultural, educational, political and propagandist possibilities of the medium, it was unthinkable that Governments should disinterest themselves in the programmes. Accordingly we find control, to a greater or less degree, universally imposed on broadcasting. Under a crude commercial system, this control is slight and negative; while, at the other end of the scale, a despotic or dictatorial Government is inevitably tempted to employ broadcasting for the propagation of its own ideas. Between these extremes lie (a) "goodwill" commercial broadcasting tempered by Government regulation, as in the United States since 1927; (b) systems constituted as commercial companies, but subjected to the continuing supervision of a Government department, and limited as to profits; (c) companies commercial in form, in which the Government holds a controlling interest, as in Germany, Austria and Czechoslovakia; and (d) organizations of the type of the British Broadcasting Corporation or the Danish radio council in which a national broadcasting authority is constituted by, but stands apart from, the ordinary machinery of, the State. The success of an organization of the last type depends essentially upon the public's according to its executives and its traditions a confidence that is independent of its political outlook towards the Government of the day; hence it has usually been instituted as the result of prior experience, successful or unsuccessful, of other forms, and not at the outset.

The executive or internal organization of broadcasting is very similar in all countries, but there is one important divergence of practice that should be mentioned. In some countries the engineering side of the work is wholly in the hands of the State telegraph authority, and the broadcasting organization as a distinct body is limited to the provision and execution of the programmes. In others the engineer service is as much a part of the broadcasting organization as are the programme and the administrative departments. That the question is not a simple one may be gauged from the fact that of the two most highly-developed services in Europe the one works under the first and the other under the second system. In the British view there are many factors, such as engineer interest in the details of studio acoustics and management on the one hand and artistic interest in the control of modulation on the other, that make it undesirable for any hard and fast line to be drawn between the two sides of the work.

In most countries broadcasting organizations derive their revenue from the yield of the licence fees paid to the postal authorities in respect of listening sets, a share of which (varying from 50% to 90%) is paid over to the broadcasting service. In some countries taxes are levied upon the sale of receiving sets and parts, and most broadcasting organizations derive a small subsidiary revenue from the issue of programme journals and other publications auxiliary to their work. Elsewhere no charge is made for the possession of receiving sets, and broadcasting is supported either by advertisement or by subsidy from the radio industry. So far as Europe is concerned this system is generally held to be wanting in the indispensable guarantees of regularity, quality and impartiality, and the general tendency is to adopt the pure licence system. In Italy a part of the revenue of the national broadcasting organization (which is of the British type) is provided from general taxation.

Public Influence and Public Relations.—Certain particular aspects of broadcasting considered as a public service call for brief mention. These are its relations with the organized musical life of the community, its specifically educational (as distinct from its general cultural) mission, its religious rôle, its news functions and lastly its place in, or by the side of, political life. The opinion may be ventured that the advent of broadcasting has certainly temporarily, and perhaps permanently, arrested a decline which was setting in in the musical life of the European nations owing to a variety of circumstances, amongst them the enhanced costs of ordinary musical performances, the growing popularity of light, showy and ephemeral entertainment, the development of the cinema and the dance hall, and the effectively diminished incomes of the old leisured classes. Broadcasting has not indeed directly checked or altered these tendencies, but it has compensated them by the universal diffusion of music that a generation ago was quite beyond the reach of the masses, by interpreting that music through its critics, lecturers and journal-contributors, and often by performing works that in existing conditions private promoters cannot afford to mount, either because of the magnitude of the work or because of its relatively small "drawing power" from the commercial point of view.

On its strictly educational side, broadcasting addresses itself to two main classes—the schools, in which listening is "communal" and the instruction given is amplified by the teacher on the spot, and the adult student, who may be an individual or a member of a study-group. Opinions differ as to the relative importance of broadcasting in the two cases. In Great Britain, for example, the school side was dealt with first, adult education being a later development, of which the full potentialities can only be realized under a system of "alternative" programmes. In Germany, on the contrary, adult education took precedence, and a special service with a station of its own was created for its purposes, while Austria provides courses of very varied kinds, often of an advanced character, in its ordinary programmes. Broadcasting is also used for keeping scattered professional men in touch with progress (*e.g.*, country doctors in Poland), for giving primary education to children in mobile homes (*e.g.*, of Dutch bargemen) or scattered outside school range (*e.g.*, Russia). A service of particular value is that of scientific instruction for agriculturists. Languages are taught by nearly all broadcasting organizations, and the radio movement has considerably enhanced public interest in the synthetic or international languages.

The part played by broadcasting in the religious life of the communities varies from country to country according to its creeds, the relations of Church and State, and other factors; but there are few countries in which it does not exist. In Great Britain a definite policy of broadcasting a simple form of service and addresses without sectarian bias was adopted from the first, agreement having been obtained between the accredited representatives of the chief Christian Churches as to common fundamentals. In countries predominantly Roman Catholic, on the other hand, religious broadcasting has only been accepted with a reserve, though rarely excluded altogether, and in Holland facilities are shared between the different communions, each being free to propagate its own tenets without regard to the others. More generally fears have been felt that the ability to receive religious services at home would deplete the congregations of the Churches themselves. Experience in Great Britain has not justified these fears, and any loss to the Churches on this score is more than compensated by the spread of their influence over many hundreds of thousands who do not usually attend their services, as well as by the value of the religious broadcast to invalids and aged persons.

The relation of broadcasting to the press and other sources of public information is necessarily an intimate one. To a certain extent they are competitive, and this fact has created many difficulties for broadcasters which only time can wholly remove; but from the wider standpoint of public utility it is easily seen that they are rather mutually complementary than antagonistic. News as transmitted by the broadcaster is brief, oral and non-recorded, and in the nature of things it cannot be surveyed as a page is surveyed by the reader in search of matter that concerns or interests him. The descriptive broadcasting of races, ceremonies, etc., during the occurrence itself, on the contrary, justifies itself as "actuality" and the news element in it is incidental. It is between the spoken and the printed information *at second hand* that the question here considered lies, and the answer to it is probably that the two services will develop side by side, the rôle of the former being to relate bare facts in the briefest possible form, and that of the latter to amplify and comment on them.

Broadcasting, which addresses millions in every country nightly by direct speech to the individual in his own home, possesses a wider audience than any section of the press and any part of the older social machinery of communication. This fact has its advantages and its dangers. On the one side the leaders of the political and economic life of the community are enabled by it to make sober personal touch with the people without intermediaries and thus it constitutes a means of civic integration unparalleled since the days of the Greek city-state; on the other side, the temptation to direct the machinery with a bias is correspondingly great. At first, therefore, the general practice in countries where broadcasting is centrally controlled was to exclude all controversial matters (other than Government statements, broadcast as such without involving the broadcaster's responsibilities towards his public). Experience, however, has shown that this negative neutrality is insufficient and incompatible with the high rôle of broadcasting as well as with the modern conception of citizenship, and opinion tends more and more to the view that the treatment of controversial subjects (under proper safeguards as to impartiality and moderation) is a proper and necessary part of the function of a broadcasting service.

See J. C. W. Reith, *Broadcasting over Britain* (1924); B. B. C. annual publications since 1927; and relevant Parliamentary Papers, Cmd. 1,951, Comd. 2,599, Cmd. 1,822, Cmd. 2,756. (J. C. W. R.)

AMERICAN SYSTEM

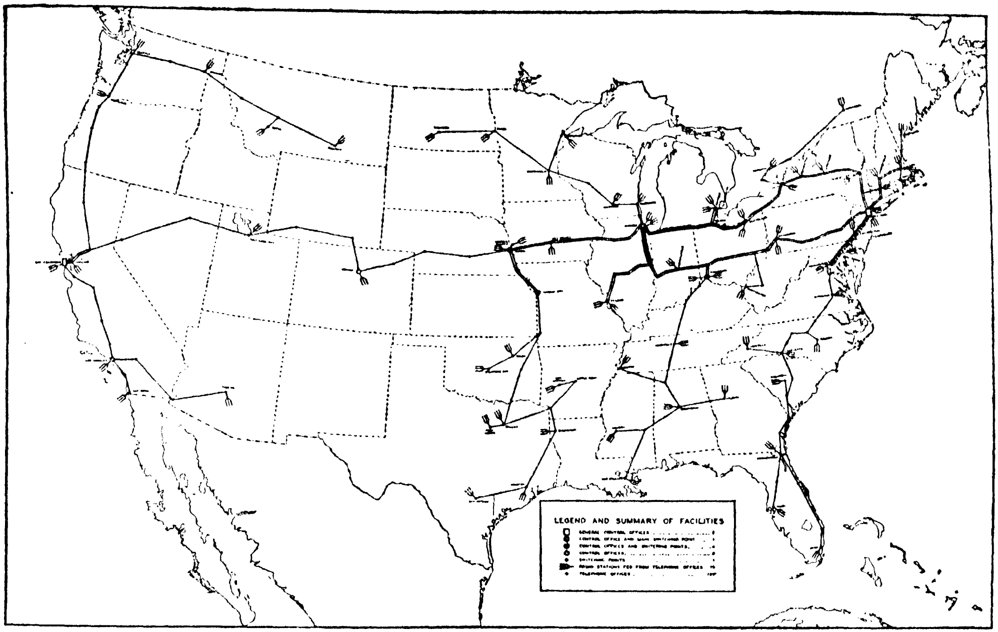
In the United States broadcasting has been developed by private enterprise, with a minimum of Government supervision. This freedom from restraint, while at times giving rise to unsatisfactory conditions, has encouraged competition and has doubtless been an important factor responsible for the rapid growth which has taken place. There is complete absence of any restriction or hindrance to the ownership and use of receiving apparatus, in that no licences are required and there are no fees to be paid. Since there is no financial support for the broadcasting of programmes derived directly from the listeners through the payment of a fee, other and less direct sources of support have been relied upon. Private enterprise has been forced to find its own means of economic justification and this has added a further element of competitive effort to the development of the industry.

HISTORY OF DEVELOPMENT

The first experimental attempts at the broadcasting of music by radiotelephony were made in the United States as early as 1916, notably by Dr. Lee De Forest. Further experiments by others, particularly in 1919–20, led to the establishment in 1920 of the first broadcasting stations for commercial exploitation of the new idea. One of the earliest and most successful of these stations was KDKA at East Pittsburgh, Pa., owned by the Westinghouse Electric and Manufacturing Company. The popular interest engendered in the territory around Pittsburgh by the broadcasting of presidential election returns, and subsequently of musical programmes, made evident the possibilities of profit in the manufacture and sale of receiving equipment. This has subsequently proved to be one of the two major sources of financial support for broadcasting activities in America.

The fame attained by the organizations operating the first broadcasting stations, as a result of popular interest in the novelty, brought clearly into view the second major source of financial support, viz., the realization of valuable advertising by the broadcaster. This was something which appealed not merely to manufacturers of electrical apparatus but to business men in general.

Commercial Boom.—During the season 1921–22 the sale of radio receiving sets and of component parts for use in home con-



COURTESY OF THE AMERICAN TELEPHONE AND TELEGRAPH CO

FIG. 3.—TYPICAL OPERATING LAYOUT FOR A BROADCASTING SYSTEM

struction of sets began a "boom" which was followed immediately by a big increase in transmitting stations. A classification made in February 1923 shows that about half the stations licensed up to that time were associated with radio or electrical concerns. Next in importance came educational and religious institutions, newspapers and publications, and department stores. The greatest mortality rate was among stations operated by radio and electrical concerns. This indicated the effect of the advertising idea in broadcasting. More powerful stations, sending better programmes, were being financed by organizations not profiting from the sale of receiving equipment.

Station WEAF was established in New York by the American Telephone and Telegraph Company for the purpose of offering broadcasting facilities on a time rental basis to all who wished to broadcast. The radio channels had become so crowded by stations that it was difficult for any more to find adequate places. Also there were many interests which desired to broadcast their own special programmes but did not wish to go into the project so deeply as to invest in a station equipment. Sponsored programme broadcasting, as instituted in this way, was clearly based on advertising value, and the definite undisguised use of radio broadcasting for advertising purposes was started.

Interconnection of Stations.—The first use of wire telephone lines in 1922 for interconnecting a station in New York and a station in Chicago, to broadcast simultaneously a description of a football game, introduced a new idea into radio broadcasting. The popular interest was then running largely toward receiving distant stations.

The use of a long-distance telephone line to bring programmes of special interest into the field of local reception simultaneously at a number of places was of evident value in broadcasting features of national appeal. It was of both economic and cultural importance Performances by leading artists at a centrally located station studio could be sent out to other stations Smaller stations could afford to offer programmes, obtained by wire, of much greater excellence than those they could produce for themselves A regular interchange of programmes by wire was initiated between WEAF in New York and WCAP in Washington, D.C., and subsequently other stations were added to the "chain." For special features of national importance large groups of stations were temporarily interconnected.

While many programmes could be performed in a studio, there were orchestra concerts, political meetings, athletic contests and the like which, by their very nature, could not be transferred to a studio. Telephone wires were brought into use for carrying such programmes from the microphones at the sources to the broadcasting stations and to the central offices, from which they could be despatched by wire to other stations

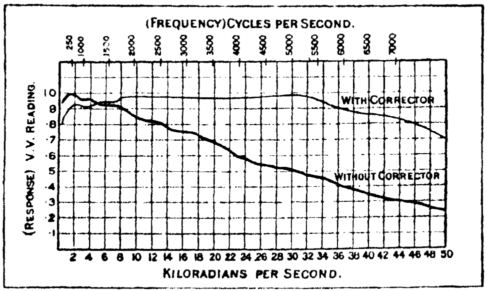


FIG. 4.—FREQUENCY RESPONSE CURVES OF A LAND LINE WITH AND WITHOUT CORRECTOR CIRCUITS

The two curves show improvement following the use of line correctors. The lower curve shows response of an uncorrected line at various frequencies, while the upper curve is the frequency response of the same line after corrector circuits have been used

Shortly after broadcasting became established on the wavelengths around 300 to 400 metres it was discovered that much shorter wavelengths, in the range from 15 to 50 or 60 metres, could be received over very long distances. The use of these waves has been developed not only for intercontinental radio telegraph and telephone services but also for the broadcasting of programmes directly to other countries or for the exchange of programmes between national networks by radio relay on short waves. Some of the larger American broadcasting stations have auxiliary short wave transmitters upon which their programmes are also radiated to reach greater distances either domestic or foreign.

Receiving Sets.—The first broadcast receivers were crystal detector or regenerative vacuum tube sets, the listening being done through telephone headsets. The next steps were to the high frequency amplifier type of radio receiver, which eliminated the objectionable interfering squeals and whistles of the regenerative type and to the use of crude loud-speakers which permitted listening with greater comfort and freedom. The batteries required in earlier sets for operation of the vacuum tubes were a source of expense and inconvenience which passed with the development of "battery eliminators" and "power packs" which permitted deriving the necessary tube power supply from the ordinary lamp socket or base-board outlet. Unified sets including the receiver circuit, power pack and improved loud-speakers, all in one harmonious cabinet design, characterized the emergence of radio equipment from it's early unsightly stage to a permanent acceptance as part of the average home facilities. At the same time there was a gradual shift to the superheterodyne type of receiving circuit. Attention was then concentrated by engineers and manufacturers on improvements in performance. Widening of the frequency range of response has resulted in higher fidelity reproduction and the inclusion of automatic volume control, tone compensation devices, tuning indicators and the like have overcome many of the limitations of earlier sets.

The development of world-wide broadcasting on short waves and the attempts on the part of many foreign stations to make their programmes attractive to American listeners have resulted in the development of the "all wave" receiver which not only is capable of receiving foreign stations but also permits the curious listener to eavesdrop on police, aeronautical and other commercial radio transmitters not provided with privacy apparatus. There is also a tendency to include in some newer sets provision for receiving ultra short waves below 10 metres.

The Position of the Government.—When broadcasting became important there were in force, in the United States, the London International Radiotelegraph Convention and two other Federal laws, all framed, eight years before, in 1912. These aimed primarily at regulating the maritime use of radiotelegraphy, particularly at promoting safety of life at sea. The administration of national radio affairs relating to commercial stations was entrusted to the Department of Commerce, and the secretary of Commerce was given certain power to make regulations. But the extent to which the law gave the Executive Department of the Government authority was not clear.

In order to obtain advice as to the problems needing Government action, the secretary of Commerce, Herbert Hoover, endeavoured to bring those interested into accord through the agency of a series of general conferences of which the first was held Feb. 27–28, 1922. At this time there were only about 50 licensed broadcasting stations. By the time of the Second National Radio Conference, March 20–24, 1923, the number had risen to about 550. These stations were crowded together into narrow wave bands, and conditions of interference had become intolerable. The conference divided itself into committees which brought forth recommendations dealing with such matters as increasing the frequency band allocated to broadcasting to include all the range from 550 to 1350kc. (wave-length, 545–222m.), the classification of stations in regard to the quality of service rendered, and the establishment of a geographical zoning basis for frequency assignments to reduce interference. The Department of Commerce put into force regulations which broadly carried out the recommendations of this conference.

The stage of development of broadcasting and its relation to the Government toward the end of 1924 are well illustrated by the following excerpt from the address of secretary of Commerce Hoover, at the opening of the Third National Radio Conference on Oct. 6 of that year.

"Radio has passed from the field of an adventure to that of a public utility. We have, in fact, established an entirely new communication system, national in scope. At the end of four years, 530 (stations) are in operation, making radio available to every home in the country. The sales of radio apparatus have increased from a million dollars a year to a million dollars a day. It is estimated that over 200,000 men are now employed in the industry and the radio audience probably exceeds 20 millions of people."

At this conference the frequency band available for broadcasting was widened to 550 1,500kc. (wave-length, 545–200m.). This gave a total of 96 channels each 10kc. wide, of which six were by co-operative agreement assigned to the exclusive use of Canadian stations. The largest transmitting sets in common use had an output of 500 watts but the advantages of increasing power were being recognized.

The conference recommendations cleared the way for the use of greater power. Stations of 5 to 10kw. were established during the following year and at least two stations (KDKA and WGY) were experimenting with still higher powers.

The desire to broadcast caused such pressure towards increasing the number of stations on already overcrowded channels that when the Fourth National Radio Conference met on Nov. 9–11, 1925, the need for limiting the number of stations to be licensed was one of the principal matters discussed. In spite of the recommendations of the conference against the granting of new licences and the attempts of the Department of Commerce to find a means of permitting more stations to be operated, dissatisfaction of those unable to obtain suitable arrangements increased, until the situation was precipitated by a Chicago station, which, without authority, began to use one of the channels allocated to Canada.

The Department of Commerce brought suit in the courts and lost, it being held that the department had no authority to deny licences or to enforce frequency assignments. While the large majority of stations continued to abide by the rulings of the department a number of stations, popularly called "wave jumpers," proceeded to select waves which suited them and to operate on these waves.

Act of 1927.—The chaotic conditions brought about by wave jumping hastened legislative action and the Radio Act of 1927 became a law on Feb. 23, 1927. This act took the responsibility of licensing stations from the secretary of Commerce and placed it in the hands of a Federal Radio Commission of five men appointed by the President. Appeal from the decisions of the commission was to the courts. The commission was given rather broad powers to classify and license stations; to assign operating frequencies; to determine locations and operating times and powers of stations; to establish areas of service; to make regulations to prevent interference; to regulate chain broadcasting stations; to hold hearings, summon witnesses and compel production of documentary evidence. The licensing authority need grant a licence only "if public convenience, interest and necessity will be served thereby."

This put a stop to the unchecked increase in the number of stations which followed the Department of Commerce's defeat in the courts.

In 1928 an amendment to the Act of 1927, requiring equality in assignment of broadcasting rights to the five geographical zones into which the country was divided, made necessary a revision of station assignments. Perhaps the most important feature of this revision was the establishment of a group of "clear channels" each of which was assigned to a single high power station to enable it to give the maximum range of service.

Other channels, designated regional channels, accommodate two or more lower power stations in different parts of the country. The number of broadcasting stations dropped from 681 in 1927 to 606 in 1929.

International Agreements.—While the regulation of broadcasting in the so-called "broadcast band" of 550 to 1500 kilocycles is essentially a domestic matter, the fact that transmission on

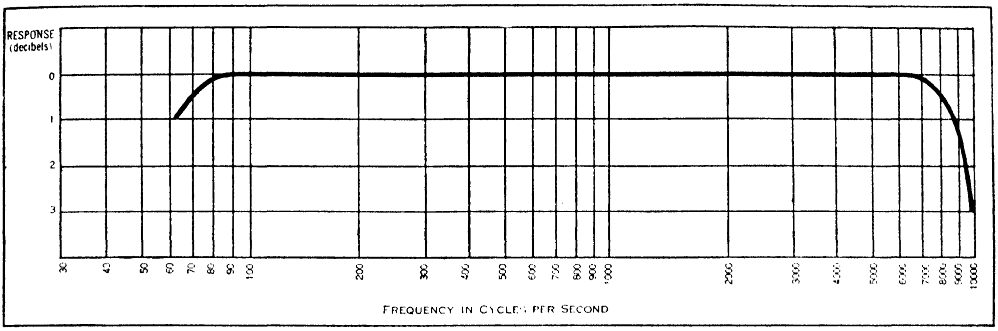


FIG. 5.—A TYPICAL FREQUENCY RESPONSE CHARACTERISTIC OF A MODERN BROADCASTING TRANSMISSION SYSTEM

these waves can affect adjacent countries and that transmission on short waves can produce interference at great distances has caused certain agreements as to use of waves for broadcasting to be included in the international agreements on radio communication to which the United States is a party. These are the International Radio Telegraph Convention of Washington signed in 1927 and the International Tele-communications Convention of Madrid signed in 1932. An agreement on division of channels with Canada was reached through diplomatic channels by an exchange of notes in 1932.

Communications Act of 1934.—On July 1, 1934 there was established by Act of Congress a "Federal Communications Commission" of seven men to deal not only with matters of national broadcast regulation but also with interstate and foreign telephone and telegraph communication by wire and radio. The Commission is divided into three divisions of which one, called the "Broadcast Division," carries on substantially the functions previously exercised by the Federal Radio Commission which the new Communications Commission superseded.

A recent trend in broadcast regulation has been to permit experimental operation with increased transmitter power, in one case up to 500 kilowatts, and with increased band width to give high fidelity transmission. There has also been a tendency to permit increase in the number of low power stations operating on regional channels. The total number of stations was 629 on September 30, 1935.

High powered American stations operate in the same general frequency band with lower powered stations. There is nothing analogous to the European stations operating at lower frequencies (longer wave-lengths).

BROADCASTING AS A BUSINESS

One element of importance in advertising is the number of possible customers it reaches. The value of combining the toll broadcasting idea with the chain broadcasting idea, to increase the audience and thereby to justify the expense of better programmes, was self-evident.

WEAF, the pioneer sponsored programme broadcasting station, being owned by the telephone company which also operated the long distance telephone service of the country, naturally served as an important centre for the development of commercial chain broadcasting. Arrangements were worked out whereby the cost of such service could be distributed equitably between the programme sponsor and the individual chain stations using the programme.

For advertising programmes the individual chain stations received a portion of the chain rental charges paid by the advertiser. These stations could also obtain, by paying a fee, non-advertising programmes supplied by the central management of the chain.

In 1926 the National Broadcasting Company, organized by the General Electric Company, the Westinghouse Electric and Manufacturing Company, and the Radio Corporation of America, purchased WEAF and undertook the management of WJZ and WRC owned by the Radio Corporation of America. The chain broadcasting activities centring on these stations were continued and expanded.

Subsequently the Columbia Broadcasting Company and other similar companies were organized and the dissemination of programmes by wire circuits to chains of stations for simultaneous broadcast over large areas has come into general use. In 1931 the telephone companies had over 100,000 miles of wire equipped for programme transmission in the United States. Typical chain layouts included, among others: a "Red Network" joining 53 stations covering the country as far west as Denver, an "Orange Network" joining 11 radio stations covering the Pacific coast and extending east into Montana, Utah and Arizona, a "Purple Network" joining 83 stations spread over nearly the whole United States. On a special occasion 178 stations were connected into one network.

Patents and Copyrights.—During the early boom period of radio broadcasting many companies and individuals started the manufacture and sale of receiving sets and parts with small regard for the infringement of patents.

With the number of patents running into thousands it was a difficult task even to determine what patents might be infringed by given apparatus. In 1920 and 1921 several large electrical and communication companies which, taken together, controlled an important group of radio and other communication patents, entered into a cross-licensing agreement whereby each of the companies was enabled to proceed in its field with a satisfactory patent situation.

A considerable number of manufacturers and groups of patents were outside this arrangement but, after a period of negotiation and some litigation, licences were extended to the larger independent manufacturers under royalty agreements, and by 1927 it was generally possible for a responsible manufacturer to equip himself with such licences as would ensure him the right to put on the market receiving equipment of modern design.

The question arose as to whether the performance of a musical composition before a microphone in a private studio, so that it was broadcast by radio, constituted an infringement of copyright. The American Society of Composers, Authors and Publishers championed the cause of the holders of copyrights, and ultimately established a recognition among broadcasters of the right of the copyright proprietors to compensation for the use of their compositions.

There was discord over the matter of equitable rates of compensation, but by 1927 this seems to have been adjusted in most cases through private negotiations.

The rapid strides made in the perfection of sound pick-up and reproducing apparatus under the urge of radio broadcasting has had a stimulating effect upon other agencies for sound rendering. The phonograph, for example, is now to be found in greatly improved form combined in the same cabinet with radio receiving sets so that the amplifier and loud-speaker portions may be used by either.

Another development related to broadcasting and often used in combination with broadcast pick-up of speakers in large halls or in open air is the public address system. By means of microphones placed directly in front of the speaker and powerful amplifiers and loud-speakers or sound projectors appropriately located large crowds can be addressed successfully with reduced strain on both the speaker and his auditors.

Business Progress.—The phenomenal expansion of the radio broadcasting business which took place in 1921 and 1922 caused over-extension among many concerns and brought an inevitable reaction which was felt particularly in 1925 and 1926. A selected group of radio company stocks which was valued, in December 1924, at about 160 millions of dollars, had fallen to 65 millions by July 1926. There were many failures among the smaller concerns and the retail market was so flooded by manufacturers' over-production that many sets were sold for far less than their original price.

This experience, as a whole, was not entirely a detriment to the industry, since it forced out unstable or ill-managed concerns and caused the consolidation of others, while at the same time it tested and proved those concerns which came through it successfully. Since then the manufacture and merchandising of receiving equipment have reached a firmer basis.

In 1934 it is estimated that there were about 18,000,000 receiving sets in the United States which had cost $1,500,000,000 and which involved an annual upkeep expense of $200,000,000.

Organizations.—It is not possible to mention more than a few. The manufacturers have a Radio Manufacturers' Association and a radio division in the National Electrical Manufacturers' Association. These are active in standardization work.

The National Association of Broadcasters interests itself in legislation and in general investigations for the benefit of its members, which include a majority of the broadcasting stations. Through the co-operative efforts of these various associations and other interests, radio fairs or shows are held for the exhibition of equipment. Large annual radio shows are held in New York and Chicago

The Institute of Radio Engineers provides facilities for the discussion and publication of technical papers and the furtherance of standardization in fundamental radio instrumentalities. The National Advisory Council on Radio in Education is interested in educational broadcasting.

Future Tendencies.—To predict the future of broadcasting in America would be hazardous, but certain tendencies may be indicated. While the possibilities of educational and news broadcasting have not been fully exploited, it seems certain that the amusement feature will continue to be dominant.

There are many technical improvements in sight which may be counted on to improve the quality of service rendered to listeners. Added features of novelty are being experimented with, such, for instance, as the broadcasting of pictures, cartoons and the like, for facsimile reproduction in the home, by suitable attachments to broadcast receiving sets.

The technical progress in developing television has reached a point where the possibilities of extensive application in visual broadcasting by ultra short radio waves are limited more largely by the economic and business factors than by the technical problems.

In so far as interconnection of stations is concerned a new form of high frequency cable called "coaxial cable" has been developed by Bell Telephone engineers which is expected to facilitate chain distribution of visual programmes to broadcasting stations.

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TECHNICAL ASPECTS

The wireless telephone, which is the basis of all wireless broadcasting, first became a practical piece of apparatus after the invention of the thermionic triode (*see* THERMIONICS) during the years 1912–14. It was developed particularly for war purposes between 1914–18. Certain wireless telephone stations were erected before the World War and in non-belligerent countries during the war, and were designed chiefly for broadcasting special sorts of news. In Feb. 1920 experimental telephony transmissions were carried out in England on a frequency of 150 kilo-cycles (kc.) per second (wave-length, 2,000m.) and using a power of about 15 kilo-watts (kw.) in the aerial. These tests were withdrawn on account of alleged interference with other services. Contemporaneously with this development a station in Pittsburgh, U.S.A., heralded American broadcasting, which has been in active operation since that period. A Dutch station at The Hague, PCGG, transmitted broadcast programmes sporadically during the years 1920–22, but the station, for which private subscription was from time to time raised throughout Europe, eventually closed down. Certain German stations were during this time transmitting news and weather reports, and Dutch bankers used a telephony station for immediate quotations of market values. Early in 1922 the Radio Society of Great Britain obtained permission to transmit a programme of music and entertainment for half an hour in each week from a ¼kw. station. This station, 2MT Writtle, was the first station to do regular and scheduled broadcasting in Britain. The British Broadcasting Company started officially in Nov. 1922, but since August of that year a station, 2LO, located on the roof of Marconi house, had been radiating occasional experimental transmissions simultaneously with Writtle. When the B.B.C. started it absorbed 2LO, which became its London station, and also 5IT (Birmingham) and 2ZY (Manchester) operated at that time for the B.B.C. Development in all countries was rapid; during 1923 several European broadcasting stations began operations, and in 1935 there existed over 300 active broadcasting stations in Europe, the average station power being 24 kilowatts.

First Principles.—The underlying technique of broadcasting involves a wireless telephone transmitter radiating electric waves nearly equally in all directions, and any number of receivers able simultaneously to detect the intensity of such waves. These waves (in general, of frequency from 1,500 to 150kc. per sec.) are modulated in intensity by any sound desired to be broadcast and these modulations are detected in a receiver. The modulation of the electric waves involves a microphone, which, when acted upon by sound waves, converts the varying pressures of the surrounding air into correspondingly varying electrical pressures. These electrical pressures may be amplified, from their original relatively feeble value, to modulate, in the broadcasting transmitter, the intensity of the power (which varies in common practice from 1·0 to 200k.w.) of high frequency electric currents in the transmitting aerial. This modulation of the high frequency aerial currents causes a sympathetic modulation of the radiated electric waves. The electric waves falling upon any receiving aerial, adjusted to give the most efficient response, cause high frequency currents to be set up, which, when detected, produce currents copying to a greater or lesser extent the original microphone currents. The receiver currents are made to move a diaphragm in the telephones or loud-speaker which, with action inverse to that of the microphone, produces pressures in the surrounding air making a recognizable imitation of the sound acting upon the distant microphone.

Distortion of the original electrical impulses may take place in each of the necessary energy conversions, and it is important to make each conversion as distortionless as possible. Sound contains a combination of frequencies from 20 to 15,000 or even 20,000 vibrations per second. The response of the human ear varies with individuals and many ears are insensitive to sound vibrations above 10,000 periods per second. In the reproduction of the human voice, for naturalness and intelligibility and for the giving of an adequate sound picture of an orchestra, the human ear is contented with reproduction if every frequency from 50 to 10,000 vibrations a second is present in its right proportion The problem, as it concerns good quality reproduction, is to produce an electrical system, from microphone to loud-speaker, which gives an equal response to every equal energy value of frequency between the limits stated above. This is far from easy, because successive errors add in cascade and there is a remarkable tendency for every piece of apparatus involved in the chain to respond to the middle frequencies (500–1,000 periods per sec.) to which the ear is most sensitive. This gives the "snarly" quality associated in some degree with almost all forms

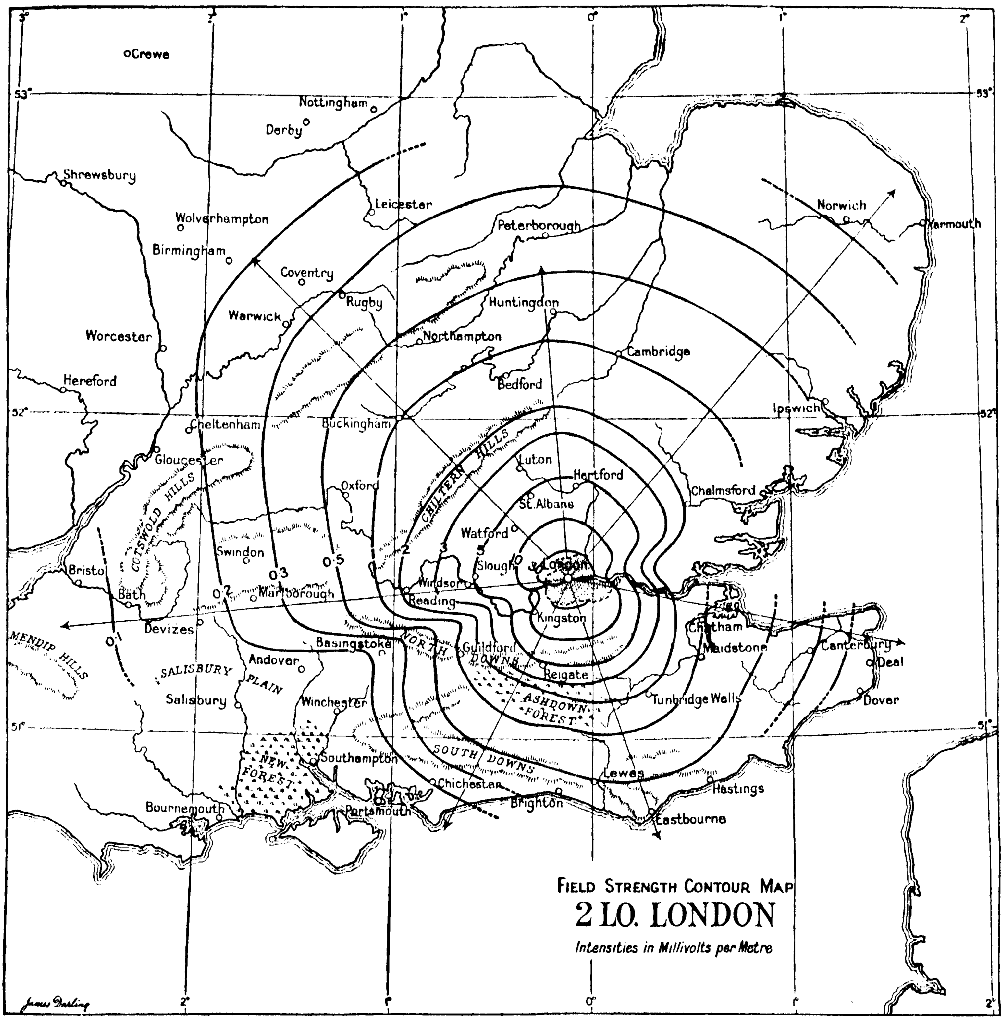


FIG. 6.—RADIO CONTOUR MAP, SHOWING THE FIELD STRENGTH CONTOURS ROUND THE LONDON BROADCASTING TRANSMITTER. OBSERVATIONS WERE MADE AT MANY POINTS ALONG EACH OF THE 7 LINES SHOWN AND ELABORATE PRECAUTIONS WERE TAKEN TO ENSURE THAT THE MEASUREMENTS DID NOT INCLUDE ANY REFLECTED OR INDIRECT RAY. THE "DIPS" OR "BAYS" IN THE CONTOUR LINES IN EASTERLY AND WESTERLY DIRECTIONS ARE BELIEVED TO BE DUE TO THE SCREENING BY IRONWORK OF THE TWO MASTS SUPPORTING THE AERIAL OF THE STATION

of apparatus for mechanical and mechanico-electrical reproduction of sound. Undoubtedly, however, the ear is aided by the imagination, and the individual may derive pleasure from what is theoretically inferior.

BROADCASTING TECHNIQUE

Broadcasting technique necessitates some considerable additions to the bare essentials of a wireless telephone transmitter in order that the system may conform to the canons of the new art. The essential links in the chain between artist and listener can be classified as follows: (1) The microphone and its attendant amplifier. (2) The studio or place of origination of programme. (3) The "mixing" of artificial echo, "effects," incidental music, speech, etc., to combine to make a given impression upon the listener. (4) The central control room. (5) The land line or wireless link to enable programmes to be initiated at one point while radiated from another station or radiated simultaneously from several stations. (6) The broadcast transmitter. (7) The broadcast receiver. It will also be necessary to discuss (8) the distribution and power of the transmitters; (a) service area; (b) interference between the various broadcasting stations; (c) distribution for national systems. (A basic broadcasting system is shown diagrammatically in fig. 1.)

(1) **The Microphone and Its Amplifier.**—Every microphone (called in America and by telephone engineers a transmitter) relies for its action upon the sound waves causing a movement of some armature which, by such movements, generates electric currents in the microphone. The generation of current

by armature movement may be involved by a change of capacity, a change of movement of a conductor in a magnetic field, or a change of resistance in a direct current circuit. The excellence of a microphone may be judged in terms of its response characteristic and its degree of background noise. The response characteristic of a microphone is measured first, as to its ability to give equal electrical response for equal sound wave pressure at any frequency between the limits of the audible range; and second, as to its capacity to give, at any frequency, proportionality between input sound pressure and output electrical response. Every microphone has an intrinsic background noise caused by the polarizing current or by the associated amplifier valves, or by both these in combination. Microphones must be compared for background noise at a given sensitivity.

A perfect response characteristic must involve a complete absence of mechanical resonance within the range of frequency considered. This is not easy, as every armature tends to resonate at some (audible) frequency. Carbon and condenser microphones have been constructed with a view to eliminating resonance by using a diaphragm stretched to have a resonance above the audible limit. Carbon microphones have been used, notably one invented by E. Reisz and developed by H. J. Round, in which the layer of carbon is thin enough to give resonance effects at frequencies above audibility. Certain microphones have been developed (1930–35) in which the armature is designed to be more sensitive to sound coming from one direction than from another. These have great usefulness in auditoria where background noises are liable to be strong compared with the sounds desired to be broadcast. Thus, for instance, when broadcasting orchestras playing in restaurants or speeches made at banquets, a better balance is obtained by the use of these, so-called, directional microphones.

Broadcasting microphones having excellent response characteristics are extremely insensitive compared with ordinary commercial types (as used on ordinary telephones) in which resonance can be permitted, and their electrical output has to be amplified considerably before it can be used efficiently for transmission by telephone lines to a nearby control room or distribution centre. There may be ten or more studios in a broadcasting headquarters, and therefore the studios may be, even in the same building, a relatively long way from the control room. The currents generated by the microphone are extremely feeble and therefore liable to be interfered with by induction from electric power and lighting circuits if long leads are used. Amplification is therefore divided into two halves, the A amplifier, located as closely as is convenient to the microphone, the output from which goes eventually to the B amplifier situated in the central control room. The frequency characteristic of such amplifiers, *i.e.*, their response over the audible gamut, must be as even as possible. Connections between the amplifier and microphone and the amplifier and cable for connecting to the relatively distant control room or transmitter must be through transformers. Transformers are necessary owing to the impossibility of matching the impedance of the output or input valve to the cable or microphone. It is not easy to design a transformer giving an equal response over a frequency range of 200:1 (50 to 10,000 periods per second), but by the use of spaced windings and high permeability iron, it has been proved by experience that a reasonably good characteristic curve may be obtained. (Figure 2 shows by means of a curve the frequency response of a good modern amplifier.)

(2) **Place of Origination of Programme.**—*Broadcasting studio* is the name given to the specially arranged room in which artists perform for broadcasting. It is of utmost importance to arrange for the acoustics of the studio to be as perfect as possible for its particular purpose. It is usually unwise in the present condition of the art, to allow a large acoustical reverberation in the studio. In speech, when intelligibility is of primary importance it is necessary to use highly damped rooms. For music generally a greater amount of reverberation is desirable and even necessary though a large orchestra and a quartet require different studio reverberation constants. As a practical basis it is best to reduce permanently the reverberation constant of the studio to something less than that required for most purposes and then, in some mechanical or electrical way, to add synthetic reverberation. Changing the reverberation of the actual studios, where each may have to be used indifferently for all sorts of different performances, is not practical.

The usual way of reducing the reverberation of a room has been to cover the walls and ceiling with drapery, but, though this is satisfactory in principle, it is ugly and insanitary. The British Broadcasting Corporation and the National Broadcasting Company of America have made practical attempts to do away with drapery. The later B.B.C. studios have their walls covered with a hard paper backed by felt, while embrasures and deep bays prevent high acoustical frequency reverberations. A thick carpet covers the floor and the ceiling has movable draperies. The American organizations employ a form of aero concrete. In British practice artificial echo is introduced by using two microphones, one of which is connected through amplifiers direct to the transmitter, while the other is connected through a separate amplifier to a loud-speaker installed in a room with a high degree of reverberation. The loud-speaker in this room faces a microphone, the currents from which are injected into the direct transmitter circuit. The amount of echo current from the echo microphone is directly controllable by a handle, and therefore the extent of superimposed echo may be varied conveniently according to the type of item being broadcast.

In Great Britain approximately 20% of the programme hours is supplied from outside sources, such as church services, public gatherings, theatres and restaurants, etc. In the case of the transmission of a concert from an outside hall it is often found that the acoustics of the building are different from those of a studio and the best results can be obtained only by experiment. As this is done at a rehearsal before the transmission it is necessary to estimate the changes in reverberation which will result when an audience is present. At the same time it is necessary to adjust the balance of the transmission by the relative placing of soloists, orchestra and microphone, so as to obtain a proper balance. The outside broadcast engineers install their apparatus, consisting of microphones and A amplifiers, wherever and whenever it is required. Connection to the distribution centre of the broadcast organization is made by land line. Where it is necessary for the microphone to be moving during the transmission, as in the case of a running commentary on the Oxford and Cambridge boat race, lines cannot, of course, be used, and connection has to be made to some stationary point by means of a wireless link. In this instance the A amplifier would be replaced by a low-power wireless transmitter the emissions from which can be received at some stationary point and the transmission then passed to the distribution centre.

(3) **"Mixing."**—The development of the dramatic programme, with attendant incidental music and effects, has necessitated the frequent use of several studios simultaneously. It is not feasible for small studios to concentrate artists, chorus, orchestra, effects, producers, etc., together; several studios must be employed, and the transmissions from each of these combined in a "mixing" room through which the outputs of all studios pass on their way to the central control room. Signalling circuits are installed between all studios and the mixing room, between the mixing room and the control room and between the control room and all the studios. The outside broadcast circuits can also be led through the mixing room as it is sometimes required to superimpose external effects on a studio programme. The mixing room is also connected by a land line to a wireless receiving station and here any distant transmitting wireless station, permanent or temporary, may be picked up and re-broadcast over the normal national broadcast system.

(4) **The Central Control Room.**—At this link in the chain of transmission two definite functions are fulfilled; viz., that of adjusting the level of low frequency energy to modulate more or less the transmitter high frequency currents, and that of distributing the programmes to one or more transmitters, centres or listening points.

The first of these functions, that of controlling the intensity of output to the local and other transmitters which are taking the programme, is necessary for the following reason: a brass band gives a volume of sound output hundreds of times greater than a person whispering or a distant nightingale; if the sensitivity of the microphone or its amplifier were not varied, either the listener would never hear the nightingale or the brass band would vastly overmodulate the constant-power transmitter; during the musical items, if the pianissimo passages were not amplified and the fortissimo passages not reduced a little on the amplifier, an inferior sound picture would be rendered even on the best receivers.

The second stage of amplification in the broadcast chain is situated in the control room, and is known as the B amplifier, which is designed for variable sensitivity, and it is the duty of the "controller" continuously to control the intensity of the transmission with the idea of giving to the listener the best possible sound picture of the original. A point on which much variety of practice and opinion exists is whether this control of volume should be in the hands of engineers or of artists. The advantage of the latter is that a score can be followed with a view to the anticipation of a forte passage and a consequent slight reduction in time to prevent over-modulation, and vice versa for the prevention of under-modulation during pianissimo passages. The eye, and not the ear, must be the criterion for the accurate judgment of the effects of controlling, and each "control" amplifier is equipped with two meters—one to show a maximum which must not be passed, the other to show the volume being radiated at any instant. It is necessary to have two instruments, because the permissible maximum for a given volume is not the same with different voices, instruments, studio acoustics, etc. In addition, the depth of modulation at every instant throughout the transmission is checked mechanically on a recording modulation meter to show up any faults due to the human element.

The second function of the control room is to provide a means of handling conveniently the distribution of the one or more programmes to those transmitters which are sharing the transmission with the local station. In practice the problems of programme building are simplified enormously by the ease with which stations can be made to exchange programmes and by the reduction to an absolute minimum of the time taken in making changes. The system depends on the use of a multiplicity of relays, amplifiers, alarms, line terminal switching, etc. Finally, the engineer in charge of the control room is responsible for the maintenance of all transmission logs (in the case of the British system accurate to a second) and for the cutting and timing of the transmission generally.

(5) **The Land Line and Wireless Link.**—It is necessary to have as many stations as there are channels of free ether available. If an event or performance of nation-wide interest is to be broadcast it is necessary to allow all subscribers an equal chance of hearing. This is made possible by using telephone lines or cables to connect the point at which the event takes place, first to the nearest distribution centre in the broadcast system, and thence to all stations that require to take the programme. This is called *simultaneous broadcasting* in Britain, or *chain broadcasting* in the United States. All lines of great length introduce an impedance which varies with different frequencies. This means that a microphone system giving a perfect response characteristic will, if connected to a long line, produce at the end of that line a distorted output unless precautions are taken to equalize inherent distortions. There are in general two types of line—overhead and cable. The former is the familiar type suspended on porcelain insulators carried on poles, while the latter is buried in trenches. An inch diameter buried cable, for instance, may carry 150 circuits. The overhead line would appear to introduce less distortion than the cable because its distributed self-capacity is lower than that of the buried type. Cable can, however, be treated to give a good characteristic, *i.e.*, less differing impedance to different frequencies, by a system of loading. Light loaded cables which are, however, more expensive, have characteristics suitable for broadcasting work.

The currents in any long line attenuate (steadily decrease as they proceed away from the original source), but this effect is more rapid in the case of a cable than it is with open or overhead lines. This attenuation can, however, be overcome by the use of thermionic amplifiers placed at regularly spaced intervals along the line. These are called "repeaters" and the points at which they exist "repeater points," and such are extensively used in modern trunk telephone routes (*see* TELEPHONE). The commercial type of repeater, which enables a conversation in both directions to be raised in level, is both unsuitable and unnecessary for broadcasting. The broadcast repeater need only work in one direction, but must maintain an even response characteristic. Apart from the problem of attenuation and the precautions which are taken to overcome it, every line will introduce some distortion by cutting down certain frequencies in favour of others. It is therefore essential to employ a frequency response correction by the termination of lines at repeater points and at their final terminations with a filter containing concentrated inductance and capacity.

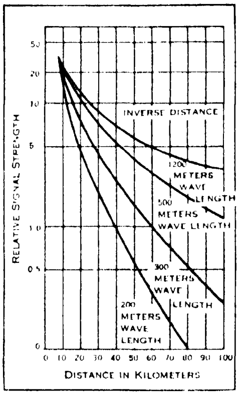


FIG. 7.—CURVES SHOWING THE STRENGTH OF THE SIGNAL AT VARIOUS DISTANCES FROM THE TRANSMITTER FOR VARIOUS WAVE LENGTHS

Owing to the fact that the cable cannot be used for connecting different continents separated by wide oceans, the "wireless link" should play a part in long range broadcasting. Stations using very high frequencies (15.000 to 7.500kc., 20 to 40m.) can be picked up over ranges equal to the maximum distances existing on the earth. Unfortunately the solution of the problem of sufficiently satisfactory reception for re-broadcasting purposes is incomplete; there is not a guarantee of service on short waves although they offer possibilities for future success. Since 1923 America has sent out programmes from short wave stations which can be heard, conditions permitting, all over the world. Usually reception is too inferior to be compared to that existing with the national services from local stations though occasionally programmes from America have been re-broadcast in Britain. Early in the year of 1927 Holland started sending short wave transmissions which have been heard sporadically throughout the world. The British Broadcasting Corporation has erected a group of stations at Daventry which direct their several radiations over different great circle world paths with a view to giving a broadcasting service particularly to the British Dominions and Colonies.

(6) **The Broadcast Transmitter.**—The general principles and practice of wireless telegraphy and telephony transmission are dealt with in the articles WIRELESS TELEGRAPHY and TELEPHONE, and therefore discussion of this point will be confined to essentials. The basic system of modulation for broadcasting transmitters is known as "choke control." In this system the power supplied to the oscillation generator, which generates the high frequency currents in the aerial for radiation, is varied in sympathy with the amplified microphone currents by the action of control valves. As in the case of other links in the broadcast chain, the problem is principally one of achieving a perfect frequency and volume response characteristic, *i.e.*, proportionality between the limits of maximum and minimum modulation and an equal modulation at all frequencies for any given input volume. Economy in power, ease of maintenance or accessibility, and trustworthiness are also important factors. Two systems of modulation make use of choke control, the one modulating the aerial currents at high power and the other at low power. In the former (used almost exclusively, except by the German administration) the modulation system is in effect a low frequency power amplifier with sufficient power to modulate the aerial oscillations; in the

latter, modulation takes place at low power, whereafter a high frequency amplifier increases the power of the modulated high frequency currents to the desired value The British Broadcasting Corporation uses low power modulation in all their regional stations except the Droitwich long wave station (1935) which uses a system of high power modulation. Fig. 5 shows the frequency response characteristic of that station which has an aerial power of 140kw. In Germany a system is employed in which modulation is achieved by an alteration of the constants of the grid circuit of an oscillation generator High-power modulation is in use in practically all other countries, such as America, France, Sweden, Denmark, Italy, Spain, etc., while some central European States use the German grid system as well for different stations.

Most antennae systems for a modern installation are half wave-length aerials supported on steel towers. A single tower having a height of half the wave-length employed is sometimes used as the aerial. The Budapest aerial is the tallest structure in Europe, approximately 1,000ft. high Modern technique mostly employs aerials located 20 to 100ft. from the transmitter buildings, the power output of oscillations being fed to the aerial via a two-wire feeder. This increases the radiation qualities of the aerial and has no compensating disadvantage.

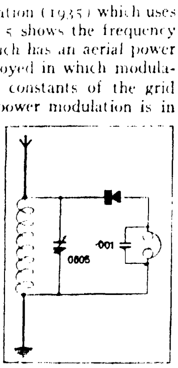


FIG. 8.—DIAGRAM OF THE CIRCUIT OF A CRYSTAL RECEIVER

(7) **The Broadcast Receiver.**—Broadcasting receivers may be of the valve or crystal type. The valve set requires the installation of some power supply, and is essential in areas of weak signal strength or in areas of normal signal strength where only small aerials can be erected or anywhere for loud-speaker use. (Reference should here be made to figs. 8, 9 and 10, giving crystal 3-valve and 5-valve lay-outs.)

Development in receiving sets has taken two paths. The rare high fidelity product has concentrated upon obtaining a wide frequency-response characteristic and a large undistorted power output almost regardless of cost. Often as much as 10 watts power is available to energise the loud speaker. The ubiquitous receiver has been developed more and more with a view to reducing its retail price and increasing both its sensitivity and selectivity with the object of "bringing in" as many stations as possible. The great increase of both the power and the number of stations working in Europe has forced the designers of typical receivers to narrow the band width of response in order to select the wanted station's transmissions free from interference by other stations. The latter development has been necessarily accompanied by a degradation of the quality of music obtainable. The reduction of price has vastly increased the sales of this type of instrument. A large market has been found for the "all mains" set which, where public supply current is available, is energised entirely from the mains and does not require the use of batteries. Battery and crystal sets are however still widely used, the former because many houses are not supplied with electric power, the latter still maintaining its popularity because of the satisfying quality of headphone music and, perhaps more, because of its reliability, simplicity and cheapness.

The design of good loud-speakers proceeds apace and some excellent types are available. It should be remembered that no loud-speaker can give good quality if its input is limited or distorted by the receiver. The basic technical problem is to obtain conditions of transmission allowing the listener to obtain good quality reproduction and a choice between different types of programmes' In America, where ten or more stations, separated by only, say, 30 to 50kc., may have practically equal field strengths over an area, some extremely selective receivers have been produced, but their ability to eliminate many stations in favour of one is often only achieved by depreciating the frequency response. In most European countries where distribution in thickly populated areas has been on a single programme basis, the development of high selectivity without a loss in the quality of reproduction has been retarded. This has permitted greater freedom in the design of high frequency circuits, and the response characteristics which are obtained are excellent. The ideal receiver should produce a square resonance curve 20kc. wide, movable as a whole, without loss of its shape or change in width, over the required frequency gamut of all broadcasting stations. This movement and all other adjustments should be operated simultaneously by one handle, the receiver being efficiently energized from the electric supply.

(8) **The Distribution and Power of the Transmitters.**—(a) *Service area.* It is necessary to ensure that the programme shall suffer no interruption from extraneous electric waves from whatsoever source. As the distance between the listener and the broadcast transmitter is increased so will the liability to interruption be increased; *i.e.*, as the receiver is located further and further away from a station, the ratio of the required signal to the unwanted interference becomes less and less. This ratio is not a function of the type of aerial nor the type of receiver used by the listener, because if more amplification is used both the disturbances and the broadcast signal are each proportionately increased. If radiation is perfectly symmetrical around a broadcasting station then the rate of decay, or attenuation, of signal strength is equal along any line drawn from the transmitter. Thus an area may be enclosed by a circle within which the signal strength is greater than a certain amount. By common experience in the regular reception of signals of various field strengths, it is possible to estimate service ranges in terms of degree of interruption. Service areas have been defined arbitrarily in terms of field strength, as follows:

Service Area	*Boundaries in Millivolts per metre* (a convenient method of expressing strength of signal)
"Wipe-out"	Over 30 mv. per metre
A	,, 10 ,, ,, ,,
B	,, 5 ,, ,, ,,
C	,, 2·5 ,, ,, ,,

These definitions of service area have been accepted and adopted by the technical committee of the Union Internationale de Radiophonie Within a "wipe-out" area uninterrupted service can be guaranteed, unless the interference is produced by listeners themselves producing oscillations in their receiving aerials. There will be difficulty in a wipe-out area in "cutting out" the local station in order to receive more distant and weaker transmissions from other stations. In an "A" service area very little interruption will exist even in large towns where extensive use is made of electrical apparatus likely to cause a disturbance. In a "B" service area there may be, in a minority of cases, some interference. Crystal reception is possible with good equipment up to the outer boundaries of a "B" service area. In a "C" service area amplification

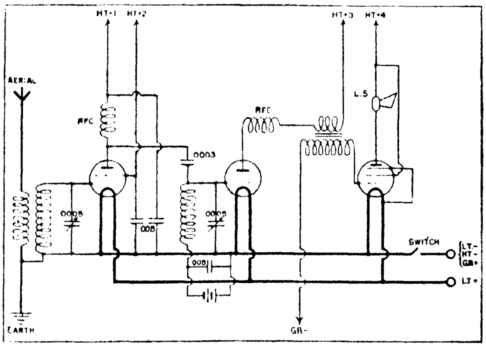


FIG. 9.—DIAGRAM OF A THREE-VALVE, OR THREE-TUBE, RECEIVER
This receiver employs a screened grid, high frequency amplifier, anode bend detector and a five-electrode transformer coupled with low frequency amplifier

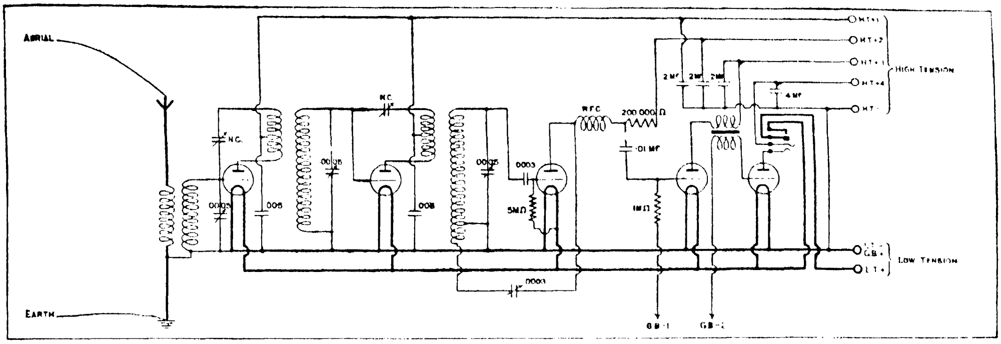


FIG. 10 — DIAGRAM OF A FIVE-VALVE, OR FIVE-TUBE, RECEIVER
This receiver employs two high frequency amplifiers neutralised, a detector, two low frequency amplifiers, one resistance capacity coupled and the other transformer coupled

by valve receivers is essential, and some interruption, depending upon local conditions, is highly probable.

No service area, whatever the power of the station, can be much greater than 100 miles radius, when using frequencies of the order of 1,500 and 500kc. (200 to 600m. wave-length), owing to wide variations of received signal strength after nightfall. This variation of signal strength is called "fading" or "night effect." Fading is believed to be due to the existence of a ray from the broadcasting station which does not travel directly over the earth's surface, but travels upwards and is then bent down from an electrified layer (called the Kennelly-Heaviside layer) in the upper atmosphere. This indirect ray does not remain constant, owing to the momentary variations of the refractive power of the electrified layer; and for this reason the listener has to contend with a constantly changing signal strength which ruins the musical value of the programme. The listener must in fact depend for service upon the direct ray which can only outbalance the reflected ray at distances which are, in practice, seldom greater than 100 miles.

For any given radiated power the extent of service area is affected by three variables: frequency of wave emitted (and therefore wave-length), type of ground around a station and what is found upon it (trees, houses, etc.), and type of transmitting aerial. The higher the frequency the more quickly the direct ray waves attenuate. The use of longer wave-lengths might appear advisable as the waves are less attenuated and the service area for a given power greatly increased. This is true, but the longer the wave-length the fewer the channels available in a given wave-length gamut. For instance, there are 50 channels in the wave band of 200 to 300m., and only one channel in the band of 1,500 to 1,600 metres. The situation with regard to interference by all the users of aether is so serious that very few "long" wave-length channels are available for broadcasting, and at the Washington Conference of 1927 only six channels were allotted for the use of broadcasting transmitters. The provisions of the Washington conference regarding long-wave broadcasting were largely ignored in Europe. The Madrid conference (1932) decided to allocate waves between 1,000 and 2,000 metres for European broadcasting services. The ideal system of producing extensive service areas relies upon a combination of long and medium waves. If no other wireless services required the use of the aether, waves of frequency 1,500 to 1,000kc. would be used for low power local services, from 1,000 to 500kc. for regional broadcasting, and from 500 to 200kc. for national broadcasting.

When waves pass over water, or wet, treeless and unpopulated ground, they do not attenuate so quickly as when they pass over ground covered by forests or towns. In fig. 6 a field strength contour map is shown, giving the result of observations for the London station, 2LO. It will be remarked that the service area is anything but circular, and that listeners, living at equal distances from the transmitter but in different directions from it will not receive the same strength of signal. This is caused by the difference in attenuations in different directions, due to the various types of obstacle over which the signal passes. Fig. 7 is a family of curves showing the attenuation of field strength when 1 kw. power is radiated at different frequencies over average English pastoral country.

(b) *Interference Between Stations.* Every broadcasting station operates by the modulation of electric waves sent out from its antennae. A more exact mode of expression would be to say that waves are sent out at a frequency N_{cw} and have added and subtracted from them waves of frequency N_m, where N_{cw} is the carrier wave and N_m the modulated wave frequency. Thus a complex disturbance $N_{cw} + N_m$ and $N_{cw} - N_m$ is radiated. Expressing this numerically, if a note of 1,000 periods per sec., *e.g.*, a note of a violin, is to be radiated and the carrier wave frequency is one million, then there are radiated out into the aether waves of frequency one million, one million plus a thousand, and one million minus a thousand. It is the function of the receiver to detect the production of beats by these frequencies so as once more to produce the note of a thousand in the telephones or loud-speakers. The added and subtracted waves are called side bands. As it is desired to reproduce frequencies up to a maximum of 10,000 cycles per second (10kc.) each broadcasting transmitter occupies effectively a frequency spectrum within the aether of 20kc. or 10kc. each side of the carrier wave frequency. If therefore a second station has the frequency of its carrier wave separated by less than 20kc. we should expect the side bands of one to interfere with the side bands of another. This assumes, theoretically, that frequency space must be left for the accommodation of two simultaneous 10kc. side bands in order that they shall not combine to produce less than a further 10kc. frequency.

At the Washington Conference of 1927 it was agreed by the Governments to allocate a frequency band for broadcasting from 1,500kc. per sec. to about 550kc. per sec. (200m. to 545m.). This means that with 30kc. separation between stations, about 30 channels exist for the exclusive use of all the broadcasting organizations. It might be expected that such a number of available channels could be increased by duplication because of the large geographical distance between stations. This is partly true, but even if stations as much as 3,000 miles apart are not separated in frequency by a minimum of 10kc. interference will result during hours of darkness and service areas will be reduced. This means that there exists room for approximately 95 medium-frequency stations if each is to be assured moderately free aether. In the lower frequencies 64kc. have been allocated, giving room for an additional six to seven stations only. It will be appreciated that relatively few channels exist for all the European broadcasting stations, numbering 300 or more.

A solution to the problem has been attempted in Europe by the technical committee of the Union Internationale de Radiophonie which represents approximately 80% of the broadcasting organizations of Europe. A plan was drawn up which gave, of the channels existing, a certain number for the exclusive use of each nation. The allocation of this number was based upon the area, population and "intellectual and commercial importance" of each nation, the latter factor being calculated upon the number of telephone calls made and telegrams sent in a given year in each country. It was found that there existed far more stations than frequencies. A certain number of frequencies therefore were classified as non-exclusive, to be shared by stations far apart in geographical distance. Such stations have to be content now to give a purely local service, as their service areas are seriously diminished by interference from the other stations with which they share channels. The remaining frequencies were allotted "exclusively" to particular nations for the use of their more important stations, whether such stations were already existing or contemplated. In spite of formal acceptance in 1926, many nations had not by the end of 1927 carried out their part in the readjustment and conditions were little improved. By 1935 comparative stability was reached; but the crowding of stations limits good quality reproduction to a strictly local station.

(c) *Distribution for National Systems.* Broadcasting has grown up in a somewhat haphazard way and knowledge has come in terms of actual experience. So far, all nations have realized that many stations of fairly low power give the most uniform distribution of service area. The system of distribution now existing in Britain is typical of most countries where the responsibility for providing a national service has been vested in one authority. It was built up first by the erection of eight main stations for the service of the principal towns and districts. These stations had "C" service areas of only about 30 miles radius, and therefore left much of the country, urban and rural, almost unserved. Other urban areas were filled up by smaller stations. These small stations are known as *relay stations* because they are linked by land line to some central studio and repeat the programme of a main station. (With a limited income it is not wise unduly to dilute programme revenue, otherwise variation in mediocrity alone results.) The main and relay stations brought practically all urban areas within a "B" service area, and consequently the rural areas only remained uncovered. This was done by one high-power station working on a lower frequency and, with the assistance of the other stations, 80% of the population were brought within the "B" service area of one programme. This involved the use of 21 channels.

This system of distribution was of relatively rapid growth in England as compared with other contemporary organizations and, being temporarily adequate, caused over two million listeners to subscribe to the service. During the years 1926 and 1927 the number of European stations rapidly increased and with their expansion the mutual interference between stations became more serious on account of the limited number of channels available. The once sufficient national distribution was so restricted by interference that it became necessary to build afresh, but with fewer stations of higher power and giving a greater service area per channel.

In countries, such as France and Spain, where private enterprise alone, chiefly or in part, provides the broadcasting service, stations are found grouped round urban areas and rural areas are comparatively neglected. This is a very obvious development since the stations are supported by advertisement revenue and therefore require to compete with others by covering densely populated areas. Nevertheless the problem of free aether is as acute in the United States as it is in Europe, and the policy which would allow the high-power station to seize for itself what aether it requires, resulting in the consequent survival of the richest organization, is an undesirable solution.

In Britain a scheme, called the regional scheme, has been framed to be gradually put into practice from 1928 onwards. The essential feature of this new scheme of distribution is the use of few, but high-powered, stations so designed and sited as to give a choice of two programmes to the maximum number of listeners. By locating two high-power transmitters at the same point their service areas are made almost coincident so that, given adequate separation between their carrier frequencies, everyone within their service areas has an equal facility for the reception of *both* programmes. A method of minimizing interference is to work two stations on exactly the same carrier wave frequency. Researches on this subject made by the B.B.C. from 1926 to 1928 show that, in spite of the fact that the carrier and side bands of each station must interfere, nevertheless good service results from one station at the points where its field strength is greater than five times that of the other sharing its wave, provided each station transmits the same programme. This should allow some economies in aether channels. Already America, Sweden, Germany and Great Britain have made attempts to place such a scheme into practical operation. (*See* also Radio and Sound.) (P. P. E.)

See L. B. Turner, *Wireless Telegraphy and Telephony* (1921); W. Greenwood, *Text-Book of Wireless Telegraphy and Telephony* (1925); A. H. Morse, *Radio: Beam and Broadcast, its Story and Patents*; J. Lawrence Pritchard, *Broadcast Reception in Theory and Practice* (1926).

BROADCAST MUSIC is one of the most prominent features of all wireless entertainment programmes, alike in Europe and America, as well as, it may be added, in all other parts of the world—Japan for instance—where broadcasting is known. Naturally, however, the mode of procedure adopted in this case and that varies greatly, and it has been thought desirable accordingly for present purposes to deal separately with existing methods and conditions in (I.) Europe and (II.) the United States.

I. GREAT BRITAIN AND THE CONTINENT

The growth of British broadcasting in its first six years can be most easily measured by the advance in the quantity and the quality of the music transmitted. Music,—of every class, because every degree of taste has to be catered to— formed all along the bulk of the programmes, latterly some 70 per cent. But the first broadcast music was of a very humble order, comparable rather with a parish room entertainment than with a serious concert. In the early days,—the latter part of 1922,—the broadcasting of opera, oratorio, or symphony concert may have been dreamt of; it was certainly not thought of as within the realm of possible achievement.

The first broadcast concert recorded in Great Britain was a garden fête at Hampstead in July, 1922, at which listeners were treated to an entertainment of unconsidered trifles of the lightest type, a note was printed at the foot of the programme, announcing that an organ pipe would be blown before the transmission to assist listeners in the tuning of their receiving sets. During the next four months, various other musical feasts helped to prepare wireless enthusiasts for the first so-called orchestral programme. It was provided by some nine players plus an assisting pianist, and comprised a selection of better class light orchestral music with vocal and instrumental relief. That was in December, 1922. It was a considerable advance upon its predecessors, but it was a slight matter compared with what was to happen in the next few weeks. The British National Opera Company was giving a Christmas season at the Royal Opera House, Covent Garden, and its directors were approached by the British Broadcasting Company (as it then was) with a view to arranging a broadcast from the theatre. On Jan. 8, 1923, Mozart's "Magic Flute" was transmitted with such success that performances of "Hänsel und Gretel," "Pagliacci," "Siegfried," "The Marriage of Figaro," "Faust," "Madame Butterfly," "La Bohème," and "The Valkyrie," followed in quick succession. And a noteworthy feature of that early stage of broadcasting's history is that the performance of Puccini's "La Bohème" had the added glamour of Dame Nellie Melba's collaboration.

The success of broadcasts on so large a scale had the inevitable result of widening the scope of the Company's own musical organization to an extent and with a rapidity that can be only briefly summarized here. The orchestra was increased, for instance, from the nine good men and true who carried the whole burden of the early concerts, by the addition of a Mustel organ which filled in the missing wood-wind parts, and by a cornet and trombone. The next step was to reinforce the Mustel organ by single wood-wind and two horns, together with a contra-bassoon to strengthen the basses. Next, the strings were augmented, and then the wood-wind; an extra trumpet, another trombone, a harp were added in turn, until a small permanent symphony orchestra of 37 carefully chosen players, with complete wood-wind, brass, and percussion, came into being. The organization is run on the "no deputy" system and can be augmented to 50, 60 or more players selected from a list of regular reinforcements. And, as a permanent chorus was established about the same time, it soon became possible to arrange complete opera and oratorio transmissions as well as concerts of symphonic music: the broadcasting studio became an opera house or concert hall according to the requirements of the programme.

While these changes and developments were going forward in the London studios—the headquarters of British broadcasting, similar organizations were being built up at the other main stations of the company. By the end of 1924 there were eight other towns in England, Scotland and northern Ireland, each of which possessed its own permanent "Wireless" orchestra and choir, conducted by a musician of experience and repute. For the first time in the history of British music, daily concerts were being given on all seven days of the week, by orchestras and choirs capable of undertaking the most serious and important works in practically every branch of music. Light and popular music naturally formed the backbone of the programmes: as interest in wireless spread, the newcomers to the great body of listeners naturally included many thousands to whom serious music was a new thing. A gradually increasing proportion of the best music of every age and country was broadcast, and at least once a week, something of the standard of a symphony concert was broadcast from every station of the company.

Some system was needed, to prevent overlapping and omission, and a scheme was prepared in accordance with which the so-called "standard music" was performed regularly on a definite plan

Nor was it only orchestral and choral music which was thus carried into most British homes. Chamber music, songs, and instrumental pieces have all been cultivated with the same care and thoroughness. At the London station a special feature was made of contemporary chamber music. Apart from the regular broadcasts of established masterpieces, a series is organized each season with the specific object of presenting to British listeners something of the latest developments in the chamber music of all schools and countries. In that way Great Britain has kept in touch with modern tendencies.

But transmissions of music from the stations were by no means the sole consideration of the Company and, later, of the Corporation. It was soon realized that greater value and interest could be given to the programmes by the broadcasting of public concerts. But here, strong opposition from existing concert organizations had to be faced, so strong indeed that the company had to institute its own public concerts. These were inaugurated by a short season at the Central Hall, Westminster, in the winter and spring of 1924 and 1925 A number of concerts in the provinces were also relayed, notably those of the Hallé Orchestra, Manchester,—which was, incidentally, the first organization to recognize the permanent importance of broadcasting,—the Scottish Orchestra, the Liverpool Philharmonic Society, the Birmingham City Orchestra, and others which were alive to the value of the new service.

During 1924 and 1925, a further series of symphony concerts was arranged by the B.B.C., in the Royal Opera House, Covent Garden. Later, the Albert Hall was tried, with an orchestra enlarged to 150 players, to meet the acoustical shortcomings of that vast auditorium. Eventually, however, the Queen's Hall, whose lessees were originally unflinching opponents of wireless music, opened its doors to broadcasting, and by the autumn of 1927, the real centre of London, as of British, music, became also the scene of the B.B.C.'s most important concerts. It will no doubt remain so until such time as the Corporation finds itself the possessor of a concert hall.

Since the autumn of 1928, choral works at these concerts have been sung by "The National Chorus," a voluntary body of 250 picked voices recruited by the B.B.C. from choral societies in the London area. Its members are all pledged to continue in active membership of their original societies, the B.B.C. hoping thus not only to avoid trespassing, but even to assist the cause of British choral music.

In 1927 the Corporation assumed responsibility for the Queen's Hall Promenade Concerts, which were on the point of coming to an untimely end. With Sir Henry Wood as conductor, the Corporation carried out a series of concerts on the traditional lines, following it in 1928 with a longer and equally successful season. Co-operation with other concert undertakings throughout the country is extending, and in 1928 the Corporation joined hands with several local authorities to found the National Orchestra of Wales, to give regular symphony and popular concerts in Cardiff. Side by side with its development of public symphony concerts, the Corporation has cultivated opera, not only by transmissions from the studios with a repertoire ranging from Monteverdi and Handel to Puccini, Debussy and Schönberg, but also by broadcasts of performances under the management of the International Company at Covent Garden, the British National, and Carl Rosa companies.

To sum up, it is not too much to say that every form of music, in the best form in which it can be heard,—from the Three Choirs Festival or the great cathedral services, through all the range of oratorio, opera, choral and symphony concerts, down to dance music and revues, in Britain, and even, by means of continental relays, abroad, has been, in the first six years of British broadcasting, brought within the reach of every home throughout the country. (P. P.)

II. UNITED STATES

When wireless was first considered for amusement purposes in the United States it was recognized that a new set of problems would have to be solved to meet conditions that were very different from those encountered in wireless used for commercial purposes, the only use made of it until that day. It was also recognized at the outset that the most important factor in the broadcasting of amusements would be the transmission of music. Its general appeal and its wide range both instrumentally and in composition gave promise of giving great variety of entertainment But naturally there was ignorance at first as to (1) what types of music could best be broadcast and (2) what kinds would most readily interest the listening public One thing, however, was certain, namely, that a far better kind of reception for the listener would have to be developed than had been attained for commercial uses. At this time, those who had devoted their time to wireless were largely engineers and their associates who were primarily concerned with its mechanical problems, but obviously if musical performances were to be introduced this demanded qualified direction and the careful study alike of the technical considerations involved and of the tastes of the public.

In the result, solo singers, male and female, were heard first; then chamber music organizations, such as string quartets and wood-wind ensembles; and finally full orchestras. As to the kind of music chosen it was found from the first that "popular" music made inevitably the widest appeal and further that with the then increasing craze for jazz music, the jazz orchestra was a particularly useful medium for broadcasting purposes; and jazz has remained in a prime position during the years intervening, a fact due both to the popular taste in music and to the exceptionally happy manner in which the typical jazz orchestra lends itself to effective transmission. Those, therefore, who may be disposed to decry the prominence given to this kind of music in broadcasting programmes must find a reason, if not a justification, for it in this fact.

Voices at first presented severe problems, especially the high soprano, which in spite of considerable research and careful adjustments remains still the most difficult kind of voice to broadcast. The contralto voice, on the other hand, is generally satisfactory, the like applying to tenors, barytones and basses. In the case of vocal ensembles the male quartet has proved a far better medium than the mixed quartet, a fact which is accountable for the large number of excellent male quartet performances which are to be heard in radio programmes to-day. So far as choruses are concerned, it has not been found practicable to broadcast more than from 16 to 20 voices from a broadcasting studio. But successful broadcasts of larger bodies have been made from what is known as a "remote control," that is by placing the microphone in a concert hall when a public performance is being given.

And the same plan has been adopted with good effect in the case of orchestral music, such famous organizations as the New York Philharmonic, the Boston Symphony and the New York Symphony orchestras, to name but three of many, having all been constantly heard in this way. The last-named orchestra has also been broadcast from a special studio in New York in a series of performances separate and distinct from its own regular concerts. In this manner the performances of these great symphonic organizations have been enjoyed by millions of music lovers who would otherwise never have had an opportunity to hear them and so have been enabled to make acquaintance, in many cases for the first time, with some of the most important works of the great masters.

Ranging between jazz and symphony, radio broadcasters have to a certain extent presented music in all other divisions of musical literature as well. Thus chamber music, religious music, operetta and musical comedy have all been represented. In the case of chamber music it is perhaps worth while pointing out that special care should be exercised in regard to the works chosen. For unless the listener to whom chamber music is new finds this music of distinct appeal, he will in no sense be won by it and will inevitably turn his dial, exercising a prerogative which is every radio listener's. Works of a decidedly melodic nature are the safest for broadcasting purposes, as has been established in numerous tests. On the other hand, harmonic subtleties which may come through well enough in concert performances are apt to suffer badly in radio transmission and thus only an imperfect account of a composition of this type is presented to the listener.

In general it may be said that there is certainly a wide field for all types of programmes and that the future of broadcasting would seem to depend on its universality of appeal more than on anything else. Commercial broadcasting, that is, hours of broadcasting which are paid for by large commercial corporations, has in many cases arrested the wheels of progress in this field, the desire too often being merely to interest the largest number of listeners by means of performances of the most popular and obvious types of music, in presentations often undignified and boisterous. But this would seem to be but a passing phase, and the more enlightened broadcasters of this class have long since begun to recognize the value of good music in their appeals to the unseen public.

Attempts have been made to broadcast recitals of organ music, as well as performances on the organ in church services, many of which are regular features of Sunday radio programmes. On the whole, however, the organ does not broadcast well, owing partly to its excessive volume, which is apt to present difficulties to the operators responsible for its transmission. Fearing, consequently, that the full organ will "blast" and generally work havoc, the latter are inclined too often to adopt excessive toning-down methods which are fatal to satisfactory results so far as the hearer is concerned.

Nor is it only organ music which suffers in this way. Indeed, the situation which obtains to-day as regards the artistic sending out of music requires the attention of all serious-minded musicians and music lovers As has been already said, while wireless itself is not new, its application for the purposes of entertainment is still in its comparatively early stages: to which it may be added that it demands specially-trained and musically-equipped operators if the best results are to be expected. Yet in point of fact comparatively few of the earlier operators, whose standard of culture generally speaking hardly surpassed that of telegraphists, were so equipped, nor are they to-day, many of them possessing no knowledge of music at all. Hence the unsatisfactory character of so many of the broadcast performances, as these men do not know the compositions which they are sending out and frequently, by a simple move of the hand on their boards, destroy a musical effect which an orchestra and conductor have perhaps spent hours of rehearsal to obtain.

The future, certainly as regards the broadcasting of concert music, or music that is of better quality than the popular music of the day, will call for operators schooled in musical literature, and sensitive to the effects which conductors, instrumentalists and vocalists are striving to achieve. The question is indeed whether the existing operators are to become musicians or whether those already musically trained should be chosen as operators; and there can hardly be any doubt as to the course which should be adopted. Hence it is probable that all radio stations of the future will be manned by musically-educated operators who will be capable of dealing in an efficient and artistic manner with the musical performances which they are called on to send out.

There has been considerable speculation as to what the tastes of the radio audience really are. Arguments have been advanced contending that as a large percentage of this audience is unfamiliar with concert music, the projecting of programmes of this kind of music on the air cannot satisfy the general taste. There would seem, however, to be another side to this. In the drama and in all departments of the stage, whether light opera, grand opera, or musical comedy, there have always been those who believe in giving the public the obvious, and frequently, the meretricious, classifying this procedure under the head of giving the public "what it wants." A consideration of the history of the stage offers convincing proof, however, that in the long run this is not always the soundest or even the most profitable policy. On the contrary, managers of the more far-sighted class have constantly produced works with limited appeal but definite artistic substance, which in time have become classics and whose original unpopularity has seemed incomprehensible to later generations. And, beyond question, this is the policy which will always commend itself to the idealist and to the director with vision, as opposed to the one who desires immediate success, universal approval and quick commercial profits.

Radio broadcasting in the United States of America will unquestionably be obliged to make the choice between these conflicting policies. (A. W. Kr.)

BROADSIDE, sometimes termed BROADSHEET, a single sheet of paper containing printed matter on one side only. The broadside seems to have been employed from the beginning of printing for royal proclamations, papal indulgences and similar documents. England appears to have been its chief home, where it was used chiefly for ballads but also as a means of political agitation and for personal statements of all kinds, especially for the dissemination of the dying speeches and confessions of criminals. It is prominent in the history of literature because several important poems, by Dryden, Butler and others, originally appeared printed on the "broad side" of a sheet. The term is also used of the simultaneous discharge of the guns on one side of a ship of war.

In Advertising.—In advertising, "broadside" means a single sheet of paper with an advertising message printed either on one side or on both sides that is distributed by mail or otherwise by an advertiser to customers or prospective customers. These sheets, often as large as 25in. by 38in., are folded down to a size practicable for mailing purposes, generally not larger than 5 by 10 inches. When distributed by mail, the broadside is sometimes enclosed in an envelope; on other occasions it is sent without an envelope, the address being placed on the broadside itself, which commonly is prevented from unfolding by such devices as a paster, the postage stamp or a clip. As the reader unfolds the broadside, each area disclosed by this unfolding usually bears an advertising message or other printing. The chief characteristic of the broadside is its impressive size when fully opened, a fact which permits the advertiser to secure marked emphasis through the employment of big type, and large headlines and illustrations. Some broadsides are issued with the intention of having the merchants to whom they are sent display them in their windows.

BROADSTAIRS, a watering-place in the Isle of Thanet (Kent), England, 3 mi. S.E. of Margate, on the Southern railway. Pop. of urban district of Broadstairs and St. Peter's (est. 1938) 13,230. Area 4.7 sq.mi. From 1837 to 1851 Broadstairs was a favourite summer resort of Charles Dickens, who, in a sketch called "Our English Watering-Place," described it as "left high and dry by the tide of years." This seaside village, with its "semicircular sweep of houses," grew into a considerable town owing to the influx of summer visitors. A concert pavilion was opened in 1933 and in 1935 the council bought the Northcliffe estate of 263 ac., including a golf course. Dickens' residence was called Fort House, but it became known as Bleak House, through association with his novel of that name. Broadstairs has a small pier for fishing boats, first built in the reign of Henry VIII. Not far off is the site of a chapel of the Virgin, to which ships were accustomed to lower their topsails as they passed. Kingsgate, north of Broadstairs on the coast, changed its name from St. Bartholomew's Gate in honour of Charles II's landing here with the duke of York in 1683 on his way from London to Dover.

BROADSWORD, a sword with a broad blade, used normally for delivering a cut rather than a thrust. (*See* CLAYMORE.)

BROADWAY, the main street of New York city (*see* NEW YORK CITY).

BROCA, PAUL (1824–1880), French surgeon and anthropologist, was born at Sainte-Foy la Grande, Gironde, June 28, 1824. After completing his medical studies in Paris, he rose rapidly in his profession; in 1867 he became a member of the Academy of Medicine and professor of surgical pathology to the Faculty. He published treatises on cancer, aneurism, etc., and in 1861 announced his discovery of the seat of articulate speech in the left side of the frontal region of the brain, since known as the convolution of Broca. To him is due the formula that a full-grown man should weigh as many kilogrammes as he measures centimetres in height over one metre. But his name is associated most closely with the modern school of anthropology. Establishing the Anthropological Society of Paris in 1859, of which he was secretary till his death, he was practically the inventor of the modern science of craniology. He founded *La Revue d'Anthropologie* in 1872, and it was in its pages that the larger portion of his writings appeared. Later Broca turned to the exclusive study of the brain, in which his greatest triumphs were achieved (*see* APHASIA). He died July 9, 1880. He received his Legion of Honour in 1868 and was honorary fellow of learned societies throughout the world.

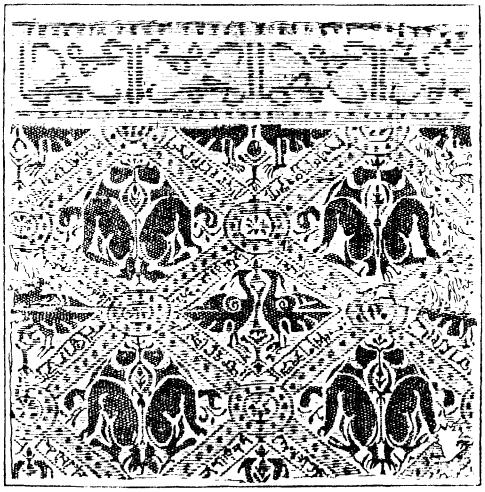
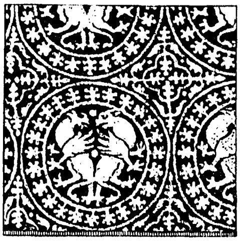


FIG. 1.—SICULO-SARACENIC BROCADE OF THE 11TH OR 12TH CENTURY
Five and one-half inches square, this brocade is woven in red and olive green silks and gold thread on a cream-coloured ground. Along the top is the Kufic inscription, "Ar-rahman" (The Merciful), several times repeated

BROCADE, the name usually given to a class of decorative textiles enriched on their surface with weavings in low relief, of which the floating threads at the back hang loose or are cut away.



BY COURTESY OF THE DIRECTOR OF THE VICTORIA AND ALBERT MUSEUM

FIG. 2.—RHENISH-BYZANTINE BROCADE OF 12TH OR 13TH CENTURY
This brocade is woven in gold thread on a red silk ground 7 by 9¼ inches

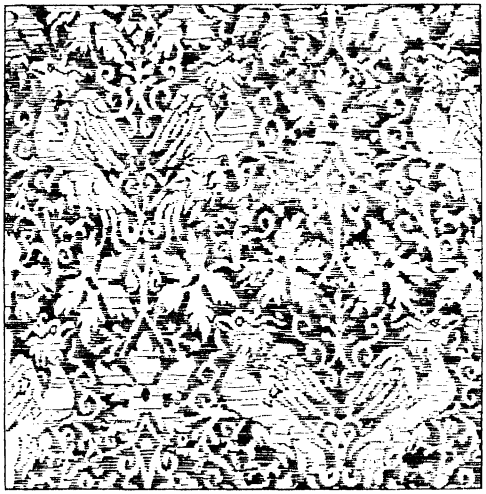


FIG. 3.—NORTH ITALIAN BROCADE OF THE 14TH CENTURY, 11 IN. SQUARE
This is a piece of blue satin brocaded with gold threads. The bird shapes are remotely related to, if not derived from, the Chinese mystical "fong-hoang" (鳳 凰)

The Latin word *broccus* is related equally to the Italian *brocato*, the Spanish *brocar* and the French *brocarts* and *brocher*, and implies a form of stitching or broaching, so that textile fabrics woven with an appearance of added stitching or broaching have consequently come to be termed "brocades." A Spanish document dated 1375 distinguishes between *los draps d'or é d'argent o de seda* and *brocats d'or é d'argent*, a difference which is perceived when, for instance, the make of cloths of gold, Indian kincobs, is compared with that of Lyons silks *brochés* with threads of gold, silk or other material. Indian kincobs and dainty gold and coloured silk-weavings of Persian workmanship are sometimes called brocades, although in neither is the ornamentation broché or brocaded. A wardrobe account of King Edward IV. (1480) has an entry of "satyn broched with gold"—a description that applies to a north Italian brocade of the 14th century, such as that shown in fig. 3. Some three centuries earlier, decorative stuffs were partly *brochés* with gold threads by oriental weavers of Persia, Syria and parts of southern Europe and northern Africa; and the 11th or 12th century Siculo-Saracenic specimen in fig. 1, is an example in which the heads of the pairs of animals and birds are broached with gold thread. Of typically Mohammedan design finely displayed, is the sumptuous Siculo-Saracenic brocade of coloured silks and gold threads from the famous Hotel des Tiraz in Palermo made into an official robe of Henry VI. (1165–97) as emperor of the Holy Roman empire, and now in the cathedral of Regensburg (fig. 2); it is a variety of brocade design of 12th or 13th century Rhenish-Byzantine manufacture. Spanish weavers, contemporarily working at Almeria, Malaga, Grenada and Seville used corresponding designs. In the 14th century the making of satins heavily brocaded with gold threads was associated conspicuously with such Italian towns as Lucca, Genoa, Venice and Florence. Fig. 3 is from a piece of

14th century dark-blue satin broched in relief with gold thread in a design similar to that in the background of Orcagna's "Coronation of the Virgin," now in the National Gallery, London. During the 17th century, Genoa, Florence and Lyons vied with each other in making brocades. Fig. 4 is of a piece of French brocade of late 17th century, and fig. 5 is from a more simply composed design, in which the brocading is done with coloured silks only. During the 18th century Spitalfields competed with Lyons in manufacturing many sorts of brocades, specified in a collection of designs preserved in the art library of the Victoria and Albert museum in London, as "brocade lustring, brocade tabby, brocade tissue, brocade damask, brocade satin, Venetian brocade, and India figured brocade." Brocading in China seems to be of considerable antiquity, and Dr. Bushell in his valuable handbook on Chinese art cites a notice of five rolls of brocade with dragons woven upon a crimson ground, presented by the emperor Ming Ti of the Wei dynasty, in the year A.D. 238, to the reigning empress of Japan; and varieties of brocade patterns are recorded as being in use during the Sung dynasty (960–1279). The first edition of an illustrated work upon tillage and weaving was published in China in 1210, and contains an engraving of a loom constructed to weave flowered-silk brocades such as are woven at the present time at Suchow, Hangchow and elsewhere. Although described usually as brocades, certain specimens of imperial Chinese robes sumptuous in ornament, sheen and the glisten of golden threads, are woven in the tapestry-weaving manner and without brocading.

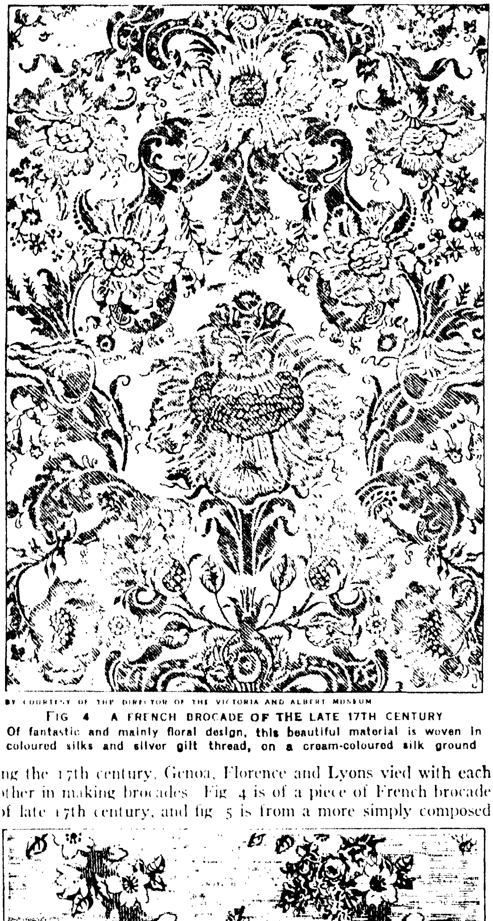


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FIG. 4.—A FRENCH BROCADE OF THE LATE 17TH CENTURY

Of fantastic and mainly floral design, this beautiful material is woven in coloured silks and silver gilt thread, on a cream-coloured silk ground

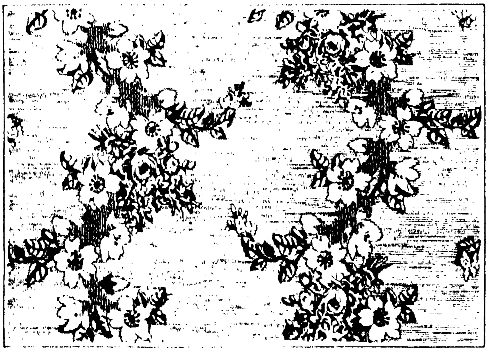

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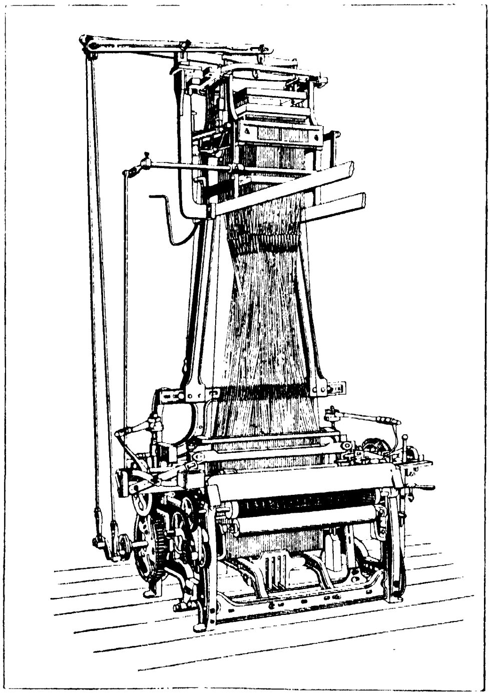
FIG. 5.—FRENCH BROCADE OF 3RD QUARTER OF THE 18TH CENTURY

This silk brocade is woven on a pale blue ribbed ground, with a pattern of roses and other flowers 45 in. by 19½ inches

BROCADE OF COTTON. The word brocade is employed as a conventional trade term to describe a wide range especially of cotton fabrics of simple structure and consisting of one series each of warp and weft threads, as distinct from compound structures with two or more of each series of those threads. Originally, however, the term "brocade" applied more particularly to fabrics produced from silk and sometimes richly embellished with figuring of gold and silver threads that were "broched," "pricked" or "stitched" into the woven fabric in order to develop a raised or embossed pattern, in the style of embroidery. (*See* BROCADE.)

The type of fabrics generally described as "cotton brocades," as produced by modern powerlooms (of which a typical model is illustrated in fig. 1), are embellished with Jacquard figuring developed by causing either warp, weft, or both series of threads to "float," or lie more or less freely, in the figure portions of the



BY COURTESY OF MESSRS. HACKING AND COMPANY, LTD

FIG. 1.—LANCASHIRE MODERN POWER LOOM, EQUIPPED WITH DOUBLE-ACTING JACQUARD MACHINE AND FIGURING HARNESS FOR COTTON BROCADE FABRICS

design, usually on a neutral ground texture of the plain calico or "tabby" weave, or other suitable weave structure, in order to develop an effect in contrast with that of the figuring.

Cotton brocades constitute one of the largest classes of woven fabrics that are employed for an infinite variety of domestic purposes, as, for example, bed counterpanes, hangings, curtains, table covers, and similar household articles; while those of lighter texture are used as ladies' and children's dress fabrics.

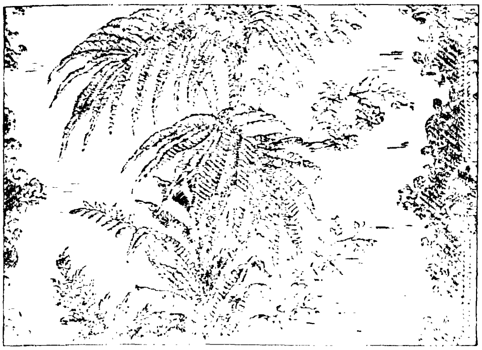


FIG. 2.—COTTON BROCADE WITH ALL-WEFT FIGURING ON A NEUTRAL GROUND TEXTURE OF THE CALICO WEAVE

Cotton brocade fabrics may be broadly classified under the following chief modifications, viz :

1. With all-weft figuring on a neutral ground texture of the calico weave, as in the example illustrated in fig. 2.
2. With all-warp figuring on a neutral ground texture.
3. With all-weft figuring on an all-warp ground texture.
4. With all-warp figuring on an all-weft ground texture.
5. With warp and weft figuring on a neutral ground texture.
6. With warp and weft figuring on a diapered ground texture, as in the example illustrated in fig. 3.

Reversible Fabrics.—In addition to these chief modifications, the brocade principle of weaving permits of endless combinations of the above-named variations. It will be apparent, therefore, that brocade textures are virtually reversible in respect of the general design, but not in respect of colour where warp and weft threads are of different colour.

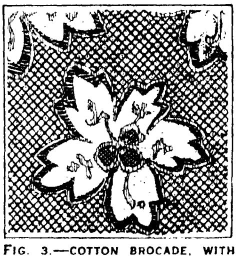


FIG. 3.—COTTON BROCADE, WITH WARP AND WEFT FIGURING ON A DIAPERED GROUND TEXTURE

Brocade fabrics are made either one-sided or reversible, according to the particular purpose for which they are intended. If they are not reversible they are usually produced with warp and weft of widely different counts and quality, and also with a greater number of threads per inch in one direction than in the other. For the purpose of hangings and curtains in which both sides of the fabric are exposed to view, the disparity in the counts, quality, and the relative amount of warp and weft, may be less pronounced than for dress materials and furnishing fabrics, of which one side only will be exposed to view, when in use. *See* H. Nisbet, *Grammar of Textile Design* (1927). (H. N.)

BROCCHI, GIOVANNI BATTISTA (1772–1826), Italian mineralogist and geologist, was born at Bassano. His treatise on the iron mines of Mella, *Trattato mineralogico e chemico sulle miniere di ferro del dipartimento del Mella* (1808), procured him the office of inspector of mines in the recently established kingdom of Italy. His most important work is the *Conchiologia fossile subapennina con osservazioni geologiche sugli Apennini, e sul suolo adiacente* (Milan, 1814), containing accurate details of the structure of the Apennine range, and an account of the fossils of the Italian Tertiary strata compared with existing species. In his *Dello stato fisico del suolo di Roma* (1820) he corrected the erroneous views of Breislak, who conceived that Rome occupies the site of a volcano, to which he ascribed the volcanic materials that cover the seven hills. Brocchi died at Khartum while on a geological expedition to the Sudan.

BROCCOLI. In the United States the name broccoli has been applied to two different vegetables, with much resultant confusion. Heading broccoli (*Brassica oleracea* form *botrytis*) is superficially indistinguishable from Cauliflower (*B. oleracea* form *botrytis cauliflora*) and is regularly bought as cauliflower in the food markets without any possible objections. The large, white, firm compact "curd" of abortive flower parts forms deeply within the rosette of large leaves. It is essentially a large, more cold-hardy, slower-growing, winter type of cauliflower. Sprouting broccoli (*B. oleracea* var. *italica*) also called Italian broccoli and green sprouting broccoli, produces a tall, branching plant. The edible parts are the tops of the green, thick main central flower stalks and the secondary stalks together with the dark green cluster of unopened flower buds. The terminal 8 or 9 in. of the flower stalk and flower buds is harvested together with a few of the small cauline leaves. The flavour is distinctive but more like cabbage than like cauliflower. Sprouting broccoli became popular in the U.S. only after 1920 although well known in England and Europe for a long time. It is usually boiled briefly and served with butter, olive oil or cream sauce. (*See* CABBAGE.) (V. R. B.)

BROCHANTITE, a mineral species consisting of a basic copper sulphate ($Cu_4[OH]_6SO_4$), crystallizing in the orthorhombic system. The crystals are usually small and are prismatic or acicular in habit; they have a perfect cleavage in one direction. They are transparent to translucent, with a vitreous lustre; and are of an emerald-green to blackish-green colour. Specific gravity 3.907; hardness 3½–4. The mineral has been found associated with malachite, etc., in copper mines at several places. A microscopical examination of the green copper ores of secondary origin in the Clifton and Morenci district of Arizona proves brochantite to be of extremely common occurrence mostly intergrown with malachite, which effectually masks its presence. (L. J. S.)

BROCK, SIR ISAAC (1769–1812), British soldier and administrator, was born at St. Peter Port, Guernsey, on Oct. 6, 1769. Joining the army at the age of 15 as an ensign of the 8th regiment, he became a lieutenant-colonel in 1797, after less than 13 years' service. From 1802 to 1805 he was with his regiment in Canada, returning thither in 1806 in view of the imminence of war between Great Britain and the United States. In 1810 he assumed the command of the troops in Upper Canada, and then took over the civil administration of that province as provisional lieutenant-governor. On the outbreak of the war of 1812 Brock had to defend Upper Canada against invasion by the United States. In the face of many difficulties and not a little disaffection, he organized the militia of the province, drove back the invaders, and on Aug. 16, 1812, with about 730 men and 600 Indians commanded by their chief Tecumseh, compelled the American force of 2,500 men under General William Hull (1753–1825) to surrender at Detroit, an achievement which gained him a knighthood of the Bath and the popular title of "the hero of Upper Canada." From Detroit he hurried to the Niagara frontier, but on Oct. 13 was killed at the battle of Queenston Heights.

His *Life and Correspondence* by his nephew, Ferdinand Brock Tupper (2nd ed., 1847), still remains the best; later lives are by D. R. Read (Toronto, 1894), and by Lady Edgar (1905).

BROCK, SIR THOMAS (1847–1922), English sculptor, was the chief pupil of Foley, and later became influenced by the new romantic movement. His group "The Moment of Peril" was followed by "The Genius of Poetry," "Eve," and other ideal works that mark his development. His busts, such as those of Lord Leighton and Queen Victoria; his statues, such as "Sir Richard Owen" and "Dr. Philpott, bishop of Worcester"; his sepulchral monuments, such as that to Lord Leighton in St. Paul's cathedral, a work of singular significance, refinement and beauty; and his memorial statues of Queen Victoria, at Hove and elsewhere, are examples of his power as a portraitist, sympathetic in feeling, sound and restrained in execution, and dignified and decorative in arrangement. The colossal equestrian statue of "Edward the Black Prince" was set up in the City Square in Leeds in 1901, the year in which the sculptor was awarded the commission to execute the vast Imperial Memorial to Queen Victoria in front of Buckingham Palace. Brock was elected an associate of the Royal Academy in 1883 and full member in 1891. Among his later works were: busts of King Edward VII (1911), Lord Lister (1913, for the Royal College of Surgeons, London) and Edwin Abbey, R.A. (1917, for the British School in Rome); statues of Captain Cook (1914, in the Mall, London) and of Lord Sydenham (1915, in Bombay). In 1911 he was created K.C.B. He died in London Aug 22, 1922.

BROCKDORFF-RANTZAU, ULRICH, COUNT VON (1869–1928), German diplomatist, was born in Slesvig Nord, May 29 1869. He entered the diplomatic service in 1894. He was consul-general at Budapest, 1909–12 and German minister at Copenhagen, 1912–18. On Dec. 20, 1918, he was appointed secretary of state for foreign affairs, in which capacity he led the German delegation at the Peace Conference at Versailles in April 1919. Unwilling to advise the German government to accept the terms of the Treaty of Versailles, he resigned on June 20. In 1922 he was appointed German ambassador in Moscow. He died while on leave in Berlin on Sept. 8, 1928.

BROCKEN, a mountain of Germany, in Prussian Saxony, the highest point (3,733 ft.) of the Harz, and indeed of north Germany. Its huge, granite-strewn dome commands magnificent views in all directions; to Magdeburg and the Elbe, Leipzig and the Thuringian forest. A mountain railway (12 mi.) gives access to the summit. In the folklore of north Germany the Brocken holds an important place, and long after the introduction of Christianity traditional rites continued to be enacted here annually on Walpurgis night (May 1). In literature it is represented in the famous "Brocken scene" in Goethe's *Faust*.

BROCKEN BOW, SPECTRE OF THE BROCKEN. A phenomenon frequently observed on mountain peaks but recorded in literature with special reference to the Brocken is an enormously magnified shadow of an observer cast when the sun is low upon the upper surfaces of clouds that are below the mountain. The shadow, often accompanied by coloured bands, is known as the spectre of the Brocken and is given a mystical significance in the folklore of the mountain. The phenomenon of rainbow-like bands around a shadow on clouds, called the Brocken bow or *glory* is commonly observed in aeroplanes. When an aeroplane is flying above a cloud layer in sunlight, a system of coloured rings is seen around the shadow of the aeroplane on the clouds. This ring or bow has a diameter about the same as the wingspread of the aeroplane. The phenomenon is recognized as one of diffraction (*see* LIGHT) and the droplets of the cloud are thought to behave like tiny mirrors which, if the analogy is correct, would produce the same effect as a diffraction screen. The effect is visible only against the shadow. The colours exhibited depend on the size of the droplets, the largest ones producing the most brilliant colours. (H. R. B.)

BROCKES, BARTHOLD HEINRICH (1680–1747), German poet, was born at Hamburg on Sept. 22, 1680. He studied jurisprudence at Halle, and after extensive travels in Italy, France and Holland, settled in his native town in 1704. In 1720 he was appointed a member of the Hamburg senate, and entrusted with several important offices. Six years (from 1735 to 1741) he spent as *Amtmann* (magistrate) at Ritzebüttel. He died in Hamburg Jan. 16, 1747. Brocke's poetic works were published in a series of nine volumes under the fantastic title *Irdisches Vergnügen in Gott* (1721–48); he also translated Marini's *La Strage degli innocenti* (1715), Pope's *Essay on Man* (1740), and Thomson's *Seasons* (1745). He was one of the first German poets to substitute for the bombastic imitations of Marini, to which he himself had begun by contributing, a clear and simple diction. His verses, artificial and crude as they often are, express a reverential attitude towards nature and a religious interpretation of natural phenomena which was new to German poetry.

Brockes' autobiography was published by J. M. Lappenberg in the *Zeitschrift des Vereins für Hamburger Geschichte*, ii (1847). *See* also A. Brandl, *B. H. Brockes* (1878), and D. F. Strauss, *Brockes und H. S. Reimarus* (*Gesammelte Schriften*, ii).

BROCKET, the name given to a yearling stag of the red-deer (*q.v.*), and hence to several South American deer whose simple horns resemble those of a stag a year old.

BROCKHAUS, FRIEDRICH ARNOLD (1772–1823), German publisher, was born at Dortmund, on May 4, 1772. He devoted two years at Leipzig to the study of modern languages and literature, after which he set up an emporium for English goods. In 1805 he began business as a publisher. About 1808 Brockhaus purchased the copyright of the *Konversations-Lexikon*, which was started in 1796, and in 1810–11 he completed the first edition of this encyclopaedia (17th ed. 1908–10; new impression 1920); a second edition under his own editorship was begun in 1812. His business extended rapidly, and in 1818 Brockhaus removed to Leipzig, where he established a large printing house. Among the more extensive of his many literary undertakings were the critical periodicals—*Hermes*, the *Literarisches Konversationsblatt* (afterward the *Blätter für literarische Unterhaltung*), and the *Zeitgenossen*, and some large historical and bibliographical works, such as Raumer's *Geschichte der Hohenstaufen*, and Ebert's *Allgemeines bibliographisches Lexikon*. F. A. Brockhaus died at Leipzig on Aug. 20, 1823. The business was carried on by his sons, Friedrich (1800–65), who retired in 1850, and Heinrich (1804–74), under whom it was considerably extended. In the years 1842–48, Heinrich Brockhaus represented Leipzig in the Saxon second chamber, was made honorary citizen of that city in 1872, and died there on Nov. 15, 1874. He was succeeded by his sons Eduard (1829–1914), and Rudolf (1838–98). Eduard was a member of the Reichstag (1871–78), and one of the accepted leaders of the book trade in Germany. The business was continued by members of the family.

See H. E. Brockhaus, *Friedrich A. Brockhaus, sein Leben und Wirken nach Briefen und andern Aufzeichnungen* (Leipzig, 1872–81), and *Die Firma F. A. Brockhaus von der Begründung bis zum hundertjährigen Jubiläum 1805–1905* (Leipzig, 1905).

Another of Friedrich's sons, HERMANN BROCKHAUS (1806–1877), German Orientalist, was born at Amsterdam on Jan. 28, 1806. He was appointed extraordinary professor in Jena in 1838, and in 1841 at Leipzig, where in 1848 he was made ordinary professor of ancient Semitic. He died at Leipzig on Jan. 5, 1877. His most important work was the *editio princeps* (1839) of the *Kathā-sarit-sāgara*, "The Ocean of the Streams of Story" the large collection of Sanskrit stories made by Soma Deva in the 12th century.

BROCKLESBY, RICHARD (1722–1797), English physician, was born at Minehead, Somersetshire, on Aug. 11, 1722. He was educated at Baltimore, in Ireland, where Edmund Burke was a schoolfellow, studied medicine at Edinburgh, and graduated at Leiden in 1745. Appointed physician to the army in 1758, he served in Germany during part of the Seven Years' War, and on his return settled down to practise in London. In 1764 he published *Economical and Medical Observations*, which contained suggestions for improving the hygiene of army hospitals. He was warmly attached to Dr. Johnson, to whom about 1784 he offered an annuity of £100 for life, and whom he attended on his deathbed, while in 1788 he presented Burke with £1,000, and offered to repeat the gift "every year until your merit is rewarded as it ought to be at court." He died on Dec. 11, 1797, leaving his house and part of his fortune to his grandnephew, Dr. Thomas Young.

BROCKTON, a city of Plymouth county (Mass.), United States, about 20 mi. S. of Boston; served by the New York, New Haven and Hartford railroad. Its area is 21.4 sq.mi. Its population in 1920 was 66,254, of whom 17,124 were foreign-born whites, and in 1940, by the federal census, was 62,343.

The manufacture of men's shoes is the main industry. In 1940 there were 21 shoe factories with an output valued at $35,000,000; 59 boot and shoe cut stock and findings factories with products valued at $14,339,555. There are also numerous other industries producing articles used by the shoe manufacturers, such as patterns, trimmings, rands, blackings and stains (for which the water supply is especially suited), machinery and tools. Brockton is the trading centre for a large population, and is headquarters of the county farm bureau. An annual fair, with an attendance in recent years of over 215,000, has been held since 1873, to promote the agricultural, industrial and educational interests of the city and the county. No dividends are paid, the directors serve without salary, and the profits are used for such purposes as providing scholarships for boys and girls of the county.

The savings banks of the city in 1940 carried 62,391 accounts, with deposits aggregating $7,334,000. The assessed valuation of property was $72,252,275. The city spends annually nearly $1,000,000 on public schools and libraries, and nearly $300,000 on sanitation and the conservation of health. For three successive years it won the state award for the best milk supply in Massachusetts. Its death rate is exceptionally low for an industrial city.

Brockton was a part of Bridgewater until 1821, when it was incorporated as the town of North Bridgewater. Its present name was adopted in 1874, and the city was chartered in 1881. It was the first city in Massachusetts to abolish all grade crossings (1896); and was a pioneer in using electricity for lighting the streets and operating the street railway system.

BROCKVILLE, first town incorporated in upper Canada (1832), port of entry, Ontario, Canada, capital of Leeds county, named after General Sir Isaac Brock, 119 mi. S.W. of Montreal, on the left bank of the St. Lawrence, and Canadian National railway, with a branch to the Canadian Pacific. Steamers go to St. Lawrence and Lake Ontario ports, and it is a summer resort. Hardware, furnaces, agricultural implements, automobiles, motor boats and chemicals are made. It is a dairy centre, and ships large quantities of cheese and butter. Pop. (1941) 11,342.

BROD, MAX (1884–), German writer, was born in Prague on May 27, 1884, of Jewish parents. He received his education in Prague, and afterward worked there, first as a government official, and later on the staff of the *Prager Tagblatt.* Brod's work is strongly steeped in that peculiar compound of the Jewish Czech and German national spirits which makes the German literature of Prague a thing apart—fantastic, mystic, with flashes of violent realism, strongly erotic, intellectually acute and abnormally sensitive to atmosphere. Brod's own work is further characterized by exceptional narrative skill and limpidity of style. His chief works are: *Schloss Nornepygge* (1908); *Jüdinnen* (1909); *Weiberwirtschaft* (1913); *Tycho Brahes Weg zu Gott* (1916; English tr. *Tycho Brahe's Redemption,* 1928); *Reubeni* (1925); *Die Frau, nach der man sich sehnt* (1927); *Lord Byron kommt aus der mode* (1929), a play; *Heinrich Heine* (1934); *Novellen aus Böhmen* (1936); *Franz Kafka* (1937).

BROD, a rural town of Yugoslavia, on the left bank of the river Sava. Pop. (1931) 13,778. The railway from Zagreb to Belgrade crosses the river here; and Brod is the junction for the principal Bosnian line, to Sarajevo, Mostar and the Adriatic. In the partition of Yugoslavia in 1941 Brod became a part of Croatia, an Italian protectorate. Brod has a considerable transit trade in cereals, wines, spirits, prunes and wood. Its chief industries are plum-growing and pig-rearing. It has also a distillery and showrooms for agricultural implements. It is sometimes called Brod na Savi to distinguish it from Basanski Brod across the river. The town owes its name to a ford (Serbian *brod*) of the Sava, and dates at least from the 15th century. Brod was frequently captured and recaptured in the wars between Turkey and Austria; and it was here that the Austrian army mustered in 1878 for the occupation of Bosnia.

BRODERIP, WILLIAM JOHN (1789–1859), English naturalist, was born in Bristol and became a metropolitan police magistrate, first at the Thames police court and then at Westminster. He was one of the founders of the Zoological Society of London, and his collection of shells was ultimately bought by the British Museum. His works are *Zoological Recreations* (1848) and *Leaves from the Note-book of a Naturalist* (1852).

BRODIE, SIR BENJAMIN COLLINS (1783–1862), 1st Bart., English physiologist and surgeon, was born in 1783 at Winterslow, Wiltshire. He was assistant surgeon at St. George's hospital for more than 30 years. In 1810 he was elected a fellow of the Royal Society. Probably his most important work is *Pathological and Surgical Observations on the Diseases of the Joints,* in which he attempts to trace the beginnings of disease in the different tissues that form a joint, and to give an exact value to the symptom of pain as evidence of organic disease. This volume led to measures of a conservative nature in the treatment of diseases of the joints, with consequent reduction in the number of amputations and the saving of many limbs and lives. His name is applied to certain diseases of the bones and joints. Brodie was created a baronet in 1834, and was the first president of the General Medical council. He died at Broome Park, Surrey, Oct. 21, 1862.

See F. H. Garrison, *History of Medicine,* p. 484 (1929).

BRODIE, PETER BELLINGER (1815–1897), English geologist, was born in London, and studied at Emmanuel college, Cambridge, where he came under the spell of Sedgwick. Entering the church in 1838, he held various preferments, but all his leisure time was devoted to geology. In the Vale of Wardour he discovered in Purbeck Beds the isopod named by Milne-Edwards *Archaeoniscus Brodiei.* Fossil insects formed the subject of his special studies (*History of the Fossil Insects of the Secondary Rocks of England,* 1845), and many of his papers relate to them.

See Memoir by H. B. Woodward in *Geological Magazine,* 1897.

BROEKHUIZEN, JAN VAN (Janus Broukhusius), (1649–1707), Dutch classical scholar and poet, was born at Amsterdam. He entered the army, and in 1674 was sent with his regiment to America, in the fleet under Admiral de Ruyter, but returned to Holland the same year. In 1678 he was sent to the garrison at Utrecht, where he became the friend of Graevius. Later he became a captain of one of the companies then at Amsterdam. After the Peace of Ryswick, 1697, his company was disbanded and he retired on a pension.

His Dutch poems, in which he followed the model of Pieter Hooft, were first published in 1677; a later edition, with a biography by D. van Hoogstraten, appeared in 1712, the last edition, 1883, was edited by R. A. Kollewijn. His classical reputation rests on his editions of Propertius (1702) and Tibullus (1707). His Latin poems (*Carmina*) appeared in 1684; a later edition (*Poemata*) by D. van Hoogstraten appeared in 1711. The *Select Letters* (*Jani Browkhusii Epistolae Selectae,* 1889 and 1893) were edited by J. A. Worp, who also wrote his biography (1891).

BROENDSTED, PETER OLUF (1780–1842), Danish archaeologist and traveller, was born at Fruering in Jutland. After a visit to Italy, he spent the years 1810–13 in research and excavation in Greece; later (1820–21), while envoy at the papal court, he visited Sicily and the Ionian Islands for that purpose. In 1832 he returned to Copenhagen as director of the museum; he was made rector in 1842 and died in the same year. His principal work was *Travels and Archaeological Researches in Greece* (in German and French, 1826–30), of which only two volumes were published, dealing with the island of Ceos and the metopes of the Parthenon. A volume of his letters (*Memoirer og Breve*) was published at Copenhagen in 1926.

BRÖGGER, WALDEMAR CHRISTOFER (1851–1940), Norwegian geologist, born in Christiania (Oslo) on Nov. 10, 1851, and educated in that city. He was professor of mineralogy and geology from 1881 to 1890 in the university of Stockholm, and from 1890 in the university of Christiania, of which he later became Rector. His observations on the igneous rocks of south Tirol compared with those of Christiania afford much information on the relations of the granitic and basic rocks. The subject of the differentiation of rock-types in the process of solidification as plutonic or volcanic rocks from a particular magma received much attention from him. He dealt also with the Palaeozoic rocks of Norway, and with the late glacial and post-glacial changes of level in the Christiania region. He died Feb. 17, 1940.

BROGLIE, DE, the name of a noble French family which, originally Piedmontese, emigrated to France in the year 1643. The head of the family, François Marie (1611–56), then took the title of comte de Broglie. He had distinguished himself as a soldier, and died as a lieutenant-general, at the siege of Valenza, July 2, 1656. His son, Victor Maurice, Comte de Broglie (1647–1727), served under Condé, Turenne and other great commanders of Louis XIV, becoming *maréchal de camp* in 1676, lieutenant-general in 1688, and marshal of France in 1724.

The eldest son of Victor Maurice, François Marie, afterward Duc de Broglie (1671–1745), served continuously in the War of the Spanish Succession and was present at Malplaquet. The war in Italy called him into the field again in 1733, and in the following year he was made marshal of France. In the campaign of 1734 he fought the battles of Parma and Guastalla. A famous episode was his narrow personal escape when his quarters on the Secchia were raided by the enemy on the night of Sept. 14, 1734. In 1735 he directed a war of positions with credit, but he was soon replaced by Marshal de Noailles. He was governor-general of Alsace when Frederick the Great paid a secret visit to Strasbourg (1740). In 1742 de Broglie was appointed to command the French army in Germany, but such powers as he had possessed were failing him, and he had always been the "man of small means," safe and cautious, but lacking in elasticity and daring. The only success obtained was in the action of Sahay (May 25, 1742), for which he was made a duke.

His son, Victor François, Duc de Broglie (1718–1804), served with his father at Parma and Guastalla, and in 1734 obtained a coloncley. In the German War he took part in the storming of Prague in 1742, and was made a brigadier. In 1744 and 1745 he saw further service on the Rhine, and in 1756 he was made *maréchal de camp*. He subsequently served with Marshal Saxe in the low countries, and was present at Roucoux, Val and Maastricht. At the end of the war he was made a lieutenant-general. During the Seven Years' War he served successively under d'Estrées, Soubise and Contades, being present at all the battles from Hastenbeck onwards. His victory over Prince Ferdinand at Bergen (1759) won him the rank of marshal of France from his own sovereign and that of prince of the empire from the emperor Francis I. In 1760 he won an action at Corbach, but was defeated at Vellinghausen in 1761. After the war he was in disgrace until 1778, when he was given command of the troops designed to operate against England. He opposed the Revolution with determination, and after his emigration, commanded the "army of the princes" for a short time (1792). He died at Munster in 1804.

Another son of the first duke, Charles François, Comte de Broglie (1719–1781), is chiefly remembered in connection with the *Secret du Roi*, the private, as distinct from the official, diplomatic service of Louis XV. of which he was the ablest and most important member.

The son of Victor François, Victor Claude, Prince de Broglie (1757–1794), served in the army, attaining the rank of *maréchal de camp*. He served with Lafayette and Rochambeau in America, was a member of the Jacobin Club, and sat in the Constituent Assembly, constantly voting on the Liberal side. He served as chief of the staff to the Republican army on the Rhine; but in the Terror he was denounced, arrested and executed at Paris on June 27, 1794. His dying admonition to his little son was to remain faithful to the principles of the Revolution, however unjust and ungrateful.

Achille Charles Léonce Victor, Duc de Broglie (1785–1870), statesman and diplomatist, son of the last-named, was born in Paris on Nov. 28, 1785, and died in Paris, Jan. 25, 1870. In 1809, he was added to the Council of State, over which Napoleon presided in person; and was sent by the emperor on diplomatic missions, as attaché, to various countries. He received, in June, 1814, a summons from Louis XVIII. to the Chamber of Peers. There, after the Hundred Days, he distinguished himself by his courageous defence of Marshal Ney, for whose acquittal he, alone of all the peers, both spoke and voted. On Feb. 15, 1816, he was married at Leghorn to the daughter of Madame de Staël. He returned to Paris at the end of the year, but took no part in politics until the elections of Sept. 1817 broke the power of the "ultra-royalists" and substituted for the *Chambre introuvable* a moderate assembly. During the last critical years of Charles X.'s reign, de Broglie identified himself with the *doctrinaires*, among whom Royer-Collard and Guizot were the most prominent. After the July revolution he was minister of education for a few months. After the insurrection of June 1832, de Broglie took office once more as minister for foreign affairs (Oct. 11). His tenure of the foreign office was coincident with a very critical period in international relations. But for the sympathy of Great Britain under Palmerston, the July monarchy would have been completely isolated in Europe; and this sympathy the aggressive policy of France in Belgium and on the Mediterranean coast of Africa had been in danger of alienating. The Belgian crisis had been settled, so far as the two powers were concerned, before de Broglie took office; but the concerted military and naval action for the coercion of the Dutch, which led to the French occupation of Antwerp, was carried out under his auspices. The good understanding of which this was the symbol characterized also the relations of de Broglie and Palmerston during the crisis of the first war of Mohammed Ali (*q.v.*) with the Porte, and in the affairs of the Spanish peninsula their common sympathy with constitutional liberty led to the treaty of alliance between Great Britain, France, Spain and Portugal, signed at London on April 22, 1834. De Broglie had retired from office in the February preceding, and did not return to power till March of the following year, when he became head of the cabinet. In 1836, on the defeat of the government, he once more resigned, and never returned to official life. He had found France isolated and Europe full of the rumours of war; he left her strong in the English alliance and the respect of Liberal Europe, and Europe freed from the restless apprehensions which were to be stirred into life again by the attitude of Thiers in the Eastern Question and of Guizot in the affair of the "Spanish marriages." From 1836 to 1848 de Broglie held almost completely aloof from politics. The revolution of 1848 was a great blow to him. He took his seat, however, in the republican National Assembly and in the Convention of 1848, and, as a member of the section known as the "Burgraves," did his best to stem the tide of socialism and to avert the reaction in favour of autocracy which he foresaw. He shared with his colleagues the indignity of the *coup d'état* of Dec. 2, 1851, and remained for the remainder of his life one of the bitterest enemies of the imperial régime, though he was heard to remark, with that caustic wit for which he was famous, that the empire was "the government which the poorer classes in France desired and the rich deserved." The last twenty years of his life were devoted chiefly to philosophical and literary pursuits.

Besides his *Souvenirs*, in 4 vols. (1885–88), the duc de Broglie's published works include *Écrits et discours* (3 vols., 1863); *Le Libre Échange et l'impôt* (1879); *Vues sur le gouvernement de la France* (1861). This last was confiscated before publication by the imperial government. *See* Guizot, *Le Duc de Broglie* (1870), and *Mémoires* (1858–67); and the histories of Thureau-Dangin and Duvergier de Hauranne.

Jacques Victor Albert, Duc de Broglie (1821–1901), his eldest son, was born at Paris on June 13, 1821. After a brief diplomatic career at Madrid and Rome, the revolution of 1848 caused him to withdraw from public life. He had already published a translation of the religious system of Leibnitz (1840). His contributions to the *Revue des deux Mondes* and the Orleanist and clerical organ *Le Correspondant*, were afterwards collected under the titles of *Études morales et littéraires* (1853) and *Questions de religion et d'histoire* (1860). These were supplemented in 1869 by a volume of *Nouvelles études de littérature et de morale*. His *L'Église et l'empire romain au IVᵉ siècle* (1856–66) brought him a seat in the Academy in 1862. In 1870 he succeeded his father in the dukedom. In the following year he was elected to the National Assembly for the department of the Eure, and a few days later (on Feb. 19) was appointed ambassador in London; but in March 1872, in consequence of criticisms upon his negotiations concerning the commercial treaties between England and France, he resigned his post and took his seat in the National Assembly, where he became the leading spirit of the monarchical campaign against Thiers. On the replacement of the latter by Marshal MacMahon, the duc de Broglie became president of the council and minister for foreign affairs (May 1873), but in the reconstruction of the ministry on Nov. 26 transferred himself to the ministry of the interior. His tenure of office was marked by an extreme conservatism, which roused the bitter hatred of the Republicans, while he alienated the Legitimist party by his friendly relations with the Bonapartists, and the Bonapartists by an attempt to effect a compromise between the rival claimants to the monarchy. The result was the fall of the cabinet on May 18, 1874. Three years later (May 16, 1877) he was entrusted with the formation of a new cabinet, with the object of appealing to the country and securing a new chamber more favourable to the reactionaries than its predecessor had been. The result, however, was a decisive Republican majority. The duc de Broglie was defeated in his own district, and resigned office on Nov. 20. Not being re-elected in 1885, he abandoned politics for historical work. He died in Paris on Jan. 19, 1901.

Besides editing the *Souvenirs* of his father (1886, etc.), the *Mémoires* of Talleyrand (1891, etc.) and the *Letters* of the Duchess Albertine de Broglie (1896), he published *Le Secret du roi, Correspondance secrète de Louis XV. avec ses agents diplomatiques*, 1752–74 (1878); *Frédéric II et Marie Thérèse* (1883); *Frédéric II. et Louis XV.* (1885); *Marie Thérèse Impératrice* (1888); *Le Père Lacordaire* (1889); *Maurice de Saxe et le marquis d'Argenson* (1891); *La Paix d'Aix-la-Chapelle* (1892); *L'Alliance autrichienne* (1895); *La Mission de M. de Gontaut-Biron à Berlin* (1896); *Voltaire avant et pendant la Guerre de Sept Ans* (1898); *Saint Ambroise*, translated by Margaret Maitland in the series of "The Saints" (1899).

BROGUE. (1) A rough shoe of raw leather (Gael. *brog*, a shoe) worn in parts of Ireland and the Scottish Highlands, and applied generally to shoes intended for country wear. (2) A dialectical accent, especially used of the Irish accent in speaking English.

BROHAN, AUGUSTINE SUSANNE (1807-1887), French actress, was born in Paris on Jan. 22 1807 and died on Aug. 16 1887. She made her first Paris appearance at the Odéon in 1832 as Dorine in *Tartuffe*. She appeared at the Comédie Française, Feb. 1834, as Madelon in *Les Précieuses ridicules*, and Suzanne in *Le Mariage de Figaro*, and continued to act until 1842.

Her elder daughter, JOSEPHINE FÉLICITÉ AUGUSTINE BROHAN (1824–1893), made her *début* at the Comédie Française on May 19, 1841, as Dorine in *Tartuffe*, and Lise in *Rivaux d'eux-mêmes*. She retired in 1866.

Susanne Brohan's second daughter, ÉMILIE MADELEINE BROHAN (1833–1900), made her *début* at the Comédie Française in a new comedy by Scribe and Legouvé, *Les Contes de la reine de Navarre* (Sept. 1, 1850). Her name is especially associated with *Le Monde où l'on s'ennuie*, *Par droit de conquête*, *Les Deux Veuves*, and *Le Lion amoureux*, in which, as the Marquise de Maupas, she had one of her greatest successes. She retired in 1886.

BROKE or **BROOKE, ARTHUR** (d. 1563), English author, wrote the first English version of the story of Romeo and Juliet. *The Tragicall Historye of Romeus and Juliet* (1562) is a rhymed account of the story, taken, not directly from Bandello's collection of novels (1554), but from the French translation (*Histoires tragiques*) of Pierre Boaistuau or Boisteau, surnamed Launay, and François de Belleforest. Broke adds some detail to the story as told by Boisteau. As the poem contains many scenes which are not known to exist elsewhere, but which were adopted by Shakespeare in *Romeo and Juliet*, there is no reasonable doubt that it may be regarded as the main source of the play. Broke perished by shipwreck in 1563, on his way from Newhaven to join the English troops fighting on the Huguenot side in France.

See, for a close comparison of Shakespeare's play with Broke's version, the reprint of the poem edited by P. A. Daniel for the New Shakespeare Society (1875).

BROKE, SIR PHILIP BOWES VERE, BART. (1776–1841) was born at Broke Hall, near Ipswich, England, entered the navy in 1792, and rose rapidly in the service. In 1813 he was in command of the "Shannon," which was then cruising off Boston, watching the "Chesapeake," an American frigate of the same nominal force but heavier armament. On June 1 Broke, finding his water supply getting low, wrote to Lawrence, the commander of the "Chesapeake," asking for a meeting between the two ships, stating the "Shannon's" force, and guaranteeing that no other British ship should take part in the engagement. Before this letter could be delivered, however, the "Chesapeake," under full sail, ran out of Boston harbour, crowds of pleasure boats accompanying her to witness the engagement. As the "Chesapeake" rounded to on the "Shannon's" weather quarter, at a distance of about 50 yards, the British frigate received her with a broadside. A hundred of the "Chesapeake's" crew were struck down at once, Lawrence himself being mortally wounded. A second broadside increased the confusion, and, her tiller-ropes being shot away, the American frigate drifted foul of the "Shannon." Broke sprang on board with some 60 of his men following him. After a brief struggle the fight was over. Within 15 minutes of the firing of the first shot, the "Chesapeake" struck her flag, but Broke himself was seriously wounded. For his services he was rewarded with a baronetcy, and subsequently was made a K.C.B. His exploit captivated the public fancy, and his popular title of "Brave Broke" gives the standard by which his action was judged. Its true significance, however, lies deeper. Broke's victory was due not so much to courage as to forethought. His wound incapacitated him for further service. He died in London on Jan 2 1841.

BROKEN HILL (Willyama), a famous mining city in Yancowinna county in the central west of New South Wales, 35 m. from the South Australian border. It lies at an elevation of 1,000 ft. on the east flank of the Barrier range, some 200 m. from Spencer's gulf and 550 from the east sea-board. The region is sub-arid, hot in summer, cool (with frosts) in winter; mean annual temperatures: 78°–51° F; absolute extremes: 115·9°–28·5° F; average annual rainfall *c.* 10 in., but erratic—3·6-17·6; average annual evaporation: *c.* 7 ft. 6 in. Heavy dust-storms are frequent. The mulga, bluebush and salt-bush hills and plains, richly grassed after rains, form rather poor pastoral country where not bared by the mining settlements. The highly compressed and tilted sedimentary (pre-Cambrian) rocks (with igneous intrusions and quartz reefs) of the Barrier range had a "replacement" lode which outcropped as two connected arcs over a distance of *c.* 3 m. with a width varying from 200 to 3 ft. The outcrop originally appeared as a manganiferous ironstone (gossan) ridge and was first mined (1883–84) for tin, though silver and lead mines of some value had previously been worked in the area, notably at Silverton. Secondary enrichment, due partly to the arid climate, had led to ores (native silver, chlorides, etc., and further down, lead carbonates) of extraordinary richness in the upper parts. Below these the ores became lead-zinc-silver sulphides of lower but more uniform value. By 1924 workings had reached a depth of 1,800 ft.; some 35,000,000 tons of ore had been removed (1925) and a further 13,000,000 tons, with uncalculated reserves beyond, were available. The value of the total output (to end of 1938) was £172,000,000 and £44,000,000 had been paid in dividends. The maximum output was in 1913—1,750,000 tons; thereafter the average has been *c.* 1,250,000 tons, though 1919 and 1920 were years of strikes, low prices and very low production. Ore-treatment methods have changed along with the type of ore and the growth of technical knowledge. To-day the zinc-lead-silver sulphides are uniformly dealt with by the "flotation" (eucalyptus oil) process. Smelting and concentrating, formerly conducted on the field, were progressively transferred to Port Pirie (South Australia) on Spencer's gulf (254 m. by rail) where fuel, fluxes and transport are more readily available. The zinc residues were for long used as filling or accumulated as enormous dumps. In 1913 *c.* 500,000 tons of zinc concentrates yielding some 200,000 tons of zinc or ⅕ of the world's supply, were shipped abroad from Broken Hill; only 5–7,000 tons zinc were produced at Port Pirie. In 1918, after experimental work, zinc production was started on a large scale (100 tons per diem) at Risdon (Hobart, Tasmania), where water-power is available for the electrolytic process. Considerable quantities of zinc concentrates (1938: 66,000 tons) are still exported (United Kingdom, Europe and Japan) but Risdon takes increasing quantities and amongst its by-products produces sulphuric acid valuable in the manufacture of superphosphates. The lead ores are now smelted almost entirely at Port Pirie. Broken Hill is the third city of New South Wales. Its population shows the fluctuations natural to a mining centre (1914: *c.* 35,000; 1933: 26,925). It is substantially built and well equipped. The difficulty of water supply has been met by the construction of two large dams, 10 and 19 miles distant respectively, and the construction of two additional reservoirs was under consideration in 1928. Broken Hill is 335 m. by rail from Adelaide and its main economic and business relations are with South Australia. Recently the line to Sydney (703 m.) has been completed and forms a possible alternative route from Adelaide to Sydney.

BROKEN HILL PROPRIETARY COMPANY LIMITED. This company was formed in Aug., 1885, to develop seven mining leases at Broken Hill, New South Wales, on the now famous Barrier Range. On account of the great size of the lode it was soon found that the ordinary system of mining was inadequate, and, consequently, the "square set" system of timbering was adopted. This was, as work progressed, supplemented at a later date by the "open cut," which was applied to the whole length of the mine for about 250ft. in depth. Open stoping with filling was carried out in the hard sulphide ore.

The development of the lode was phenomenal, the width of the oxidized ore, in places, being no less than 300ft. The extraordinary variety of the ores from the mine, many of these being refractory ores, raised many unusual problems. At first, direct smelting in a reduction plant, situated at Broken Hill on the property, was adopted. Later, when silicious ores came into view, chloridizing plants as well as an amalgamating plant were installed to deal with them.

With the advent of sulphide ores the method of treatment was considerably modified and water concentration took place by tables and jigs. The flotation of zinc concentrates was successfully accomplished at this mine for the first time in the world. As time went on the process has been varied, and with the invention, by the company's officers, of differential flotation (Bradford process), separate concentrates were made of the zinc and lead contents.

Smelting.—The first reduction plant was constructed at Broken Hill in 1886. Additions to the plant were made, until it included 15 furnaces of 80 ton capacity each. At this time, the products of the mine were shipped to Europe as silver-lead bullion. In 1889, however, the company decided to establish its own refinery, and this was brought into being at Port Pirie in South Australia. The resultant lead was sold in the markets of England, Europe, and the East, as well as supplying the requirements of the Australian States, and nearly the whole of the silver was sold to China and India. Part of the output of zinc concentrates went for production of spelter, the balance being shipped overseas. In 1898, it was decided to close down the smelters at Broken Hill and to concentrate smelting operations at Port Pirie. In 1915, the works at Port Pirie were sold. The total amount of mineral produced at this mine, to May 1927, was:

Silver	183,600,000 oz.
Lead	1,305,000 tons
Zinc	564,000 tons

Iron and Steel Works.—The leases of the company having developed large quantities of iron ore, the question of its utilization for the production of iron and steel was seriously considered, and after exhaustive enquiries a decision was arrived at to embark on this new enterprise. As a result of this decision, an iron and steel works was built at Newcastle, N.S.W., close to coal supplies, and about 100m. N. of Sydney. Operations here are conducted on the most modern lines. The ore is quarried in South Australia, from the side of the mountain, hauled 35 miles, loaded by belt-conveyors into the company's own ships and conveyed to Newcastle.

The plant in 1927 comprised 224 by-product coke ovens; four blast furnaces of a total capacity of 10,000 tons per week; nine basic open hearth furnaces capable of producing 10,000 tons of steel per week, a 35in. blooming mill, 28in. rail mill, 18in., 12in. and 8in. merchant mills, and a continuous rod mill. Associated with these are a large electric power station, a steel foundry, and a direct metal foundry and large machine shop.

The production figures from the inception of the steel works to May 31, 1927, were:—

Steel	2,500,000 tons
Pig Iron	2,500,000 tons

The works supply a large proportion of the railway material required by the various governments of Australia, as well as meeting the demands of engineering workshops throughout Australia. The population of the district immediately surrounding the works has increased since their inception by no less than 44,000 inhabitants. The wages bill amounts, under normal conditions, to £1,750,000 per year. The original capital in 1885 was £304,000. The authorized capital in 1927 was £3,000,000, of which £2,687,708 had been paid up; the debentures outstanding stood at £1,518,600, the reserve fund at £1,535,000. (L. C. M.)

BROKER. A broker is an agent who for a commission or fee bargains or negotiates between his principal and a third party for the purchase or sale of property or contractual rights without having title and usually without having possession of the property. When he does have possession of the property, he holds it as bailee or in a fiduciary capacity. The broker is an independent contractor and not a servant. An individual, firm, or corporation may act as a broker. Brokers handle merchandise, future contracts for the purchase or sale of goods, real estate, stocks and bonds, insurance, shipping, commercial paper, etc.

The broker has the authority, expressly conferred on him or impliedly necessary, to execute his power. His acts are binding on his principal unless he exceeds his authority. The principal cannot repudiate the acts of his broker if the broker was acting within the apparent scope of his authority. A third person is not bound by secret instructions to the broker but he is under obligation to ascertain the extent of the broker's authority. The broker may be given authority to warrant the goods. He usually has no such implied authority unless it is customary in his trade. He usually has no authority to buy and sell on credit unless expressly conferred or unless customary in the trade. In the sale of merchandise, he has no authority to pass title. He usually has no implied authority to receive payment unless the principal is not disclosed. He usually has no authority to contract in his own name.

Brokers may have authority to fix or agree to prices and to bind their principals to sell or buy at such prices; they may be required to submit bids or offers to their principals for acceptance; or they may be limited to sales made at prices specified by their principals. A broker can neither purchase from nor sell to his principal unless the latter expressly assents thereto or with full knowledge of all the facts and circumstances acquiesces in such sale or purchase. The law does not permit a broker to act in his own personal interest to the detriment of his principal, as, for example, making a secret profit for himself. This usually prevents a broker representing opposite parties.

Brokers may have continuous relations with their principals, or may act under a separate contract for each transaction. Contracts between the principal and his broker may be written or oral. Contracts can usually be terminated at will unless granted for a definite period. If a broker is employed for a definite period and the principal revokes the contract earlier without cause he may be held liable for damages. The broker may be given an exclusive agency to sell the principal's goods in a specified territory. This prevents the principal from selling through another agent. If the principal himself sells direct to a buyer in this territory, the courts do not agree as to the right of the broker to collect a commission on the lost sale. The broker may be granted an exclusive right to sell the principal's goods in a specified territory. If the principal makes a direct sale in the territory, the broker is entitled to his commission.

Ordinarily the broker has earned his commission when the contract is completed between the principals and is entitled to it whether or not the goods are ever delivered or paid for. In practice some principals do not make all such payments, and the brokers elect to keep the business of the principal rather than sue for the commissions due.

States have the right under their police power to regulate or license brokers, and this right is exercised in some states and in some municipalities under power from their states. Bonds may be required, especially when brokers handle margins or securities.

Merchandise Brokers.—There are three main classes of brokers selling goods: the free-lance broker, the manufacturers' agent and the selling or sales agent

Free-lance brokers are defined by the U.S. census bureau as "wholesale middlemen whose function it is to negotiate transactions between buyers and sellers. They act as agents for their principals, who are usually wholesalers or producers, although they sometimes represent retailers as well. . . . They do not take title to the goods . . . nor do they ordinarily have possession of the goods nor finance their clients."

There were 4,710 such brokers in the United States in 1939 with sales of $3,391,000,000 for that year. There were 168 in Canada with sales of $130,000,000 in 1930. They operate in highly specialized fields and are most important in the sale of foods, cloth, cotton, grains, livestock, fresh fruits and vegetables, chemicals, lumber and oils. Usually they are not limited as to territory and may sell (or buy) at any place where the opportunity offers. They are not permanently bound to any set of principals but may represent anyone who wants to sell (or buy) goods in their field.

Manufacturers' agents, according to the U.S. census bureau, "sell part of the output of certain manufacturers with whom continuous relations are maintained. These agents are limited as to (a) territory of operations, and (b) prices and terms of sale. Their principal function is selling, although they may also warehouse some of the goods." They are usually paid a commission but sometimes work on a salary basis. They usually represent two or more manufacturers, selling supplementary but noncompeting products. There were nearly 10,000 manufacturers' agents in the United States in 1939 with sales of more than $1,500,000,000 for that year, while in Canada there were 825 with sales of $127,000,000 in 1930. They are important in the sale of automotive equipment, chemicals, cloth, clothing, electrical appliances, furniture and home furnishings, canned foods, groceries, hardware, machinery, steel, paper, plumbing supplies and equipment.

Selling agents (called sales agents in the food trades), usually sell the entire output of a given line of goods for one or more manufacturers with whom they maintain continuous relations. They often give their principals financial assistance. Selling agents differ from manufacturers' agents in the following respects: (1) They normally handle the entire output of their clients; (2) they may sell everywhere while manufacturers' agents are limited in their territory of operation; (3) they have full authority with regard to prices, terms, etc., while the authority of manufacturers' agents is limited in this regard; and (4) they frequently finance their clients and offer assistance in connection with their advertising and other sales promotion activities. Selling agents act as the sales departments of the manufacturers they represent. There were 1,487 selling agents in the United States in 1939 with sales of $1,742,000,000 for that year, while Canada had 64 with sales of $42,000,000 in 1930. They are particularly important in the sale of cloth, coal, metals, clothing, chemicals, groceries, lumber and millwork, machinery and yarn.

The chief functions of these three types of merchandise brokers are selling goods for their principals, giving information and advice to their principals, and, in the case of selling agents, helping to finance their principals. These brokers usually sell to industrial buyers, wholesalers, institutions, and some of the larger retailers such as chain or multiple stores and department stores. One broker represents several producers. It is, therefore, cheaper for a producer to sell through a broker than to maintain his own sales organization. These brokers have relatively small expenses; in 1939 the average expenses of the free-lance brokers were 1.5% of their sales; manufacturers' agents without stocks, 4%, with stocks, 11.7%; and selling agents, 3.7%. Commissions vary from a fraction of 1% up to 5% or 10%, with a few higher. Free-lance brokers seldom receive more than 3% or 4% and relatively few commissions are more than 6%, except for manufacturers' agents which carry stock, and for selling agents on small accounts. Obviously the brokers cannot spend a great deal of time creating demand for products at these rates. They handle principally staple products sold on the basis of grade or products for which the manufacturers have created demand through their advertising.

Brokers operate in central markets where supply and demand meet to determine prices. The prices of staple products change frequently. The producers located outside central markets find it difficult to keep up price changes and many of them depend upon their brokers for information as to current prices and often also for advice on the trends of future prices.

Selling agents most frequently represent small companies which are too small to afford competent sales organizations or which are unacquainted with selling methods and with buyers. They prefer to devote their entire attention to production and turn the selling over to agents. The agents often help to finance their principals. This they may do by endorsing their notes, discounting their accounts receivable, or loaning them money.

Buying Brokers.—There are also brokers who specialize in buying for their principals. These are found, for example, in the hardware, grocery, produce, textile and apparel trades. These brokers locate goods for their principals, negotiate purchase contracts, sometimes secure quantity prices by combining the orders from several buyers, close the contracts, and give their principals price information. Brokers are found in the hardware, grocery, textile and apparel trades who represent the buyers but who receive their commissions from the sellers. Some of them followed a practice of rebating a part of their commissions to the buyers until this practice was stopped under the Robinson-Patman amendment to the Clayton Anti-trust act. Brokers representing buyers and paid by the sellers have come in for considerable criticism, it being said that they do not always fully represent the interests of the buyers when their pay comes from the sellers.

In the women's garment and dry goods trade, the buying brokers are commonly called *resident buyers*. Most of those in the United States are located in New York where this trade centres. They represent department, dry goods and apparel stores located throughout the United States, Canada and other countries. They maintain offices for use of the store buyers when in New York, locate goods for the inspection of the buyers, and make purchases on instruction of the stores. They are paid a commission or salary, or a combination of the two.

Future Contracts on Exchanges.—Brokers are important in executing contracts for the future purchase or sale of goods on the commodity or produce exchanges such as the Liverpool Corn Trade association, the Chicago Board of Trade, the Liverpool Cotton exchange, the New York Cotton exchange, and the New York Coffee and Sugar exchange. They represent principals in buying and selling contracts, but on the exchanges they are principals and are liable for the fulfilment of their contracts. The rules of the exchanges require them to be men of financial responsibility and they must maintain margins with the exchange or its clearing association to cover their open contracts. The brokers in turn usually require their principals to keep sufficient margins with them to cover fluctuations in the prices of the commodities covered by the contracts. All contracts are presumed to be made in accordance with the rules of the exchange on which they are executed.

Future contracts often involve speculation and gambling. Gambling is illegal in many jurisdictions. Future contracts call for actual delivery of the goods and it is this fact that makes them legal. However, some courts have held that a contract between the broker and his principal is unenforceable if the circumstances show that it is a gambling transaction. The Illinois supreme court has held: "A transaction conducted in accordance with the rules of the Chicago Board of Trade through a third party, a member of the Board, who contemplates future delivery, does not render the transaction valid between the immediate parties who, the circumstances show, did not and could not contemplate deliveries." The broker, it was held, should consider his principal's need for the commodity and his financial ability to pay for it before agreeing to execute the orders.

Overlapping Activities.—It should be remembered that men engage in business for profit and not to operate within certain legally defined fields. Many brokers engage in other activities and many concerns not called brokers act as brokers. Thus a brokerage concern may itself also buy goods. In doing so, it is a merchant and not a broker. In the food trade this practice is so common that concerns that are both brokers and merchants are called *merchandising brokers*. If more than one-half of the business of a concern is done on a brokerage basis, the U.S. census bureau classes it as a broker, while if more than one-half of its business is done as a merchant it is classed as a wholesaler. Similarly, a brokerage concern may receive some goods on consignment and have them in its possession. On such transactions, it is legally a commission merchant (factor). In the grain trade it is very common for the same concern to act as commission merchants for the sale of cash grain, as brokers for the execution of future contracts on the floors of the exchange, and as merchants buying and selling grain for themselves. They are usually called "brokers."

The commission merchant, or factor, differs from the broker in that he has the goods in his possession and, as an agent of the owner, passes title to the buyer. In the case of farm products such as grain, livestock, and fruits and vegetables he often has authority to use his discretion as to the prices he accepts—that is, he sells at the market. In the case of manufactured products, the goods are often consigned to wholesalers and retailers for sale only at prices named by the owners. Historically, the names *commission merchant* and *factor* were synonymous. The factor in the cotton trade financed the planters during the growing season and sold their cotton. The business of factors in this trade had been declining for many years and by 1945 was near the vanishing point. Factors are important in the naval stores trade. They finance the still operators in the woods and sell their turpentine and rosin.

The term *factoring* has largely taken on another meaning, the financing of accounts receivable for manufacturers. The factor acts as the credit department for the manufacturers he represents, passing upon applications for credit, paying the seller when the goods are shipped, and collecting the accounts. However, under the non-notification plan, the seller collects the account as the agent of the factor. The manufacturer using a factor needs no credit department, and secures his money as soon as the goods are shipped and the invoice and bill of lading turned over to the factor. The factor charges a commission on the value of the accounts factored and interest on the money advanced. Factoring is an old practice in the textile trades, and since 1925 it has been extended to other trades.

Real estate brokers are very numerous. They usually act as agents of sellers in finding buyers for designated pieces of property and negotiating the prices, or they act for buyers in finding suitable properties and negotiating for their purchase. They are usually paid commissions by the sellers, but when they represent buyers they may be paid by them.

Real estate brokers are specialized agents with limited powers. Contracts for the purchase and sale of real estate must be in writing. The broker, therefore, cannot execute the contract unless he has a power of attorney. The real estate broker must keep his acts within the bounds of his authority. The owner is usually bound by representations of his agent if they are within the apparent scope of his authority. Examples would be statements as to the quantity or quality of timber on the land, the extent to which the land was subject to overflow from streams, and the fixtures belonging to the land.

Stockbrokers, commission houses, or commission brokers differ from other types of brokers in that they handle the stocks and bonds which they buy and sell for their principals. They buy and sell securities for their principals (customers) on the floors of stock exchanges, of which they usually are members, or privately in what are known as "over the counter sales." Stockbrokers usually maintain offices in the city or cities where the exchanges of which they are members are located and often in other cities. They may also transact business for brokers who are not members of the exchanges. A commission house usually has one or more members who execute the orders on the floors of the exchanges (known as "floor traders") and other members who stay in their offices to transact business with their customers. The broker may be instructed to sell at the market, at a designated price, or at any price over a named minimum. Many of his transactions are carried on with margins and the securities may be left with him as margin. If the price of the securities drops until they are insufficient to cover the required margin, the customer is asked for more margin, and if he fails to post it the broker has a right to sell the securities to protect his interest. Many place "stop loss" orders with their brokers—that is, orders to sell the securities if the price drops to a stated figure.

The stockbroker has four relationships: (1) he is an agent and his customer is his principal in executing orders to buy and sell; (2) he is a pledgee for stock purchased on margin and held as security for the unpaid balance; (3) he is a creditor for money advanced to his customers; and (4) he is a trustee of stocks and bonds left with him not as security for a debt. He is not free to pledge these for loans and to do so is fraudulent and a criminal offense. He may, however, pledge securities left with him as margin, in the absence of agreement to the contrary, to secure loans to the amount advanced to the customers.

Stockbrokers have only such authority as is conferred on them and must carry out their instructions in detail and in accordance with the rules of the exchange on which the order is to be executed. The customer who engages a broker to execute orders on an exchange is usually presumed to contract with him in accordance with the rules and customs of the exchange. The broker must obey his instructions in all their details and is liable to his principals for any loss from his failure to do so.

Securities held by the broker as pledgee or trustee cannot be taken by creditors of the broker if the latter becomes insolvent. Although he deals in his own name, title to the stocks and bonds purchased for his customers are deemed to be in the latter so that his assignee or trustee in bankruptcy acquires no title to them. In case of death of a customer for whom a marginal account is carried, the broker may under English law and by the rules of most exchanges close the account immediately if the securities can be sold advantageously; if not, he may have an appraisal made of the value of the securities and use this in his claim against the estate. If the customer is adjudicated a bankrupt, the broker should close the account if this can be done to leave a balance over the margin; otherwise he cannot assert a claim for loss sustained from a decline in value. If the account cannot be closed without a loss, he should report to the bankruptcy court and ask for permission to close it. (*See* also BILL-BROKER; STOCKBROKER; STOCK EXCHANGE.)

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BROKMEYER, HENRY CONRAD (1828–1906), U.S. philosopher and legislator, was born on Aug. 12, 1828, near Minden, Prussia, the son of a Jewish merchant. He attended the local public schools until the age of 16 when he emigrated to the U.S., arriving without funds or a knowledge of English. He went to St. Louis in his 20th year, and worked there for two months as a tanner. Following the same trade in Memphis, Tenn., and Columbus, Miss., he saved enough to matriculate at Georgetown college, Georgetown, Ky. At the end of two years, he left as a result of theological differences with the president. His formal education was completed at Brown University, Providence, R.I.

In 1854 he returned to Missouri, built a rude home in the backwoods of Warren county, and for two years, living on what he hunted, devoted himself to the study of nature, philosophy, and the science of human government. On his return to St. Louis in 1858, he came to know William Torrey Harris (*q.v.*) and a small circle of young men to whom he introduced the writings of Hegel, impressing them with the practicality of philosophy. But in a short time he again fled a fixed social order and took up farming in Warren county. Illness brought him back to St. Louis, where he resumed his self-ordained mission of interpreting Hegel's *Larger Logic*. This book has been spoken of by those close to Brokmeyer as his bible, and the basis of his adjustment from individual and social anarchism to an acceptance of the world in which he found himself, after his two experiments at isolation.

In 1860, supported by his friends, he worked on a first English translation of the *Larger Logic*. Although the manuscript was completely revised in 1892, neither of the highly Teutonic translations was ever published, the second one resting in the Missouri Historical society. After the Civil War, during which he served in the militia and rose to the rank of lieutenant colonel, he resumed his philosophical activities, and in Jan. 1866 the St. Louis Philosophical society was formed with Brokmeyer as its first president. The nucleus of the organization marking the birth of the "St. Louis Movement" included Harris, Snider, Thomas Davidson, George H. Howison, Adolph Kroeger, and J. Gabriel Woerner. According to Woodbridge Riley, Harris was considered the interpreter of this systematic study of German idealism, Snider its historian and Brokmeyer its oracle.

The following year saw the beginning of *The Journal of Speculative Philosophy*, the first American metaphysical journal, in which appeared the early philosophical writings of William James, John Dewey and Josiah Royce. Brokmeyer contributed several papers including "Letters on Faust," but his literary efforts were never very successful. Concurrent with his first interest, philosophy, Brokmeyer was also active in public life. In 1862 he was sent to the Missouri legislature as a Union Democrat. After a two-year term, he set up a law practice in St. Louis, where in 1866 he became a city alderman. In 1870 he was elected to the state senate, and in 1875 was active in shaping the legislative department at the state's constitutional convention. In the same year he was also lieutenant governor, and in 1876–77 was acting governor during the illness of Governor John Smith Phelps. Brokmeyer died on July 26, 1906.

BROMBERG (Polish *Bydgoszcz*), a town of Poland, province of Pomorze, 4.2 mi. from the Vistula, the centre of an important network of railways. Pop. (1931) 117,528; (est. 1939) 141,000 The Bromberg canal connects the Brahe with the Notec, and thus establishes communication between the Vistula and Oder. The town has an active trade in agricultural products and is the chief centre of the Polish timber industries. Originally a border town between Poland and Pomerania, it suffered from the raids of the Teutonic knights. Restored by Casimir the Great in 1346, its commerce flourished, but declined in the 17th century. By the Treaty of Tilsit it became part of the grand duchy of Warsaw. In 1813 it was occupied by the Prussians, and was held by Prussia from 1815 to 1918. It fell again to German armies Sept. 3, 1939.

BROME, ALEXANDER (1620–66), English poet, wrote many drinking songs and satirical verses in favour of the Royalists and against the Rump. He published in 1661 *Songs and other Poems*, containing songs on various subjects, followed by a series of political songs, ballads, epistles, elegies and epitaphs, epigrams and translations. Izaak Walton wrote an introductory eclogue for this volume in praise of the writer, and his gaiety and wit won for him the title of the "English Anacreon" in Edward Phillips's *Theatrum Poetarum*. Brome published in 1666 a translation of Horace, by himself and others, and was the author of a comedy entitled *The Cunning Lovers* (1654). He also edited two volumes of Richard Brome's plays.

BROME, RICHARD (d. 1652), English dramatist, was originally a servant of Ben Jonson, and owed much to his master. The development of his plots, the strongly marked characters, and the amount of curious information to be found in his work, all show Jonson's influence. The relation of master and servant developed into friendship, and our knowledge of Brome's personal character is chiefly drawn from Ben Jonson's sonnet to "my old faithful servant and by his continued virtue my loving friend, Mr. Richard Brome," prefixed to *The Northern Lasse* (1632), the play which made Brome's reputation. The relation of master and servant did not necessarily imply lack of education on Brome's part; since Jonson expected his servant (*see* Epigram CI) to read "a piece of Virgil, Tacitus, Livy or some better book to his friends at supper." Brome's genius lay entirely in comedy. He has left 15 pieces. *Five New Playes* (ed. by Alex. Brome, 1653) contained *Madd Couple Well Matcht* (acted 1639?); *Novella* (acted 1632); *Court Begger* (acted 1632); *City Witt; The Damoiselle or the New Ordinary. Five New Playes* (1659) included *The English Moor, or The Mock Marriage; The Love-Sick Court, or The Ambitious Politique; Covent Garden Weeded; The New Academy, or The New Exchange;* and *The Queen and Concubine. The Antipodes* (acted 1638, pr. 1640); *The Sparagus Garden* (acted 1635, pr. 1640); *A Joviall Crew, or the Merry Beggars* (acted 1641, pr. 1652, revised in 1731 as an "opera"), and *The Queenes Exchange* (pr. 1657), were published separately. He collaborated with Thomas Heywood in *The late Lancashire Witches* (pr. 1634). *A Joviall Crew* is generally considered the best of these. It was the last play to be acted before the theatres were closed in 1642 by order of parliament.

See A. W. Ward, *History of English Dramatic Literature*, vol. iii, pp. 125–131 (1899), the article by Rev. Ronald Bayne in *Cambridge History of English Literature*, vol. vi, where there is an admirable account of Brome's work; and E. K. R. Faust, *Richard Brome* (Halle, 1887). *The Dramatic Works of Richard Brome . . .* reprinted, 1873.

BROMELIACEAE, in botany, a family of Monocotyledons, confined to tropical and subtropical America; it consists of about 65 genera and 850 species. It includes the pineapple (*q.v.*) and also the so-called Spanish moss, an epiphytic plant, which hangs in long gray lichen-like festoons from the branches of trees, a native of Mexico and the southern United States; the water required is absorbed from the moisture in the air by peculiar hairs which cover the surface of the shoots. The plants are generally herbs with a shortened stem bearing a rosette of leaves and a spike or panicle of flowers. They are dry-country plants (xerophytes) and for the most part epiphytic; the narrow leaves are protected by a thick cuticle, and have a sheath which embraces the stem and forms, with the sheaths of the other leaves of the rosette, a basin in which water collects, with fragments of rotting leaves and the like. Peculiar hairs are developed on the inner surface of the sheath by which the water and dissolved substances are absorbed. The leaf margins are often spiny, and the leaf spines of *Puya chilensis* are used by the natives as fishhooks. Several species are grown as hothouse plants for the bright colour of their flowers or flower bracts, *e.g.*, species of *Tillandsia, Billbergia, Aechmea. See* illus. on p. 234.

For the North American species *see* L. C. Smith, *Bromeliaceae in North American Flora* 19(2), 61–228 (1938).

BROMFIELD, JOHN (1779–1849), U.S. merchant, was born in Newburyport, Mass., on April 11, 1779. He was descended from Edward Bromfield who emigrated from England in 1675, settling in Boston. His early education was received at home, and in 1792 he was enrolled as a pupil at the Dummer academy in Byfield. At 14 he received employment in the countinghouse of Larkin and Hurd of Charlestown, followed by apprenticeship with several mercantile houses. In the spring of 1809 he was engaged as agent for Theodore Lyman, Sr., and sent to China for a year, entrusted with considerable funds. Several European ventures in the next few years proved financial failures and in 1813 he returned to Boston. A small capital accumulated during the year in Canton China, was carefully invested and reinvested, occasionally in manufacturing but mainly on the exchange. Bromfield believed wealth to be a trust and distributed it liberally. His literary interests led to a gift of $25,000 toward the founding of the Boston Athenaeum which became one of the outstanding private libraries in the United States. At his death his property was valued at more than $200,000. His will directed that $110,000 of this sum be distributed among a group of specified charitable institutions: $40,000 was divided equally between the Massachusetts General hospital and the McLean asylum; and $10,000 each was willed to the Massachusetts Eye and Ear infirmary, the Boston Female asylum, the Asylum for Indigent Boys, the Farm school at Thompson's Island, the Asylum for the Blind, the Seaman's Aid society, and Newburyport, the town of his birth. Bromfield died on Dec. 9, 1849.

BROMIDE, chemically, a compound of bromine with an element or an organic radical, or a salt of hydrobromic acid, such as sodium bromide. Various bromides are of value in medicine, especially potassium bromide which is extensively used as a cardiac and cerebral depressant. From the application of the term bromide in the sense of a nerve sedative has arisen the colloquial meaning of a bromide as a platitude; a person whose inane conversation bores excessively is called bromidic.

BROMINE, a deep red, liquid, non-metallic element of the halogen group, which takes its name from its pungent unpleasan smell (*βρῶμος*, a stench). It was first recognized as an element and isolated by A. J. Balard in 1826 from the salts in the waters of the Mediterranean. It has the symbol Br, the atomic number 35, and the atomic weight 79·92. Bromine does not occur in nature in the uncombined condition, but in combination with various metals is very widely but sparingly distributed. Potassium, sodium and magnesium bromides are found in mineral waters, in river and sea-water, and occasionally in marine plants and animals. Its chief commercial sources are the salt deposits at Stassfurt in Prussian Saxony, in which magnesium bromide is found associated with various chlorides, and the brines of Michigan, Ohio, Pennsylvania and West Virginia, U S A.; a scheme is being developed for the extraction of bromides from the Dead Sea (1927).

SLENDER HANGING BRANCHES OF SPANISH MOSS. A PERCHING PLANT WHICH HANGS IN FESTOONS FROM TREES IN THE SOUTHERN UNITED STATES AND TROPICAL AMERICA. (SEE PREVIOUS PAGE)

Manufacture.—The chief centres of the bromine industry are Stassfurt and the central district of Michigan. It is manufactured from the magnesium bromide contained in "bittern" (the mother liquor of the salt industry), by two processes, the continuous and the periodic. The continuous process depends upon the decomposition of the bromide by chlorine, which is generated in special stills. A regular current of chlorine mixed with steam is led in at the bottom of a tall tower filled with broken bricks, and there meets a descending stream of hot bittern: bromine is liberated and is swept out of the tower together with some chlorine, by the current of steam, and then condensed in a worm. Any uncondensed bromine vapour is absorbed by moist iron borings, and the resulting iron bromide is used for the manufacture of potassium bromide. Commercial bromine is rarely pure, the chief impurities present in it being chlorine, hydrobromic acid, and bromoform. It is usually purified by repeated shaking with potassium, calcium or ferrous bromide, and subsequent redistillation, a process which removes the chlorine and a part of the other impurities.

Properties.—Bromine at ordinary temperatures is a mobile liquid of fine red colour, which appears almost black in thick layers. It boils at 50°C., forming a deep red vapour, which exerts an irritating and directly poisonous action on the respiratory organs. It solidifies to a dark brown solid which melts at −7·3°C. Its specific gravity is 3·18828 $(\frac{0^\circ}{4^\circ})$, latent heat of fusion 16·185 calories, latent heat of vaporization 45·6 calories, specific heat 0·1071. Its properties are altered to a remarkable degree by prolonged drying; a specimen which had been dried for eight years melted at −4·5°C. and boiled at 118°C., a rise of 60 degrees (H. B. Baker) (*see* DRYNESS, CHEMICAL). Bromine is soluble in water, to the extent of 3·226 grammes of bromine per 100 grammes of solution at 15°C., the solubility being slightly increased by the presence of potassium bromide. The solution is of an *orange-red* colour, and is quite permanent in the dark, but on exposure to light, gradually becomes colourless, owing to decomposition into hydrobromic acid and oxygen. By cooling the aqueous solution, hyacinth-red octahedra of a crystalline hydrate of composition $Br_2 \cdot 10H_2O$ are obtained (Bakhuis Roozeboom). Bromine is soluble in chloroform, alcohol and ether.

Its chemical properties are in general intermediate between those of chlorine and iodine; thus it requires the presence of a atalytic agent, a fairly high temperature, or actinic light to bring bout its union with hydrogen. It does not combine directly with oxygen, nitrogen or carbon. With the other elements it unites to form bromides, often with explosive violence; phosphorus detonates in liquid bromine and inflames in the vapour; iron is occasionally used to absorb bromine vapour, potassium reacts energetically, but sodium requires to be heated to 200°C. The chief use of bromine in analytical chemistry is based upon oxidizing action of bromine water. Bromine and bromine water both bleach organic colouring matters. Bromine is used extensively in organic chemistry as a substituting and oxidizing agent, and also for the preparation of addition compounds. It is used in the liquid form, in vapour, in solution, and in the presence of the so-called "bromine carriers" (*see* below). The solvents in which bromine is employed are usually ether, chloroorm, acetic acid, hydrochloric acid, carbon bisulphide or water. The choice of solvent and of other conditions is important, for he velocity of the reaction and the nature of the product may vary according to the solvent used, or according to whether the reaction is conducted in sunlight or not. The action of bromine s sometimes accelerated by the use of compounds which behave catalytically, the more important of these "carriers" being iodine, iron, ferric chloride, ferric bromide, aluminium bromide and phosphorus. For oxidizing purposes bromine is generally employed in aqueous and in alkaline solutions, one of its most important applications being by Emil Fischer, in his researches on the ugars. The most important determinations of the atomic weight of bromine are those of G. P. Baxter based on the ratios Ag:AgBr, and AgCl:AgBr; and of P. A. Guye and E. Moles, based on the density of hydrogen bromide.

Hydrobromic Acid.—This acid, HBr, the only compound of hydrogen and bromine, is in many respects similar to hydrochloric acid, but is rather less stable. It may be prepared by passing hydrogen gas and bromine vapour through a tube containing heated platinum spiral. It cannot be prepared with any degree of purity by the action of concentrated sulphuric acid on romides, since secondary reactions take place, leading to the liberation of free bromine and formation of sulphur dioxide. The usual method employed for the preparation of the gas consists n dropping bromine on to a mixture of amorphous phosphorus and water, when a violent reaction takes place and the gas is rapidly liberated; an aqueous solution may be obtained by passing ulphuretted hydrogen through bromine water. At ordinary emperatures hydrobromic acid is a colourless gas which fumes strongly in moist air, and has an acid taste and reaction. It can be condensed to a liquid, which boils at −68·7°C. (under a pressure of 760 mm.), and, by still further cooling, gives colourless crystals which melt at −88·5°C. It is readily soluble in water, forming the aqueous acid, which when saturated at 0°C. has a specific gravity of 1·78 and contains 82·02% HBr. When boiled, the aqueous acid loses either acid or water until a solution of constant boiling point is obtained, containing 48% of the acid and boiling at 126°C. under atmospheric pressure; should the pressure, however, vary, the strength of the solution boiling at a constant temperature varies also. Hydrobromic acid is one of the "strong" acids, being ionized to a very large extent even in concentrated solution, as shown by the molecular conductivity increasing by only a small amount over a wide range of dilution.

Bromides.—Hydrobromic acid reacts with metallic oxides, hydroxides and carbonates to form bromides, which can in many cases be obtained also by the direct union of the metals with bromine. As a class, the metallic bromides are solids at ordinary temperatures, which fuse readily and volatilize on heating. The majority are soluble in water, the chief exceptions being silver, mercurous, palladous and lead bromides; the last is, however, soluble in hot water. They are decomposed by chlorine, with liberation of bromine and formation of metallic chlorides; concentrated sulphuric acid also decomposes them, with formation of a metallic sulphate and liberation of bromine and sulphur dioxide. The non-metallic bromides are usually liquids, which are readily decomposed by water. Hydrobromic acid and its salts can be readily detected by the addition of chlorine water to their aqueous solutions, when bromine is liberated; or by warming with concentrated sulphuric acid and manganese dioxide, the same result being obtained. Silver nitrate in the presence of nitric acid gives with bromides a pale yellow precipitate of silver bromide, $AgBr$, which is sparingly soluble in ammonia. For their quantitative determination they are precipitated in nitric acid solution by means of silver nitrate, and the silver bromide is well washed, dried and weighed.

Acids.—No oxides of bromine have been isolated, but three oxy-acids are known, viz., hypobromous acid, $HBrO$, bromous acid, $HBrO_2$, and bromic acid $HBrO_3$. Hypobromous acid is obtained by shaking together bromine water and precipitated mercuric oxide, followed by distillation of the dilute solution *in vacuo* at low temperature (about 40°C.). It is a very unstable compound, breaking up, on heating, into bromine and oxygen. The aqueous solution is light yellow in colour, and possesses strong bleaching properties. Bromic acid is obtained by the addition of the calculated amount of sulphuric acid (previously diluted with water) to the barium salt; by the action of bromine on the silver salt, in the presence of water, $5AgBrO_3 + 3Br_2 + 3H_2O = 5AgBr + 6HBrO_3$, or by passing chlorine through a solution of bromine in water. The acid is only known in the form of its aqueous solution; this is, however, very unstable, decomposing on being heated to 100°C. in water, oxygen and bromine. By reducing agents such, for example, as sulphuretted hydrogen and sulphur dioxide, it is rapidly converted into hydrobromic acid. Hydrobromic acid decomposes it according to the equation $HBrO_3 + 5HBr = 3H_2O + 3Br_2$. Its salts are known as bromates, and are as a general rule with difficulty soluble in water, and decomposed by heat, with evolution of oxygen. Bromine forms compounds with fluorine (BrF_2) and iodine (IBr), but only a series of mixed crystals with chlorine.

Applications.—The salts of bromine are widely used in photography, especially bromide of silver. In medicine it is largely employed in the form of bromides of potassium, sodium and ammonium, as well as in combination with alkaloids and other substances.

Medicinal Use.—Bromide of potassium is the safest and most generally applicable sedative of the nervous system. Whilst very weak, its action is perfectly balanced throughout all nervous tissue, so much so that Sir Thomas Lauder Brunton has suggested its action to be due to its replacement of sodium chloride (common salt) in the fluids of the nervous system. Hence bromide of potassium (or bromide of sodium, which is possibly somewhat safer still though not quite so certain in its action) is used as a hypnotic, as the standard anaphrodisiac, as a sedative in mania and all forms of morbid mental excitement, and in hyperaesthesia of all kinds. Its most striking success is in epilepsy, for which it is the specific remedy. It may be given in doses of from 10 to 50 grains or more, and may be continued without ill effect for long periods in grave cases of epilepsy (*grand mal*). Of the three bromides in common use the potassium salt is the most rapid and certain in its action, but may depress the heart in morbid states of that organ; in such cases the sodium salt (of which the base is inert) may be employed. In whooping-cough, when a sedative is required but a stimulant is also indicated, ammonium bromide is often invaluable. The conditions in which bromides are most frequently used are insomnia, epilepsy, whooping-cough, delirium tremens, asthma, migraine, laryngismus stridulus, the symptoms often attendant upon the climacteric in women, hysteria, neuralgia, certain nervous disorders of the heart, strychnine poisoning, nymphomania and spermatorrhoea. Hydrobromic acid is often used to relieve or prevent the headache and singing in the ears that may follow the administration of quinine and of salicylic acid or salicylates.

BROMLEY, SIR THOMAS (1530–1587), English judge born in Staffordshire in 1530, was educated at Oxford and called to the bar at the Middle Temple. Through family influence and the patronage of the lord keeper, Bacon, he made way in his profession, becoming recorder of London in 1566, and solicitor-general (1569). He sat in parliament successively for Bridgnorth, Wigan and Guildford. In 1579 he was made lord chancellor. As an equity judge he showed profound knowledge; Shelley's case (*q.v.*) is a landmark in English law. He presided at the trial of Mary, queen of Scots (1586), but the strain proved too much for his strength, and he died on April 12, 1587, and was buried in Westminster Abbey.

See Foss, *Lives of the Judges* (1848–64); J. Campbell, *Lives of the Lord Chancellors.*

BROMLEY, municipal and parliamentary borough of Kent, England, 10½ mi. S.S.E. of London by the S.R. Pop. (1938) 59,470. Area 10.2 sq.mi. It lies on high ground north of the small River Ravensbourne in a well-wooded district and is a favourite residential locality for those whose business lies in London. There are 492 ac. of public open spaces in the borough. The former palace of the bishops of Rochester (now a school) was erected in 1777. The manor belonged to this see as early as the reign of Ethelbert. In the gardens is a chalybeate spring known as St. Blaize's well, which was in high repute before the Reformation. The church of St. Peter and St. Paul, mainly Perpendicular, with a Norman font, was destroyed in World War II, except for the tower. Bromley college was founded by Bishop Warner in 1666 for "twenty poor widows of loyal and orthodox clergymen." In the vicinity of Bromley, Bickley is a similar residential township, and Hayes Common a favourite place of excursion.

Bromley was incorporated in 1903. The parliamentary borough, formed in 1918, includes the borough of Beckenham and the urban district of Penge and returns one member.

BROMPTON, a south-western district of London, England, in the south-east of the metropolitan borough of Kensington. Brompton road, leading south-west from Knightsbridge, is continued as Old Brompton road and Richmond road, to join Lillie road, at which point are the Metropolitan District and Southern Railway stations of West Brompton. Brompton Oratory, the Imperial institute, the Victoria and Albert museum, the Imperial College of Art, the Natural History museum, the Imperial Science museum, the Imperial College of Science and Technology, the offices of the University of London, the Brompton consumption hospital and the West London or Brompton cemetery are included in this district, which is mainly occupied by residences. (*See* KENSINGTON.)

BROMSGROVE, urban district, Worcestershire, England, 12 mi. N.N.E. of Worcester, with a station 1 mi. from the town on the Bristol-Birmingham L.M.S. line. Pop. (1938) 23,540. Area 14.5 sq.mi. It lies in an undulating district near the foot of the Lickey hills. The railway toward Birmingham here ascends for 2 mi. the steepest gradient (1 in 37) in England over such a distance. There remain several picturesque half-timbered houses dating from 1572 and later. The church of St. John, mainly Perpendicular in date, is placed above the town. There is a well-known grammar school, founded by Edward VI, and an open air school for crippled children. Bromsgrove is a market town, but there are manufactures, *e.g.*, of nails and buttons. The river Salwarpe works a number of mills in the neighbourhood. Near the town are L.M.S. railway carriage works.

BRONCHIECTASIS (*see* also Respiratory System, Diseases of), dilatation of the bronchi, a condition occurring in many diseases of the lungs. Bronchitis, both acute and chronic, chronic pneumonia and phthisis, acute pneumonia and broncho-pneumonia, may all leave after them a bronchiectasis whose position is determined by the primary lesion. Other causes are tracheal and bronchial obstruction, as from the pressure of an aneurism, new growth, etc. It is chiefly a disease of middle age, but may occur in debilitated children after measles, whooping cough, etc. The dilatation is cylindrical or saccular, and the medium and smaller sized tubes are generally affected, except where the cause is mechanical. The affection is usually of one lung only. Emphysema is a very common accompaniment. Cough is paroxysmal, and though severe is intermittent, the patient being entirely free for many hours at a time. The effect of posture is great. If the patient lie on the affected side, he may be free from cough the whole night, but if he turn to the sound side, or if he rise and bend forward, he brings up large quantities of foetid bronchial secretion. Where the dilatation is saccular it may come up in such quantities and with so much suddenness as to gush from the mouth. When the disease has lasted long, clubbing of fingers and toes is common. The diagnosis between this condition and a tuberculous cavity in the lung is often very difficult. Often the patient's condition can be greatly alleviated. Creosote vapour baths are eminently satisfactory. A mechanical treatment much recommended by some of the German physicians is that of forced expiration and, more recently, surgical drainage of the cavities has been adopted.

BRONCHITIS, the name given to inflammation of the mucous membrane of the bronchial tubes (*see* Respiratory System, Anatomy of). Two main varieties occur, specific and nonspecific. The bronchitis met with in typhoid fever and diphtheria, influenza, measles, pneumonia, due to the micro-organisms causing these diseases, is specific; that which results from extension from above, or from chemical or mechanical irritation, is nonspecific. It is convenient to describe it, however, under the clinical divisions of *acute* and *chronic* bronchitis.

Acute bronchitis generally arises as the result of exposure to cold, particularly if accompanied with damp, or of sudden change from a heated to a cool atmosphere. The symptoms vary according to the severity of the attack, *i.e.*, according to the extent to which the inflammatory action spreads in the bronchial tubes. The disease usually manifests itself at first as a common cold with feverishness and general constitutional disturbance. A short, painful, dry cough, rapid and wheezing respiration, a feeling of rawness and pain in the throat and behind the breast bone, and of oppression or tightness throughout the chest, mark the early stages of the disease. If the smaller bronchi are involved extensively, dyspnoea is severe.

After a few days expectoration accompanies the cough, at first scanty and viscid or frothy, but soon becoming copious and mucopurulent. In general, after free expectoration has been established the more urgent and painful symptoms abate; and though the cough may persist for three or four weeks, the patient is ultimately restored to health.

The case is different when inflammation spreads into, or primarily affects, the minute ramifications of the bronchial tubes in immediate relation to the air-cells of the lungs; giving rise to *capillary bronchitis* or *broncho-pneumonia* (*see* Respiratory System, Diseases of and Pneumonia). When this takes place the symptoms already detailed are intensified, and the patient's life is in danger. The feverishness and restlessness increase, the cough becomes incessant, the respiration extremely rapid and laboured, the nostrils dilating with each effort, and evidence of impending suffocation appears. The surface of the body is pale or dusky, the lips are livid, while breathing becomes increasingly difficult, and is attended with suffocative paroxysms which render the recumbent posture impossible. Unless speedy relief is obtained somnolence and delirium set in and death ensues.

Acute bronchitis must at all times be looked upon as a serious ailment. It is pre-eminently dangerous at the extremes of life, and it is one of the most fatal diseases of those periods.

Bronchitis is often very severe in alcoholic persons, in those who suffer from any disease affecting directly or indirectly the respiratory functions, such as consumption or heart disease, and in children who are or have been suffering from measles and whooping-cough.

One source of danger in bronchitis is collapse of the lung. Occasionally a branch of a bronchial tube becomes plugged with secretion, and the area of the lung to which this branch conducts ceases to be inflated on inspiration. The small quantity of air imprisoned in the portion of lung gradually is absorbed, but no fresh air enters, and the part collapses and becomes solid. Increased difficulty of breathing is the result, and where a large portion of lung is affected by the plugging of a large bronchus, a fatal result may rapidly follow, especially in children.

Treatment.—In mild cases warmth, light diet and diluent drinks alone are necessary. In severer cases expectorants, perhaps with the addition of a little opiate if pain be severe, may be required. In children, however, opium must be given with the greatest caution because of their extreme sensitiveness to this drug. Not a few "soothing mixtures" contain opium in quantity sufficient to be dangerous when administered to children. In addition fomentations and inhalations are often of use.

When the bronchitis is of the capillary form, the great object is to maintain the patient's strength, and secure expulsion of the morbid secretion from the fine bronchi. In addition to other remedies stimulants are called for from the first, and should the cough be ineffectual in relieving the bronchial tubes, the administration of an emetic dose of sulphate of zinc may produce a good effect. It may be necessary to administer oxygen.

During the whole course of any attack of bronchitis attention must be paid to nourishment of the patient; and during the subsequent convalescence, particularly in elderly persons, tonics and stimulants may have to be prescribed.

Chronic bronchitis may arise as the result of repeated attacks of the acute form, or it may exist altogether independently. It occurs more frequently among persons advanced in life than among the young, although no age is exempt from it. The usual history of this form of bronchitis is that of a cough recurring during the colder seasons of the year, and in its earlier stages, departing entirely in summer, so that it is frequently called "winter cough." In many persons subject to it, however, attacks are apt to be excited at any time by very slight causes, such as changes in the weather; and in advanced cases of the disease the cough is seldom altogether absent. The symptoms and auscultatory signs of chronic bronchitis are on the whole similar to those pertaining to the acute form, except that the febrile disturbance and pain are much less marked. The cough is usually more troublesome in the morning than during the day. There is free and copious expectoration, and occasionally this is so abundant as to constitute *bronchorrhoea.*

Chronic bronchitis leads to alterations of structure in the affected bronchial tubes, their mucous membrane becoming thickened or even ulcerated, while occasionally permanent dilatation of the bronchi takes place, often accompanied with profuse foetid expectoration. In long-standing cases the nutrition of the lungs becomes impaired, and dilatation of the air-tubes (*emphysema*) and other complications result, giving rise to breathlessness.

Chronic bronchitis may arise secondarily to some other ailment, especially Bright's disease and heart disease. The influence of occupation is seen in the frequency in which persons following certain employments suffer from chronic bronchitis. The inhalation of vegetable dust is very liable to produce bronchitis through the irritation produced by the dust particles and the growth of organisms carried in with the dust. Consequently, millers and grain-shovellers are especially liable to it, while next in order come weavers and workers in cotton factories.

The treatment to be adopted in chronic bronchitis depends upon the severity of the case, the age of the patient and the presence or absence of complications. Tonics with cod-liver oil will be found advantageous. In those aggravated forms where the slightest exposure to cold air brings on fresh attacks, confinement to a warm room or removal to a more genial climate during the winter months is indicated.

BRONCHOTOMY, a medical term used for a surgical incision into the throat; now superseded by the terms laryngotomy, thyrotomy and tracheotomy, which indicate more accurately the place of incision.

BRONCO, usually incorrectly spelt BRONCHO (Spanish for *rough*), an untamed horse, especially in the United States, a mustang.

BRONGNIART, ADOLPHE THÉODORE (1801–1876), French botanist, son of the geologist Alexandre Brongniart, was born in Paris Jan. 14, 1801. In 1831 he became assistant to R. L. Desfontaines at the Musée d'Histoire Naturelle, and two years later succeeded him as professor, a position he continued to hold until his death Feb. 16, 1876. Brongniart's paper on the classification and distribution of fossil plants (1822) was followed by others bearing chiefly upon the relation between extinct and existing forms. His important "Prodrome" (contributed to the *Grand Dictionnaire d'Hist. Nat.,* 1828, t.lvii.) brought order into chaos by a classification in which the fossil plants were arranged, with remarkably correct insight, along with their nearest living allies, and which forms the basis of all subsequent progress in this direction. It is of especial botanical interest, because, in accordance with Robert Brown's discoveries, the Cycadeae and Coniferae were placed in the new group *Phanérogames gymnospermes.* In this book attention was also directed to the succession of forms in the various geological periods. His great *Histoire des végétaux fossiles,* which itself was not destined to be more than a colossal fragment, was published in successive parts from 1828 to 1837. His other important palaeontological contributions are his observations on the structure of *Sigillaria* (*Arch. Mus. Hist. Nat.* i., 1839) and his researches on fossil seeds, of which a full account was published posthumously in 1880.

His memoir "Recherches sur la génération et le développement de l'embryon des Phanérogames" (*Ann. Sci. Nat.* xii., 1827) contains the first valuable account of the development of the pollen; as also a description of the structure of the pollen-grain, the confirmation of G. B. Amici's (1823) discovery of the pollen-tube, the confirmation of R. Brown's views as to the structure of the unimpregnated ovule (with the introduction of the term "sac embryonnaire"). It shows how nearly Brongniart anticipated Amici's subsequent (1846) discovery of the entrance of the pollen-tube into the micropyle, fertilizing the female cell.

His systematic work is represented by a large number of papers and monographs, many of which relate to the flora of New Caledonia; and by his *Énumération des genres de plantes cultivées au Muséum d'Histoire Naturelle de Paris* (1843, ed. 2, 1850), which is a landmark in the history of classification in that it forms the starting-point of the system, modified successively by A. Braun, A. W. Eichler and A. Engler, which is now adopted in Germany. With J. V. Audouin and J. B. A. Dumas, his future brothers-in-law, he established the *Annales des Sciences Naturelles* in 1824; he also founded the Société Botanique de France in 1854, and was its first president.

For accounts of his life and work see *Bull. de la Soc. Géol. de France* (1876), and *La Nature* (1876); the *Bulletin de la Soc. Bot. de France* for 1876, vol. xxiii., contains a list of his works.

BRONGNIART, ALEXANDRE (1770–1847), French mineralogist and geologist, son of the eminent architect who designed the Bourse and other public buildings of Paris, was born in that city, and became professor of natural history in the Collège des Quatre Nations. In 1800 he was made director of the Sèvres porcelain factory, a post which he retained to his death. In his hands Sèvres became the leading factory in Europe, and the researches of an able band of assistants enabled him to lay the foundations of ceramic chemistry. He succeeded Haüy as professor of mineralogy in the Museum of Natural History; but he did not confine himself to mineralogy, for it is to him that we owe the division of reptiles into the four orders of Saurians, Batrachians, Chelonians and Ophidians; and fossil as well as living animals engaged his attention. His *Traité des arts céramiques* (1844) is a classic.

Brongniart was also the coadjutor of Cuvier in the admirable *Essai sur la géographie minéralogique des environs de Paris* (1811), originally published in *Ann. Mus. Hist. Nat.* (1808), xi.

BRONN, HEINRICH GEORG (1800–1862), German geologist, was born on March 3, 1800, at Ziegelhausen near Heidelberg. He took his degree as doctor of medicine at Heidelberg in 1821, and in the following year was appointed professor of natural history. His great work, *Lethaea Geognostica* (2 vols., Stuttgart, 1834–38; 3rd ed., with F. Römer, 3 vols., 1851–56), has been regarded as one of the foundations of German stratigraphical geology. Of his *Handbuch einer Geschichte der Natur* (1841 *seq.*), the third part included his famous *Index Palaeontologicus.* He died at Heidelberg on July 5, 1862.

BRONSART VON SCHELLENDORF, PAUL (1832–1891), Prussian general, was born at Danzig on Jan. 25, 1832. He entered the Prussian Guards in 1849. During the war of 1870 he was chief of a section on the Great General Staff, and conducted the preliminary negotiations for the surrender of the French at Sedan. As minister for war (1883–89) he carried out many important reforms in the Prussian army, in particular the introduction of the magazine rifle. He was appointed in 1889 to command the 1st Army Corps at Königsberg. He died on June 23, 1891, at his estate near Braunsberg. Bronsart's military writings include two important works: *Ein Rückblick auf die taktischen Rückblicke* (2nd ed., 1870), a pamphlet written in reply to Captain May's *Tactical Retrospect of 1866;* and *Der Dienst des Generalstabes im Frieden und im Kriege* (1st ed., 1876; 3rd ed., revised by General Meckel, 1893; new ed. by the author's son, Major Bronsart von Schellendorf, 1904), a comprehensive treatise on the duties of the general staff. The edition of 1893 was translated into English and issued officially to the British army as *The Duties of the General Staff.* Major Bronsart's new edition of 1904 was re-issued in English by the general staff, under the same title, in 1905.

BRONTË, CHARLOTTE (1816–1855), **EMILY** (1818–1848) and **ANNE** (1820–1849), English novelists, were the children of Patrick Brontë, an Irishman, who was born at Emsdale, Co. Down, on March 17, 1777. His paternal name was Brunty, but this he changed when he came to England. Although the son of humble parents, he had saved sufficient by the age of 25 to support him at Cambridge, and he entered St. John's college in 1802; then, on taking his degree four years later, he became curate of Wethersfield, Essex. At Hartshead-cum-Clifton, Yorkshire, where he had afterwards accepted a curacy, he married Maria, daughter of Thomas Branwell of Penzance, in 1812. She was a woman of delicate constitution, and died of cancer on Sept. 15, 1821, the mother of six children. Hartshead was the birthplace of her elder daughters, Maria (1813–1825) and Elizabeth (1814–1825); then when the family had moved to Thornton in the same county, Charlotte was born on April 21, 1816, Patrick Branwell in 1817, Emily Jane in August, 1818, and Anne in March 1820. Three months after Anne's birth, her father accepted the living of Haworth nine miles from Bradford, where he remained as rector for the rest of his life.

On the death of Mrs. Brontë, her husband invited his sister-in-law, Elizabeth Branwell, to live with his family at Haworth and to care for the children. She taught them the simple arts, but took her meals apart and had but slight intercourse with them. Branwell was educated by his father, but the latter, again, was of eccentric personality. A man of more than average intelligence (he was the author of two volumes of verse and other works) and undoubtedly fond of his six children, yet he was unsocial in his habits, living, even taking his meals alone, in his study. Thus the children were left very much to themselves in the bleak moorland rectory. Most of their time was spent in reading and in composition, varied with walks over the moors; and their output of youthful literature was enormous. In the course of 15 months, before she was 15 years of age, Charlotte was responsible for 23 "novels" alone, and in these writings, though they are of no intrinsic value, there is ample evidence of the astonishing precocity displayed by the young family.

The children were educated, during their early life, at home, except for a single year which Maria, Elizabeth, Charlotte and Emily spent in the Clergy Daughters' school at Cowan's Bridge. Here the fees were extremely low, and the food was correspondingly bad, while the discipline was unpardonably harsh. The horrors experienced at Cowan's Bridge were afterwards depicted by Charlotte in *Jane Eyre*, the name of the school being disguised as "Lowood"; but in this terrible picture it is necessary to allow for some exaggeration. In 1831 Charlotte was sent to Miss Margaret Wooler's school at Roe Head, Dewsbury, where she improved her drawing, French and composition; a year later, she returned home to assist in the instruction of her sisters. Although her shyness and reserve, her ignorance in some directions and her precocity in others, were noted by her school companions at Roe Head, this year of her life was a happy one, and bore fruit in the lasting friendships which she made with Mary Taylor and Ellen Nussey; her correspondence with Miss Nussey, indeed, which continued until her death, has provided much of what we know of her life. The next three years at Haworth, varied with visits to one or other of these two friends, were spent in reading and composition; but financial considerations, and especially the cost of supporting Branwell, persuaded her in 1835 to become governess with Miss Wooler, whose school, a year later, was removed to Dewsbury. Emily, accompanying her as a pupil, suffered from home-sickness and remained only three months; her place was then taken by Anne.

When Charlotte returned, on account of ill-health, to Haworth in 1838, she received an offer of marriage from Ellen Nussey's brother Henry, who was a clergyman, but this proposal, and a second one from a curate named Bryce, she refused. Her opinion of curates, whom in one place she describes as "a self-seeking, vain and empty race," was singularly embittered especially in view of her marriage later on. At this time her literary endeavours were somewhat damped by a letter which she received from Southey; she had sent him some manuscripts for his opinion, and his reply discouraged her. It was necessary to supplement the family income, and Charlotte made new plans. After serving for some months as nursery governess to the Sidgwicks of Stonegappe and to the Whites of Rawdon, Yorkshire, it occurred to her that she might attain to a greater independence if she herself possessed a school. Her aunt agreed to finance this experiment, and Charlotte proposed to visit the Continent in order to acquire a more thorough knowledge of modern languages; early in 1842 she went with Emily to Brussels as pupil in the Pensionnat Heger. The talent displayed by both his English students brought them to the special notice of the principal teacher, Constantin Heger, who was a man of unusual perception, and in whose hands they rapidly acquired a mastery of the language. After eight months, however, their studies were abruptly cut short by the death of their aunt on Oct. 20, 1842, and they both returned to England. Charlotte was on the whole happy in Brussels, but Emily pined for home and for the wild moorland air. Yet it seems clear that in Brussels, reserved as she was, Emily was better appreciated than Charlotte. Her passionate nature was more easily understood than Charlotte's decorous temperament. Elizabeth Branwell bequeathed to her nieces a sum which carried a certain independence with it, and, discarding the plan to found a school outside, the sisters now decided to take pupils at their father's house. Charlotte, however, in order to perfect her knowledge of French, accepted an invitation from M. Heger to return as instructress to Brussels, and the whole of 1843 she spent abroad. This year was not a happy one for her. She was lonely and grew depressed, her strong religious convictions were upset in a Roman Catholic country, while there is reason to believe that Mme. Heger became jealous of her. That the latter was unjust in her suspicions can hardly be questioned. Certainly the letters which Charlotte sent her master after she had left Brussels finally, indicate a profound and moving attachment to him, but on the other hand there is not the slightest reason to suppose that M. Heger felt anything beyond friendliness and admiration for his pupil's talents. Charlotte returned to Haworth on Jan. 2, 1844.

The events which followed were not calculated to dissipate her gloom. Prospectuses were issued of the school which they proposed to found at the vicarage, but to that distant village no pupils were attracted. Worse than this disappointment was the moral collapse of Branwell, who about this time became a confirmed drunkard. He had been a lad of great promise, and it was hoped that he would become an artist; but his fondness for drink and for questionable companions, besides a more general feebleness of character, had manifested themselves early in his life and with disastrous results. From his youth onwards, his life was a series of disgraces. He squandered his parent's money in futile efforts to become a painter, and turned at last to private tuition as a means of earning his living. A short period of employment with the Leeds and Manchester railway terminated with his dismissal in 1842 on account of culpable negligence, and his career closed in 1845 when he was turned out of Mr. Robinson's house at Thorp Green, justly charged with making love to his employer's wife. The last years of his life were spent at Haworth, where he loafed at the village inn, shocked his sisters by his excesses, and finally died in delirium tremens.

In 1845 Charlotte came across some poems by Emily, and this led to the discovery that all three had written verse. A year later was published jointly a volume of poems by "Currer, Ellis and Acton Bell," the initials of these pseudonyms being those of the sisters; but the book was issued at their own expense, and only two copies were sold. Yet lack of notice did not deter them from further efforts. Each had a novel completed, for which they persevered in their endeavours to find a publisher. After a long and discouraging series of refusals, Charlotte was rewarded in 1847 by a polite letter from the firm of Smith and Elder, whose reader, while rejecting her novel *The Professor*, expressed himself very willing to examine the three-volume romance which she had mentioned to him. This was *Jane Eyre*, then in process of completion. Written in a period of sadness consequent upon Branwell's collapse, upon the growing blindness of her father, and upon the now manifest ill-health of her sisters, it was a work of incomparably greater power than *The Professor*. When she sent it to Smith and Elder, their reader, W. S. Williams, was so excited that he sat up all night reading it; and on its publication in Aug. 1847, success was immediate. "Currer Bell" at once became a famous name. Although the book was full of improbabilities and often displayed a naïve ignorance of the world, its characterization was so sure and its passion so overwhelming, that its faults were easily forgotten. Charlotte's extreme shyness induced her to keep her name secret for some time after the appearance of *Jane Eyre*, but when she visited London in 1848, to see her publishers her real name could no longer be concealed from them.

Her stay in London was very brief, and on her return to Haworth, fresh misfortunes were awaiting her to dissipate whatever elation she may have felt. Branwell died on Sept. 24, and hardly had Charlotte recovered from the breakdown which followed this shock than Emily's health began rapidly to fail. She had been ill for some time, but now her breathing became difficult, and she suffered great pain. Yet it was only two hours before her death on Dec. 19, after she had struggled from her bed and dressed herself, that she would allow a doctor to be called. This stoicism was characteristic of her whole life. With her death the most enigmatical and perhaps the greatest of the Brontës passed away. Our record of her life is extremely meagre, for she was silent and reserved, and left no correspondence of interest, while her single novel, *Wuthering Heights*, darkens rather than solves the mystery of her spiritual existence. This book had been accepted early in 1847 by J. Cautley Newby, of London, but its publication was delayed until after the appearance of *Jane Eyre*. Its greatness was not soon recognized, and many years elapsed before anything beyond a clumsiness of construction and a savagery of mood were generally perceived in it. So difficult is the book to "place," and so charged with a significance which it is difficult to explain, that doubts of all kinds have grown up round it. At first it was widely regarded as an early work of "Currer Bell," and later on as a creation of Branwell's; but there is no reason for rejecting Charlotte's statement that the novel was by her sister, while there is good evidence in Branwell's writings for not crediting him with so great a book as this. It is true that he claimed at least a share of the authorship, but this was no more, probably, than the idle boast of a drunkard. Emily's poems (she alone of the sisters possessed a true poetic gift) throw most light upon her mind and heart. From them we learn of her stoicism, her deism and of her passion for the moors which almost amounted to "nature worship"; and there are also passages which plainly indicate that she had had mystical experiences. Besides the poems, which give some idea of her personality, there is an idealized portrait of Emily in the heroine of Charlotte Brontë's *Shirley;* but of external biographical material little that is of value has been preserved.

On May 26 of the next year Anne died at Scarborough, where she had gone for the sake of her health. Gentle, open and submissive, she was in many respects the antithesis of Emily, but she was nevertheless the deepest in her confidence. Along with *Wuthering Heights*, she had submitted a novel to Newby, and this, *Agnes Grey*, was also accepted. Both books were published in Dec. 1847, but Anne's novel achieved no more success than her sister's. *Agnes Grey* was succeeded by *The Tenant of Wildfell Hall;* which was issued by the same publisher in the following June; but no outstanding merit can be claimed for either of Anne's novels, though they have perhaps suffered mainly by comparison with the work of her greater sisters. Her verses were graceful and often expressed with considerable beauty the pathos and gentleness of her personality, while some of her hymns are sung to this day.

In the interval between the death of Branwell and of Emily, Charlotte had been engaged upon a new novel—*Shirley*. Two-thirds were written, but the story was then laid aside while its author was nursing her sister Anne. She completed the book after Anne's death, and it was published in Oct. 1849. The following winter she visited London as the guest of her publisher, Mr. George Smith, and was introduced to Thackeray, to whom she had dedicated *Jane Eyre*. The following year she repeated the visit, sat for her portrait to George Richmond, and was considerably lionized by a host of admirers. In Aug. 1850 she visited the English lakes as the guest of Sir James Kay-Shuttleworth, and met Mrs. Gaskell, Miss Martineau, Matthew Arnold and other interesting men and women. During this period her publishers assiduously lent her books, and her criticisms of them contained in many letters to Mr. George Smith and Mr. Smith Williams make very interesting reading, though she could never separate artistic and moral values. In 1851 she received a third offer of marriage, this time from Mr. James Taylor, who was in the employment of her publishers. A visit to Miss Martineau at Ambleside, Westmorland and also to London to the Great Exhibition made up the events of this year. On her way home she visited Manchester and spent two days with Mrs. Gaskell. During the year 1852 she worked hard on *Villette*, which was published in Jan. of 1853. In Sept. of that year she received a visit from Mrs. Gaskell at Haworth; in May 1854 she returned it, remaining three days at Manchester, and planning with her hostess the details of her marriage with her father's curate, Arthur Bell Nicholls (1817–1906), who had long been a pertinacious suitor but had been discouraged by Mr. Brontë. The marriage took place in Haworth church on June 29, 1854. Charlotte and her husband spent their honeymoon in Ireland returning to Haworth, where they made their home with Mr. Brontë, Mr. Nicholls having pledged himself to continue in his position as curate to his father-in-law. After less than a year of married life, however, Charlotte Nicholls died of an illness following on childbirth, on March 31, 1855. She was buried in Haworth church by the side of her mother, Branwell and Emily. The father died in 1861, and then her husband returned to Ireland, surviving until 1906.

The bare recital of the Brontë story can give no idea of its undying interest, its exceeding pathos. Their life as told by their biographer Mrs. Gaskell is as interesting as any novel. Their achievement, however, will stand on its own merits. Anne Brontë's two novels, it is true, though constantly reprinted, survive principally through the exceeding vitality of the Brontë tradition. Emily is great alike as a novelist and as a poet. Her "Old Stoic" and "Last Lines" are among the finest achievement of poetry that any woman has given to English literature. *Wuthering Heights* stands alone as a monument of intensity owing nothing to tradition, nothing to the achievement of earlier writers. It was a thing apart, passionately sincere, unforgettable, haunting in its grimness, its grey melancholy. Emily Brontë has a sure and certain place in English literature. As a poet or maker of verse Charlotte Brontë is undistinguished, but there are passages of pure poetry of great magnificence in her four novels, and particularly in *Villette*. The novels *Jane Eyre* and *Villette* will always command attention whatever the future of English fiction, by virtue of their intensity, their independence, their rough individuality. It is essential to realize the early Victorian atmosphere in which Emily and Charlotte Brontë wrote their novels if the greatness of their achievement is to be realized. They shocked their contemporaries by showing their heroines consumed by naked passion, and made a breach in the then conventional theory that woman was merely the loved and not the lover. The problem that has tormented all their biographers, and critics is how they learned to know passion as they did when their lives were spent in the Haworth parsonage so familiar to all their readers. Their world was built up in their own imagination, and it is this which makes its truth and its universal appeal.

The *Life of Charlotte Brontë*, by Mrs. Gaskell, was first published in 1857. Owing to the many controversial questions it aroused, as to the identity of Lowood in *Jane Eyre* with Cowan Bridge school, as to the relations of Branwell Brontë with his employer's wife, as to the supposed peculiarities of Mr. Brontë, and certain other minor points, the third edition was considerably changed. The *Life* has been many times reprinted, but may be read in its most satisfactory form in the Haworth edition (1902), issued by the original publishers, Smith, Elder and Co. To this edition are attached a great number of letters written by Charlotte Brontë to her publisher, George Smith. The first new material supplied to supplement Mrs. Gaskell's *Life* was contained in *Charlotte Brontë; a Monograph*, by T. Wemyss Reid (1877). This book inspired A. C. Swinburne to issue separately a forcible essay on Charlotte and Emily Brontë, under the title of *A Note on Charlotte Brontë* (1877). A further collection of letters written by Charlotte Brontë was contained in *Charlotte Brontë and Her Circle*, by Clement Shorter (1896), and interesting details can be gathered from the *Life of Charlotte Brontë*, by Augustine Birrell (1887). *The Brontës in Ireland*, by William Wright (1893), *Charlotte Brontë and Her Sisters*, by Clement Shorter (1906), and the Brontë Society publications, edited by Butler Wood (1895–1907). A. M. F. Robinson (Mme. Duclaux) wrote a separate biography of Emily Brontë in 1883, and an essay in her *Grands Écrivains d'outre-Manche*. *The Brontë's Life and Letters*, by Clement Shorter (1907) contains the whole of C. Brontë's letters in chronological order. Four additional letters, addressed by Charlotte to M. Heger in 1844–45, show the depths of Charlotte's attachment. The most important of the later studies on the Brontë sisters are May Sinclair, *The Three Brontës;* E. Dimnet, *Les Soeurs Brontë* (1910; E. trans. *The Brontë Sisters*, 1927); Romer Wilson, *All Alone: the life of Emily Brontë* (1928); Rosamonde Langbridge, *Charlotte Brontë, a psychological study* (1929); Charles Simpson, *Emily Brontë* (1930).

BRONTE, province of Catania, Sicily, on the western slopes of Mt. Etna, 24 mi. N.N.W. of Catania direct, and 34 mi. by rail. Pop. (1936) 17,673 (town); 17,918 (commune).

The town was founded by Charles V, with an estate originally belonging to the monastery of Maniacium (Maniace), and was granted to Nelson by Ferdinand IV of Naples in 1799 as a dukedom.

BRONTOSAURUS, a gigantic amphibious dinosaur, more properly termed *Apatosaurus*. It was allied to *Diplodocus* (*q.v.*), but more heavily built, with an estimated weight of about 40 tons and a maximum length of 70 ft. (*See* REPTILES; DINOSAURIA.)
(A. S. RR.)

BRONX, THE, a borough of New York city (*q.v.*) since 1898; formerly a district comprising several towns in Westchester county. Area (land) 41 sq.mi., population (1940) 1,394,711.

BRONZE, an alloy formed wholly or chiefly of copper and tin in variable proportions. The word has been etymologically connected with the same root as appears in "brown," but according to M. P. E. Berthelot (*La Chimie au moyen âge*) it is a place-name derived from *aes Brundusinum* (cf. Pliny, *Nat. Hist.* xxxiii. ch. ix. §45. 'specula optima apud maiores fuerunt Brundusiana, stanno et aere mixtis'). A Greek ms. of about the 11th century in the library of St. Mark's, Venice, contains the form βροντήσιον and gives the composition of the alloy as 1 lb. of copper with 2 oz. of tin. The product obtained by adding tin to copper is more fusible than copper and thus better suited for casting; it is also harder and less malleable. A soft bronze or *gun-metal* is formed with 16 parts of copper to 1 of tin, and a harder gun-metal, such as was used for bronze ordnance, when the proportion of tin is about doubled. The *steel bronze* of Colonel Franz Uchatius (1811–81) consisted of copper alloyed with 8% of tin, the tenacity and hardness being increased by cold-rolling. Bronze containing about 7 parts of copper to 1 of tin is hard, brittle and sonorous, and can be tempered to take a fine edge. *Bell-metal* varies considerably in composition, from about 3 to 5 parts of copper to 1 of tin. In *speculum metal* there are 2 to 2½ parts of copper to 1 of tin. Statuary bronze may have from 80 to 90% copper, the rest tin, or tin with zinc and lead. Bronze in British and French copper coinage is 95% copper, 4% tin, and 1% zinc. The U.S. cent is 95% copper (45.6 grains) and 5% tin and zinc (2.4 grains).

Many copper-tin alloys employed for machinery bearings contain a small proportion of zinc, which gives increased hardness. "**Anti-friction** metals," also used in bearings, are copper-tin **alloys** in which the amount of copper is small and there is antimony in addition. Of this class an example is "Babbitt's metal" invented by Isaac Babbitt (1799–1862); it originally consisted of 24 parts of tin, 8 parts of antimony and 4 parts of copper, but in later compositions for the same purpose the proportion of tin is often considerably higher.

Phosphor Bronze. Bronze is improved in quality and strength when fluxed with phosphorus. Alloys prepared in this way, and known as *phosphor bronze*, may contain only about 1% of phosphorus in the ingot, reduced to a mere trace after casting, but their value is nevertheless enhanced for purposes in which a hard strong metal is required, as for pump plungers, valves, the bushes of bearings, etc. Bronze again is improved by the presence of manganese in small quantity, and various grades of *manganese bronze*, in some of which there is little or no tin but a considerable percentage of zinc, are used in mechanical engineering.

Alloys of copper with aluminium, though often nearly or completely destitute of tin, are known as *aluminium bronze*, and are valuable for their strength and the resistance they offer to corrosion. By the addition of a small quantity of silicon the tensile strength of copper is much increased; a sample of such *silicon bronze*, used for telegraph wires, on analysis was found to consist of 99.94% of copper, 0.03% of tin, and traces of iron and silicon.

The bronze (Gr. χαλκός, Lat. *aes*) of classical antiquity consisted chiefly of copper, alloyed with one or more of the metals, zinc, tin, lead and silver, in proportions that varied as times changed or according to the purposes for which the alloy was required. Among bronze remains the copper is found to vary from 67 to 95%. From the analysis of coins it appears that for their bronze coins the Greeks adhered to an alloy of copper and tin till 400 B.C., after which time they used also lead with increasing frequency. Silver is rare in their bronze coins. The Romans also used lead as an alloy in their bronze coins, but gradually reduced the quantity, and, under Caligula, Nero, Vespasian, and Domitian, coined pure copper coins; afterwards they reverted to the mixture of lead. So far the words χαλκός and *aes* may be translated as bronze. Originally, no doubt, χαλκός was the name for pure copper. It is so employed by Homer, who calls it ἐρυθρός (red), αἴθοψ (glittering), φαεινός (shining), terms which apply only to copper. But instead of its following from this that the process of alloying copper with other metals was not practised in the time of the poet, or was unknown to him, the contrary would seem to be the case from the passage (*Iliad* xviii. 474) where he describes Hephaestus as throwing into his furnace copper, tin, silver and gold to make the shield of Achilles, so that it is not always possible to know whether when he uses the word χαλκός he means copper pure or alloyed. Still more difficult is it to make this distinction when we read of the mythical Dactyls of Ida in Crete or the Telchines or Cyclopes being acquainted with the smelting of χαλκός. It is not, however, likely that later Greek writers, who knew bronze in its true sense, and called it χαλκός, would have employed this word without qualification for objects which they had seen unless they had meant it to be taken as bronze. When Pausanias (iii. 17. 6) speaks of a statue, one of the oldest figures he had seen of this material, made of separate pieces fastened together with nails, we understand him to mean literally bronze, the more readily since there exist very early figures and utensils of bronze so made.

For the use of bronze in art, *see* METAL WORK.

BRONZE AGE: *see* ARCHAEOLOGY.

BRONZE AND BRASS ORNAMENTAL WORK. The use of bronze dates from remote antiquity. This important metal is an alloy composed of copper and tin, in proportions which vary slightly, but may be normally considered as nine parts of copper to one of tin. Other ingredients which are occasionally found are more or less accidental. The result is a metal of a rich golden brown colour, capable of being worked by casting—a process little applicable to its component parts, but peculiarly successful with bronze, the density and hardness of the metal allowing it to take any impression of a mould, however delicate.

This process is known as *cire perdue*, and is the most primitive and most commonly employed through the centuries, having been described by the monk Theophilus, and also by Benvenuto Cellini. Briefly, it is as follows: A core, roughly representing the size and form of the object to be produced, is made of pounded brick, plaster or other similar substance and thoroughly dried. Upon this the artist overlays his wax, which he models to the degree required in his finished work. Passing from the core through the wax and projecting beyond are metal rods. The modelling being completed the outer covering which will form the mould has to be applied; this is a liquid formed of clay and plaster sufficiently thin to find its way into every detail of the wax model. Further coatings of liquid are applied, so that there is, when dry, a solid outer coating and a solid inner core held together by the metal rods, with the work of art modelled in wax between. Heat is applied and the wax melts and runs out, and the molten metal is poured in and occupies every detail which the wax had filled. When cool, the outer casing is carefully broken away, the core raked out as far as possible, the projecting rods are removed and the object modelled in wax appears in bronze. If further finish is required it is obtained by tooling. (W. W. W.)

GREEK AND ROMAN

Copper came into use in the Aegean area towards the end of the predynastic age of Egypt about 3500 B.C. The earliest known implement is a flat celt, which was found on a neolithic house-floor in the central court of the palace of Knossos in Crete, and is regarded as an Egyptian product. Bronze was not generally used until a thousand years or more later. Its first appearance is probably in the celts and dagger-blades of the Second City of Troy, where it is already the standard alloy of 10% tin. It was not established in Crete until the beginning of the Middle Minoan age (M.M.I., *c.* 2000 B.C.). The Copper age began in northern Greece and Italy *c.* 2500 B.C., much later than in Crete and Anatolia, and the mature Italian Bronze age of Terremare culture coincided in time with the Late Aegean (Mycenaean) civilization (1600–1000 B.C.). The original sources both of tin and copper in these regions are unknown.

Earliest Implements and Utensils.—Tools and weapons, chisels and axe-heads, spearheads or dagger-blades, are the only surviving artifacts of the Copper age, and do not show artistic treatment. But some Early Minoan pottery forms are plainly copied from metal prototypes, cups and jugs of simple construction and rather elaborate design. The cups are conical and some-

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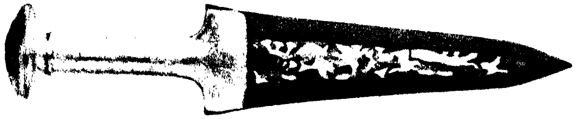
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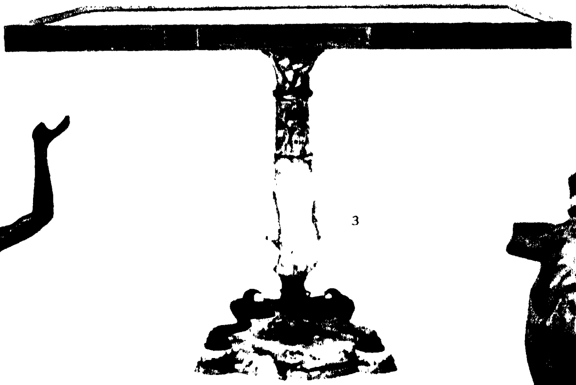
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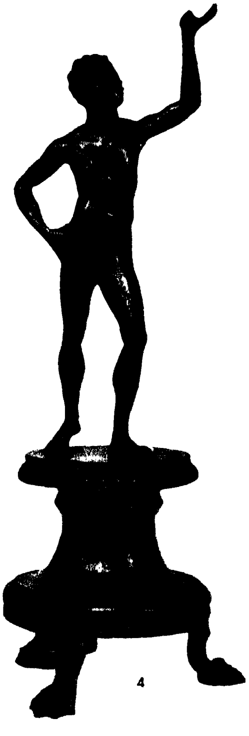
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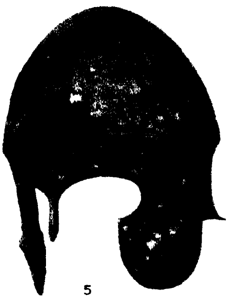
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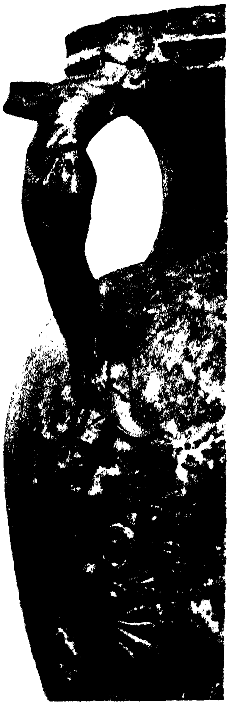
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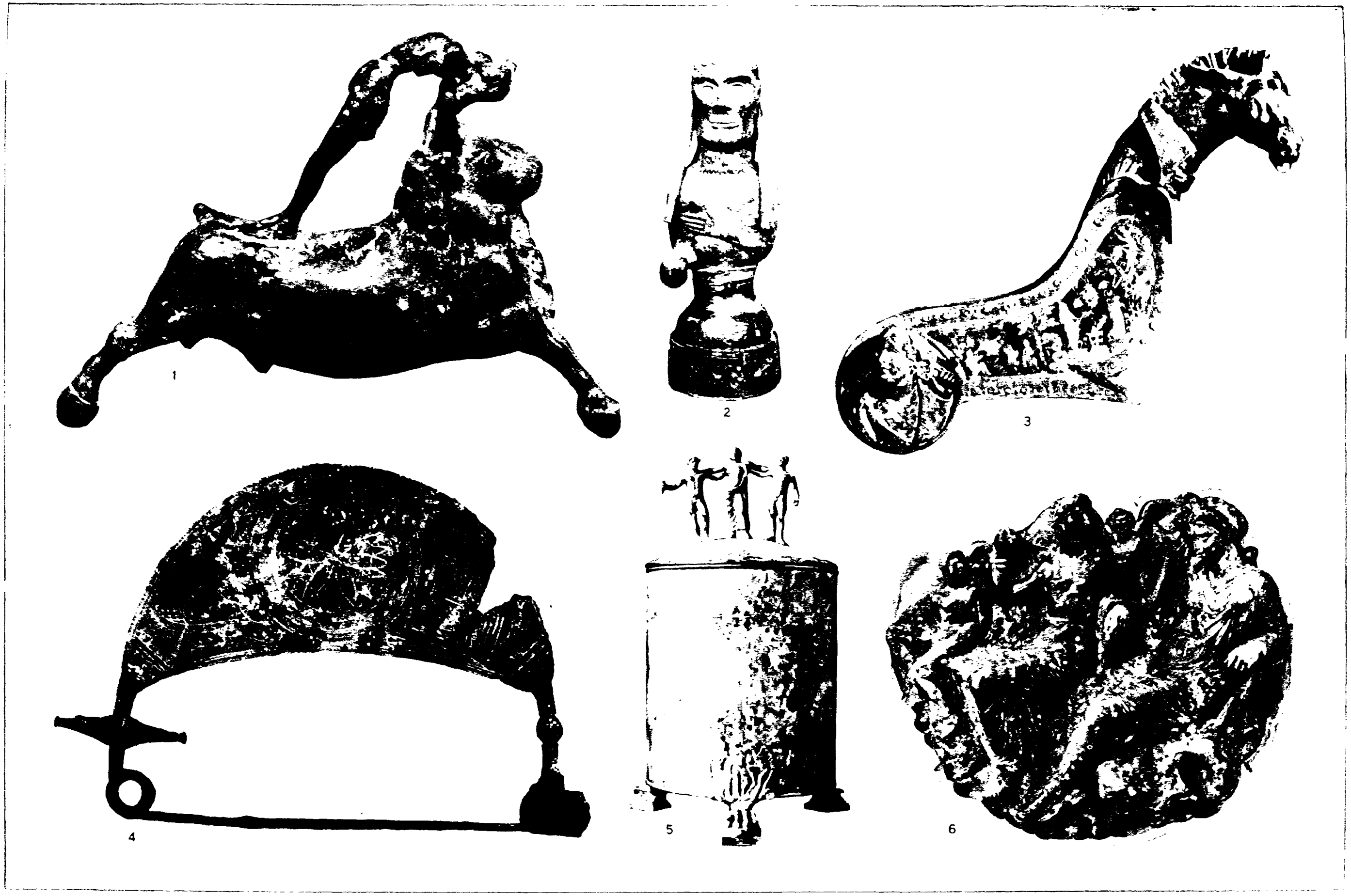
BY COURTESY OF (1, 3) METROPOLITAN MUSEUM OF ART; (2, 4, 5, 6) THE TRUSTEES OF THE BRITISH MUSEUM

GREEK AND ROMAN BRONZE FROM 1600 B. C. TO A. D. 400

1. Restoration of a bronze dagger of the later Minoan period (about 1600–1100 B.C.) from a grave shaft at Mycenae. It is inlaid with gold and niello and has a floral design. In the original (National Museum, Athens) only the blade is preserved. 2. Reproduction of Mycenaean dagger similar to fig. 1. The design on the blade represents cats hunting birds. 3. Table of variegated around the top has palmetto and rosette ornaments inlaid with silver and niello; the first century A.D. 4. Hellenistic statuette of negro boy on pedestal; about 200 B.C. 5. Greek bronze helmet found at Salonika, executed about 500 B.C. 6. Handle of Greek amphora (Pourtales vase) with silver inlay; 500 B.C.



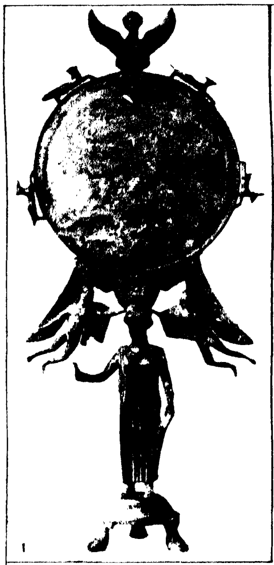
BY COURTESY OF (1, 2, 4, 6) THE TRUSTEES OF THE BRITISH MUSEUM; PHOTOGRAPHS, (3, 5) ALINARI

GREEK AND ROMAN BRONZES

1. **Man leaping over a bull.** Plaster cast of a Minoan bronze statuette, probably used as a weight
2. **Bronze bust of a female figure found in the Polledrara tomb at Vulci.** The base is ornamented with **charioteers, lions and winged monsters.** Early 6th century B.C.
3. **Bronze footrest of a couch inlaid with silver.** Found at Amiternum. Conservatori Museum, Rome
4. Fibula of the geometrical period, engraved with a ship, which the helmsman steers with his foot
5. The Ficoroni cista in the Villa Giulia, Rome, finest of the engraved Latin boxes; it is decorated with scenes depicting the myth of the Argonauts and signed by a Roman artist. 3rd century B.C.
6. Cast of bronze relief, probably from a mirror case, showing Aphrodite and Anchises on Mount Ida

PLATE III

BRONZE AND BRASS ORNAMENTAL WORK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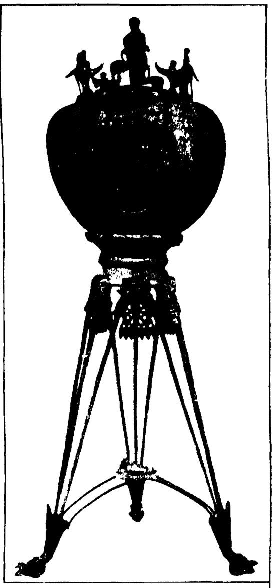
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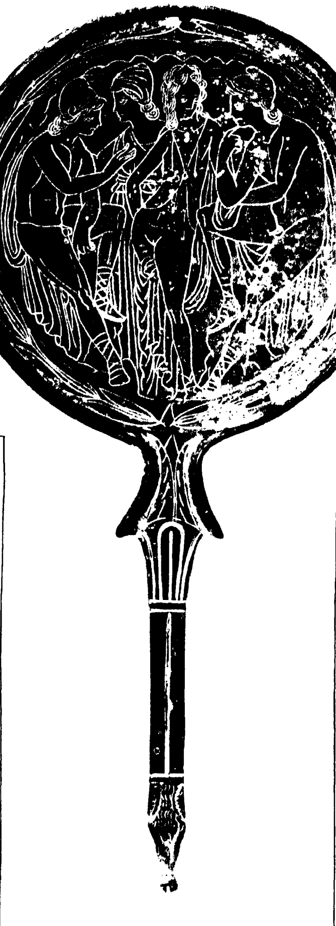
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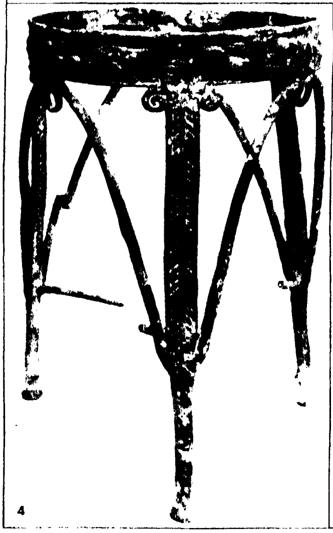
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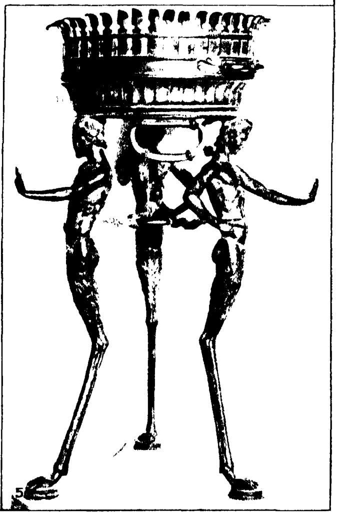
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GREEK AND ROMAN BRONZE

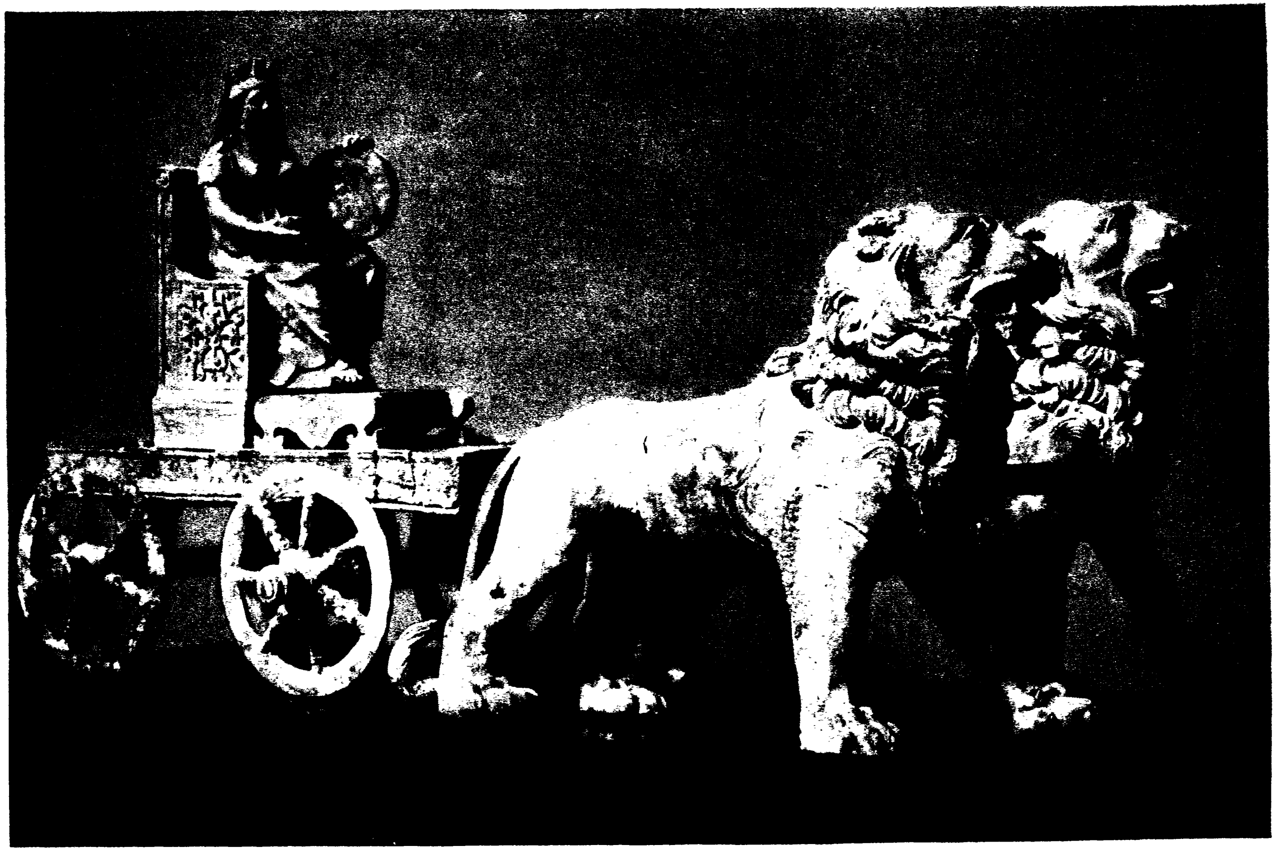
1. Greek mirror of polished bronze. 5th century B.C. The figure forming the stand probably represents Aphrodite. On each side of the attachment connecting the handle with the disk is a flying Eros, and along the edge of the disk are two hounds pursuing a fox and a rabbit

2. Etruscan vase from Capua on a tripod of the 5th century B.C. Figures of horsemen decorate the rim of the vase, with a goddess in the centre. The tripod is an Etruscan imitation of Ionic Greek work

3. An Italic bronze mirror of the 4th to the 3rd century B.C. As in less common mirrors of this period, found chiefly at Praeneste, the handle is cast in one piece with the disk. The back of the disk is decorated with an engraved scene showing the Dioscuri with two women

4. Tripod of simple open-work construction from Cyprus. Late Mycenaean (1000–800 B.C.). Rim is engraved with figures of lions pursuing stags

5. Tripod of three satyrs from Herculaneum. In the Museo Nazionale, Naples



IN THE ALTMAN COLLECTION, METROPOLITAN MUSEUM OF ART

BRONZE STATUETTE OF THE GODDESS CYBELE IN HER PROCESSIONAL CART, DRAWN BY TWO LIONS

This group of statuettes, found and put together in Rome, probably dates from the 2nd century A.D. It is thought to represent a ceremony in the [illegible] of Cybele, the mother goddess, which consisted in carrying the goddess' statue on a chariot from her temple on the Palatine to the river Almo, where it was bathed and [illegible] back to the temple.

The group is 3 feet 5 inches in length and represents Cybele carrying a drum in one hand and a bowl in the other. The upper surface of the chariot and the side pieces of the throne are decorated with floral designs cast separately and soldered on.

times have a stem-foot; there are oval jars with long tubular spouts, and beaked jugs with round shoulders set on conical bodies. Heads of rivets which tie the metal parts together are often reproduced as a decorative element in clay. The spouted jars and a pierced type of axe-head indicate that the metallurgical connections of Early Minoan Crete were partly Mesopotamian.

MINOAN AND MYCENAEAN

Weapons and Implements.—It is known that Middle Minoan bronze work flourished as an independent native art. To the very beginning of this epoch belongs the largest sword of the age, found in the palace of Mallia. It is a flat blade, 79 cm. long, with a broad base and a sharp point; there is a gold and crystal hilt but no ornament on the blade. A dagger of somewhat later date, now in the Metropolitan Museum of New York, is the earliest piece of decorated bronze from Crete. Both sides of the blade are engraved with drawings: bulls fighting and a man hunting boars in a thicket. Slightly later again (M.M. III) are a series of splendid blades from mainland Greece, which must be attributed to Cretan craftsmen, with ornament in relief, or incised, or inlaid with gold, silver and niello. The most elaborate inlays, pictures of men hunting lions and cats hunting birds, are on daggers from the shaftgraves of Mycenae (*see* GOLDSMITHS' WORK). These large designs cover the whole of the flat blade except its edge, but on swords, best represented by finds at Knossos, the ornament is restricted to the high midribs which are an essential feature of the longer blades. The type belongs to the beginning of the Late Minoan (Mycenaean) age. The hilt is made in one piece with the blade; it has a horned guard, a flanged edge for holding grip-scales, and a tang for a pommel. The scales were ivory or some other perishable substance and were fixed with bronze rivets; the pommels were often made of crystal. A rapier from Zapher Papoura (Knossos) is 91·3 cm. long; its midrib and hilt-flange are engraved with bands of spiral coils, and its rivet-heads (originally gold-cased) with whorls. Ordinary Mycenaean blades are enriched with narrow mouldings, parallel to the midribs of swords and daggers, or to the curved backs of one-edged knives. The spearheads have hammered sockets. Other tools and implements are oval two-edged knives, square-ended razors, cleavers, chisels, hammers, axes, mattocks, ploughshares and saws. Cycladic and mainland Greek (Helladic) weapons show no ornament but include some novel types. A tanged spearhead has a slit (Cycladic) or slippered (Helladic) blade for securing the shaft; and the halberd, a west European weapon, was in use in Middle Helladic Greece. There are few remains of Mycenaean metal armour; a plain cheek-piece from a helmet comes from Ialysos in Rhodes, and a pair of greaves from Enkomi in Cyprus. One of the greaves has wire riveted to its edge for fastening.

Utensils.—Middle and Late Minoan and Mycenaean vessels are many. First in size are some basins found at Tylissos in Crete, the largest measuring 1·40 metres in diameter. They are shallow hemispherical bowls with two or three loop-handles riveted on their edges, and are made in several sections. The largest is composed of seven hammered sheets, three at the lip, three in the body, and one at the base. This method of construction is usual in large or complicated forms. The joints of necks and bodies of jugs and jars were often masked with a roll-moulding. Simpler and smaller forms were also cast. The finest specimens of such vases come from houses and tombs at Knossos. Their ornament is applied in separate bands, hammered or cast and chased, and soldered on the lip or shoulder of the vessel. A richly decorated form is a shallow bowl with wide ring-handle and flat lip, on both of which are foliate or floral patterns in relief.

A notable shape, connecting prehistoric with Hellenic metallurgy is a tripod-bowl, a hammered globular body with upright ring-handles on the lip and heavy cast legs attached to the shoulder.

Statuettes.—Purely decorative work is rare among Minoan bronzes, and is comparatively poor in quality. There are several statuettes, very completely modelled but roughly cast; they are solid and unchased, with blurred details. Well known are a figure of a praying or dancing woman from the Troad, now at Berlin, and another from Hagia Triada; praying men from Tylissos and Psychro, another in the British Museum, a flute-player at Leyden, and an ambitious group of a man turning a somersault over a charging bull, in an English collection. This last was perhaps a weight; there are smaller Mycenaean weights in the forms of animals, filled with lead, from Rhodes and Cyprus. Among the latest Mycenaean bronzes found in Cyprus are several tripod-stands of simple openwork construction, a type that has also been found with transitional material in Crete and in Early Iron age (Geometric) contexts on the Greek mainland. Some more elaborate pieces, cast in designs of ships and men and animals, belong to a group of bronzes found in the Idaean cave in Crete, most of which are Asiatic works of the ninth or eighth century B.C. The openwork tripods may have had the same origin. They are probably not Greek.

HELLENIC AND ITALIAN

The Geometric Period.—During the dark ages of the transition from bronze to iron the decorative arts stood almost still but industrial metalwork was freely produced. There are a few remains of Geometric bronze vessels, but as in the case of the Early Minoan material, metal forms are recorded in their pottery derivatives. Some vase-shapes are clearly survivals from the Mycenaean repertory, but the greater number are new, and these are elementary and somewhat clumsy, spherical or biconical bodies, huge cylindrical necks with long band-handles and no spouts. Ceramic painted ornament also reflects originals of metal, and some scraps of thin bronze plate embossed with rows of knobs and lightly engraved in hatched or zig-zag outline doubtless represent the art which the newcomers brought with them to Greek lands. This kind of decorative work is better seen in bronzes of the closely related Villanova culture of north and central Italy. A novel feature is the application of small figures in the round, particularly birds and heads of oxen, as ornaments of handles, lids and rims. The Italian Geometric style developed towards complication, in crowded narrow bands of conventional patterns and serried rows of ducks; but contemporary Greek work was a refinement of the same crude elements. Engraving appears at its best on the large catch-plates of fibulae, some of which bear the earliest known pictures of Hellenic mythology. Small statuettes of animals were made for votive use and also served as seals, the devices being cast underneath their bases. There is a large series of such figures, mostly horses, standing on engraved or perforated plates, which were evidently derived from seals; among the later examples are groups of men and centaurs. Pieces of tripod-cauldrons from Olympia have animals lying or standing on their upright ring-handles, which are steadied by human figures on the rims. Handles and legs are cast, and are enriched with graceful geometric mouldings. The bowls are wrought, and their shape and technique are pre-Hellenic. Here are two of the elements of classical Greek art in full course of development: the forms and processes of earlier times invigorated by a new aesthetic sense.

Oriental Influence.—A third element was presently supplied in the rich repertory of decorative motives, Egyptian and Assyrian, that was brought to Europe by Phoenician traders or fetched from Asia by adventurous Greeks. A vast amount of oriental merchandise found its way into Greece and Italy *c.* 800 B.C. There is some uncertainty about the place of manufacture of much of the surviving bronze work, but the same doubt serves to emphasize the close resemblance that these pieces, Phoenician, Greek or Etruscan, bear to their Assyrian or Egyptian models. Foremost among them are the bowls and shields from the Idaean cave in Crete. These interesting bowls are embossed with simple bands of animals, the shields with bold and complicated designs of purely oriental character. It is unlikely that a Greek craftsman in this vigorous Geometric age could suppress his style and produce mechanical copies such as these. So in Etruscan graves beside inscribed Phoenician bowls there have been found great cauldrons, adorned with jutting heads of lions and griffins, and set on conical stands which are embossed with Assyrian winged monsters.

Classical Greek and Etruscan.—The bowl and stand were favourite archaic forms The Greek stand was a fusion of the cast-rod tripod and the embossed cone. Some early examples have large triangular plates between the legs, worked in relief; but the developed type has separate legs and stays of which the joints are masked with decorative rims and feet and covering-plates. These ornaments are cast and chased, and are modelled in floral, animal and human forms The feet are lions' paws, which sometimes clasp a ball or stand on toads; the rims and plaques bear groups of fighting animals, warriors, revellers or athletes, nymphs and satyrs, or mythological subjects in relief. Feasters recline and horsemen gallop on the rims of bowls; handles are formed by single standing figures, arched pairs of wrestlers, lovers holding hands, or two vertical soldiers carrying a horizontal comrade. Nude athletes serve as handles for all kinds of lids and vessels, draped women support mirror-disks around which love-gods fly, and similar figures crown tall shafts of candelabra Handle-bases are modelled as satyr-masks, palmettes and sphinxes. This is Greek ornament of the 6th and later centuries. Its centres of manufacture are not precisely known, but the style of much archaic work points to Ionia. Etruscan fabrics approach their Greek originals so closely that it is not possible to separate them in technique or design, and the Etruscan style is no more than provincial Greek. Bronze was quite plentiful in Italy, the earliest Roman coinage was of heavy bronze, and there is literary evidence that Etruscan bronzes were exported. The process of line engraving seems to have been a Latin speciality; it was applied in pictorial subjects on the backs of mirrors and on the sides of large cylindrical boxes, both of which are particularly connected with Praeneste. The finest of all such boxes, the Ficoroni *cista* in the Villa Giulia at Rome, bears the signature of a Roman artist. These belong to the 4th and 3rd centuries B.C. Greek mirrors of the same period are seldom engraved; the disk is usually contained in a flat box which has a *repoussé* design on its lid.

Hellenistic and Roman.—Hellenistic and Graeco-Roman forms are more conventional, and the new motives that belong to these periods are mostly floral. Busts and masks are the usual handle-plaques and spouts; heads and limbs of various animals are allotted certain decorative functions, as for instance the spirited mules' heads mentioned by Juvenal, which formed the elbow-rests of dining-couches. These structural pieces are frequently inlaid with silver and niello. Bronze chairs and tables were commonly used in Hellenistic and Roman houses, and largely took the place of the monumental vases that were popular in earlier days. Small household articles, such as lamps, when made of bronze are usually Roman, and a peculiarly Roman class of personal ornament is a large bronze brooch inlaid with coloured enamels, a technique which seems to have had a Gaulish origin.

Fine Art.—Bronze statuettes were also made in every period of antiquity for votive use, and at least in Hellenistic and Roman times for domestic ornaments and furniture of household shrines. But the art of bronze statuary hardly existed before the introduction of hollow casting, about the middle of the 6th century, B.C. The most primitive votive statuettes are oxen and other animals, which evidently represent victims offered to the gods. They have been found abundantly on many temple sites. But classical art preferred the human subject, votaries holding gifts or in their ordinary guise, or gods themselves in human form. Such figures are frequently inscribed with formulas of dedication. Gods and goddesses posed conformably with their traditional characters and bearing their distinctive attributes are the most numerously represented class of later statuettes. They are a religious *genre*, appearing first in 4th century sculpture and particularly favoured by Hellenistic sentiment and Roman pedantry. Many of them were doubtless votive figures, others were images in domestic shrines, and some were certainly ornaments. Among the cult-idols are the dancing Lares, who carry cornucopias and libation-bowls. The little Heracles that Lysippus made for Alexander was a table-ornament (*epitrapezios*): he was reclining on the lion's skin, his club in one hand, a wine-cup in the other

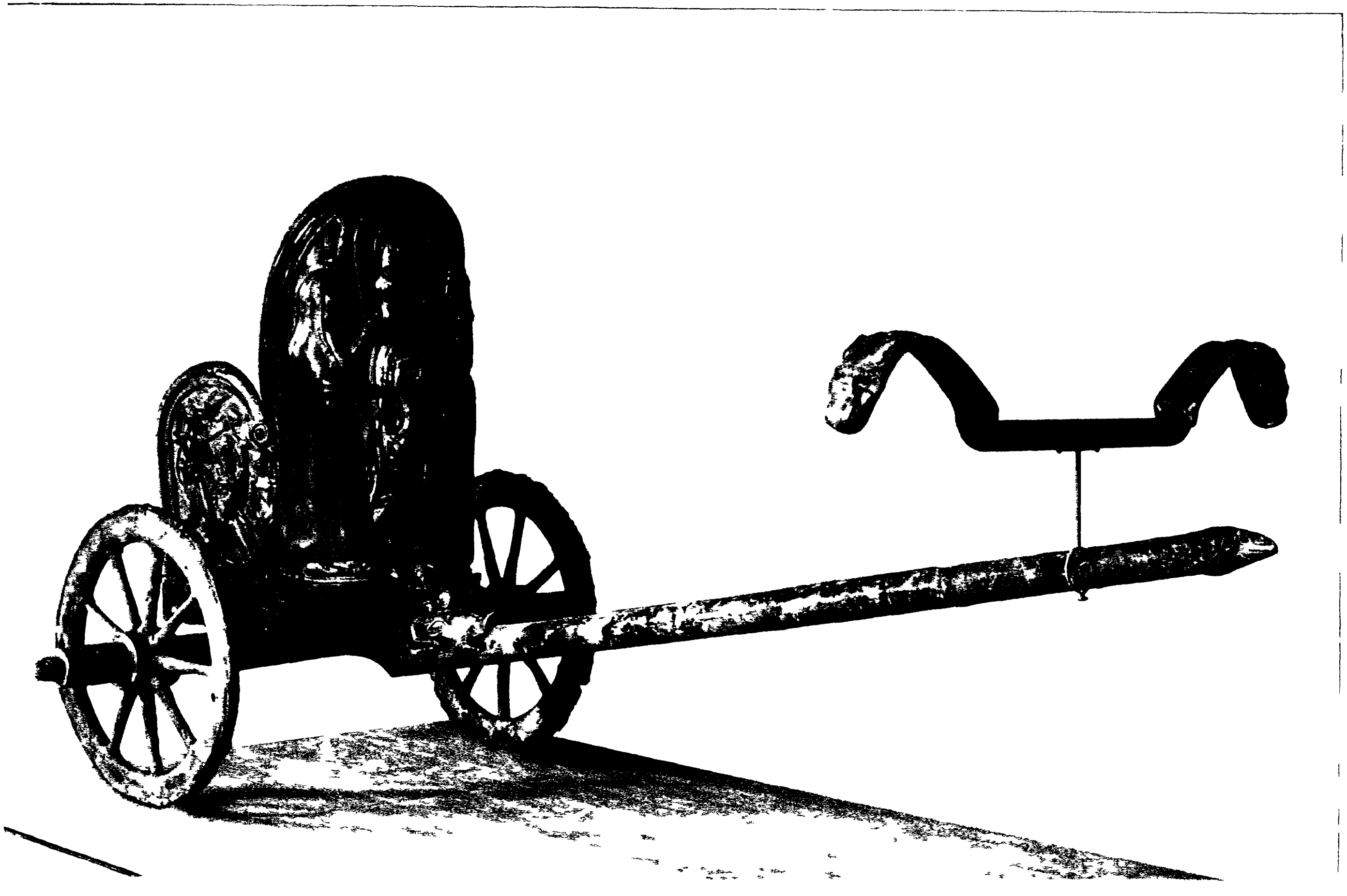
Technique.—With the invention of hollow casting bronze became the most important medium of monumental sculpture, largely because of its strength and lightness, which admitted poses that would not be possible in stone. But the value of the metal in later ages has involved the destruction of nearly all such statues (*see* Musnobian, *North African Archaeology*). The few complete figures that survive, and a somewhat more numerous series of detached heads and portrait-busts, attest the excellence of ancient work in this material. The earliest statuettes are chiselled, wrought and welded; next in time come solid castings, but larger figures were composed of hammered sections, like domestic utensils, each part worked separately in *repoussé* and the whole assembled with rivets (σφυρήλατα). Very little of this flimsy fabric is extant, but chance has preserved one bust entire, in the Polledrara Tomb at Vulci. This belongs to the early 6th century B.C., the age of *repoussé* work. The process was soon superseded in such subjects by hollow casting, but beaten reliefs, the household craft from which Greek bronze work sprang, persisted in some special and highly perfected forms, as handle-plates on certain vases, *emblemata* on mirror-cases, and particularly as ornaments of armour, where light weight was required. The Siris bronzes in the British Museum are shoulder-pieces from a 4th century cuirass. Casting was done by the *cire-perdue* process in clay moulds, but a great deal of labour was spent on finishing. The casts are very finely chased, and most large pieces contain patches, inserted to make good the flaws. Heads and limbs of statues were cast separately and adjusted to the bodies: besides the evidence of literature and of the actual bronzes there is an illustration of a dismembered statue in the making on a painted vase in Berlin.

Pliny and other ancient writers have much to say in regard to various alloys of bronze—Corinthian, Delian, Aeginetan, Syracusan—in regard to their composition and uses and particularly to their colour effects, but their statements have not been confirmed by modern analyses and are sometimes manifestly false. Corinthian bronze is said to have been first produced by accident in the Roman burning of the city (146 B.C.) when streams of molten copper, gold and silver mingled. Similar tales are told by Plutarch and Pliny about the artists' control of colour: Silanion made a pale-faced Iocasta by mixing silver with his bronze, Aristonidas made Athamas blush with an alloy of iron. There is good evidence that Greek and Roman bronzes were not artificially patinated, though many were gilt or silvered. Plutarch admires the blue colour of some very ancient statues at Delphi, and wonders how it was produced; Pliny mentions a bitumen wash, but this was doubtless a protective lacquer; and a 4th century inscription from Chios records the regulations made there for keeping a public statue clean and bright. (*See* Greek Art; Roman Art; Sculpture; Numismatics; Seals.) (E. J. F.)

EUROPEAN BRASS AND BRONZE

This article is not concerned with sculpture in bronze, but rather with the many artistic applications of the metal in connection with architecture, or with objects for ecclesiastical and domestic use. Why bronze was preferred in Italy, iron in Spain and Germany and brass in the Low Countries cannot be satisfactorily determined; national temperament is impressed on the choice of metals and also on the methods of working them. Centres of artistic energy shift from one place to another owing to wars, conquests or migrations.

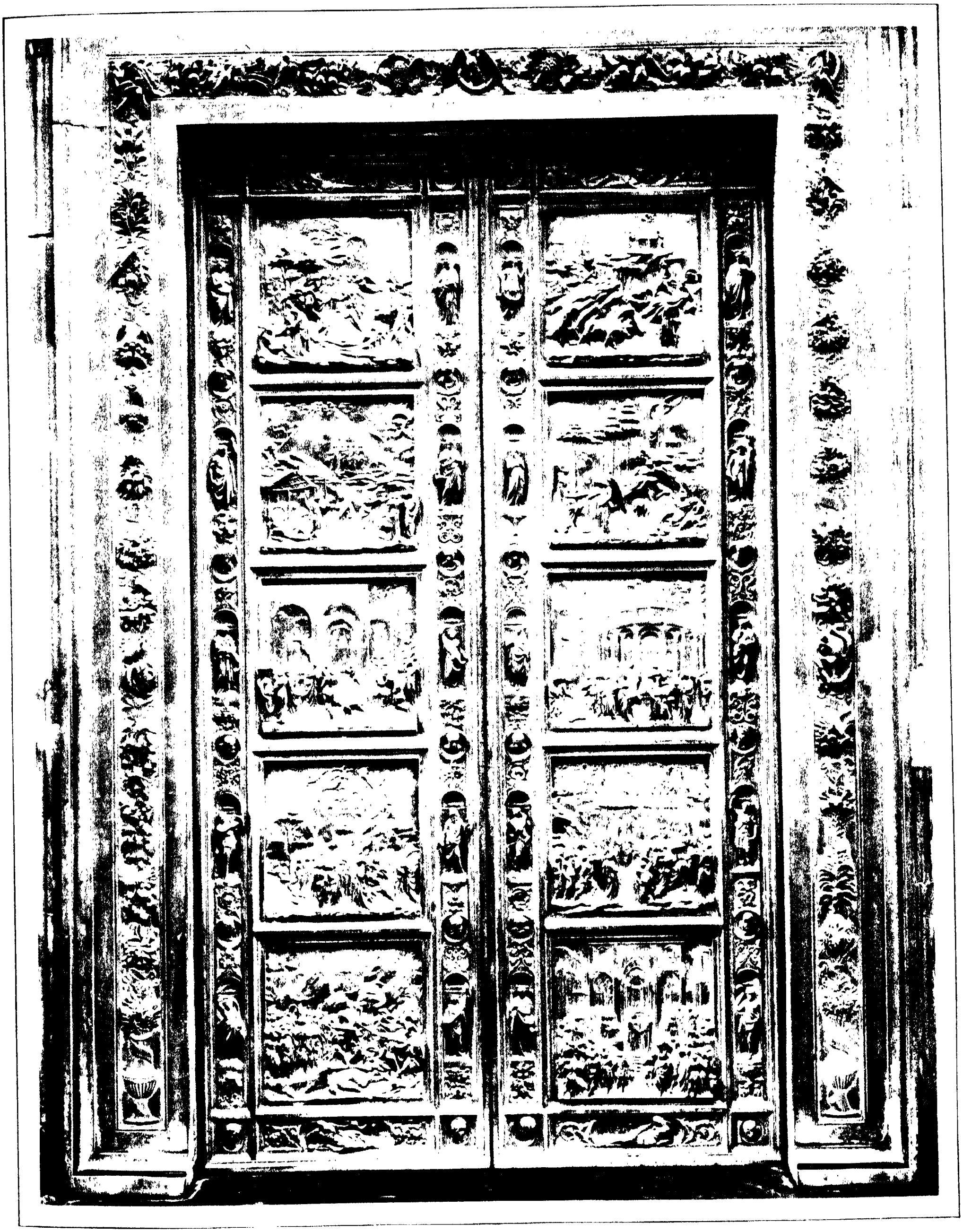
Leaving alone remote antiquity and starting with imperial Rome, the working of bronze, inspired probably by conquered Greece, is clearly seen. There are ancient bronze doors in the Temple of Romulus in the Forum; others from the baths of Caracalla are in the Lateran church, which also contains four fine gilt bronze fluted columns of the Corinthian order. The Naples museum contains a large collection of domestic utensils of bronze, recovered from the buried towns of Pompeii and Herculaneum, which show a high degree of perfection in the working of the metal, as well as a wide application of its use. A number of moorings in the form of finely-modelled animal heads, made in the 1st century A.D., and recovered from Lake Nemi in the Alban hills some years ago, show a further acquaintance with the skilful working of this metal. The chair of Dagobert in the Bibliothèque



BY COURTESY OF THE METROPOLITAN MUSEUM, NEW YORK

ETRUSCAN BRONZE CHARIOT

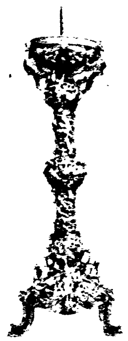
This unique example of repoussé bronze was found in 1902 in a tomb near Monteleone, Italy. It has been mounted on a modern wooden frame. Its artistic merit is enhanced by the remarkable green patina caused by the centuries during which it was buried.



PHOTOGRAPH, ALINARI

"PORTA DEL PARADISO" ON THE BAPTISTRY, FLORENCE

The bronze east door on the baptistry of San Giovanni, designed by Lorenzo Ghiberti, is a famous example of Italian metal-work of the 15th century. The panels represent in relief scenes from the Old Testament. Each portal is surrounded by statuettes of scriptural personages, and the door frame is ornamented with a border of foliage, flowers, birds and animals in Renaissance style. The beauty of these portals caused Michelangelo to declare them worthy to be the gates of Paradise



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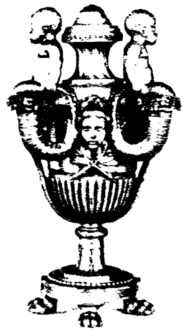

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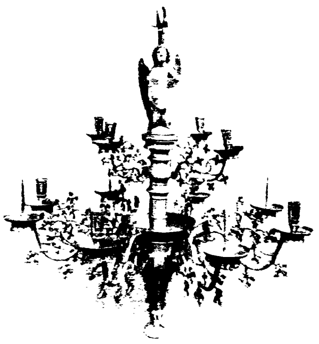

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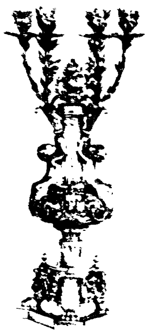

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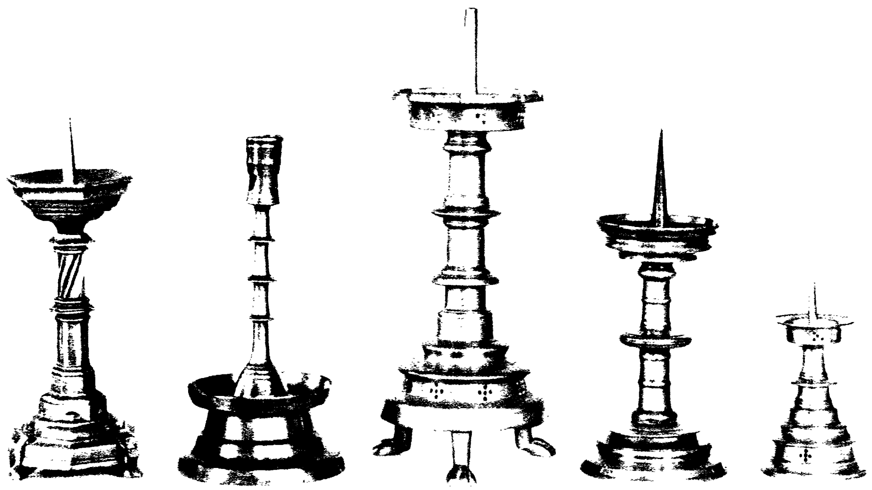

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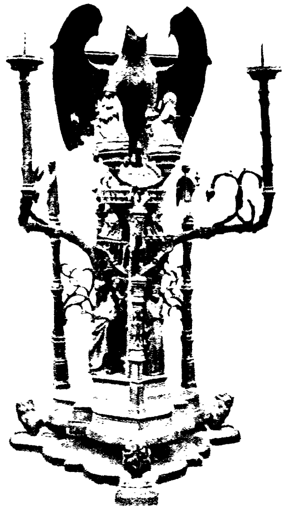

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BY COURTESY OF (1-5) THE DIRECTOR OF THE VICTOR A AND ALBERT MUSEUM, (6) THE RECTOR, OSCOTT COLLEGE, BIRMINGHAM

CANDLESTICKS, LIGHTHOLDERS AND A LECTERN

1. The Gloucester candlestick. English, about 1110. It is gilt bell-metal and stands nearly 2 feet high
2. One of a pair of chased ormolu candelabra for four lights. French, last quarter of the 18th century
3. English brass chandelier, probably of the 14th century. The lights are arranged in two tiers, the lower one for eight candles. The stem has at the top a figure of an angel carrying a shield
4. One of a pair of chased ormolu candelabra for six lights. French, last quarter of the 18th century
5. More common types of pricket and socket altar candlesticks in use in Europe during the Middle Ages
6. Lectern in St. Mary's college, Oscott. The shaft, with pierced tracery, rests on couchant lions and is surmounted by an eagle, the traditional symbol of St. John the Divine. The outspread wings of the bird form the book-rest

Nationale, Paris, appears to be a Roman bronze curule chair, with back and part of the arms added by the abbot Suger in the 12th century.

Byzantium, from the time when Constantine made it the seat of empire, in the early part of the 4th century, was for 1,000 years renowned for its work in metal. Its position as a trade centre between East and West attracted all the finest work provided by the artistic skill of craftsmen from Syria, Egypt, Persia, Asia Minor and the northern shores of the Black sea, and for 400 years, until the beginning of the Iconoclastic period in the first half of the 8th century, its output was enormous. Several Italian churches still retain bronze doors cast in Constantinople in the later days of the Eastern empire, such as those presented by the members of the Pantaleone family, in the latter half of the 11th century, to the churches at Amalfi, Monte Cassino, Atrani and Monte Gargano. Similar doors are at Salerno; and St. Mark's, Venice, also has doors of Greek origin.

The period of the Iconoclasts fortunately synchronized with the reign of Charlemagne, whose power was felt throughout western Europe. The craftsmen who were forced to leave Byzantium were welcomed by him in his capitals of Cologne and Aix-la-Chapelle and their influence was also felt in France. Another stream passed by way of the Mediterranean to Italy, where the old classical art had decayed owing to the many national calamities, and here it brought about a revival. In the Rhineland the terms "Rhenish-Byzantine" and "Romanesque," applied to architecture and works of art generally, testify to the provenance of the style of this and the succeeding period. The bronze doors of the cathedral of Aix-la-Chapelle are of classic design and date probably from Charlemagne's time. All through the Middle Ages the use of bronze continued on a great scale, particularly in the 11th and 12th centuries. Bernward, bishop of Hildesheim, a great patron of the arts, had bronze doors made for St. Nicholas' church (afterwards removed to the cathedral) which were set up in 1015; great doors were made for Augsburg somewhere between 1060 and 1065, and for Mainz shortly after the year 1000. A prominent feature on several of these doors is seen in finely-modelled lion heads, with conventional manes and with rings hanging from their jaws. These have their counterpart in France and Scandinavia as well as in England, where they are represented by the so-called sanctuary knocker at Durham cathedral. Provision of elaborate tomb monuments and of church furniture gave much work to the German founder, the former largely in the nature of sculpture. Mention may be made of the seven-branch candlestick at Essen cathedral made for the abbess Matilda about the year 1000, and another at Brunswick completed in 1223; also of the remarkable font of the 13th century made for Hildesheim cathedral at the charge of Wilbernus, a canon of the cathedral. Other fonts are found at Brandenburg and Wurzburg. Of smaller objects such as ewers, holy-water vessels, reliquaries and candelabra, a vast number were produced. Most of the finest work of the 15th century was executed for the Church. The end of the Gothic period in Germany found the great craftsman, Peter Vischer of Nuremberg, and his sons, working on the bronze shrine to contain the reliquary of St. Sebald, a finely-conceived monument of architectural form, with rich details of ornament and figures; among the latter appearing the artist in his working dress. The shrine was completed and set up in the year 1516. This great craftsman executed other great works at Magdeburg, Römhild and Breslau. Reference should be made to the colossal monument at Innsbruck, the tomb of the emperor Maximilian I., with its 28 bronze statues of more than life size. Large fountains in which bronze was freely employed were set up, such as those at Munich and Augsburg. The tendency was to use this metal for large works of an architectural or sculpturesque nature; while at the same time smaller objects were produced for domestic purposes.

Italy.—By the 12th century the Italian craftsmen had developed a style of their own, as may be seen in the bronze doors of S. Zeno, Verona (which are made of hammered and not cast bronze), Ravello, Trani and Monreale. Bonnano da Pisa made a series of doors for the duomo of that city, one pair of which remains. The 14th century witnessed the birth of a great revival in the working of bronze, which was destined to flourish for at least four centuries. Bronze was the metal beloved of the Italian craftsman; in that metal he produced objects for every conceivable purpose, great or small, from a door-knob to the mighty doors by Lorenzo Ghiberti at Florence, of which Michael Angelo remarked that they would stand well at the gates of Paradise. Niccolo, Giovanni and Andrea Pisano, Ghiberti, Brunelleschi, Donatello, Verrocchio, Cellini, Michael Angelo, Giovanni da Bologna—these and many others produced great works in bronze. Benedetto da Rovezzano came to England in 1524 to execute a tomb for Cardinal Wolsey, part of which, after many vicissitudes, is now in the crypt of St. Paul's cathedral. Pietro Torregiano of Florence executed the tomb of Henry VII. in Westminster Abbey. Alessandro Leopardi, at the beginning of the 16th century, completed the three admirable sockets for flag-staffs which still adorn the piazza of St. Mark's, Venice. A further development showed itself in the production of portrait medals in bronze, which reached a high degree of perfection and engaged the attention of many celebrated artists. Bronze plaquettes for the decoration of large objects exhibit a fine sense of design and composition. Of smaller objects, for church and domestic use, the number was legion. Among the former may be mentioned crucifixes, shrines, altar and paschal candlesticks, such as the elaborate examples at the Certosa, Pavia; for secular use, mortars, inkstands, candlesticks and a large number of splendid door-knockers and handles, all executed with consummate skill and perfection of finish. Work of this kind continued to be made throughout the 17th and 18th centuries.

France.—Wars and internal troubles must account for the disappearance of work in bronze; it is hardly likely that a nation with so many schools of fine craftsmen in the various metals could have failed to work in bronze. The great bronze seven-branched candlestick in Milan cathedral has a base and lower part decorated with intricately-designed ornament which is considered by many to be French work of the 13th century; the upper part with the branches was added in the second half of the 16th century. A portion of a foot of a similar object, showing the same intricate decoration, existed formerly at Reims, but was unfortunately destroyed during the World War.

In the 16th century the names of Germain Pilon and Jean Goujon are sufficient evidence of the ability to work in bronze. A great outburst of artistic energy is seen from the beginning of the 17th century, when works in ormolu or gilt bronze were produced in huge quantities. The craftsmanship is magnificent and of the highest quality, the designs at first refined and symmetrical; but later, under the influence of the rococo style, introduced in 1723, aiming only at gorgeous magnificence. It was all in keeping with the spirit of the age, and in their own sumptuous setting these fine candelabra, sconces, vases, clocks and rich mountings of furniture are entirely harmonious. The "ciseleur" and the "fondeur," such as Gouthière and Caffieri, associated themselves with the makers of fine furniture and of delicate Sèvres porcelain, the result being extreme richness and handsome effect. The style was succeeded after the Revolution by a stiff, classical manner which, although having a charm of its own, lacks the life and freedom of earlier work. In London the styles may be studied in the Wallace collection, Manchester square, and at the Victoria and Albert museum, South Kensington; in New York at the Metropolitan museum.

England.—Casting in bronze reached high perfection in England, where a number of monuments yet remain. William Torel, goldsmith and citizen of London, made the bronze effigy of Henry III., and later that of Queen Eleanor for their tombs in Westminster Abbey; the effigy of Edward III. was probably the work of one of his pupils. No bronze fonts are found in English churches, but a number of processional crucifixes have survived from the 15th century, all following the same design and of crude execution. Sanctuary rings or knockers exist at Norwich, Gloucester and elsewhere; the most remarkable is that on the north door of the nave of Durham cathedral which has sufficient character of its own to differentiate it from its Continental brothers and to suggest a Northern origin. The Gloucester candlestick in the Victoria and Albert museum, South Kensington, displays the power and imagination of the designer as well as an extraordinary manipulative skill on the part of the founder. According to an inscription on the object, this candlestick, which stands some 2ft. high and is made of an alloy allied to bronze, was made for Abbot Peter who ruled from 1109 to 1112. While the outline is carefully preserved, the ornament consists of a mass of figures of monsters, birds and men, mixed and intertwined to the verge of confusion. As a piece of casting it is a triumph of technical ability. For secular use the mortar was one of the commonest of objects in England as on the Continent; early examples of Gothic design are of great beauty In later examples a mixture of styles is found in the bands of Gothic and Renaissance ornament, which are freely used in combination. Bronze ewers must have been common; of the more ornate kind two may be seen, one at South Kensington and a second at the British Museum These are large vessels of about 2ft. in height, with shields of arms and inscriptions in bell-founders' lettering Many objects for domestic use, such as mortars, skillets, etc , were produced in later centuries.

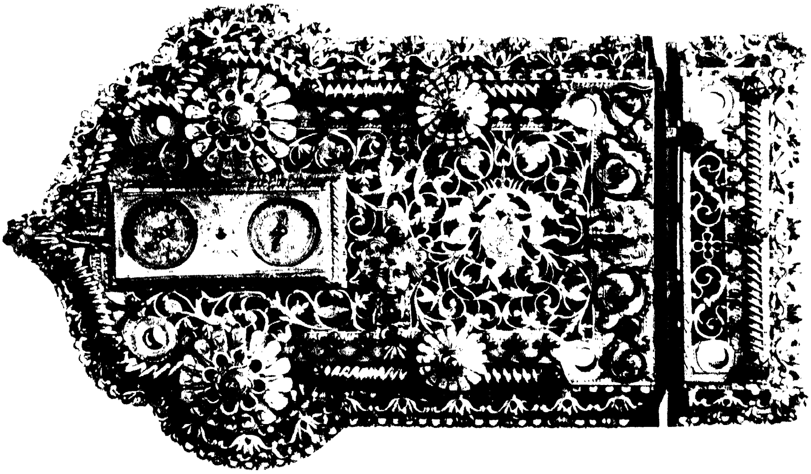
Bells.—In northern Europe, France, Germany, England and the Netherlands bell-founding has been an enormous industry since the early part of the Middle Ages Unfortunately a large number of mediaeval bells have been melted down and recast, and in times of warfare many were seized to be cast into guns. Early bells are of graceful outline, and often have simple but well designed ornaments and very decorative inscriptions; for the latter a separate stamp or die was used for each letter or for a short group of letters. In every country bell-founders were an important group of the community; in England a great many of their names are known and the special character of their work is recognizable. Old bells exist in the French cathedrals of Amiens, Beauvais, Chartres and elsewhere; in Germany at Erfurt, Cologne and Halberstadt. The bell-founding industry has continued all through the centuries, one of its later achievements being the casting of "Big Ben" at Westminster, in 1858, a bell of between 13 and 14 tons in weight.

In recent years bronze has to some extent replaced iron for railings, balconies and staircases, in connection with architecture; the style adopted is stiffly classical, which does not call for a very large amount of ornamentation, and the metal has the merit of pleasant appearance and considerable durability.

Brass.—Brass is an alloy composed of copper and zinc, usually for sheet metal, and casting in the proportion of seven parts of the former to three of the latter Such a combination secures a good, brilliant colour. There are, however, varieties of tone ranging from a pale lemon colour to a deep golden brown, which depends upon a smaller or greater amount of zinc. In early times this metal seems to have been sparingly employed, but from the Middle Ages onward the industry in brass was a very important one, carried out on a vast scale and applied in widely different directions. The term "latten," which is frequently met with in old documents, is rather loosely employed, and is sometimes used for objects made of bronze; its true application is to the alloy we call brass In Europe its use for artistic purposes centred largely in the region of the Meuse valley in south-east Belgium, together with north-eastern France, parts of Holland and the Rhenish provinces of which Cologne was the centre. As far back as the 11th century the inhabitants of the towns of Huy and Dinant are found working in this metal; zinc they found in their own country, while for copper they went to Cologne and Dortmund, and later to the mines of the Harz mountains. Much work was produced both by casting and repoussé, but it was in the former process that they excelled. Within a very short time the term "dinanderie" was coined to designate the work in brass which emanated from the foundries of Dinant and other towns in the neighbourhood Their productions found their way to France, Spain, England and Germany. In London the Dinant merchants, encouraged by Edward III, established a "Hall" in 1329 which existed until the end of the 16th century; in France they traded at Rouen, Calais, Paris and elsewhere. The industry flourished for several centuries, but was weakened by quarrels with their rivals at the neighbouring town of Bouvignes; in 1466 the town was sacked and destroyed by Charles the Bold. The brass-founders fled to Huy, Namur, Middelburg, Tournai and Bruges, where their work was continued. The earliest piece of work in brass from the Meuse district is the font at St. Bartholomew's church, Liège, a marvellous vessel resting on oxen, the outside of the bowl cast in high relief with groups of figures engaged in baptismal ceremonies; it was executed between 1113 and 1118 by Renier of Huy, the maker of a beautiful censer in the museum of Lille. From this time onward a long series of magnificent works were executed for churches and cathedrals in the form of fonts, lecterns, paschal and altar candlesticks, tabernacles and chandeliers; fonts of simple outline have rich covers frequently adorned with figure subjects; lecterns are usually surmounted by an eagle of conventional form, but sometimes by a pelican; a griffin surmounts the lectern at Andenne. The stands which support these birds are sometimes of rich Gothic tracery work, with figures, and rest upon lions; later forms show a shaft of cylindrical form, with mouldings at intervals, and splayed out to a wide base. A number are found in Germany in the Cologne district, which may be of local manufacture; some remain in Venice churches. About a score have been noted in English churches, as at Norwich, St. Albans, Croydon and elsewhere. For the most part they follow the same model, and were probably imported from Belgium; fine brass chandeliers exist, at the Temple church, Bristol, at St. Michael's Mount, Cornwall, and in North Wales The lecterns must have set the fashion in England for this type of object; for several centuries they are found, as at St. George's chapel, Windsor, King's college chapel, Cambridge, St. Paul's cathedral and some London churches. In the region of Cologne much brass-work was produced and still remains in the churches; mention must be made of the handsome screen in the church of Xanten, the work, it is said, of a craftsman of Maestricht, Holland, at the beginning of the 16th century.

Holland, Norway and Sweden also produced chandeliers, many of great size: the 16th and 17th-century type is the well known "spider," large numbers of which were also made in England and still hang in many London and provincial churches. Holland also showed a great liking for hammered work, and produced a large number of lecterns, altar candlesticks and the like in that method. The large dishes embossed with Adam and Eve and similar subjects are probably of Dutch origin. These differ considerably from the brass dishes in which the central subject—the Annunciation, St. George, St. Christopher, the Agnus Dei, a mermaid or flowers—is surrounded by a band of letters, which frequently have no significance beyond that of ornamentation; the rims are stamped with a repeating pattern of small designs. This latter type of dish was probably the work of Nuremberg or Augsburg craftsmen, and it should be noticed that the whole of the ornament is produced by hammering into dies or by the use of stamps; they are purely mechanical pieces.

Brass was widely used for smaller objects in churches and for domestic use. Flemish and German pictures show candlesticks, holy-water stoups, reflectors, censers and vessels for washing the hands as used in churches. The inventories of Church goods in England made at the time of the Reformation disclose a very large number of objects in latten which were probably made in the country. In general use was an attractive vessel known as the aquamanile; this is a water-vessel usually in the form of a standing lion, with a spout projecting from his mouth; on the top of the head is an opening for filling the vessel, and a lizard-shaped handle joins the back of the head with the tail. Others are in the form of a horse or ram; a few are in the form of a human bust, and some represent a mounted warrior. They were produced from the 12th to the 15th century. Of domestic objects the number was legion: mortars, small candlesticks, warming pans, trivets, fenders; these date mainly from the 17th and 18th centuries, when brass ornamentation was also frequently applied to clock-dials, large and small. Two English developments during the 17th century call for special notice. The first was an attempt to use enamel with brass, a difficult matter, as brass is a bad medium for enamel. A number of objects exist in the form of fire-dogs, candlesticks, plaques and vases, the body of which is of brass roughly cast with a design in relief; the hollow spaces between the



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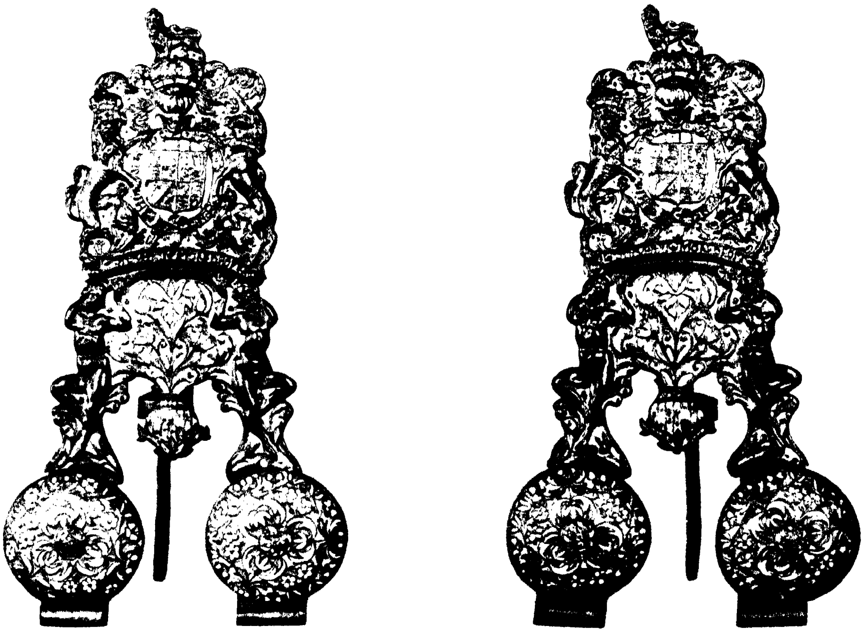

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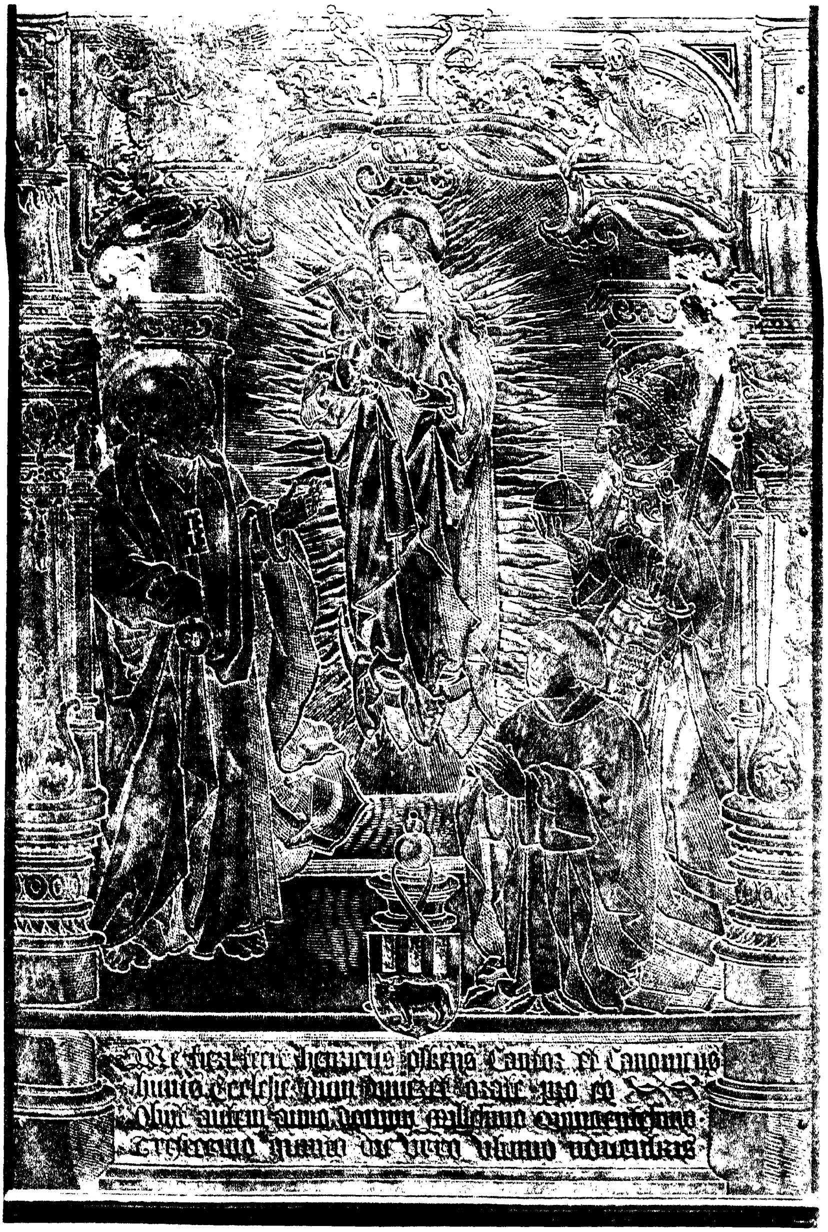
BY COURTESY OF THE DIRECTOR OF THE VICTORIA AND ALBERT MUSEUM

17TH CENTURY BRASS LOCK AND FIRE-DOGS

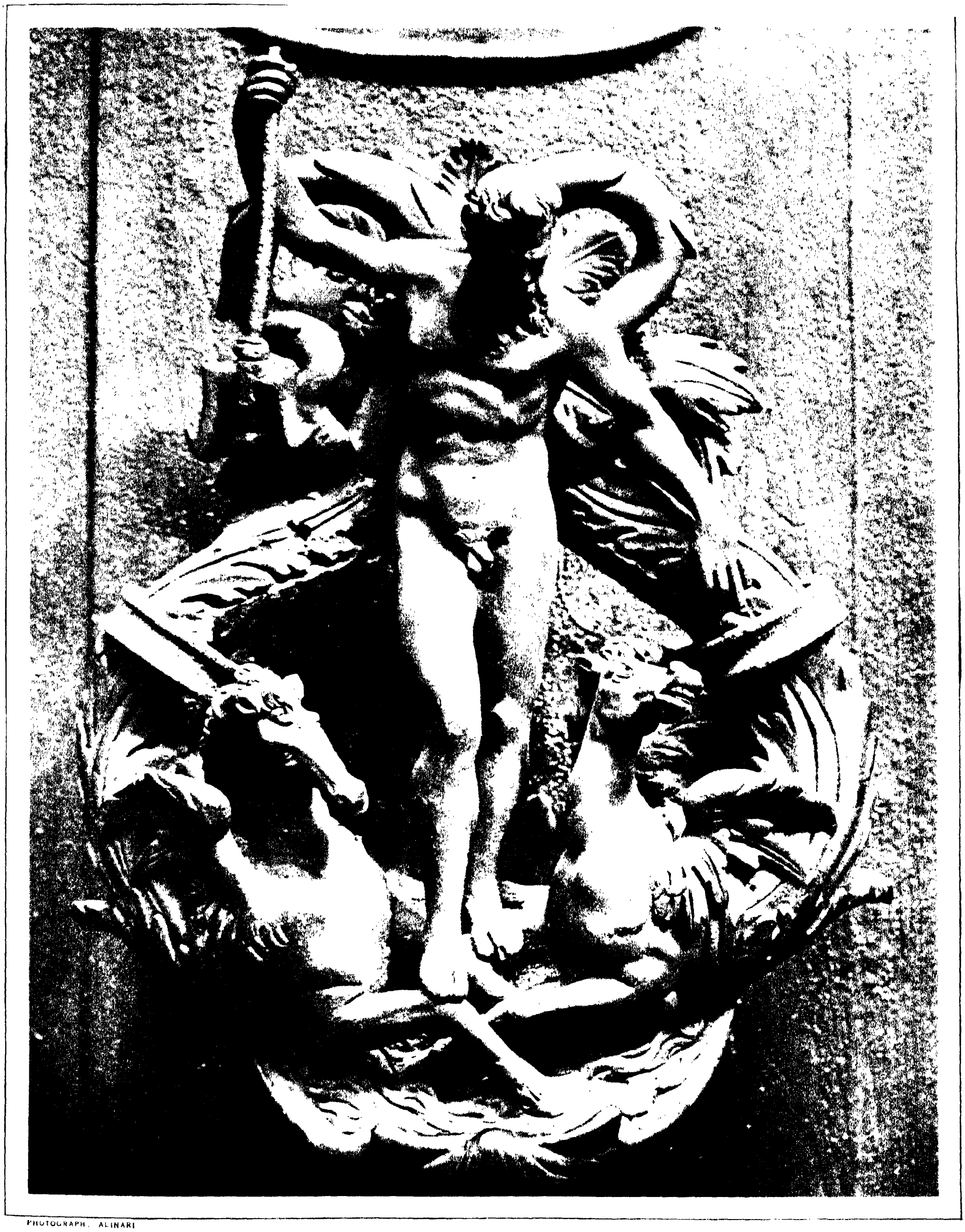
1. An English brass lock characteristic of the elaborate open-work style introduced in the 17th century. The case is cast in a graceful pattern of bird forms, animals' heads, cherubs and foliage
2. 17th century enamelled fire-dogs believed to have been made for James I. of England. They consist of the royal arms of the house of Stuart supported by two nude male figures separated by a conventional floral ornament and resting on convex discs. The enamel is in blue, green and white, with touches of red in the royal coat and supporters


Me fieri fecit henricus oskens Cantor et Canonicus
huius Ecclesie dum vivus erat orate pro eo
Obiit autem anno domini millesimo quingentesimo
tricesimo quinto die vero ultimo novembris

BY COURTESY OF THE DIRECTOR OF THE VICTORIA AND ALBERT MUSEUM

GERMAN MONUMENTAL BRASS OF THE 16TH CENTURY

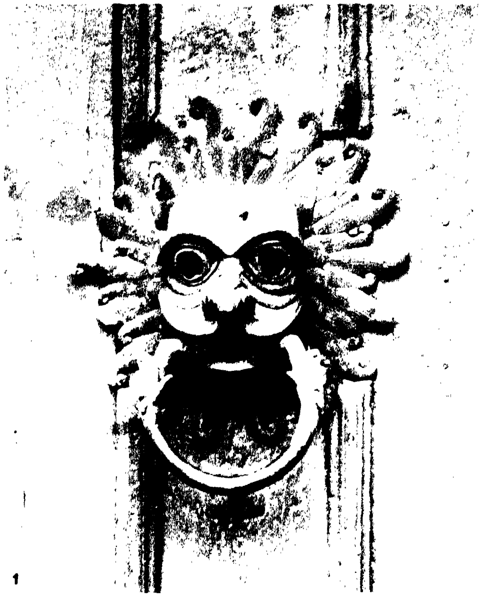
Brass inscribed to the memory of Henricus Oskens, Cologne, 1535. The Blessed Virgin, surrounded by an aureole of flames and rays, is in the centre; S. Peter stands to the left, carrying the key of heaven for the deceased, who is kneeling, while behind him is his patron saint, the Emperor S. Henry, in full armour. The inscription reads: "Henry Oskens, Chanter and Canon of this church, had me made while he was living, pray for him. And he died 1535, on the last day of November"



PHOTOGRAPH, ALINARI

VENETIAN BRONZE KNOCKER OF THE 16TH CENTURY

This bronze knocker, from the Palazzo Trevisan, Venice, has a design that occurs frequently, with variations, among Venetian palace knockers of the period. Neptune, brandishing his trident, stands upon two sea-horses. Their tails are thrown up behind him in elaborate foliation, while they paw the sea foam in the shell at the base of the knocker. The artist is unknown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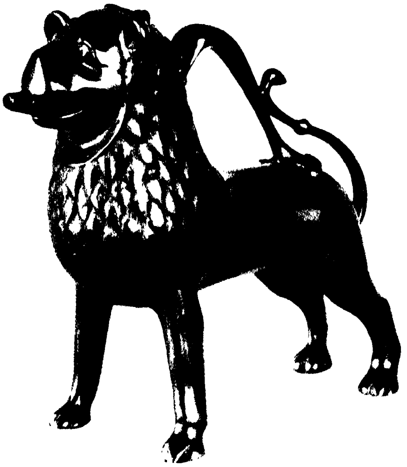
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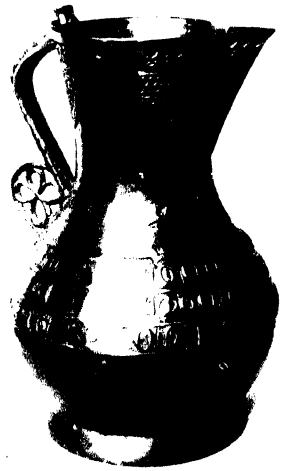
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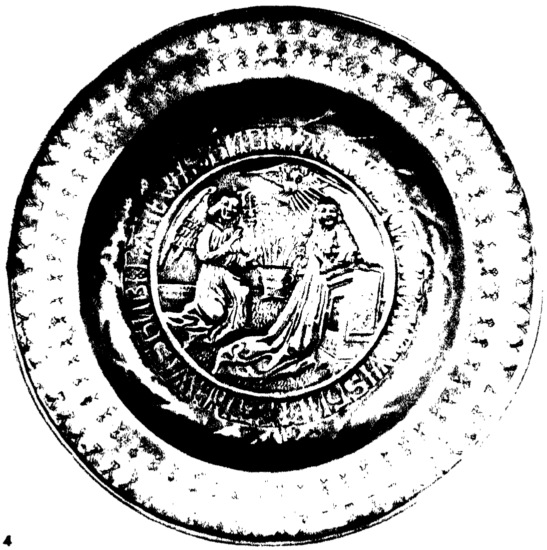
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BY COURTESY OF (1) B. C. CLAYTON, (2, 3, 4) THE DIRECTOR OF THE VICTORIA AND ALBERT MUSEUM

ENGLISH BRONZES

1. The sanctuary knocker on the north door of the nave of Durham cathedral, England (1133–40), probably the most ancient knocker extant. The design suggests Scandinavian origin.
2. An English aquamanile in the form of a standing lion. A spout projects from the mouth, and the opening for filling is on the top of the head. This type of vessel was commonly used with basin during the middle ages for handwashing at table
3. 14th-century English flagon of cast bronze from a manor house in Norfolk. It is decorated with the old royal arms of England and an inscription in Gothic letters: "Goddes grace be to this place. Amen. Stand utter (stand away) from the fyre and lat onjust (let one just) come nere"
4. Round hammered brass dish of the 16th or 17th century. The centre scene, representing the Annunciation, is surrounded by a band of letters. The rim is stamped with a pattern of small designs

lines of the design are filled in with patches of white, black, blue or red enamel, with very pleasing result. The nearest analogy is found in the small enamelled brass plaques and icons produced in Russia in the 17th and 18th centuries. The second use of brass is found in a group of locks of intricate mechanism, the cases of which are of brass cast in openwork with a delicate pattern of scrollwork and bird forms sometimes engraved. A further development shows solid brass cases covered with richly engraved designs. The Victoria and Albert museum, London, contains a fine group of these locks; others are *in situ* at Hampton Court Palace and in country mansions.

During the 18th century brass was largely used in the production of objects for domestic use; the manufacture of large hanging chandeliers also continued, together with wall-sconces and other lighting apparatus. ¶In the latter half of the 19th century there came an increasing demand for ecclesiastical work in England; lecterns, alms dishes, processional crosses and altar furniture were made of brass; the designs were for the greater part adaptations of older work and without any great originality.

Monumental Brasses.—The working of memorial brasses is generally considered to have originated in north-western Germany, at least one centre being Cologne, where were manufactured the latten or "Cullen" plates for local use and for exportation. But it is certain that from mediaeval times there was an equal production in the towns of Belgium, when brass was the favoured metal for other purposes. Continental brasses were of rectangular sheets of metal on which the figure of the deceased was represented, up to life-size, by deeply incised lines, frequently filled with mastic or enamel-like substance; the background of the figures was covered with an architectural setting, or with ornament of foliage and figures, and an inscription. In England, possibly because the metal was less plentiful, the figures are usually accessories, being cut out of the metal and inserted in the matrices of stone or marble slabs which form part of the tomb; architectural canopies, inscriptions and shields of arms are affixed in the same way. Thus the stone or marble background takes the place of the decorated brass background of the Continental example. The early method of filling in the incisions has suggested some connection with the methods of the Limoges enamellers of the 13th century. The art was introduced into England from the Low Countries, and speedily attained a high degree of excellence. For many centuries it remained very popular, and a large number of brasses still remain to witness to a very beautiful department of artistic working.

The earliest existing brass is that of Bishop Ysowilpe at Verden, in Germany, which dates from 1231 and is on the model of an incised stone, as if by an artist accustomed to work in that material. In England the oldest example is at Stoke D'Abernon church, in Surrey, to the memory of Sir John D'Abernon, who died in 1277. Numerous brasses are to be found in Belgium, and some in France and Holland. Apart from their artistic attractiveness, these ornamental brasses are of the utmost value in faithfully depicting the costumes of the period, ecclesiastical, civil or military; they furnish also appropriate inscriptions in beautiful lettering.

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CHINESE BRONZE

History.—The bronze products of China have been from the earliest times of so high a degree of excellence, both artistic and technical, that they may truly be classed among the fine arts. So early as any reliance can be placed upon records the Chinese appear to have been enthusiastic amateurs and collectors of bronzes, and up to the present day it is this very enthusiasm which has seemed to prevent a scientific attitude among Chinese antiquarians when the question of the dating of old bronzes is concerned. In the Sung dynasty (960–1279) great collections of animal bronzes began to be found, and the names now used for various types of bronzes often originated in that period. Volumes of encyclopaedic proportions were written about them. The volumes were often profusely illustrated, but with drawings that were anything but scientifically accurate.

The bronzes in the Chinese collections may be divided roughly into two classes: (1) those whose surface has been worked over and (2) those which remain in the same condition as when they were first excavated. Those bronzes which have been for many years in famous Chinese collections have in most cases been worked over and vastly improved in appearance. Bronzes, as first excavated, should prove the most reliable documents, but scientific excavation is as yet hardly established in China, and it is difficult to ascertain the true facts concerning the finding of any piece which may come upon the market. Even though a perfectly reliable eye witness may testify to having been present at the excavation of a bronze, the chances are that he is not a trained archaeologist, and is unable to interpret correctly the conditions under which the bronze has been found. So far, we know very few important excavations of bronzes which may be dated with any approximation of certainty. Remarkably fine specimens of bronzes exist in the collections of China, Korea, Japan, Europe and America, and the history of some of the pieces in the Chinese collections is known for several hundred years, for illustrated catalogues of bronzes were compiled during the Sung dynasty (A.D. 960–1279), and have come down to us together with later and more copious works, some in many volumes. They include: a famous work called the Ting Lu, written in the 6th century by Yu Li, and another in 20 volumes called the San Li Tu written in the 10th century by Nieh Tsung-yi. Both of these, however, have relied too much on imagination to be considered reliable. The most important early catalogue is in 30 volumes and dates from the Sung dynasty; its title is Hsüan Ho Po Ku T'ou Lu, and it was written in the 12th century by Wang Pu; it has been often reprinted. The most famous of all the catalogues is one in 42 volumes, compiled for the Emperor Ch'ien Lung and printed in 1751. It illustrates his splendid collection of bronzes in the Peking palace and is called Hsi Ch'ing Ku Chien. There are many others of which a number are devoted to a discussion of inscriptions on bronzes.

Treatises on bronzes were written during the Chou dynasty (1122–249 B.C.) and from one of these we get our first information about their manufacture. Indeed, so great is the respect for ancient bronzes in China that in the year 116 B.C., when an old bronze *ting* was found in the bank of a river in Shensi, the name of the reign was changed in honour of the event. The reverential attitude of the Chinese towards antiquity, the permanent nature of the metal alloy, and the fact that the earliest important bronzes are all of a ceremonial or sacrificial nature have combined to place them high in the esteem of Chinese connoisseurs from the earliest times.

Since 1936 several types of bronze can be dated with fair certainty in the 15th-14th centuries B.C., but it is quite evident, from the skill of design and execution, that these bronzes are by no means the earliest, as such perfection of manufacture is achieved only after much experimentation and long years of experience. In the Royal Ontario Museum of Archaeology in Toronto there are several bronzes which seem to be legitimate ancestors of the Anyang pieces (of around 1400 B.C.), but how remote their ancestry may be is still to be discovered.

The most important contributions to the dating of Chinese bronzes have been presented by Professor Bernhard Karlgren, under the auspices of the Museum of Far Eastern Antiquities, Stockholm. Dr. Karlgren got together a vast number of inscriptions from early bronzes whose authenticity had been passed upon by conservative Chinese scholars. In these texts he found three characters that never appeared on vessels which bore inscriptions easily classified as Chou. He had 450–500 such inscriptions. Having segregated these supposedly earliest bronzes, Dr. Karlgren arranged them in categories of design and form to see whether they possessed any outstanding characteristics not found in the later vessels. This seems to be the first systematic study of this subject and the results have proved its essential correctness. Borderline cases are always difficult, but early bronzes can with some confidence be divided into three classes,—Shang (or Shang-Yin, as some prefer to call it), Chou, and an intermediate transitional class which might belong to either. Also, the Chou vessels can be subdivided into chronological groups.

Throughout the long stylistic development of Chinese bronzes, their most outstanding characteristic is the thorough amalgamation of basic form and surface ornament. The motives which decorate and enrich the surfaces are always integral parts of the object itself and not extraneous motives aimlessly applied. It matters not that the general effect of a bronze may be either of extreme simplicity or of great elaboration—it is always a consistent unit. To be sure, the Chinese craftsman and designer was not uniformly successful. Where ritual played such an important part in his work it would be strange indeed not to find a certain percentage of mechanical repetition and some poor technical standards. It is the very narrowness of the field, however, and the insistence on tradition that makes the superlative work of the fine bronze makers so astonishing. Restricted to a small number of forms, and using decorative motives which were undoubtedly largely dictated by use and ritual, their work has a freshness and vigour that has never been surpassed. The type of decoration of the earliest bronzes was dependent upon a highly perfected technique. The decorative motives were in distinct relief and almost always with smoothly polished surface. They generally appeared against a ground subdivided by incised lines into very intricate patterns which were originally filled with some sort of dark paste or lacquer. Sometimes turquoise was used as an inlay. Thus the decorative motives were strongly emphasized and had to be vigorous in treatment in order to retain their character.

Bronze Composition and Manufacture.—Bronze was used at a very early date for both ceremonial and utilitarian purposes and doubtless the ceremonial use was the later development. It must first have been cast in single stone moulds, then in piece moulds, and finally by the lost wax process, to which complicated method we owe the earliest bronzes now known to us. The simple piece moulds were used for coins, spear-heads, halberds, swords, and such objects, where the forms were simple and flat. On the site of Anyang, capital city of 1400 B.C., have been found many fragments of jointed fire-clay moulds with the marks of fire upon them, so it is possible that such moulds were used repeatedly. Even among the very earliest vessels the handles were cast separately and welded to the body, and in some cases these handles are hollow. We can be sure then, that whether cast by lost wax or piece mould, the workmanship of the earliest Chinese bronzes known to us has never been surpassed in technical perfection. This is all the more remarkable when we realize that the Chinese of those days had no means of obtaining their metals in a pure state.

There have been several series of experiments conducted to determine the composition of early bronzes. One of the most complete studies has been published by Prof. M. Chikashigé, a Japanese, who analyzed chemically and physically a number of mirrors. It has been stated in a work pertaining to the Chou dynasty, but possibly of later date, the K'ao Kung Chi, that the proportions of copper and tin were definitely established for the making of bronzes for specific purposes. It is certain, however, that neither these metals nor any others were available to the Chinese in a form at all pure, so in all the alloys there are other metals present such as lead, zinc, antimony, iron and silver. Some of the early bronzes have a beautiful golden colour under the patina, and there are dealers who have not hesitated to state that this was due to the presence of large quantities of gold in the alloy. Chemical analyses show no gold. The proportions used in the Chou dynasty, according to the K'ao Kung Chi, are as follows:

5 parts copper, 1 part tin for bells, gongs, kettles, ceremonial vessels and measures of capacity.
4 " " 1 " " " axes and hatchets.
3 " " 1 " " " halberd-heads and tridents.
2 " " 1 " " " two-edged swords, spades, hoes and similar agricultural implements.
3 parts copper, 2 parts tin for arrowpoints and knives used as styluses for writing.
1 part copper, 1 part tin for mirrors.

The varying proportions of metals in the alloy would of course affect the colour, and we have, in consequence, a range from a coppery red colour through lighter reds and golden yellow to the nearly pure silver colour of the mirrors. The surface of most ancient bronzes, when cleaned from deposits and patina, has a dull silvery colour due to mercury. This is said by some to be the result of the accidental presence of mercury in the alloy, which has worked to the surface during long years of burial. It is more probable, however, that the mercury was used deliberately to coat the surface of the bronze and thereby produce a silver-coloured plating in cases where the alloy itself was not white. The colours produced by age and careful manipulation, now so highly valued, were of no interest to the Chinese of early ages who preferred the bronzes to be of a steely colour.

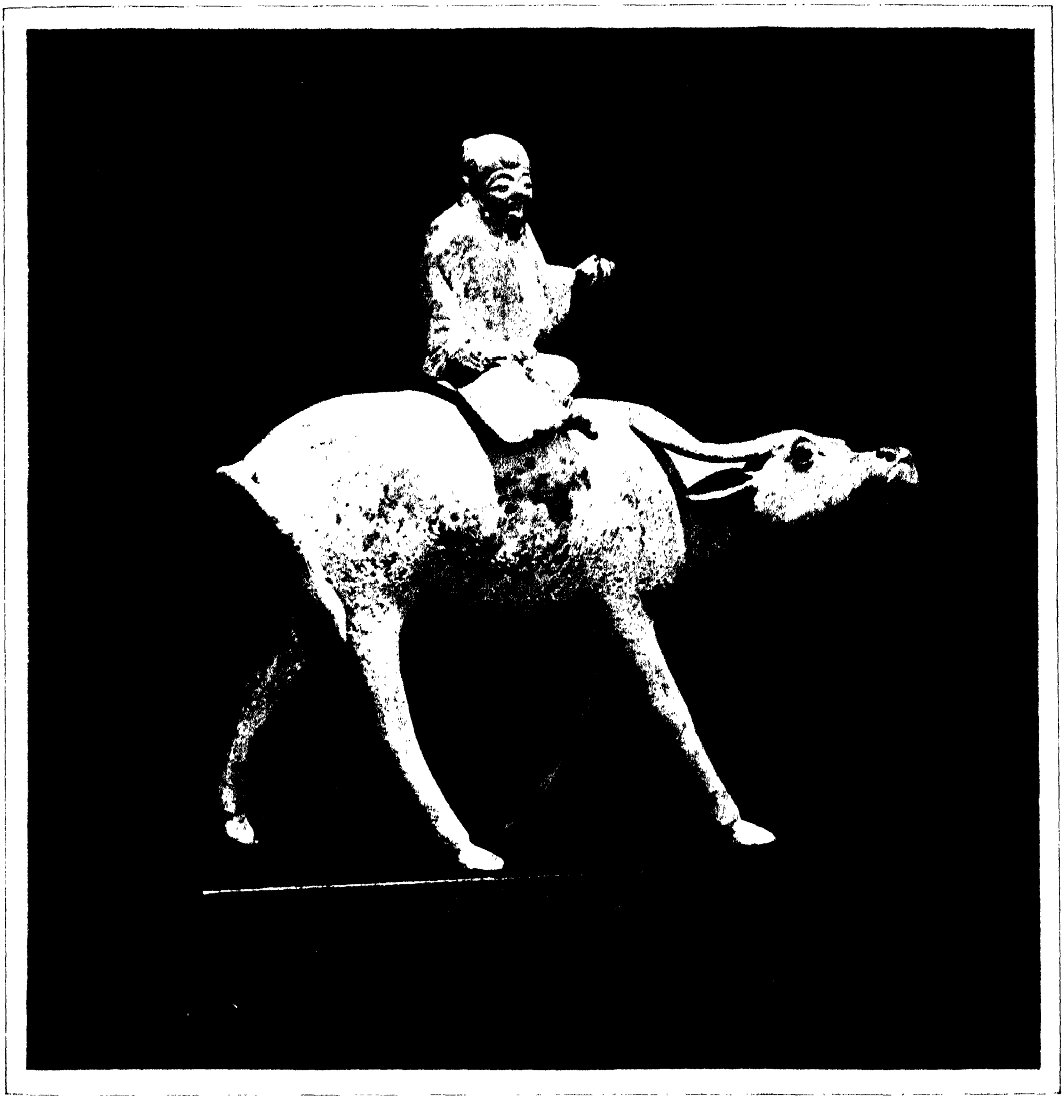
Forms and Uses.—The uses of the bronze ceremonial vessels are largely conjectural. Our information is gained from works based upon the researches of the archaeologists of the Sung dynasty, who undoubtedly had material not available to us, but whose deductions and theories would hardly be called scientific. It is believed that the sacrificial forms were based upon idealizations of vessels in common use; that some held liquids such as wine and water, and others, cereals and prepared meats. Some of them may have been used only for commemorative purposes. A man raised to high rank would cause a bronze vessel to be made in honour of the occasion, and would inscribe it, sometimes to his ancestors, to whom he believed his preferment was due, sometimes to himself. Such vessels we can be reasonably certain were always used in religious ceremonies or family sacrifices. The forms which originated in the Shang dynasty remained essentially the same (see *Decoration*) till the mid-Chou period, and those most extensively used were few in number.

All early bronzes can be characterized as dignified and massive in proportion. Whether they be large or small there is always an appearance of strength and solidity; and although not essentially clumsy, there is as yet little charm of contour such as would have been so essential to the Greeks. The few exceptions are in the profiles of some of the simpler *tsun,* and these are as sensitive in line as any works of art that have ever been made. So keenly was the line felt in such instances that the slenderness or sturdiness of the *tsun* was perfectly expressed in the quality of the profile, regardless of bulk. There is crudity perhaps in the conception of some of the decorative motives, but it is the crudeness of conception of the Romanesque period, without any traces of its awkwardness of execution. Chief among early bronze forms is the *ting* (鼎). Originally a tripod cooking pot, it assumed a great variety of shapes, some clumsy and topheavy, and others refined, but always sturdy. There is at present in the Buckingham collection in the Art Institute of Chicago, an unusually fine example of an early but refined type. It was formerly in the Tuan Fang collection. The patina is a beautiful tea-dust green, and has evidently been hand-polished for generations.

The *hsien* (甗) is generally a three-legged vessel the bottom section of which is covered by a perforated and sometimes hinged lid; it was a steamer often made in two parts, occasionally separable, and is really an archaic version of a cooking utensil well known in Chinese kitchens. It is always clumsy in form, as compared with other bronze forms.

The *yu* (卣) is a covered bucket-like utensil with a swinging bale. It has a bulbous body, always elliptical in section, and the cover fits closely down over the neck. In some cases the swinging handle is so arranged that it moves through a limited distance, allowing only sufficient room for the easy removal of the lid. The function of the *yu* was the storage and transportation of sacrificial wine, or possibly of wine for less solemn occasions. The *tsun*

BRONZE AND BRASS ORNAMENTAL WORK



FROM THE WORCESTER (MASS.) ART MUSEUM

CHINESE BRONZE INCENSE BURNER

Chinese bronze incense burner of the Sung dynasty (A.D. 960-1279) in the form of a water buffalo upon which is riding Lao-tse, the philosopher who founded the Taoist religion. The water buffalo, being one of the most dangerous and difficult beasts to tame, is chosen as a symbol of the power of the gentle thought of the philosopher. The casting of this piece is paper-thin

(尊) which, in its simplest form, is a cylinderlike beaker with concave sides, goes through a variety of changes in form without change of name. Some of the most beautiful of all the ancient bronzes are *tsun.* These beakers were used to contain liquids.

The *yi* (彝) is a wide cup, generally with two handles, though some handsome variants are known with four. The handles are sturdy, with animal heads at the top and a rectangular pendant at the bottom. This form must originally have had significance, but its origin is lost. A few specimens have been found mounted upon a square hollow base, cast all in one piece, from under the top of which depends a loop. Some Chinese archaeologists claim that a bell originally hung from this loop, which rang when the *yi* was lifted. Although the bell is of very ancient origin in China it was without a clapper for some centuries after the *yi* in question were made, so it seems hardly possible that a voiceless bell should have hung there. Bells were struck with a wooden mallet on the outer surface, and a person who held a heavy *yi* aloft in both hands could certainly not have struck a bell hanging beneath. The use of the loop remains therefore still problematical, and would not have been mentioned here were it not that it furnishes an excellent example of the fantastic speculations which have passed current in China as archaeology. The *yi* was used for offerings of grain.

Another form called *yi*, but differently written (匜), is sometimes the most fantastic of all the sacrificial vessels. These *yi* are often animal forms conventionalized into containers for sacrificial wine, and generally of a deliberately ugly or menacing aspect. The animals are usually not recognizable as members of any known species, but are extremely convincing, nevertheless.

A form called the *hu* (壺) was popular during the late Chou dynasty. It is a round-bellied jar with a spreading cylindrical neck, and a cylindrical foot. It has two ring handles suspended from flat tiger masks on the shoulders, and was used as a container for wine or water. Three of the finest of these examples are in the Buckingham collection. One bears engraved upon the neck four characters reading "Number seven eastern palace." Another of these jars approximately the same size and shape has the entire surface covered with an engraved pattern consisting of geometrical ornament and dragon-headed interlacing scroll patterns. Both these jars are of reddish bronze with a heavy gold plating, but the decorated jar has the pattern relieved in silver colour evidently obtained by painting the gold surface with mercury. The masks which support the handles of this jar are very crisply chiselled, and there can be little doubt that it is an imperial piece. The third of these jars is inlaid with a metal now much decomposed, but probably copper. A pattern of sprightly animals, facing each other in pairs, and in different registers, alternating with spirals gives vigorous decoration over the entire surface. The form of the jar is extremely simple, but it is saved from monotony and raised to a high degree of beauty by the unusual vitality of the decorating shapes.

Bells and mirrors deserve special mention. Fine bronze bells of the early periods have long been highly esteemed by Chinese collectors, particularly when they bear inscriptions, and an inscribed bell was always considered superior to an uninscribed one of greater artistic merit. The forms of early bells are all more or less alike, and they may be generally considered as representing one class, although there is a great variety in proportion and in the surface decoration. Most of the bells have projecting bosses, sometimes called nipples, arranged in regular pattern on the surface, and these have given rise to some amazing speculations among Chinese amateurs. Perhaps the most amusing is that they are the survival of tuning pegs, such as are used at present in harps and pianos. It is claimed that strings or wires were stretched between them and that the bells were tuned to various musical pitches. A simpler solution of the problem would be that they represent rivets which in early times fastened plates of metal together in bell forms before bronze could be easily cast. The bells are all flat in section, like pointed ellipses, and this form could easily develop from metal plates.

Mirrors were probably introduced from the West, as highly artistic metal mirrors were in use in Greece some time before they seem to have appeared in China and crude earlier Scythian examples are known. Nevertheless it is possible that Chinese mirrors may be as early as the sixth century B.C. The earliest examples are circular and very simple. The reflecting surface is as a rule slightly convex, and the back is decorated with concentric bands of geometrical patterns. Ritualistic mirrors sometimes had concave reflecting surfaces. Sometimes there are birds or beasts in raised outline, and sometimes characters and signs of the zodiac in the field inside the bands. A boss in the exact centre, pierced from side to side, allowed the passage of a cord which was twisted into a tassel and used as a handle for the mirror. Some of the finest mirrors date from the T'ang dynasty. The backs are covered in high relief with intertwining patterns of vines, leaves, birds and running animals, and are reminiscent of Persian taste as well as the repoussé silver work done in Asia Minor from Hellenistic times. Caravans were passing continually between China and the West, and, from the time of the Han dynasty, outside influences become a distinct factor in the development of all the crafts of China.

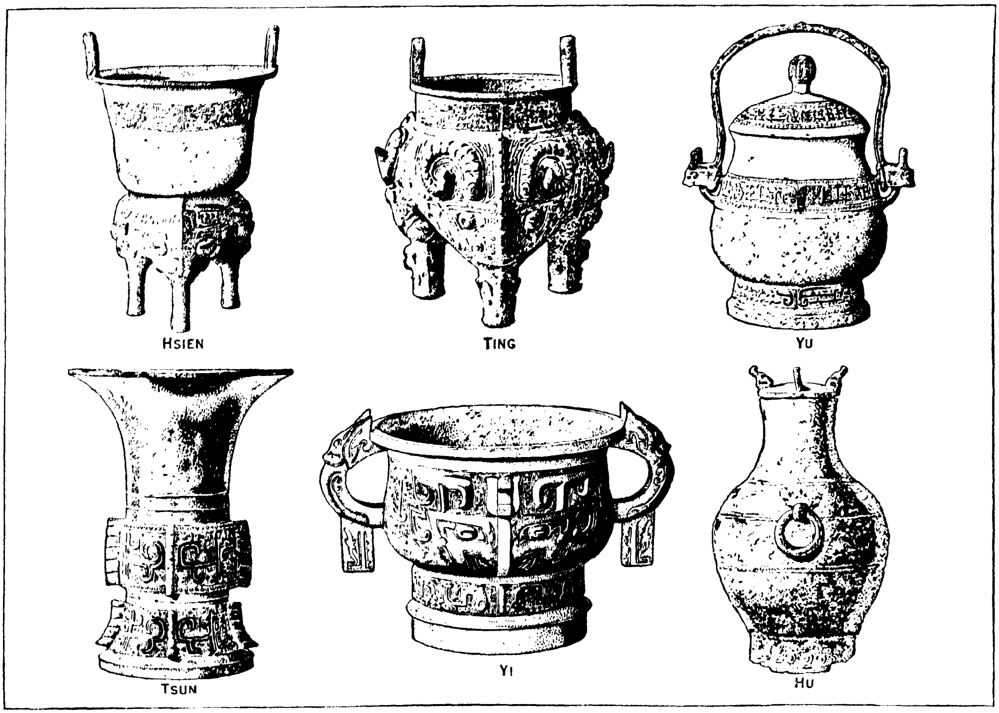
During the Six dynasties it became the custom to cast votive figures in gilt bronze, and the monasteries seem to have made a practice of keeping large numbers of these on hand, ready for dedication by the pious. It is from the inscriptions engraved on the bases at the time of such dedications that we have gained much of our information on sculptural characteristics and religious practices of the Wei and T'ang dynasties. From the end of the Chou period there is a tendency to simplify bronze forms and rely upon engraved or inlaid patterns in place of the early decorations in relief. During the Sung dynasty the keen delight in archaeological research prompted the manufacture of exact counterparts of early forms, as well as all sorts of archaistic approximations. Very few Ming bronzes have much to recommend them as works of art. They are generally the products of the virtuosity of mediocre craftsmen, produced at a time when lavish decoration had taken the place of purity of form.

Inscriptions.—In the identification of ancient bronzes the Chinese lay great stress upon inscriptions. There is still some doubt as to the meaning of certain of the ancient characters, but most of the inscriptions can be read. They vary in length from one character to several hundred, and often give accounts of historical events and the names of personages, but without dates, and without sufficient detail to make attributions to definite times or places anything more than conjectural. One of the longest on record is in the South Kensington museum, London. The shorter inscriptions read: "To the venerable father," "I have dedicated this bronze to my father Ting," "Serviceable for sons and grandsons," etc. There are also single marks, more or less pictographic, some of which represent animals, birds or men. The meaning of others is not at all clear.

As bronzes with inscriptions bring higher prices, many dealers have felt it their duty to see that all bronzes in their possession bore the right, or wrong type of inscription. Many bronzes, perfectly genuine, excellent specimens artistically, have had inscriptions added at a later date, in characters sometimes meaningless. In the ancient bronzes the inscriptions were cast in the surface like the ornament, and it is practically impossible to imitate a cast inscription by means of engraved characters, so a microscope, and even the eye alone will detect the added inscription. This is not, however, a practice of recent origin, and some very fine bronzes of the Chou dynasty bear inscriptions in Shang or Chou characters which were added to them several hundred years later.

Decoration.—Following closely the researches of Karlgren, we can divide the stylistic development of Chinese bronzes into several classes: (1) Shang (Karlgren uses the term Shang-Yin), the Shang dynasty was 1765–1122 B.C.; (2) Early Chou, 1122–950 B.C.; (3) Middle Chou, 950–770 B.C.; (4) Late Chou (Karlgren and others refer to this style as Huai, as it was first identified in the valley of the Huai River); (5) Han, 206 B.C.–220 A.D.

Styles cannot, however, be sharply differentiated and classified by accurate dates, as every style in all phases of art is a matter of gradual growth, a new influence increasing in popularity



FROM ALBERT J. KOOP'S 'EARLY CHINESE BRONZES', (LEFT TO RIGHT: TOP ROW) PLATES XX, II, XI, (LOWER ROW) PLATES IV, X-A, LIII

EARLY CHINESE BRONZES

as a current style is losing ground, so that, in a country as large and sparsely populated and without coherent organization as was the China of those days, it is quite possible that various stylistic influences were at work in different degrees in widely separated districts. It is now, and always will be, consequently, impossible to say with assurance that an undated bronze was cast in a certain year.

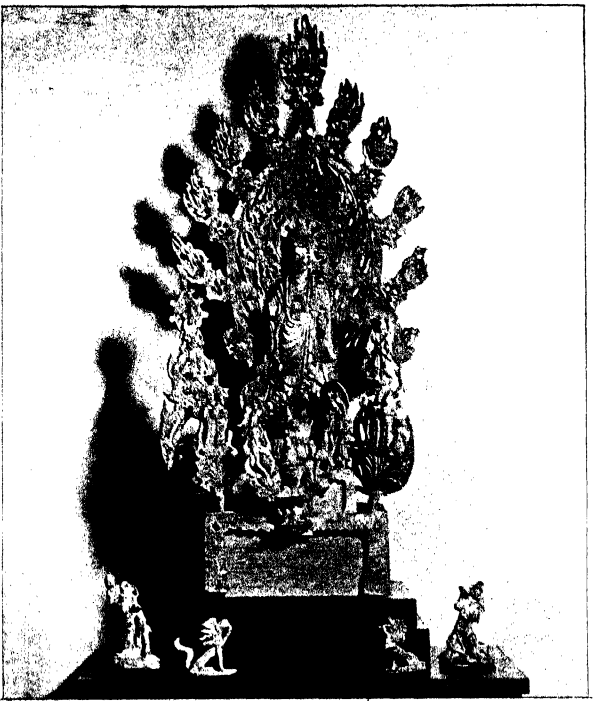
Nevertheless, with a certain amount of assurance we can state some of the main characteristics of the various periods, some of which change or disappear in succeeding epochs.

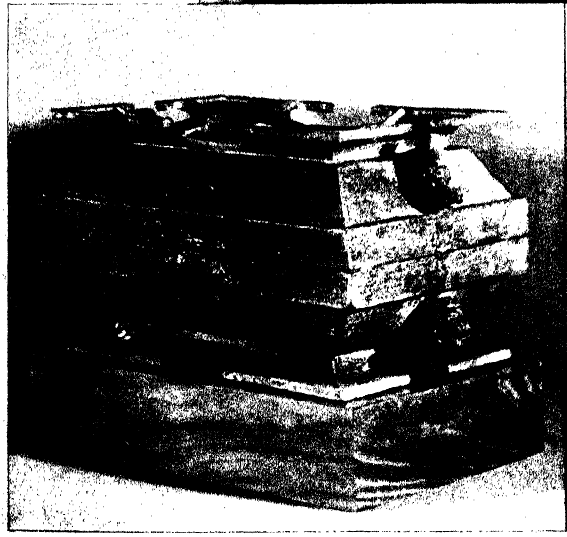
Shang.—The favourite decorative motives are cicadas, snakes, a great variety of birds, many dragon types, occasional elephants (elephants were known to the Shang people), and the t'ao-t'ieh, which appears most often of all. The t'ao-t'ieh (a title bestowed as late as the Sung dynasty) has been variously explained, but no explanation is conclusive or satisfactory. The Chinese call it the "ogre," or glutton, which really means nothing. There is no doubt that it had a very definite meaning to the Shang designers and it must have had some sort of spiritual connotation. We know that the important early bronzes were all made for ritual purposes, and that the contemporary religion was animistic—a form of worship based on the belief that natural forms and forces possessed inherent spiritual being which should be propitiated. The sinister aspect of the t'ao-t'ieh, a sort of monster mask, would naturally identify it with some awe-inspiring supernatural being. The t'ao-t'ieh then, is a generally bodiless head, displayed in a prominent place on the bronze and often dominating the design. Protruding eyes are the first noticed feature, and then a wide mouth, often without a lower jaw, with or without tusks. The nose will probably be identified with one of the vertical flanges which are seldom missing on an early bronze. Sometimes the effect of the t'ao-t'ieh is produced by "heraldic" animals facing each other on opposite sides of a flange. Each, being in profile, has but one eye, but when the attention is focussed on both of these eyes, the t'ao-t'ieh is seen rather than its component parts.

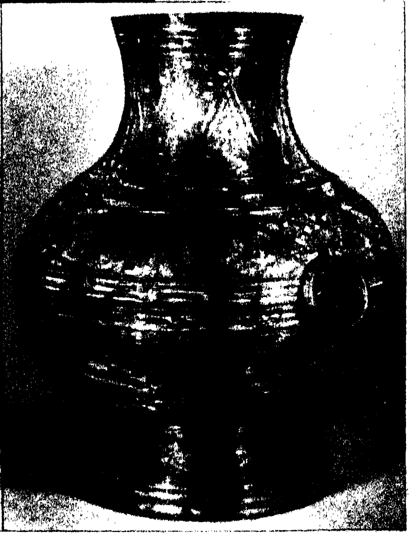
The projecting vertical flanges on practically all early bronzes are a distinctive feature. They are doubtless a decorative feature suggested first by the "fins" left on a casting which has been made in a piece-mould. The development of the flange as a decorative motif is one of the most revealing criteria in the dating of Chinese bronzes. The surface of the Shang flanges is decorated with incised lines in T-shape or L-shape, but these never pierce entirely through the form which thus remains simple. Most of the legs supporting *tings* and similar vessels were of simple cylindrical form. There were also supporting legs of animal form, flat on the sides as if made with a cookie-cutter. A type of knob shaped something like a gabled roof is also a distinctive early form. There are freestanding animal heads—the ram, the ox, the deer, and certain composite bird-animal forms. Some of these animals have bottle-shaped horns, *never* spiral horns. The thread-like ground pattern on the early bronzes is always the meander-like "thunder" pattern.

Early Chou.—During this period certain innovations gain gradual ground. Thus a bronze which at first glance might appear Shang would contain a hint of certain decorative treatments which were current in the majority of middle Chou works. The piercing of the flanges, resulting in a series of hooks or brackets is the most important phenomenon.

Middle Chou.—By this time radical changes have taken place. The austerity characteristic of the Shang work has sometimes given place to a creative fervour that could almost be termed "baroque." Several Shang types have disappeared, among them the square *ting*, the *tsun* and the *yu*. Broad figured bands of decoration appear, and the bottle-shaped animal horns have given place to a spiral type. The flanges have become less important,



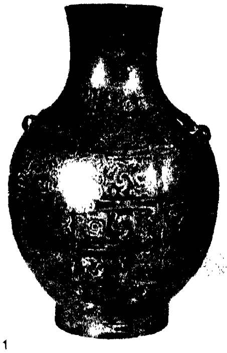




(2, 3) BY COURTESY OF THE ART INSTITUTE OF CHICAGO

CHINESE BRONZES

1. Gilt-bronze altar group of Buddha and attendant divinities, six dynasties (A.D. 221-589), in a private collection in the United States
2. Covered ceremonial dish, Chou dynasty (1122-249 B.C.)
3. Gilt-bronze ceremonial jar, Han dynasty (206 B.C. to A.D. 220)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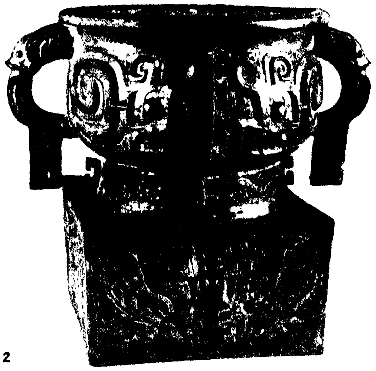
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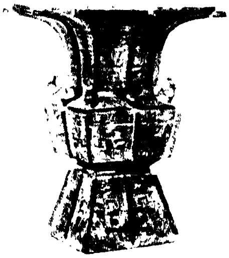
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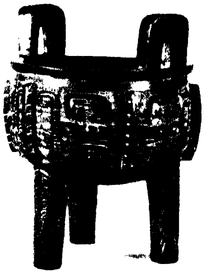
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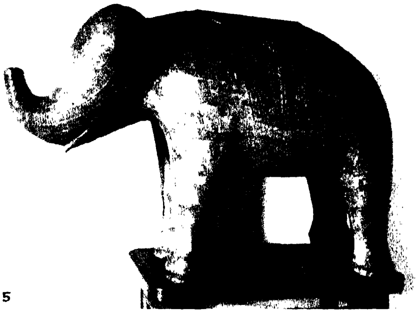
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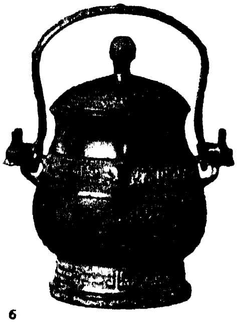
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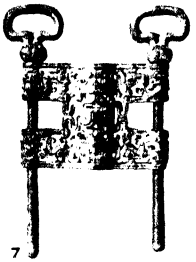
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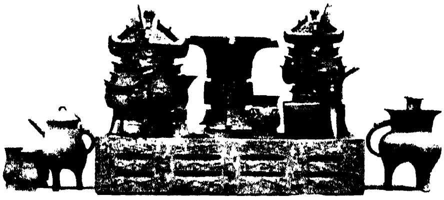
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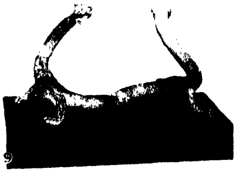
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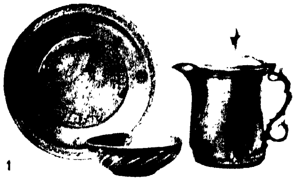
CHINESE BRONZES OF THE SHANG, CHOU AND HAN DYNASTIES

1. Ceremonial jar (Hu) of bronze inlaid with copper, 4th or 3rd century B.C. From the Art Institute of Chicago
2. Ceremonial vessel (Yi), Chou dynasty, 1122–249 B.C. From the Art Institute of Chicago
3. Ceremonial vase (Tsun), Shang dynasty, 1765–1122 B.C. From the Sumitomo Collection, Japan
4. Ceremonial tripod (Ting), Shang dynasty. From the Art Institute of Chicago
5. Elephant, probably Shang dynasty. From the Louvre, Paris
6. Ceremonial wine jar (Yu), Shang dynasty. In the Eumorfopoulos Collection
7. Double lock, late Chou dynasty. From the David Weill Collection, Paris
8. Bronze altar table with ceremonial vessels, Shang and Chou dynasties. From the Metropolitan Museum of Art, New York
9. Double-headed animal, Han dynasty, 206 B.C.–A.D. 220. From the David Weill Collection

BRONZE AND BRASS ORNAMENTAL WORK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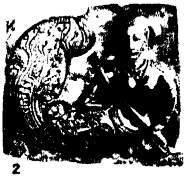
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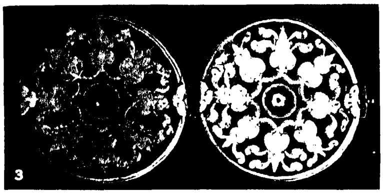
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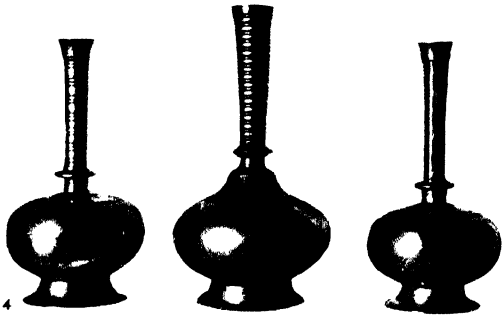
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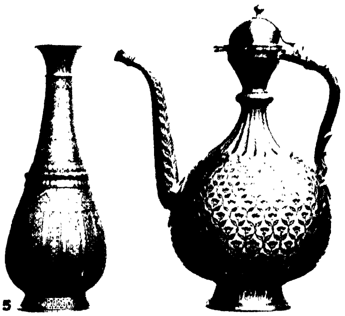
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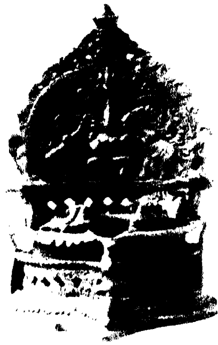
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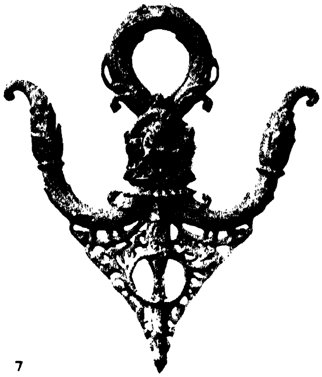
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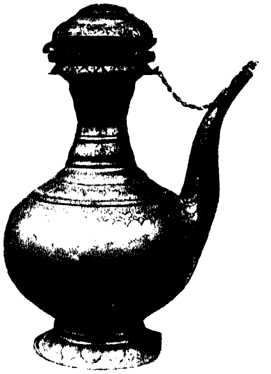
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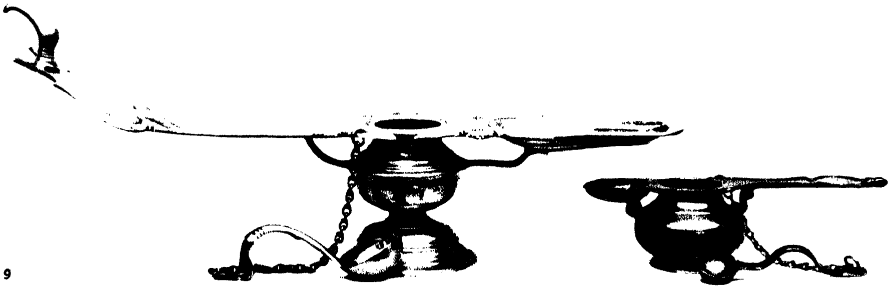
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BY COURTESY OF (5, 9) THE DIRECTOR OF THE VICTORIA AND ALBERT MUSEUM, (6) THE MUSEUM OF FINE ARTS, BOSTON, PHOTOGRAPHS, (2) THE ARCHAEOLOGICAL SURVEY OF INDIA, (1, 3, 4, 7, 8) A. K. COOMARASWAMY

INDIAN METALWORK OF THE 6TH TO THE 19TH CENTURY

1. Tinned copper ware from Kashmir. 18th and 19th century. 2. Gilt copper relief representing a *kinnari*, from the temple at Srisailam. 3. Silver inlaid copper box (*killotaya*) for chewing-lime. Ceylon, 18th century. 4. Three brass *surahis* for carrying Ganges water, 18th–19th century. 5. Brass vessels from Kashmir showing Persian influence. 6. Copper lamp. South India, about 17th century. At the back, seated Gaja-Laksmi, framed by a *makara-torana*. 7. Bronze-coated iron plummet from Bengal, 6th century. 8. Copper ewer (*kendiya*) engraved and set with gems. Ceylon, 18th century. 9. Two temple hand lamps of brass from Travancore, early 19th century. All of these objects are of various alloys, ranging from copper and brass to bronze

thin, simple and almost rudimentary. A very important type of bell, the *chung*, makes its appearance. The cylindrical legs have gone, succeeded by a curved "cabriole" type.

Late Chou.—The awe-inspiring forms of strength and ruggedness which were the main characteristics of the early periods are now seldom seen. Forms are simplified and decoration in high relief is reserved principally for masks supporting handles. A very intricate and inventive geometrical arabesque based often on intertwining animal forms has pushed the thunder pattern away, and sometimes covers entire surfaces. The units of these patterns were obviously stamped in the moulds. Plaited and rope-like patterns appear for the first time. There is a marked tendency toward "all-over" decoration. As the period progresses the interest in inlaid patterns of gold, silver and copper wire gains rapidly. It is a direct descendant of the "niello"-like decoration of the Shang bronzes, but it reaches an extraordinary degree of ingenuity and perfection. Chariot- and furniture-mountings of reddish bronze simple in form, but sumptuously inlaid with patterns of the precious metals, are an outstanding achievement

The influence of the animal art of nomad tribes shows itself in an increasing use of animal forms for decorative purposes, which continues through the Han dynasty. From the Han dynasty onward dated bronzes become much more frequent. Through the Six dynasties (221–589) when small votive groups were frequently dedicated with dated inscriptions, and the T'ang dynasty (618–907) when some of the most ornate mirrors were cast, and bronze was employed extensively for Buddhist images, the standards of the bronze founders remained high. Soon thereafter they were gone.

Patina.—Inasmuch as an interesting patina will today bring a high price for a bronze of little or no artistic merit some discussion of patinas may be useful here. True patination is produced by chemical changes brought about by the action on the bronze of chemicals in the soil in which it is buried, hastened more or less by the amount of moisture present. Some bronzes have been found in water, which produces a distinctive effect, and some are thought never to have been buried. Europeans and Americans prefer a green patina, and the Chinese consider that a velvety black is the best. Good patinas are very appealing in colour and texture, particularly if they have received careful grinding and polishing for generations, so it is not surprising to find bronzes in many museums which have absolutely no merit beyond the accidental one of colour. When a bronze is excavated its surface is naturally covered with dirt and incrustations more or less thick, underneath which is the patina caused by the disintegration of the metal surface and its combination with elements which surround it. If the patina is thick and its colour good it may be carefully ground down and polished away until the resultant bronze is actually the handiwork of a more recent craftsman who has carved out of the heavy patinated surface the original form of the bronze. The favourite Chinese method is to polish with the bare hand, relying on the oils of the skin for the sole lubrication. Generations of such polishing by hosts of patient servants has given to many famous bronzes their charm of colour. At the present time many bronzes are coming on the market just as they have been excavated, and there is an evident attempt to preserve all dirt which can be made to cling to the surface. Many European collectors wax and polish the surfaces of their bronzes, but the practice is not followed in America.

Unscrupulous dealers have not hesitated to apply artificial patinas to genuine old bronzes to increase their saleability, and this is done in a variety of ways. The simplest method is to paint them. Watercolour paints will wash off in water, and turpentine or naphtha will act as a solvent to oil colours, so these methods of falsification are easily detected. Sodium silicate, which is very slow to dissolve, is often used and in Japan exceedingly clever work is done with coloured lacquers. Waxes are used also. There is, unfortunately, no way to be absolutely certain that a bronze is genuine, but there are many ways of finding out when they are not genuine. A true patina is not easily damaged. Boiling a few hours in water, and washing with paint and varnish solvents will easily remove the more recent traces of antiquity. The lacquer does not come off so easily, but where lacquer, or a silicate, has been applied, the surface beneath is generally roughened so that if a small bit of the surface is exposed, the artificial roughening can be seen. The true patina has actually eaten into the surface and cannot in most cases be easily removed. Where the process of patination has gone far the entire bronze shell is sometimes changed in composition, and if genuine fragments of ancient bronzes are examined it will be seen that the patina penetrates deep below the surface, sometimes leaving only a slight core of the original bronze which, too, has changed in composition, if not in colour, and has become extremely brittle. On the other hand under different conditions the strength, the toughness and even the appearance of old bronzes have been little affected. Some very careful forgeries have been made by applying fragments of true malachite to the surface of the bronze with lacquer. Some types of bronze patina are actually like malachite in structure, appearance and chemical composition, but forgeries of this type may be detected under the magnifying glass by observing the stratifications of the colour layers which will not harmonize.

The Department of Chemistry of Columbia University and the Metropolitan Museum of Art of New York city have undertaken extensive experiments on the care and cleaning of bronzes which have suffered chemical disintegration. In consequence of the investigation it has been found possible to reverse the processes of disintegration by electrolysis, with amazing results. So far as appearances are concerned the process is a true reward and corroded surfaces again assume their original appearances permitting delicate details and inscriptions to be seen. When the surface has been entirely destroyed nothing can be done of course, but heavy incrustations often come away leaving an apparently undisturbed surface. This process should only be undertaken, however, with every precaution.

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INDIAN AND INDONESIAN

Copper, Brass and Bronze.—The founding of copper, brass and bronze by the *cire perdue* process is universal in India, and of high antiquity; but it may be remarked that the use of bronze is comparatively rare in the case of images, most of the so-called Indian bronzes being made of pure copper. After finishing, the casting is usually gilded by the mercury process. In the case of Nepalese copper figures, and occasionally in Jaina brass figures, a decoration with inlaid gems may be added. Small images are cast solid; much larger images were cast by the same process, but on an earthy core composed of clay, sand, charcoal and rice-husks, burnt to a cinder-like consistency. The colossal copper Buddha from Sultāngañj, of Gupta date, now in the Birmingham museum and art gallery, was cast in this manner, but in several sections; the same process is widely employed in Farther India, and is especially characteristic of the later Siamese "bronzes."

In the case of utensils such as water-vessels and ceremonial vases, lamps, etc., the same process is employed, but the casting is finished by turning on a lathe and polishing. Vessels of copper, brass or bell-metal were formerly made exclusively for domestic and religious use, but more highly ornamented types are now made largely for sale to tourists, in Benares, Madras and Ceylon. Amongst the standard forms may be mentioned water-vessels for hand use (*loṭā*), those with long necks (*surāhī*) used for carrying Ganges water to great distances for ritual purposes, and the vessels for specifically religious use in worship, such as the *arghya-patra* for consecrated water. Spouted vessels are used for drinking water, not from the spout by direct contact, but as a continuous stream poured directly into the throat (*see* DRINKING VESSELS). A special form of vessel formerly in use by Brahmanical and Buddhist ascetics was the *kamandalu or kuṇḍikā*, usually of earthenware, but sometimes of bronze, in which the long neck formed the true spout, and a lateral opening served for filling; this form passed with Buddhism to China and Korea.

The *cire perdue* process is also employed in the making of peasant jewellery in base metal. A very interesting variety of this technique is practised at Būndi in Rajputana, where the flexible anklets called *sant* are cast in one piece. A composition of wax, resin and oil is prepared in a long string, which is then twisted spirally round a stick of the diameter of the intended links; one cut along the stick separates the links, which are then interlaced every one into two others, and joined up by the application of a hot knife. When 60 or 70 rings have been thus united, the ends of the chain are joined, and the whole gently manipulated until it forms a perfectly flexible model of the future anklet. This is then dipped into a paste of clay and cowdung, and finally enclosed in an outer layer of clay. When dry the mould thus prepared is scraped until a small piece of each link is just visible, then a wax leading line is attached all round, and the whole again covered with clay. Two such moulds being placed side by side, the wax leading lines are led into a hollow at the top of the mould; this hollow cup is filled with metal and borax, and covered with clay, leaving only a blow-hole. The whole is then placed in the furnace, the wax melts, and the metal takes its place. When the mould is opened it is only necessary to remove the leading lines and file down irregularities, to have a pair of flexible anklets ready for use. Small images and toys are often made in a similar fashion from prepared wax, all the ornament being applied in the shape of the wax string; brassware similarly decorated always retains an appliqué effect in the finished product.

Some of the finest examples of Indian metal-work are afforded by temple bells, and standing and hanging lamps and lamp-chains. The bells range from those used in the hand to the great bell cast for King Bawdawpaya in Burma in 1790, the second largest in the world, and weighing over 80 tons. Lamps for burning oil are cupped for one or more wicks; those made in candelabra form, like a tree of which the branches bear innumerable lights, are especially beautiful.

Brass or copper vessels may be decorated by chased or engraved ornament or by inlay or encrustation of some other metal, according to the method already described in the case of iron. Brass inlaid with silver and copper is often very effective. Silver is applied to copper with specially good effect in the case of the huqqa covers of Purnea, Bengal. More rarely a copper vessel may be decorated with inset gems, like goldsmith's work. The characteristic brass ware of Morádábād, still extensively produced, is engraved with minute designs, relieved against a background of coloured lac, which is filled into the excavated ground by means of heat; in some of the best examples the ground colour is all black, producing a sort of imitation *bidrī*, in others red and green are also used. True enamel seems to be applied only to gold and silver, niello (*q.v.*) only to silver. The excellent tinned copper ware of Kashmir and the Punjāb is mainly used by Mohammedans for domestic purposes, and is of Persian origin.

Bidri.—One of the most distinctive of Indian metal wares is that known as *bidrī*, from the chief and, perhaps, original place of manufacture at Bidar in Hyderābād. Another main source of production, both in the 18th century and at the present day, is Lucknow. The objects made are for domestic use (Pl. xvii, figs. 1, 2, 3). The alloy is composed mainly of tin or zinc, with smaller proportions of lead and copper. After casting, and shaping on the lathe, the surface is then engraved for the application of silver inlay; finally the surface is polished and darkened by the application of a sal ammoniac and saltpetre paste mixed with oil. The designs are geometrical and floral and in the best taste (except in some modern examples, where the effect is too thin), standing out brightly in silver on the dead black ground colour of the alloy. (*See* also ARMS AND ARMOUR; COPPER; SCULPTURE TECHNIQUE: *Casting*; SILVERSMITHS' AND GOLDSMITHS' WORK; PEWTER.)

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CORROSION AND RESTORATION

The art of fabricating metal objects such as spearheads, daggers, urns, vases, statues, bracelets, etc., dates back many thousands of years. There are on exhibit to-day in all of the important museums of the world many precious specimens, often of rare beauty of design, that bear witness to the highly developed skill of the ancient metal workers and artists of Egypt, Greece, Etruria and other countries. These metal objects when unearthed to-day are at times in a very well-preserved condition. This applies, for example, to most of the bronze, silver and other metal articles found in the tomb of Tutankhamen. This tomb may be looked upon as an "ideal location" in view of the fact that corroding influences such as moisture, salts and acids were practically absent throughout the countless days of seclusion. On the other hand, there have been many old graves uncovered in which the metal implements and jewellery were found to be completely disintegrated, no vestige of the original metal or alloy remaining. The corroding agents, ever present in most soils, had converted the copper, tin, iron and lead back into mineral compounds such as oxides, chlorides and carbonates.

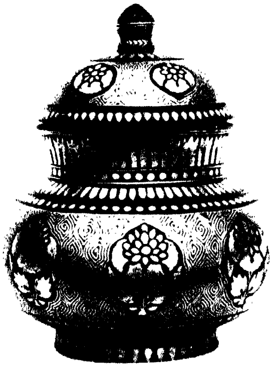
Between these two limits—complete preservation and complete disintegration—there are many intermediate stages. Very often a statue or a coin reveals upon examination a distinct metal core, the outer incrustation being composed of minerals formed from the original metal or metals.

The process of restoration, briefly outlined below (*see* C. G. Fink and C. H. Eldridge, *Report*, Metropolitan Museum of Art, New York, 1925), applies in particular to art objects of bronze and of other alloys which have suffered partial or complete disintegration while being buried or being otherwise exposed to corroding influences.

The Process of Corrosion.—It is now conceded by most authorities that the process of corrosion of a metal or an alloy is due to electro-chemical action. One or many "cells" are formed between the more noble or "positive" areas or components, and the less noble or "negative" areas of the metal. Very often there is a distinct plating out of pure silver due to disintegration of silver-copper alloys. In the case of the bronzes the products of corrosion are the oxides of tin and copper besides the pretty green (malachite) and blue (azurite) basic carbonates of copper. At times chlorides and sulphur compounds of copper are likewise present. Silver, when not alloyed, is found either as metal or as ebony-black sulphide. Gold almost invariably occurs as metal, either pure or alloyed with copper or silver.

Certain salts such as chlorides, sulphates and nitrates present in rain and in moist soil greatly hasten the process of corrosion. There are, however, other active agents, for example, acids and

BRONZE AND BRASS ORNAMENTAL WORK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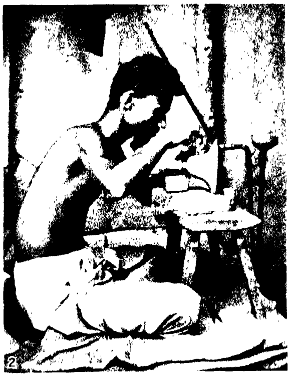
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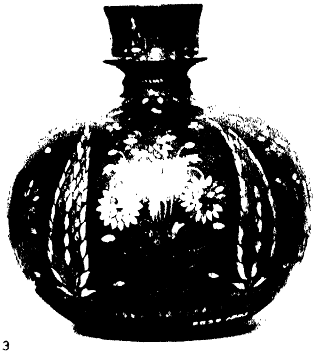
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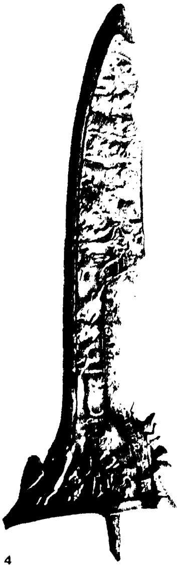
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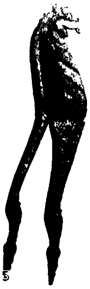
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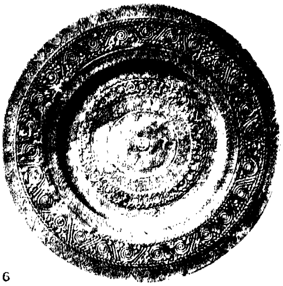
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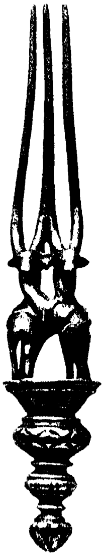
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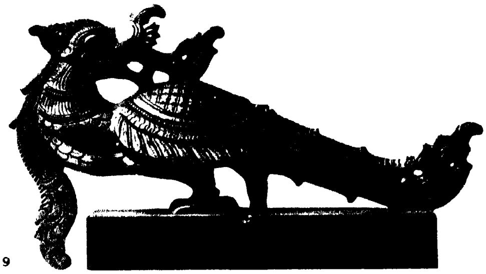
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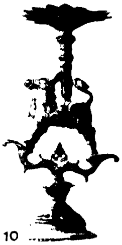
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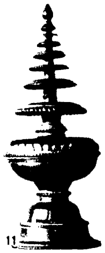
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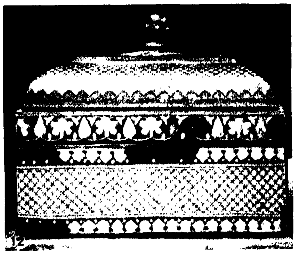
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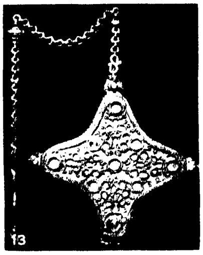
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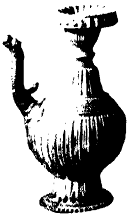
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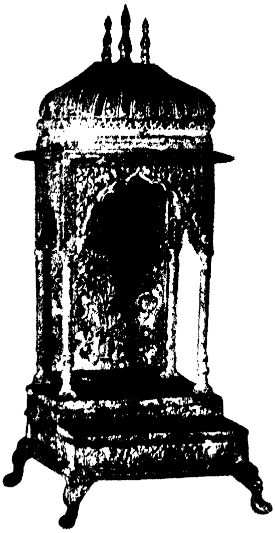
INDIAN METAL-WORK

1. Bidri vase, of damascened silver. 2. Bidri-worker making a hugga vase, 20th century. 3. Bidri hugga vase, of damascened silver and gold, 17th century. 4. Kris from Bali, probably 15th century. 5. Areca-nut slicer, damascened iron, silver and gold, of Ceylon. 6. Top of a cast brass table (serak-kale) of Ceylon, 18th century. 7. Iron pillar of Delhi, 4th century A.D. 8. South Indian brass comb, 17th and 18th centuries. 9. South Indian brass lamp ornament 18th century. 10. Bronze ritual tray (varandala), of Nepal, probably 18th century. 11. Bronze reliquary of Nepal, probably 17th century. 12. Bidri box of damascened silver, 17th century. 13. Copper betel box (killotaya), of Ceylon, 17th and 18th centuries. 14. Nepalese brass water vessel, 17th and 18th centuries

PLATE XVII

BRONZE AND BRASS ORNAMENTAL WORK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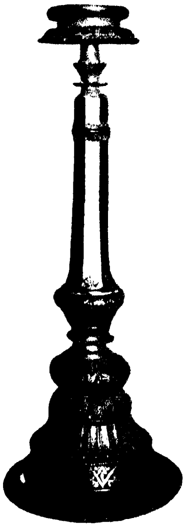
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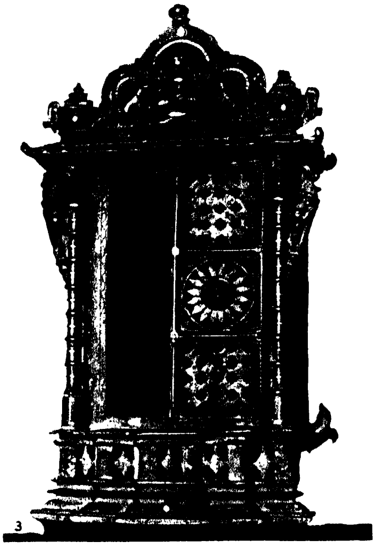
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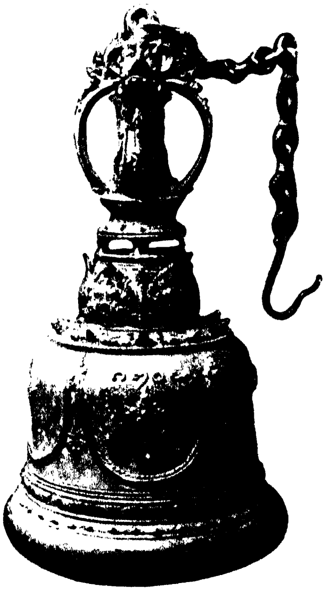
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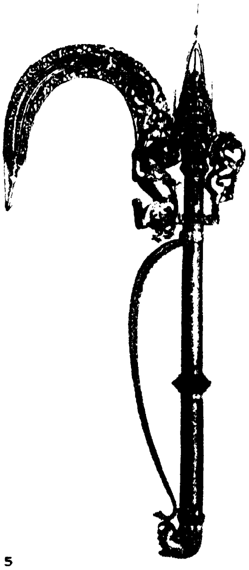
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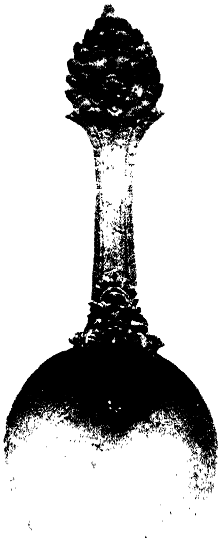
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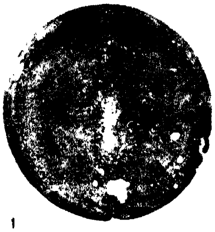
(1, 2) FROM THE WARREN E. COX COLLECTION, BY COURTESY OF (3) THE ARCHAEOLOGICAL SURVEY OF INDIA (6) THE MUSEUM OF FINE ARTS, BOSTON, PHOTOGRAPH (5) COLLECTION ARCHIVES PHOTOGRAPHIQUES

INDIAN METALWORK OF THE 10TH TO THE 19TH CENTURY

1. 17th century shrine from Darjeeling. Finials and feet are cast, the rest is repousse, with pierced work in the canopy. The surface is covered with a green patina, probably due to weather rather than burial
2. Brass lamp, heavily cast and chased. Nepal, 18th–19th century
3. Brass shrine from Jaina, 14th–15th century
4. Javanese copper bell of the 10th century
5. Carved steel elephant goad (*ankusa*) from Tanjore, 17th century
6. Copper sacrificial spoon. Cambodian, about the 10th century

All of these objects are of various alloys ranging from copper and brass to bronze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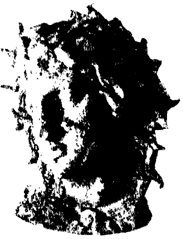
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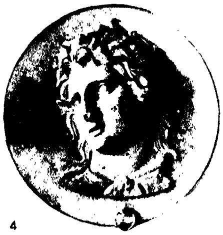
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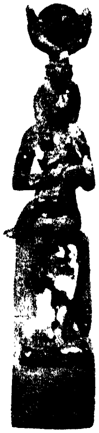
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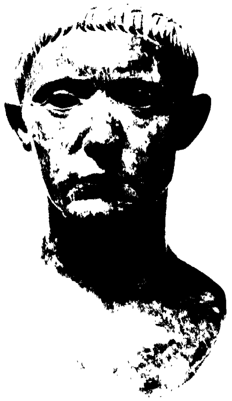
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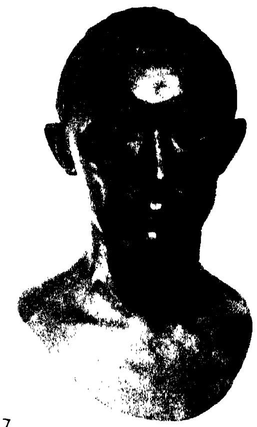
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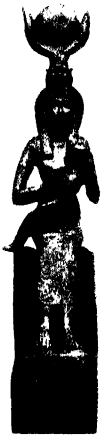
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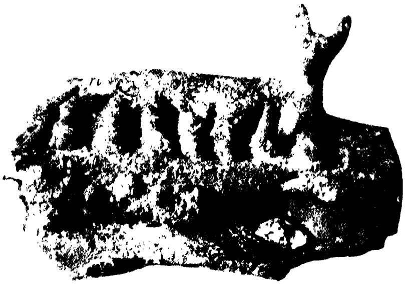
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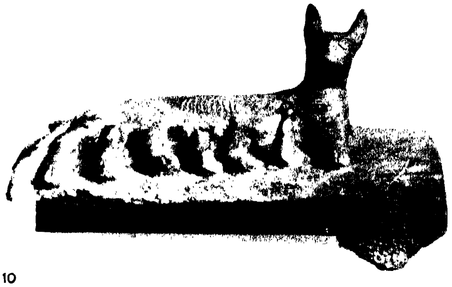
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ELECTROLYTIC TREATMENT OF ANCIENT BRONZES

1 and 2. Front views of a copper plate about 6 in. (15 cm.) in diameter, before and after treatment. It was badly corroded and covered with a thick green crust, which was successfully reduced revealing the form of the plate and the almost complete design engraved on it

3 and 4. Satyr's head in repoussé from a Greek bronze mirror, end of the 5th century B.C., before and after restoration. The tip of the nose had been broken off previous to treatment

5. Egyptian bronze statuette of the goddess Isis holding the child Horus (early Ptolemaic period, 300–200 B.C.), before treatment. The white spots are "diseased" regions of copper carbonate plus chloride. The left hand was corroded. A hard green crust covered the rest of the body

6 and 7. Roman bronze head, probably of the Augustan period, before and after treatment. It had been badly marred in the process of excavation and the surface was much corroded. A new surface of blue-green patina was evolved on the restored bronze by electro-chemical action

8. Bronze statuette shown in fig. 5, after a treatment of 21 days. Following the treatment, it was washed in warm water and patinated by submitting it to fumes of ammonia and acetic acid

9 and 10. Cat with kittens, an Egyptian bronze group statuette of the early Ptolemaic period (300 200 B.C.), before and after treatment. The surface was badly corroded and covered with a grey-green crust. The heads of two of the kittens had long ago been broken off

salts of organic origin, notably carbonic acid, which serve as electrolytes and tend to hasten the decomposition of the metal or alloy.

Of prime importance in this process of corrosion is the presence of water or moisture. In completely dry locations corrosion does not occur. Water, present merely as moisture in the soil in which the bronze lies buried, is sufficient to bring about mineralization of the surface of the bronze and eventually of its entire body.

The author's examination of the cross-section of a number of metal objects which were in the last stages of complete mineralization revealed some interesting facts: The cross-section of a Greek bronze bracelet showed a small residual metallic core, around this a $\frac{1}{8}$ in. thick layer of copper oxide (cuprite) and stannite and outside of this a layer of green basic carbonate of copper (malachite). The cross-section of another bracelet showed a metallic core composed primarily of copper and silver, then but a short space from the surface of this core, a ring of pure silver and then beyond this a layer of malachite.

It might be well to recall at this point that of the various copper minerals occurring in the earth's crust, malachite is one of the most stable, in particular, under those conditions of the atmosphere and the soil of the localities in which the human race has lived and prospered. Malachite is a decomposition product of other less stable copper minerals such as the sulphide, chalcocite, or the chloride, atacamite, or the sulphate, brochantite. During the process of corrosion of a bronze there are, as a rule, undoubtedly unstable compounds of copper first formed which are eventually transformed into the basic carbonate or malachite.

The Older Processes of Restoration.—In the past, metal objects of art had been found in dry locations, in a good state of preservation, and these needed very little preparation or cleaning before being submitted to museums or collections. On the other hand, when the metal article was covered with an earthy crust of appreciable thickness—and usually unsightly in appearance—various "radical" measures were resorted to by dealers and others. Old bronzes showed fresh chisel marks, indicating plainly that the method of removing the crust or hard outer layers was of a very crude mechanical sort. Other "restored" bronzes showed all the pit marks of strong acid cleaning. Those who have resorted to these radical chisel or acid methods of "restoration" in the past overlooked one very important fact—a fact which was only brought to light a few years ago in the course of our own researches. The fact is this: *During the process of corrosion of an art bronze the detail of design is "held" or "preserved" in the crust but not on the surface of the metal core.* The core of a badly corroded bronze is almost invariably deeply pitted and ugly in appearance.

The New Process of Restoration.—Conceding that the corrosion of metals and alloys was an electrolytic one, it was evident that if this electrolytic process of corrosion could be reversed, a method might be devised whereby the metal compounds in the crust would be reduced back to metal. After a series of experiments, expectations were fully realized, and this record, with the illustrations herewith, is the restoration process as finally worked out by the writer.

Without any preliminary cleaning, the corroded bronze object to be restored is hung as a cathode in a 2% caustic soda solution (room temperature) and low amperage direct current applied. The object is suspended with soft copper wires and is completely immersed in the solution. When there is danger that the object might not hold together during the process of reduction or restoration, it is advisable to pack the whole object in clean white sand, after making proper electrical connections, and then filling the containers with the caustic soda solution. Two or more anodes are hung up near the edge of the container. Iron, duriron and platinum anodes have been used with success. A rectangular glass battery jar of one litre capacity serves well as a container for the treatment of small bronzes. For large objects, stoneware tanks may be employed and there is no objection to the use of large sheet-iron tanks welded at the joints. A very low current density is essential. In general, the more completely mineralized the object, the lower should be the current density. From one to five amperes per square foot of exposed cathode crust surface is usually suitable, but even lower current densities are to be resorted to when the gassing at the cathode is too vigorous. It must be understood that violent gassing will cause serious injury to a soft crust, especially during the first stages of reduction. Upon first closing the electrical circuit it often happens that no appreciable current passes through the cell, due to the poor contact between the copper wire and the crust. However, this is only a temporary phenomenon and after a short time the entire crust becomes conducting. An important requisite for success is the allowance of ample time. The heavier the crust the longer the time. Bronzes with crusts of $\frac{1}{8}$ to $\frac{1}{4}$ in. in thickness usually require three to six months continuous electrolytic treatment. The metal compounds in the crust are slowly reduced back to metal and after further electrolysis the finely divided metal becomes more and more compact. Very often it is not essential to proceed to this very last stage. By careful handling and drying the finely divided metal can be conveniently compacted by means of a good grade of shellac. This latter procedure is particularly useful where detail of design is of first importance and where the object treated will be kept in a glass case. Silver alloy objects which have been badly decomposed while buried in the soil usually contain a layer of pure silver within the crust, as mentioned above. Now it is a very fortunate circumstance that the details of design of the original silver-alloy bracelet or other article are faithfully reproduced in this layer of pure silver, the product of the decuprification of the alloy. Accordingly, when restoring articles of this alloy by the electrolytic method, we reduce the malachite and other copper compounds in the crust outside of the silver. A layer composed largely of metallic copper is produced on top of the silver. In order to expose the silver underneath the article in question, at the completion of the electrolytic treatment, it is carefully dipped alternately in dilute nitric acid (10%) and in warm water until all of the copper is removed. For the removal of the last traces of copper deposited on the silver it is safer to use formic acid instead of nitric and thus avoid any possible etching of the silver surface.

Among the Greeks and Romans, and likewise among the ancient Chinese, it was often customary to apply hammered gold-leaf to the surface of bronze objects. Take, for example, the author's investigation of a decorated Roman bronze plaque which had been used for architectural purposes. The original plaque was of solid bronze, and to the surface was applied gold-leaf about $\frac{1}{1,000}$ in. thick (the human hair is about $\frac{3}{1,000}$ in. in diameter). During the process of corrosion the copper and tin salts passed through the pores of the gold-leaf and formed a heavy green crust. To remove the crust by one of the older methods of restoration, such as the chisel method or the acid method, would have resulted in complete failure, since the bronze proper was entirely mineralized and the gold-leaf had no mechanical strength, although it was tightly embedded or anchored in the red-green crust. By applying the electrolytic method of restoration, a "restored" plaque, composed of an upper and lower layer of metallic copper and in between the layer of gold-leaf was obtained. By very careful manipulation, the upper layer of the copper was dissolved and the gold underneath exposed.

Preserving the Restored Bronzes and Other Alloys.—In the case of the ordinary copper-tin and copper-tin-lead bronzes, the surface obtained by the electrolytic restoration method was coppery in colour, very much like the surface of freshly cast high copper alloys. This appearance of "newness" is usually an objection from an artistic point of view. Nearly all ancient and many modern bronzes on exhibit to-day have coats of patina either naturally formed or artificially applied. One of the commonest reagents used for *patinating* bronzes is salammoniac (NH_4Cl). However, we can not too strongly warn against the use of this salt as it will often give rise to that treacherous "bronze disease" more fully described below. Examining a large number of natural patinas, in particular those formed in Egypt, Greece and ancient Rome, a number of different shades were found: There is the beautiful red of cuprous oxide, the green of malachite and the blue of azurite. In this investigation it was evident that the closer the approach to the natural conditions under which the patinas are formed, the more beautiful and artistic would be the results. Accordingly, such methods as applying solutions with a brush or cloth were eliminated at the start The final procedure as now used consists in exposing the bronze to carbon dioxide gas after a preliminary exposure to fumes of ammonia or acetic acid or both. Beautiful shades of blues and greens are produced in irregular patches. In our American and European climates the greens are the most stable, the blue shades turning to green after some months. To produce the red shades of patina is decidedly more difficult. Artistic effects can be produced by submerging the bronze in a suspension of precipitated chalk to which has been added a little iodine, as tincture of iodine This treatment had best precede the carbonic acid treatment described above. After the bronze object has been patinated, it is then carefully dried in an oven (232° F) and upon partially cooling it is sprayed with a dilute solution of bees-wax in benzol. There is left behind an unbroken film of bees-wax more lasting and protective than most of the lacquer preparations commonly used to-day.

Silver objects of art are usually kept in the bright polished condition, although a few collectors prefer the black sulphide patina. Accordingly, in the case of the silver articles restored by our process these are, after restoration, carefully dried in an electric oven (gas ovens tarnish the silver) kept at a temperature slightly above the boiling point of water. Thereupon, the bees-wax coat is applied as described for the bronzes.

Gold or gold alloy objects seldom require a protective coating. However, if the gold is present merely as a thin leaf or film, it is better to apply the wax coating as for bronzes, in order to protect the base metal underneath the gold-leaf. But even this wax film is not an absolute protection against the destructive action of the contaminated atmosphere of a modern city. All metal objects of art should be kept in *glass cases*. The atmosphere within the case can be "corrected" by placing within the show case small open containers filled with sticks of caustic soda or caustic potash. As soon as these sticks turn to a thick liquid paste the containers should be cleaned out, dried and filled with fresh caustic. The less frequently a case is opened and the better it is sealed, the longer will the caustic remain effective.

The Bronze Disease.—The term "bronze disease" or "collector's plague" as usually applied, refers to a highly localized and usually accelerated form of corrosion. A bronze vase covered with a beautiful shiny patina may suddenly show a dull, light green spot, often not bigger than the head of a pin. If neglected, this spot grows in size more or less rapidly, depending to a large extent upon the composition of the surrounding atmosphere. The "bronze disease" has been known for many years. The "disease" may at times break out as an epidemic and nearly every bronze in a collection be affected. A "healthy" bronze may be inoculated by a mere touch of fingers which have been handling sick bronze. The immediate cause of this localized infection is difficult to determine and many have been the conjectures proffered. Our own researches indicate that one of the most frequent causes of the "bronze disease" is a grain of ammonium or other chloride or sulphate which in the presence of a little moisture reacts with the copper in the bronze to form a complex copper chloride or sulphate. This latter chloride or sulphate is unstable, however, in the presence of carbonic acid and moisture of the atmosphere and is soon converted to a basic carbonate such as malachite. The hydrochloric or sulphuric acid thus liberated is free to act upon further areas of the bronze Bronzes saturated with chlorides that had shown no signs of the disease as long as they remained in a comparative dry location, at once developed the disease upon being transferred to a moist climate. Samples of atacamite, the natural basic copper chloride mineral, and samples of brochantite, a natural basic copper sulphate, occurring in the arid regions of Chile, upon being shipped to New York and there exposed to the air immediately underwent decomposition resulting in a final copper carbonate compound.

Bronzes infected with the disease should be washed in repeated changes of boiling distilled water. In case the disease is deeply rooted the only safe procedure is to make the bronze object a cathode in a 2% sodium hydrate solution and electrolyze as in the case of the restoration process described above. During electrolysis the chloride, sulphate and other acid radicals pass to the iron anode there reacting to form basic iron salts which precipitate out of solution.

Detection of Frauds.—The manufacture of "antiques" is an industry of increasingly large proportions and it has become more and more difficult to determine whether or not a certain object is genuine or "faked." In the case of oil paintings, chemical analysis, the microscope and the X-ray have been of inestimable value and with very few exceptions conclusive answers are obtained. In the case of bronzes and other metal art objects, the detection of frauds is considerably more difficult. However, the following procedure in the examination of a doubtful specimen has been found most satisfactory and reliable: (1) microscopic examination of the patina or crust; (2) chemical analysis of the patina or crust; (3) metallographic examination of the metal core and the metal in direct contact with the patina or crust; (4) chemical analysis of the metal (or metals). In the examination of the patina we may find distinct crystalline growths of malachite or azurite, the tiny crystals partially imbedded in the underlying oxide film. Such crystalline growths are most difficult to imitate and patinas of recent origin are almost always amorphous or non-crystalline. Nevertheless, the patina may be recently formed or applied and yet the bronze may be genuine—in fact, very many of the genuine bronzes exhibited nowadays have patinas of recent or artificial formation. Accordingly, if the microstructure of the malachite or azurite particles in the crust or in the patina is distinctly crystalline and interlaced with the copper oxide layer, the bronze is very likely genuine. But an amorphous malachite deposit does not necessarily imply that the underlying bronze is not genuine. Under the outermost coating of malachite or azurite or clayey material there usually is found, in the case of genuine bronzes, a layer of copper oxide, reddish-brown to reddish-black in colour. This layer is usually of considerable thickness and is not readily applied by any rapid artificial process. In the metallographic examination of the bronze we find additional proof as to whether or not the bronze is genuine. Taking a very fine slice of metal from some inconspicuous part of the bronze, and preparing this by polishing and etching for microscopical examination we note in the case of a genuine bronze that there is a gradual change in structure as we pass to the outer exposed edge of the bronze; furthermore, we will sometimes note changes that are brought about by a very slow process of "annealing" We have referred to the process of decuperification above. Chemical analysis must be carried out with great care. We can support the findings of our metallographic investigation by determining chemically that the main body or interior of the bronze has a decidedly different composition from the layers under the outer oxide or patina surface. (C. G. F.)

BRONZING, a process by which a bronze-like surface is imparted to objects of metal, plaster, wood, etc. On metals a green bronze colour is sometimes produced by the action of such substances as vinegar, dilute nitric acid and sal-ammoniac. An antique appearance may be given to new bronze articles by brushing over the clean bright metal with a solution of sal-ammoniac and salt of sorrel in vinegar, and rubbing the surface dry, the operation being repeated as often as necessary. Another solution for the same purpose is made with sal-ammoniac, cream of tartar, common salt and silver nitrate. With a solution of platinic chloride almost any colour can be produced on copper, iron, brass, or new bronze, according to the dilution and the number of applications. Articles of plaster and wood may be bronzed by coating them with size and then covering them with a bronze powder, such as Dutch metal, beaten into fine leaves and powdered. The bronzing of gun-barrels may be effected by the use of a strong solution of antimony trichloride. A surface of copper or brass may be given an "oxidized" finish by treatment with a solution of a sulphide or an arsenical salt.

BRONZINO, IL, the name given to ANGELO ALLORI (1503–1572), Florentine painter. Bronzino was born at Monticelli, near Florence, on Nov. 17, 1503, and studied under Raffaellino del

Garbo and Jacopo da Pontormo. He was influenced by Michael Angelo and worked in Florence, where he was court portrait painter to Cosmo I., Duke of Tuscany. With the exception of Andrea del Sarto, he was the greatest portrait painter produced by Florence in the 16th century. He also painted sacred and decorative subjects, good examples of which are the "Venus, Cupid, Folly, and Time" in the National Gallery, London, and the "Limbo or the Descent of Christ into Hades," painted in 1552, in the Uffizi at Florence. The "St. Julian," and the "Judith and Holofernes," in the Pitti Palace, are among his most famous works. Of the latter there are many copies in different galleries. He painted portraits of Dante, Petrarch, and Boccaccio and of some of the famous men of his own day. His three fine paintings of Eleonora di Toledo, grand duchess of Tuscany, are in the Uffizi, the Kaiser Friedrich Museum, Berlin, and the Wallace collection, London. He was a poet as well as a painter and a member of the Florentine academy. He died in Florence on Nov. 23, 1572.

BRONZITE, in mineralogy, a member of the pyroxene group that crystallizes in rhombic system (*see* PYROXENE). The name was originally applied to the members of the series exhibiting a bronzelike lustre, due to the presence of regularly arranged inclusions. These inclusions appear in most cases to be ilmenite arranged in plates parallel to the crystallographic plane (100). They are probably, as in the similar case of diallage (*q.v.*), products of unmixing, separating from solid solution in the pyroxene on fall of temperature.

BROOCH or **BROACH,** originally an awl or bodkin, denotes a clasp or fastener for the dress, provided with a pin, having a hinge or spring at one end and a catch or loop at the other. Brooches of the safety-pin type (*fibulae*) were extensively used in antiquity, but the place of origin cannot as yet be exactly determined; it would seem to have been in central Europe, towards the close of the Bronze age, somewhat before 1000 B.C. The earliest form is little more than a pin, bent round for security, with the point caught against the head, but from the third century or thereabout, brooches have developed into works of art, many of which are exquisitely decorated and ingeniously constructed. (*See* JEWELLERY.)

BROOKE, FRANCES (1724–89), English novelist and dramatist, whose maiden name was Moore, wrote novels popular in their day. The most important were *The History of Lady Julia Mandeville* (1763), *Emily Montague* (1769) and *The Excursion* (1777). Her dramatic pieces and translations from the French are now forgotten.

BROOKE, FULKE GREVILLE, 1ST BARON (1554–1628), English poet, only son of Sir Fulke Greville, was born at Beauchamp Court, Warwickshire. He was sent in 1564, on the same day as his life-long friend, Philip Sidney, to Shrewsbury school. He matriculated at Jesus college, Cambridge, in 1568. Sir Henry Sidney, president of Wales, gave him in 1576 a post connected with the court of the Marches, but he resigned it in 1577 to go to court with Philip Sidney. Young Greville became a great favourite with Queen Elizabeth, who treated him with less than her usual caprice, but he was more than once disgraced for leaving the country against her wishes. Philip Sidney, Sir Edward Dyer and Greville were members of the "Areopagus," the literary clique which, under the leadership of Gabriel Harvey, supported the introduction of classical metres into English verse. Sidney and Greville arranged to sail with Sir Francis Drake in 1585 in his expedition against the Spanish West Indies, but Elizabeth peremptorily forbade Drake to take them with him, and also refused Greville's request to be allowed to join Leicester's army in the Netherlands. Philip Sidney, who took part in the campaign, was killed on Oct. 17, 1586, and Greville shared with Dyer the legacy of his books, while in his *Life of the Renowned Sir Philip Sidney* he raised an enduring monument to his friend's memory. About 1591 Greville served for a short time in Normandy under Henry of Navarre. This was his last experience of war. In 1583 he became secretary to the principality of Wales, and he represented Warwickshire in parliament in 1592–93, 1597, 1601 and 1620. In 1598 he was made treasurer of the navy. In 1614 he became chancellor and under-treasurer of the exchequer, and throughout the reign of James I. was a valued supporter of the king's party, although in 1615 he advocated the summoning of a parliament. In 1618 he became commissioner of the Treasury, and in 1621 he was raised to the peerage with the title of Baron Brooke, a title which had belonged to the family of his paternal grandmother, Elizabeth Willoughby. He received from James I. the grant of Warwick castle, in the restoration of which he is said to have spent £20,000. He died on Sept. 30 1628.

His only works published during his lifetime were four poems, one of which is the elegy on Sidney which appeared in *The Phoenix Nest* (1593), and the *Tragedy of Mustapha.* A volume of his works appeared in 1633, another of *Remains* in 1670, and his biography of Sidney in 1652. He wrote two tragedies on the Senecan model, *Alaham* and *Mustapha.*

Brooke left no sons, and his barony passed to his cousin, ROBERT GREVILLE (*c.* 1608–1643), who thus became 2nd Lord Brooke. This nobleman was an active member of the parliamentary party, and defeated the Royalists in a skirmish at Kineton in Aug. 1642. He was killed at Lichfield on March 2 1643. Brooke, who is eulogized as a friend of toleration by Milton, wrote on philosophical, theological and current political topics. In 1746 his descendant, Francis Greville, the 8th baron (1719–1773), was created earl of Warwick, a title still in his family.

Dr. A. B. Grosart edited the complete works of Fulke Greville for the *Fuller Worthies Library* in 1870, and made a small selection, published in the *Elizabethan Library* (1894). The life of Sidney was reprinted by Sir S. Egerton Brydges in 1816, and with an introduction by N. Smith in the "Tudor and Stuart Library" in 1907; *Caelica* was reprinted in M. F. Crow's "Elizabethan Sonnet Cycles" in 1898. *See* also an essay in Mrs. C. C. Stopes's *Shakespeare's Warwickshire Contemporaries* (1907).

BROOKE, HENRY (*c.* 1703–1783), Irish author, of county Cavan, studied at Trinity college, Dublin, and then went to London to study law. He wrote a philosophical poem in six books entitled *Universal Beauty* (1735), translated the first and second books of Tasso's *Gerusalemme liberata* (1738), and produced a tragedy, *Gustavus Vasa, the Deliverer of his Country* (1739). This play had been rehearsed for five weeks at Drury Lane, but at the last moment the performance was forbidden, on account of a supposed portrait of Sir Robert Walpole in the part of Trollio. The piece was printed and sold largely, being afterwards put on the Irish stage under the title of *The Patriot.* This affair provoked a satirical pamphlet from Samuel Johnson. He then returned to Ireland. During the Jacobite rebellion of 1745 Brooke issued his *Farmer's Six Letters to the Protestants of Ireland* (collected 1746), the form of which was suggested by Swift's *Drapier's Letters.* For this service he received the post of barrack-master at Mullingar, which he held till his death. About 1760 he entered into negotiations with leading Roman Catholics, and in 1761 he wrote a pamphlet advocating alleviation of the penal laws against them. His best-known work is the novel entitled *The Fool of Quality; or the History of Henry Earl of Moreland* (1765–1770). The characters of this book, which relates the education of an ideal nobleman by an ideal merchant-prince, are gifted with a "passionate and tearful sensibility," and reflect the real humour and tenderness of the writer. Brooke's religious and philanthropic temper recommended the book to John Wesley, who edited (1780) an abridged edition, and to Charles Kingsley, who published it with a eulogistic notice in 1859. He died at Dublin in a state of mental infirmity on Oct. 10, 1783.

BIBLIOGRAPHY.—His daughter, Charlotte Brooke, published *The Poetical Works of Henry Brooke* in 1792, but was able to supply very little biographical material. Other sources for Brooke's biography are C. H. Wilson, *Brookiana* (1804), and a biographical preface by E. A. Baker prefixed to a new edition (1906) of *The Fool of Quality.* Brooke's other works include several tragedies, only some of which were actually staged. He also wrote: *Jack the Giant Queller* (1748), an operatic satire, the repetition of which was forbidden on account of its political allusions; "Constantia, or the Man of Lawe's Tale" (1741), contributed to George Ogle's *Canterbury Tales Modernized; Juliet Grenville; or the History of the Human Heart* (1773), a novel; and some fables contributed to Edward Moore's *Fables for the Female Sex* (1744).

BROOKE, SIR JAMES (1803–1868), English soldier, traveller and rajah of Sarawak, was born at Secrore, near Benares.

He entered the service of the East India Company, and was sent out to India about 1825. On the outbreak of the Burmese War he was despatched with his regiment to the valley of the Brahmaputra; he was dangerously wounded in an engagement near Rungpore and was compelled to return home (1826). In 1830 he made a voyage to China, and during his passage among the islands of the Indian archipelago he conceived the great design of rescuing them from barbarism. On the death of his father he succeeded to a large property and bought and equipped the "Royalist," sailing in 1838 on his great adventure. On reaching Borneo he found the rajah Muda Hassim, uncle of the reigning sultan, engaged in war in the province of Sarawak with several of the Dyak tribes, who had revolted against the sultan. He offered his aid to the rajah, and the insurgents were defeated. For his services the title of rajah of Sarawak was conferred on him by Muda Hassim, but it was not until 1841 that the sultan of Borneo confirmed his title. For the next few years Brooke devoted himself to preparing a code of laws and developing commerce, at the same time stamping out the piracy which made all shipping unsafe among the islands. In his various expeditions against the raiders he was assisted by Sir Harry Keppel and other commanders of British ships of war. The capital of the sultan of Borneo was stormed and the sultan routed with his army. In 1847 Brooke returned to England and the Corporation of London conferred on him the freedom of the City. He was appointed governor and commander-in-chief of the island of Labuan with its dependencies (made a British colony after purchase from the sultan of Borneo). He was also made consul-general of Borneo. In 1849 he led an expedition against the Seribas and Sakuran Dyaks, who still persisted in piracy. He visited twice the capital of the sultan of Sala and concluded a treaty with him, which had for one of its objects the expulsion of the sea-gipsies and other tribes from his dominions. In 1851 grave charges with respect to the operations in Borneo were brought against Sir James Brooke in the House of Commons by Joseph Hume and other members, especially as to the "head-money" received. To meet these accusations and to vindicate his proceedings, he went to England. The evidence adduced was so conflicting that the matter was at length referred to a royal commission, which sat at Singapore. As the result of its investigation the charges were declared to be "not proven." Sir James, however, was soon after deprived of the governorship of Labuan and the head-money was abolished. In 1857 his house in Sarawak was attacked and burnt by Chinese pirates and he had to fly from the capital, Kuching. With a small force he attacked the Chinese and recovered the town. In the following year he returned to England, and remained there for three years. During that time he was attacked by paralysis, a public subscription was raised, and an estate in Devonshire was bought and presented to him. He made two more visits to Sarawak, and on each occasion had a rebellion to suppress. He spent his last days on his estate at Burrator in Devonshire, and on his death was succeeded, as rajah of Sarawak, by his nephew. Sir James Brooke was a man of the highest personal character, and he displayed unusual courage both in his conflicts in the East and under the charges advanced against him in England.

His *Private Letters* (1838 to 1853) were published in 1853. Portions of his *Journal* were edited by Captains Munday and Keppel (*see* also SARAWAK).

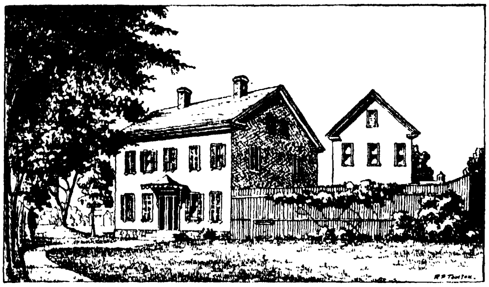
BROOKE, RUPERT (1887–1915), English poet, son of William Parker Brooke and Mary Cotterill, was born at Rugby on Aug. 3, 1887, and educated in his father's House at Rugby school. After winning poetry prizes and playing cricket and football for the school, he went to King's college, Cambridge, with a scholarship in 1906. He played a leading part in university life, helped to found the Marlowe Dramatic Society, became President of the Fabians, and took a second in Classics; and here, as throughout his life, the charm of his personality, in which his remarkable good looks were only one element, gained him innumerable friends. For the next three years he lived mainly at Grantchester, writing poetry and studying the Elizabethan drama, and paid long visits to Munich and Florence in 1911, and Berlin in 1912. His *Poems* were published in December 1911. He won a fellowship in 1913 with a dissertation on John Webster. In May 1913 he started on a year of travel in America and the South seas. In September 1914 he received a commission in the Royal Naval Division, with which he took part in the Antwerp Expedition and sailed for the Dardanelles. He died of blood-poisoning in Scyros on April 23, 1915.

He had ambitions for play-writing; though too much must not be built on his only attempt, the one-act melodrama *Lithuania,* his sense of the theatre, combined with that "sympathetic imagination for everybody and everything" which he called "the artist's one duty," were a good equipment. As for prose, his dissertation on Webster shows critical power and industrious scholarship. The *Letters from America,* full of observation and humour, have many passages of great beauty; and a word must be said of the charm of his intimate letters. In the earlier *Poems* (1905–08) he is still a boy. He writes with gusto, and a sense of verbal and metrical beauty, neither quite under control; he is too lavish with the token-coins of poetry; and though there is hardly a poem without some memorable phrase or passage, the general effect is a little turgid. The later section (1908–11) shows a great advance. Though both in his rapture and his disillusion there is still an immaturity of exuberance and bravado, and a few poems are provocatively disgusting, the beauties are more abundant. The *Human Body* (in which the influence of his favourite poet Donne shows most clearly) and two or three sonnets are completely successful; and *Diningroom Tea,* with its curiously concrete rendering of an elusive experience, is one of his finest pieces. Next came *Grantchester* (1912). This lovely poem, in its combination of tenderness and whimsicality, both steeped in the essence of poetry, is the first perfect example of that mingling of humour and beauty which is perhaps his chief distinguishing mark. Written in Germany, it is also the first expression of his deep love for England. In the best of the poems written on his travels he steps out as a master of his craft; the sonnets *Clouds* and *Psychical Research,* with the exquisite *Tiare Tahiti,* mark the highest level of his accomplishment. The publication of *1914,* almost coinciding with the news of his death, won him immediate fame. Written in the chivalrous ardour of the first moment, the sonnets are in strong contrast with the later poetry of trench-warfare; and nothing better has been said about their historical aspect than the words of Winston Churchill: "A voice had become audible, a note had been struck, more true, more thrilling, more able to do justice to the nobility of our youth in arms than any other—more able to express their thoughts of self-surrender, and carry comfort to those who watched them so intently from afar." Finally, the fragments written on his last voyage, in their union of profound feeling with the perfection of phrase and movement, hold more surely than anything else he wrote the promise of a great poet. (E. MAR.)

BROOKE, STOPFORD AUGUSTUS (1832–1916), English divine and man of letters, born at Letterkenny, Donegal, Ireland, was educated at Trinity college, Dublin. He was ordained in the Church of England in 1857, and held various charges in London. From 1863 to 1865 he was chaplain to the Empress Frederick in Berlin, and in 1872 he became chaplain in ordinary to Queen Victoria. But in 1880 he seceded from the church, being no longer able to accept its leading dogmas, and officiated as a Unitarian minister for some years at Bedford chapel, Bloomsbury. Bedford chapel was pulled down about 1894, and from that time he had no church of his own, but his eloquence and powerful religious personality continued to make themselves felt among a wide circle. He died at Ewhurst, Surrey, on March 18, 1916.

He published in 1865 his *Life and Letters of F. W. Robertson* (of Brighton), and in 1870 wrote an admirable primer of *English Literature* (new and revised ed., 1900), followed in 1892 by *The History of Early English Literature* (2 vols., 1892) down to the accession of Alfred, and *English Literature from the Beginnings to the Norman Conquest* (1898). His other works include various volumes of sermons; *Theology in the English Poets—Cowper, Coleridge, Wordsworth, Burns* (1874); *Poems* (1888); *Dove Cottage* (1890); *Tennyson, his Art and Relation to Modern Life* (1894); *The Poetry of Robert Browning* (1902); *On Ten Plays of Shakespeare* (1905); and *The Life Superlative* (1906). *See* L. P. Jacks, *Life and Letters of Stopford Brooke* (1917).

BROOK FARM (1841–47), an institute of agriculture and education, situated on 160 ac. at West Roxbury (Mass.), 9m. from Boston, was organized in the summer of 1841 by the Rev. George Ripley, a former Unitarian minister, an editor of *The Dial*, a critical literary monthly, and a leader in the Transcendentalists club, an informal gathering of the intellectuals of the period and vicinity. He was aided by his wife, Sophia Dana Ripley, a woman of wide culture and academic experience. According to the articles of agreement, their desire was to combine the thinker and the worker, to guarantee the highest mental freedom, to prepare a society of liberal, intelligent, and cultivated persons whose relations with each other would permit a more wholesome and simple life than could be led amidst the pressure of competitive institutions. There was no religious creed. Truth, justice, and order were the governing principles. Each individual was free in so far as he did not violate the rights of others.


BROOK FARM. HEADQUARTERS OF THE SECOND MASSACHUSETTS INFANTRY IN 1861, 14 YEARS AFTER THE ABANDONMENT OF THE SITE AS A SCHOOL BY THE NEW ENGLAND TRANSCENDENTALISTS

The project was financed by the sale of stock, a purchaser of one share becoming automatically a member of the institute. It was governed by a board of directors. The profits, if any, after all payments and improvements, were divided into a number of shares corresponding with the number of days' labour, every member entitled to one share for each day's labour performed. Among the original shareholders were Charles A. Dana and Nathaniel Hawthorne, who served together as the first directors of agriculture. Other members were John S. Dwight, Minot Pratt, George Partridge, Bradford and Warren Burton. Ralph Waldo Emerson, Amos Bronson Alcott, Margaret Fuller, Theodore Parker, Orestes A. Bronson, and William Henry Channing were interested visitors. It attracted not only intellectuals—though teachers remained ever in excess of farmers—but carpenters, shoemakers, and printers. It paid a dollar a day for work (physical or mental) to men and to women, and provided to all members, their children and family dependents, housing, fuel, clothing and food at approximately actual cost. For four years it published *The Harbinger*, a weekly magazine devoted to social and political problems, to which James Russell Lowell, J. G. Whittier, and Horace Greeley occasionally contributed.

In educational theory it was modern, desiring "perfect freedom of intercourse between students and teaching body." For the first and second years disciplinary measures consisted in the attempt to arouse a sense of personal responsibility, and to communicate a passion for intellectual work. There were no prescribed study hours, and each student was required to give a few hours a day to manual labour—the girls to kitchen and laundry work, the boys to hoeing and chopping. There was an infant school, a primary school, a college preparatory course covering six years. Latin, Italian, German, moral philosophy, Greek, higher mathematics, botany, the English classics, music and drawing were taught, and during the brief period of existence it attracted students from Manila, Havana, and Florida. George William Curtis, Father Isaac Thomas Hecker, and Gen. Francis C. Barlow were early students there.

For a while it looked as though the ideal of the founders would have something of a practical realization. Within three years the community—or "Phalanx" as it was called after 1844—which had begun with the original farmhouse and a small building known as the school, had grown to include four houses, work rooms, and dormitories. Then, though financing had been a constant difficulty, it of necessity put all available funds into the construction of a large central building to be known as the Phalanstery, and the leaders were still optimistic of the permanence of their venture when on the night of March 2, 1846, while they celebrated with a dance the completion of the new building, the alarm was given that it was on fire. It burned to the ground, and though the colony struggled on for a while, "the enterprise faded, flickered, died down, and expired," and the land and buildings were sold at auction on April 13, 1849.

See John Thomas Codman, *Brook Farm* (Boston, 1894); Linday Swift, *Brook Farm* (1900); and Morris Hillquit's *History of Socialism in the United States* (1903).

BROOKFIELD, city, Linn county (Mo.), U.S.A. on federal highway 36 and Burlington railway, about 130 mi. N.E. of Kansas City. The population in 1940 was 6,174. It ships large quantities of grain, hay, poultry and livestock; has railroad shops and a shoe factory; and is in the "Lafayette" coal field. The city was founded in 1858 and incorporated in 1872.

BROOKHAVEN, a city in the pine forest region of southwestern Mississippi, U.S.A., on federal highways 51 and 84, and served by the Illinois Central and Mississippi Central railways; county seat of Lincoln county. The population in 1930 was 5,288; and in 1940, 6,232. Brookhaven is the centre of large lumbering and agricultural interests; a shipping point for cotton; and the seat of Whitworth college for women (established 1858). The city was founded about 1854 and incorporated in 1870.

BROOKINGS, a city near the eastern boundary of South Dakota, U.S.A., three mi. E. of the Big Sioux river; the county seat of Brookings county. It is on federal highways 14 and 77 and is a division on the Chicago and North Western railway. The population in 1940 was 5,346.

The city is beautiful with tree-lined streets and grassy lawns. It owns and operates its telephone plant, electric plant, water system, hospital and swimming pool. Its principal industries include a modern seed-cleaning plant, creamery, wool warehouse, nursery, bottling company, cement block company and a wholesale grocery house.

Brookings is the home of South Dakota State college (est. 1881) which has 1,200 ac. for experimental purposes. The net enrolment is 1,350. The city is debt free with assets totalling more than $1,000,000.

Brookings was founded in 1879, and incorporated in 1883. A commission form of government was adopted in 1920.

BROOKITE, one of the three modifications in which titanium dioxide (TiO_2) occurs in nature; the other minerals with the same chemical composition, but with different physical and crystallographic characters, being rutile (*q.v.*) and anatase (*q.v.*). The two latter are tetragonal in crystallization whilst brookite is orthorhombic. The name was given in honour of the English mineralogist H. J. Brooke (1771–1857). Two types of brookite crystals may be distinguished. The commoner type of crystals are thin and tabular, and often terminated by numerous small and brilliant faces. These crystals are of a rich reddish-brown colour and are often translucent. Crystals of the second type have the appearance of six-sided bipyramids; these crystals are black and opaque, and constitute the variety known as arkansite.

The lustre of brookite is metallic-adamantine. There is no distinct cleavage (rutile and anatase have cleavages); hardness 5½–6; sp. gr. 4·0. The optical characters are interesting: the optic axes for red and for blue light lie in planes at right angles to each other, whilst for yellow-green light the crystals are uniaxial. The acute bisectrix of the optic axes is perpendicular to the orthopinacoid for all colours, so that this phenomenon of the crossing of the optic axial planes may be readily observed in the thin tabular crystals of the first-mentioned type.

Brookite occurs only as crystals, never in compact masses, and is usually associated with either anatase or rutile. The crystals are found attached to the walls of cavities in decomposed igneous rocks and crystalline schists; it is also found as minute isolated crystals in many sedimentary rocks. The best-known locality is Fronolen, near Tremadoc, in North Wales, where crystals of the thin tabular habit occur with crystallized quartz, albite and anatase on the walls of crevices in diabase. Similar crystals of relatively large size are found attached to gneiss at several places in the Swiss and Tirolese Alps. (L. J. S.)

BROOKLIME, known botanically as *Veronica beccabunga* (family Scrophulariaceae), a succulent herb growing on margins of brooks and ditches in the British Isles, and a native of Europe, north Africa and northwestern Asia, and naturalized in eastern North America. It has smooth spreading branches, blunt oblong leaves and small blue or pink flowers. The similar American brooklime (*V. americana*) occurs in wet places from Anticosti to Alaska, and southward to Pennsylvania and California.

BROOKLINE, a residential town of Norfolk county, Massachusetts, U.S.A., almost surrounded by Boston, and separated from the rest of Norfolk county by parts of Suffolk and Middlesex counties. Within its limits are the villages of Brookline, Cottage Farms, Longwood, Beaconsfield and Chestnut Hill. The Chestnut Hill reservoir is just outside its western boundary. It is served by the Boston and Albany railroad and by Boston electric lines. Its land area is 6.8 sq.mi. The population in 1940 was 49,786 (federal census).

Brookline is the largest municipality of Massachusetts that still operates under a town government, and for its size is wealthiest of all the cities and towns of the United States with a population of 30,000 or more. The assessed valuation of property in 1941 was $148,813,400. It has long been regarded as a model suburb. It was the home of Frederick Law Olmsted, the landscape gardener, and contains many examples of his work. The only manufactures of consequence are automobile bodies and scientific apparatus. Brookline was originally a part of Boston, called Muddy River Hamlet.

The town of Brookline was set apart from Boston and incorporated in 1705. Until 1793 it was a part of Suffolk county.

BROOKLYN, formerly a city of New York state, U.S.A., but since 1898 a borough of New York city (*q.v.*), situated at the southwest extremity of Long Island. It is conterminous with Kings county, and is bounded north by the borough of Queens, from which it is separated in part by Newtown creek; east by the borough of Queens and Jamaica bay; south by the Atlantic ocean; west by Gravesend bay, the Narrows, upper New York bay and East river, which separate it from Staten island, Jersey City and the borough of Manhattan. It has a water front of 33 mi. and extends over an area of 71 square miles. Pop. (1880) 599,495; (1890, then Kings county) 838,547; (1900) 1,166,582; (1910) 1,634,351; (1920) 2,018,356; (1930) 2,560,401 and by the 1940 federal census it was 2,698,285. Of the total inhabitants in 1940, 2,380,245 were citizens and 300,040 were aliens. Brooklyn's population then represented over 36·1% of the total (7,454,995) for greater New York.

Brooklyn is connected with Manhattan by three bridges across the East river—the lowest, known as the Brooklyn, opened in 1883; the Williamsburg, opened in 1903; and the Manhattan, opened in 1909. There are ferry connections with Staten island. Brooklyn is served directly by the Long Island railway, by numerous coastwise and transatlantic steamship lines and by elevated or surface-car lines on a large number of its streets. Subway lines, begun in 1904, connect Brooklyn with the subway systems of Manhattan. Construction of a vehicular tunnel between Hamilton avenue, Brooklyn, and the Battery in Manhattan was started in 1940.

Places of Interest and Buildings.—The surface of Brooklyn in the west section, from the lower course of the East river to Gravesend bay, varies in elevation from a few inches to nearly 200 ft. above sea level, the highest points being in Prospect park; but steep street grades even in this section are rare, and elsewhere the surface is either only slightly undulating or, as in the east and south, flat. The principal business thoroughfare is Fulton street, which begins at Fulton ferry nearly under the Brooklyn bridge, runs to Borough Hall park, and thence across the north central section of the borough. In the Borough Hall park are the borough hall, the hall of records, the new municipal building and the county courthouse. Two blocks to the north (on Washington street) is the post office, a fine granite Romanesque building. On Wallabout bay at the bend of the East river to the westward is the U.S. navy yard, the principal one in the United States, established in 1801, and commonly but incorrectly called the Brooklyn navy yard. It occupies altogether about 144 ac., contains a trophy park, parade grounds, officers' quarters, barracks and four large dry docks (respectively 700, 595, 442 and 326 ft. long), foundries and machine shops. It was being expanded in 1941 to permit the construction of two of the largest dry docks in the world (each 1,500 ft. long) by taking over the adjacent Wallabout market, covering 45 ac. At the lower end of the west water front, facing the Narrows, are a U.S. reservation and the harbour defences of Ft. Hamilton.

At the southeastern end of the borough on Jamaica bay the city built a municipal airport, Floyd Bennett field, in 1931. It covers 327 ac. In 1941 the U.S. navy took it over for a naval air base. The army has a large base at the foot of 58th street on the upper bay.

For a considerable portion of its inhabitants Brooklyn is only a place of residence, their business interests being in the borough of Manhattan; hence Brooklyn has been called the "city of homes." Oldest of the many residential districts is that on the picturesque Brooklyn Heights, west of Borough Hall park, rising abruptly from the river to a height of from 70 to 100 ft., and commanding an excellent view of the harbour. Here are hotels, large apartment houses, many private residences and numerous churches. The south shore of Brooklyn has pleasure resorts; Coney island (*q.v.*) is the most popular.

Parks and Cemeteries.—Brooklyn has more than 60 parks, playgrounds and squares constituting an aggregate of about 3,460 acres. Of these the most attractive is Prospect park, occupying about 526 ac. of high ground in the west central part of the borough, on a site made memorable by the battle of Long Island. Its large variety of trees and shrubs, its flower gardens, a palm house, ponds, a lake of 61 ac. for boating and skating, a parade ground of 40 ac. for other athletic sports, a menagerie and numerous pieces of statuary are among its objects of interest or beauty. Half a mile east of the borough hall is Fort Greene park (26 ac.) laid out on the site of earthworks (known as Ft. Greene) constructed during the American Revolution. The park system of Brooklyn also includes more than 38 mi. of parkways. Notable among them is Ocean parkway, which extends from the southern entrance of Prospect park to Seaside park (10½ ac.), Coney island. Interborough parkway connects Pennsylvania avenue with the Grand Central parkway in Queens. The Belt parkway, connecting with Southern parkway in Queens, is a fine scenic drive along the shore of Jamaica bay, Sheepshead bay, Gravesend bay, the Narrows and the upper bay and will connect with the tunnel to Manhattan, scheduled to open in 1945. The Botanic garden (61·4 ac.) at Washington and Flatbush avenues is a place of great interest.

Greenwood cemetery, one of the most beautiful cemeteries in the United States, is about ½ mi. S.W. of Prospect park. Among the principal monuments within its bounds are the soldiers', erected to the memory of those who died in the Civil War, and those erected to Roger Williams, S. F. B. Morse, Elias Howe, De Witt Clinton, Henry Ward Beecher, Peter Cooper, Horace Greeley, Henry Bergh, Henry George and James Gordon Bennett. At the main entrance is a beautiful gateway (of elaborate wrought brown stone), 142 ft. wide and having a central tower 100 ft. in height.

In the Grand Army plaza at the northern entrance to Prospect park is a soldiers' and sailors' memorial arch, adorned with high reliefs of Lincoln and Grant on horseback (by O'Donovan and Eskins) and with three large bronze groups (by Frederick MacMonnies). On the slope of Lookout Hill (185 ft.) within the park is a shaft erected in 1895 to the memory of the Maryland soldiers who valiantly defended the rear of the American army at the battle of Long Island. In the flower garden are a number of busts of famous musicians and the Prospect park honour roll, commemorating the 2,800 Brooklyn soldiers who fell in the World

War of 1914–18. A bronze statue of Lincoln overlooks the lake. At the Ninth street entrance is the Lafayette memorial monument (by D. C. French), unveiled by Marshal Joffre and M. Viviani on May 10, 1917. In Ft. Greene park is a monument to the memory of the soldiers who died in the British prison ships during the American Revolution, many of them having been buried in a vault below. Facing the borough hall is a statue in bronze (by J. Q. A. Ward) of Henry Ward Beecher, mounted on a granite pedestal with a figure at one side to commemorate his sympathy for the slave. In the centre of Williamsburg plaza stands an equestrian statue (by H. M. Shrady) of George Washington. A fine bronze statue of U. S. Grant (by W. O. Partridge) stands at the entrance of the Unity club on Bedford avenue.

Museums, Schools and Libraries.—The Brooklyn Institute of Arts and Sciences embracing numerous departments, of which those of music, philology and the fine arts have each more than 1,000 members, has general management of the Central museum, the Brooklyn Academy of Music, the Botanic garden and the Children's museum in Bedford park. The Central or Brooklyn museum, which is the outgrowth of the Apprentices' Library association founded in 1823, is in Institute park, which is separated from Prospect park by Flatbush avenue. It contains besides paintings and statuary, natural history and mineral collections, archaeological gatherings, oriental objects and Amerindian collections. The museum and Botanic garden are supported in part by the city, but their collections are provided for entirely by private contributions.

Among the educational institutions of Brooklyn are: Pratt institute, founded in 1887 by Charles Pratt (1830–91), which is one of the best schools of engineering and the applied arts in the United States; the Polytechnic institute, opened in 1855, is a high-grade school of technology; the Packer Collegiate institute, opened as the successor of the Brooklyn Female academy, in 1854, has primary, preparatory, academic and collegiate departments; Adelphi college, opened in 1896 for women, removed in 1929 to Garden City; Brooklyn college, a municipal institution opened in 1930, now housed in a splendid group of buildings on a large campus in Flatbush; St. Francis' college, opened 1858; St. John's college, opened 1870; and St. Joseph's, opened 1916 for women. The last three named institutions are maintained by the Roman Catholic church. Here, too, are the law school of St. Lawrence university, the Long Island Hospital Medical college, the Brooklyn College of Pharmacy and several schools of music. [For public schools *see* New York (City).] Among the larger libraries of the borough are the Brooklyn Public library, containing over 950,000 vols. and maintaining 31 branches, and those of the Long Island Historical society, Pratt Institute Free library, Kings County Medical society, Brooklyn museum and Children's museum, in an old family mansion, and a good law library in the county courthouse.

A Central Library building (the Raymond V. Ingersoll memorial), facing the main entrance of Prospect park, was opened by the Brooklyn Public library in 1941.

Brooklyn is well provided with charitable institutions, and has long been known as the "city of churches," from the many churches there and the clergymen who have occupied their pulpits.

Manufactures and Commerce.—Brooklyn is one of the most important manufacturing centres of the United States, most of the factories being located along or near the East river. There were in 1937, according to the U.S. census of manufactures, 4,127 industrial plants which gave employment to 135,602 wage earners and paid $156,603,490 in wages. The output of these factories was valued at $838,543,873 as compared with $2,498,878,377 for the industries of Manhattan and $3,962,292,660 for the five boroughs combined. Two great dock and terminal companies—the New York Dock, extending from the foot of Fulton street to the Erie basin, and the Bush Terminal, in South Brooklyn—handle the major portion of the water-borne traffic. Opposite Governors island is the Atlantic basin of 40 ac., with piers and brick and granite warehouses used largely for grain. A little farther south is another basin, the Erie, of about 100 ac., protected by a breakwater one mile in length, occupied by piers, warehouses and dry docks. East of the Erie is the Gowanus Bay Barge Canal Terminal, a centre for Erie canal traffic, with a $2,500,000 grain elevator. Of Brooklyn's large commerce, grain is the chief commodity; it is estimated that about four-fifths of that exported from the port of New York is shipped from here.

The water-supply of the borough is derived chiefly from the Catskill reservoirs of New York city (*q.v.*). The old Brooklyn system, which secured its supply from small streams along the south shore of Long island and from driven wells, is now used as a reserve. A part of Flatbush is supplied by the Flatbush Water Works company, a private company which secures its supply from driven wells.

History.—The first settlement within the present limits of Brooklyn was made in 1636, when some Dutch farmers took up their residence along the shore of Gowanus bay. About the same time other Dutch farmers founded Flatlands (at first called Amersfoort), on Jamaica bay, and a few Walloons founded Wallabout, where the navy yard now is. In 1642 a ferry was established across East river from the present foot of Fulton street, and a settlement grew up here which was known as The Ferry. The next year Lady Deborah Moody with some followers from New England founded Gravesend, near the southern extremity of the borough. Finally, in the year 1645, a settlement was established near the site of the present borough hall, and was called Breuckelen (also spelled Breucklyn, Breuckland, Brucklyn, Broucklyn, Brookland and Brookline) until about the close of the 18th century, when its orthography became fixed as Brooklyn. The name, Breuckelen, meaning marsh land, seems to have been suggested by the resemblance of the situation of the settlement to that of Breuckelen, Holland. Of the other towns which were later united to form the borough, New Utrecht was settled about 1650, Flatbush (at first called Medwoud, Midwout or Midwood) about 1651, Bushwick and Williamsburg in 1660. During the American Revolution the chief event was the battle of Long island, fought on Aug. 27, 1776. In 1816, when the population of the town of Brooklyn was about 4,500, its most populous section was incorporated as a village; and in 1834, when its population had increased to 23,310 the whole town was incorporated as a city. By 1850 its population had increased to 138,882. In 1855 Williamsburg, which had been incorporated as a city in 1851, and the town of Bushwick were annexed. Other annexations followed until the city of Brooklyn was conterminous with Kings county; and finally, on Jan. 1, 1898, the city of Brooklyn became a borough of New York city.

Bibliography.—S. M. Ostrander, *A History of Brooklyn and Kings County* (1894); H. W. B. Howard (ed.), *History of the City of Brooklyn* (1893); H. Putnam, "Brooklyn" in L. P. Powell's *Historic Towns of the Middle States* (1899); F. van Wyck, *Keskachauge, or the First White Settlement on Long Island* (1924); and M. S Welch, *Vrouw Knickerbocker; the Romance of the Building of Brooklyn* (1926). (E. B. Wn.)

BROOKLYN INSTITUTE OF ARTS AND SCIENCES, THE, was founded in 1823 and incorporated in 1824 as the Brooklyn Apprentices' Library Association. It changed its name in 1843, under an amended charter, to Brooklyn Institute, was reorganized in 1887–88, and a new corporation established in 1890 under the present name. Its object is to establish and maintain museums and libraries of art and science; to encourage the study of the arts and sciences and their application to the practical wants of man; to advance knowledge in science, and in general to provide means for instruction through its collections, libraries and lectures. The Institute's activities are conducted by three semi-autonomous divisions: (1) The Institute at the Academy of Music, with auxiliary departments in the arts, sciences and social studies, presents some 350 lectures, recitals and stage and film performances annually to its members. (2) The Brooklyn museum, opened to the public in 1897, contains art chronologically arranged to illustrate the cultural history of Asia, Africa, Oceania, Europe and the Americas. The Children's museum, Brower park, is administered by the Brooklyn museum. The museum buildings and their maintenance are provided by the city of New York, the exhibits and research work by private donations. (3) The Brooklyn Botanic garden, opened in 1911, comprises 61.4 ac. of various types of gardens and horticultural displays, including trees, shrubs and herbaceous plants. The grounds, buildings and conservatories are owned by New York city. Part of the cost of the Botanic Garden buildings, about one-half annual maintenance, and all exhibits are provided by private funds.

BROOKS, CHARLES WILLIAM SHIRLEY (1816–74), English novelist, playwright and journalist, was born in London April 29 1816, and died there Feb. 23 1874. He wrote, sometimes alone, sometimes in conjunction with others, slight dramatic pieces of the burlesque kind, among which may be mentioned *Anything for a Change* (1848) and *The Daughter of the Stars* (1850). In 1851 Brooks joined the staff of *Punch*, and noteworthy among his numerous contributions were the weekly satirical summaries of the parliamentary debates, entitled "The Essence of Parliament."

In 1870, on the death of Mark Lemon, "dear old Shirley," as his friends used to call him, was chosen to succeed to the editorial chair. His first novel, *Aspen Court*, was published in 1855. It was followed by *The Gordian Knot* (1860), *The Silver Cord* (1861), and *Sooner or Later* (1868) Brooks had an astonishing memory, was brilliant as an epigrammatist, was a great reader and a most genial companion.

See G. S. Layard, *A Great "Punch" Editor: Being the Life, Letters and Diaries of Shirley Brooks* (1907).

BROOKS, PHILLIPS (1835–1893), American clergyman and author, was born in Boston (Mass) Dec. 13, 1835. Through his father, William Gray Brooks, he was descended from the Rev. John Cotton; through his mother, Mary Ann Phillips, a woman of rare force of character and religious faith, he was a great-grandson of the founder of Phillips academy, Andover (Mass.). Of the six sons, four entered the ministry of the Protestant Episcopal Church. Phillips Brooks prepared for college at the Boston Latin school and graduated at Harvard in 1855. After a short and unpleasant experience as a teacher in the Boston Latin school, he began to study for the ministry in the theological seminary at Alexandria (Va.), where he did some teaching in the preparatory department. In 1859 he was ordained deacon and became rector of the church of the Advent, Philadelphia. In 1860 he was ordained priest, and in 1862 he became rector of the church of the Holy Trinity, Philadelphia. During the Civil War he upheld with nobility and power the cause of the North and the negro. In 1869 he was made rector of Trinity church, Boston, where he preached Sunday after Sunday to great congregations, until he was consecrated bishop of Massachusetts in 1891. Although he felt compelled to decline the professorship of Christian ethics at Harvard, he was for many years an overseer and preacher of the university, his influence upon the religious life of the students being deep and wide. After a brief but great episcopate of 15 months, he died, unmarried, Jan. 23, 1893. Phillips Brooks was a tall, well proportioned man of fine physique. In character he was pure, simple, endowed with excellent judgment and a keen sense of humour, and quick to respond to any call for sympathy. When kindled by his subject it seemed to take possession of him and pour itself out with overwhelming speed of utterance and richness of metaphor. His sympathy with men of other ways and thought, and with the truth in other ecclesiastical systems, gained for him the confidence and affection of men of varied habits of mind and religious traditions, and was thus a great factor in gaining increasing support for the Episcopal Church. His various volumes of sermons were widely read as were the Bohlen lectures on "The Influence of Jesus" (1879). He was the author also of some verse including the favourite Christmas hymn, "O Little Town of Bethlehem."

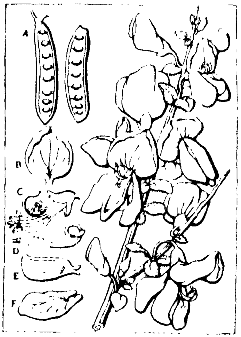
PHOTO BY A. P. B.
AFTER THE BUST BY DANIEL CHESTER FRENCH

PHILLIPS BROOKS, THE CLERGYMAN WHOSE CIVIL WAR ELOQUENCE WON MANY ADMIRERS

The best biography is by A. V. G. Allen (1900 condensed ed., 1907). M. C. Ayres, M. A. D. Howe and W. Lawrence are the authors of shorter monographs. *See* also Lyman Abbott *Silhouettes of My Contemporaries* (1921); L. O. Brastow *Representative Modern Preachers* (1904); H. C. Potter *Reminiscences of Bishops and Archbishops* (1906); and L. P. Powell *Heavenly Heretics* (1909).

BROOKS, WILLIAM KEITH (1848–1908), American zoologist, was born in Cleveland, O., on March 25, 1848. He graduated at Williams college in 1870 and later studied with Louis Agassiz (*q.v.*) at Harvard University (Ph.D., 1875). In 1876 he was made associate in Natural history at Johns Hopkins university, where he became professor of animal morphology in 1891, head of the biological laboratory in 1893 and also professor of zoology. He established a marine laboratory and made extensive and valuable researches on the morphology of various groups of marine animals, especially the tunicates, crustaceans and the oyster. As one of the ablest of American investigators, he exercised marked influence upon the biological thought and teaching of his time. Among his more important works are *Provisional Hypothesis of Pangenesis* (1877), *Heredity* (1883), *Monograph of the Genus Salpa* (1893), *Foundations of Zoology* (1899–1907), and a popular book on *The Oyster* (1891). He died at Baltimore, Md., on Nov. 12, 1908.

BROOM (*Cytisus scoparius*), a shrub of the pea family (Leguminosae) which is native to the temperate parts of Europe and Asia, and naturalized in North America. The leaves are small and usually fugacious; and their function is shared by the green stems. The bright yellow flowers scatter their pollen by an explosive mechanism; the weight of a bee alighting on the flower causes the keel to split and the pollen to be shot out on to the insect's body. When ripe the black pods explode with a sudden twisting of the valves and scatter the seeds. The twigs have a bitter and nauseous taste and have long had a popular reputation as a diuretic; the seeds have similar properties.



BROOM (CYTISUS SCOPARIUS), A EUROPEAN PLANT THAT HAS SMALL LEAVES AND YELLOW FLOWERS

A. Pod split open
B. Standard petal
C. Flower with petals removed
D. Pistil
E. One of the two keel petals
F. Lateral petal, or wing

"Butcher's broom," a very different plant, known botanically as *Ruscus aculeatus*, is a member of the family Liliaceae. It is a small evergreen shrub found in copses and woods, but rare in the southern half of England. The stout angular stems bear leaves reduced to small scales, which subtend flattened leaf-like branches (cladodes) with a sharp apex. The small whitish flowers are borne on the face of the cladodes; the berry is bright red.

BROOME, WILLIAM (1689–1745), English scholar and poet, the son of a farmer, was born at Haslington, Cheshire. where he was baptized on May 3, 1689, and died at Bath on Nov. 16, 1745. He was educated at Eton, and at St. John's college, Cambridge. He was rector of Sturston, Norfolk, and married in 1716 a fairly rich widow, Mrs. Elizabeth Clarke. When Pope undertook the translation of the *Odyssey*, he engaged Elijah Fenton and Broome to assist him. Broome translated the 2nd, 6th, 8th, 11th, 12th, 16th, 18th and 23rd books, and provided practically all the notes. He was a vain, talkative man, and did not fail to make known his real share in the translation, of which Pope had given a very misleading account in the "proposals" issued to subscribers. For the *Odyssey* Pope received £4,500, of which Broome, who had provided a third of the text and the notes, received £570. He had hoped to secure fame from his connection with Pope, and when he found that Pope had no intention of praising him he complained bitterly of being underpaid. Pope satirised him in the *Dunciad* and the *Bathos*.

Broome was also the author of some translations from Anacreon printed in the *Gentleman's Magazine*, and of *Poems on Several*

Occasions (1727). His connection with Pope is discussed in Elwin and Courthope's edition of Pope's *Works* (viii. pp. 30–186), which reproduces their correspondence.

BROOME, the most important port and town in north Western Australia, situated 18 degrees south of the equator at the southwest corner of the Kimberley region. It is the centre of a prosperous pearling fishery, and is of note in "White Australia," since only about 600 of the 2,000 residents are white. The majority are Japanese or Timor islanders, connected with the fishery.

BROOM-RAPE (*Orobanche*), a genus of brown, leafless, parasitic herbs (family Orobanchaceae) growing attached to the roots of other plants. The usually stout stem bears brownish scales, and ends in a spike of yellow, reddish-brown or purplish flowers, with a gaping two-lipped corolla. Seven species occur in the British Isles; the largest, *Orobanche major*, is parasitic on roots of shrubby leguminous plants, and has a stout stem 1 to 2 ft. high. *O. minor* is sometimes troublesome on clover crops. There are about 90 species of broom-rape, natives of temperate and subtropical regions; 15 occur in North America, 9 in California.

BROQUEVILLE, CHARLES MARIE PIERRE ALBERT, COMTE DE (1860–), Belgian politician, was born at Moll, Belgium, Dec. 4, 1860. He became prime minister on June 18, 1911. After the elections of 1912 he formed a new cabinet, in which he acted as minister of war until Aug. 1917. His army bill, making general service personal and obligatory became law in 1913. In 1914 de Broqueville was responsible for the mobilization of the Belgian army. While at Havre, after the battle of Yser, he undertook the reorganization of the army and established munition factories. In consequence of the peace proposals emanating from Prince Sixte de Bourbon and the emissaries of von der Lancken, the German civil representative in Brussels, in 1917 de Broqueville handed in his resignation as head of the cabinet. In 1917 he became foreign minister, afterwards acting as minister of reconstruction until May 1918. He became a minister of state on May 31, 1918, and was minister of the interior in M. Delacroix's cabinet from Nov. of that year until Nov. 1919, when he was elected senator for the province of Namur. He was prime minister from 1932 till Nov. 1934.

BROSCH, MORITZ (1829–1907), German historian, was born at Prague April 7 1829, and died July 14 1907, at Venice, where he had resided for over 30 years. To the series *Geschichte der europäischen Staaten* Brosch contributed *England 1509–1850* (Gotha, 1884–99), a continuation of the work of J. M. Lappenberg and R. Pauli, and *Der Kirchenstaat* (Gotha, 1880–82). Other works on English history are *Lord Bolingbroke und die Whigs und Tories seiner Zeit* (Frankfurt, 1883), and *Oliver Cromwell und die puritanische Revolution* (Frankfurt, 1886).

See A. W. Ward in the *English Historical Review,* vol. xxii. (1907).

BROSCHI, CARLO: *see* FARINELLI.

BROSELEY, industrial town, Shropshire, England, in the municipal borough of Wenlock (*q.v.*), standing high above the River Severn. Pop. of civil parish (1931) 3,216. It was once important for its collieries and iron furnaces, including those of the famous Wilkinson, and for its clay tobacco pipes. The chief industries are now the manufacture of bricks, tiles and earthenware. The 12th century name of the settlement was Burwardsley. It grew in the 18th century as one of the first centres of iron smelting, exporting much of its output by way of the Severn.

BROSSES, CHARLES DE (1709–1777), French magistrate and scholar, was born at Dijon. After a visit to Italy in 1739 he published his *Lettres sur l'état actuel de la ville souterraine d'Herculée* (Dijon, 1750), the first work upon the ruins of Herculaneum. It was during this tour that he wrote his famous letters on Italy, posthumously published in 1799 (better edition by Poulet-Malassis, *Lettres familières,* 1858). At the request of his friend Buffon, he undertook his *Histoire des navigations aux terres australes* (1756). In this work de Brosses first laid down the geographical divisions of Australasia and Polynesia, which were adopted by succeeding geographers. In 1765 appeared his work on the origin of language, *Traité de la formation mécanique des langues.* De Brosses had been occupied, during a great part of his life, on a translation of Sallust, and in 1777 he published *L'Histoire du septième siècle de la république romaine*, to which is prefixed a learned life of Sallust. De Brosses was first president of the parliament of Burgundy.

BIBLIOGRAPHY.—*See* H. Mamet, *Le Président de Brosses, sa vie et ses ouvrages* (Lille, 1874); also Cunisset-Carnot, "La Querelle de Voltaire et du président de Brosses," in the *Revue des Deux Mondes* (Feb. 15 1888).

BROTHER, a male person in his relation to the other children of the same father and mother. The word is common to the Indo-European language, *cf.* Ger. *bruder*, Dan. and Swed. *broder*, Lat. *frater*. The Sanskrit word is *bhrātār*, and the ultimate Indo-European root is generally taken to be *bhar*, to bear. "Brother" has often been loosely used of kinsmen generally, also for fictitious relationships, *e.g.*, "blood-brothers," through a sacramental rite of mutual blood-tasting, "foster-brothers," because suckled by the same nurse. "Brethren" is the name given to members of the Church, and in a narrower sense to members of a religious confraternity. Hence it is used also in fraternal societies, *e.g.*, the Freemasons. Sovereigns address one another as "brother" to imply equality.

BROTHER JONATHAN, a sobriquet or nickname for the United States; similar to Uncle Sam and to John Bull for England. It is popularly, but doubtfully, derived from Jonathan Trumbull, Governor of Connecticut during the whole of the Revolutionary War. He was a valued friend of Washington and his advice was highly regarded. When in doubt or in a position of exceptional difficulty, or in great need of supplies, Washington is reputed to have exclaimed, "We must consult Brother Jonathan," meaning Governor Trumbull. The term gradually spread as a popular name for the United States, but was never in so universal use as Uncle Sam and of late years has gradually become much less common.

BROTHERS, RICHARD (1757–1824), religious fanatic, was born in Newfoundland on Christmas day, 1757, and educated at Woolwich. He was a naval officer, and retired on half-pay in 1789. In 1791 he renounced his half-pay for conscientious reasons, and fell into considerable straits. In 1793 he declared himself the apostle of a new religion "the nephew of the Almighty, and prince of the Hebrews, appointed to lead them to the land of Canaan." At the end of 1794 he began to print his interpretations of prophecy, his first book being *A Revealed Knowledge of the Prophecies and Times*. For prophesying the death of the king and the end of the monarchy, he was arrested in 1795, and confined as a criminal lunatic. His case was brought before Parliament by Nathaniel Halhed, the orientalist, and he was removed to a private asylum in Islington. Here he wrote prophetic pamphlets which gained him many believers, among them William Sharp, the engraver, who afterwards deserted him for Joanna Southcott. He died in London on Jan. 25, 1824, in the house of John Finlayson, who had secured his release. He is generally regarded as the founder of the modern Anglo-Israelite movement.

BROTHERS OF COMMON LIFE, a religious community formerly existing in the Catholic Church. Towards the end of his career Gerhard Groot (*q.v.*) retired to his native town of Deventer, in the diocese of Utrecht, and with the assistance of his friend Florentius Radewyn, who resigned for the purpose a canonry at Utrecht, succeeded in carrying out a long-cherished idea of establishing a house wherein devout men might live in community without the monastic vows. The first such community was established at Deventer in the house of Florentius himself (*c.* 1380); and Thomas à Kempis lived in it from 1392 to 1399. Other houses of the Brothers of Common Life were in rapid succession established in the chief cities of the Low Countries and north and central Germany.

The ground-idea was to reproduce the life of the first Christians as described in Acts iv. The members took no vows and were free to leave when they chose; but so long as they remained they were bound to observe chastity, to practise personal poverty, putting all their money and earnings into the common fund, to obey the rules of the house and the commands of the rector, and to exercise themselves in self-denial, humility and piety. The rector was chosen by the community and was not necessarily a priest, though in each house there were a few priests and clerics. The majority, however, were laymen, of all kinds and degrees—nobles, artisans, scholars, students, labouring men. After the religious services of the morning the Brothers scattered for the day's work. The clerics preached and instructed the people, working chiefly among the poor; they also devoted themselves to the copying of manuscripts, in order thereby to earn something for the common fund; and some of them taught in the schools. Of the laymen, the educated copied manuscripts, the others worked at various handicrafts or at agriculture, going to the workshops in the city, or to the fields—for the idea was to live and work in the world, and not be separated from it, like the monks. Their rule was that they had to earn their livelihood, and must not beg. This feature seemed a reflection on the mendicant orders, and the idea of a community life without vows and not in isolation from everyday life, was looked upon as something new and strange. Opposition arose, and the status of the order was not finally settled until the council of Constance (1414), when their cause was triumphantly defended by Pierre d'Ailly and Gerson. For a century after this the order flourished exceedingly, and its influence on the revival of religion in the Netherlands and north Germany in the 15th century was wide and deep. During the second half of the 16th century the order gradually declined, and by the middle of the 17th all its houses had ceased to exist.

AUTHORITIES.—The chief authorities are Thomas à Kempis, *Lives of Groot and his Disciples* and *Chronicle of Mount St. Agnes* (both works translated by J. P. Arthur, the former under the title *Founders of the New Devotion*, 1905). An excellent article in Herzog-Hauck, *Realencyklopadie* (3rd ed.), "Brüder des gemeinsamen Lebens," supplies copious information with references to all the literature.

BROUGH, ROBERT (1872–1905), British painter, born at Invergordon, Ross-shire, Scotland. After two years in Paris under J. P. Laurens and Benjamin-Constant at Julian's *atelier*, he settled in Aberdeen in 1894 as a portrait painter and political cartoonist. A portrait of Mr. W. D. Ross first drew attention to his talent in 1896, and in the following year he scored a marked success at the Royal Academy with his "Fantasie en Folie," now at the National Gallery of British Art (Tate Gallery). Two of his paintings, " 'Twixt Sun and Moon" and "Childhood of St. Anne of Brittany," are in the Venice municipal gallery. Brough's art is influenced by Raeburn and by modern French training.

BROUGHAM, JOHN (1814–1880), British actor, was born in Dublin on May 9 1814 and died in New York on June 7 1880. He made his first appearance on the London stage, in 1830, at the Tottenham street theatre in *Tom and Jerry*, in which he played six characters. In 1831 he was a member of Madame Vestris's company; he remained with her as long as she retained Covent Garden, and he collaborated with Dion Boucicault in writing *London Assurance*, Dazzle being one of his best parts. In 1840 he managed the Lyceum theatre, for which he wrote several light burlesques, but in 1842 he moved to the United States, where he joined W. E. Burton's company. Later he managed various theatres, not always with financial success, and in 1860 he returned to London, where he adapted or wrote several plays, including *The Duke's Motto* for Fechter. After the Civil War he returned to New York. Brougham's theatre was opened in 1869 with his comedy *Better Late than Never*, but this proved a loss and he took to playing with various stock companies. His last appearance was in 1879 as O'Reilly, the detective, in Boucicault's *Rescued*. Brougham was the author of nearly 100 plays, most of them now forgotten. Brougham is said to have been the original of Harry Lorrequer in Charles Lever's novel.

BROUGHAM, a four-wheeled closed carriage, seating two or more persons, and drawn by a single horse or pair, or propelled by motor. The modern "brougham" has developed and taken its name from the "odd little kind of garden-chair" described by Thomas Moore, which the first Lord Brougham had made by a coachmaker to his own design.

BROUGHAM AND VAUX (brōōm vō), **HENRY PETER BROUGHAM**, 1ST BARON (1778–1868), lord chancellor of England, was born at Edinburgh, Sept. 10, 1778, the eldest son of Henry Brougham and Eleanora, daughter of the Rev. James Syme. He was educated at Edinburgh high school and at Edinburgh university, and was still a student when two papers of his on light were printed (1796 and 1797) in the transactions of the Royal Society; in 1803 he became F.R.S. But his pursuit of physical science was by way of recreation. He attended lectures in civil law, and adopted law as a profession, being admitted to the faculty of advocates in 1800. He at once went on the southern circuit, where he defended or prosecuted a few prisoners, and caused some scandal by playing a series of tricks on the presiding judge, Lord Eskgrove. The Scottish bar, however did not offer sufficient scope for his talents and his ambition. He had already appeared as junior counsel in a Scottish appeal to the House of Lords when, in 1803, he entered at Lincoln's Inn. In 1808 he was called to the English bar. In the meantime he began to write for the *Edinburgh Review* (founded in 1802), to which he contributed an extraordinary number of articles on science, politics, colonial policy, literature, poetry, surgery, mathematics and the fine arts. The prodigious success of the *Review*, and the power he was known to wield in it, brought him the friendship of Lord Grey and the leading Whig politicians. It was chiefly through his influence that the *Review* afterwards supported the Whig cause, and gave occasion for the founding of the Tory *Quarterly*. His wit and gaiety made him a social success in London. He now began his *Enquiry into the Colonial Policy of the European Powers* (Edinburgh 1803), with the idea of establishing himself in politics. Fox made him secretary to a mission (1806) headed by Lord Rosslyn and Lord St. Vincent to Portugal, then threatened with a French invasion. The mission lasted two or three months; Brougham came home out of humour and out of pocket; and meantime the death of Fox put an end to the hopes of the Whigs.

Brougham was disappointed by the abrupt fall of the ministry, and piqued that his Whig friends had not provided him with a seat in parliament. Nevertheless he wrote many pamphlets and articles in the Whig interest during the election of 1809, and in particular *An Enquiry into the State of the Nation at the commencement of the present administration* in which he attacked Pitt's foreign policy. But no seat was placed at his disposal, and he was too poor to contest a borough. At this time he joined the movement for the abolition of the slave-trade, and he remained through life not only faithful, but passionately attached to the cause. Indeed, one of the first measures he carried in the House of Commons was a bill to make the slave-trade felony, and as lord chancellor of England he had a part in the final measure of negro emancipation throughout the colonies. Before entering on practice at the English bar Brougham had acquired some knowledge of international law, and some experience of the prize courts. This probably led to his being retained as counsel for the Liverpool merchants who had petitioned both houses of parliament against the orders in council. Brougham conducted the enquiry at the bar of the House, and showed a remarkable mastery of the principles of economics and international law. The merchants nevertheless lost their case, and it was not until 1812, when Brougham was himself in parliament, that he resumed his attack on the orders in council, and ultimately conquered. His first legal success was the defence of John and Leigh Hunt, in 1811, on a charge of provoking a French invasion by publishing an article in the *Examiner* condemning military flogging. This trial established his reputation.

He took his seat in parliament early in 1810, as member for Camelford, a borough to which he was presented by the duke of Bedford. To prove that he could curb his already notorious impetuosity he vowed to keep silence for a month, and did so. His first speech was made in March, in condemnation of the conduct of Lord Chatham at Walcheren, and from that time he took part constantly in the debates of the House. His success was immediate, and his name was canvassed as a possible leader of the Whig Party if it returned to power. In 1812 he secured the formation of a committee to enquire into the state of trade, and obtained the repeal of the orders in council, which he maintained were hampering the trade of the country. At the election of 1812 Brougham stood for Liverpool and was defeated. The new House had a strong Tory majority. Brougham remained out of parliament during the four eventful years from 1812 to 1816, which witnessed the end of the war with France, and he did not conceal his resentment against the Whigs, though he himself admitted that they had grounds for their distrust of him, as he was "an indifferent party man."

He had been introduced in 1809 to the princess of Wales (afterwards Queen Caroline). In 1811 the princess began to consult him on her private affairs, after the rupture between the prince regent and the Whigs had become more decided. From that time, Brougham, in conjunction with Samuel Whitbread, became one of the princess's chief advisers; he was attached to her service, not so much from any liking for herself as from indignation against her husband, and probably with an appreciation of the political value of his position. She on the other hand does not seem to have reposed much trust in him, but found him useful and considered him too important a person to ignore or offend. Brougham strongly opposed her departure from England in 1814, but later, in 1820, proposed to the prime minister, without her knowledge, that she should be urged to resign her claim to the title of queen in return for an increased allowance of £50,000 a year.

In Feb. 1816 Brougham was returned to parliament for another pocket-borough, Winchelsea, in the gift of the earl of Darlington, and he instantly resumed a commanding position in the House of Commons. He defeated the proposal for the continuance of the income-tax; he advocated popular education; initiating a movement for the establishment of infant schools in London; and on the death of Romilly he took up with ardour the great work of the reform of the law. Nothing exasperated the Tory party more than the select committee which sat, with Brougham in the chair, in 1816 and the three following years, to investigate the state of education of the poor in London. But he was as far as ever from obtaining the leadership of the Whig Party, nor was he much more successful at the bar. The death of George III. suddenly changed this state of things. Queen Caroline at once, in April 1820, appointed Brougham her attorney-general, and Denman her solicitor-general, and they immediately took their rank in court accordingly; this was indeed the sole act of royal authority on the part of the unhappy queen. In July Queen Caroline came from St. Omer to England; ministers sent down to both houses of parliament the secret evidence which they had long been collecting against her; and a bill (the Bill of Pains and Penalties) was brought into the House of Lords for the deposition of the queen, and the dissolution of the king's marriage. The defence of the queen was conducted by Brougham, assisted by Denman, Lushington and Wilde, with equal courage and ability. He wound up the proceedings with a speech of extraordinary power and effect. The peroration was said to have been written and rewritten by him 17 times. On Nov. 10 the bill was carried, but the majority was so small that the ministry did not proceed with the bill in the Commons, and the result was a virtual triumph for the queen, which was shared by Brougham. A piece of plate was presented to him, paid for by a penny subscription of peasants and mechanics. He refused to accept a sum of £4,000 which the queen herself placed at his disposal, and took no more than the usual fees of counsel, while his salary as attorney-general remained unpaid, until it was discharged by the Treasury after her death. But from that time his fortune was made at the bar and his practice on the northern circuit quintupled. Even Lord Campbell, a rival advocate and an unfriendly critic, admitted that his position was unexampled in the profession. The meanness of George IV. and of Lord Eldon refused him the silk gown to which his position at the bar entitled him, and for some years he led the circuit as an outer barrister, to the great loss of the senior members of the circuit, who could only be employed against him. His practice rose to about £7,000 a year, but it was again falling off before he became chancellor.

Meanwhile he pursued his persistent advocacy of better education. The select committee of 1816 had disclosed the misuse of various charitable educational funds and had led to an act of 1818 appointing another committee of enquiry, which resulted later in the establishment of the charity commissioners. In 1820 Brougham prepared an Education Bill, which was rejected, owing chiefly to the necessity for co-operation with the Church of England. For the same reason it failed again in 1826. In 1820 he also proposed a compulsory education rate. Under his auspices the first steps were taken, in 1825, for the establishment of a university in London, free from all religious or sectarian distinctions. In 1827, he helped in founding the "Society for the Diffusion of Useful Knowledge," an association which gave an immense impulse to the production of good cheap books for the people. Its publications were issued at 6d. each and the first was an essay on "The Pleasures and Advantages of Science," written by himself. In 1832 he founded the *Penny Magazine*, and in 1833 the *Penny Cyclopaedia*, which was completed 11 years later, but finally caused the bankruptcy of the Society

In 1828 he delivered his great speech on law reform, which lasted six hours, in a thin and exhausted house.

The death of Canning, the failure of Lord Goderich, and the accession of the duke of Wellington to power (Jan. 1828), improved the prospects of the Whig party. At the general election of 1830 Brougham was returned as M.P. for the county of York. Parliament met in November. Brougham's first act was to move for leave to bring in a bill to amend the representation of the people; but before the debate came on the Tory government was defeated on another question (Nov. 15, 1830); the duke resigned, and was succeeded by Earl Grey.

Amongst the difficulties of the new premier and the Whig party were the position and attitude of Brougham He was not the leader of any party, and had no personal following in the House of Commons. Moreover, he himself had repeatedly declared that nothing would induce him to exchange his position as an independent member of parliament for any office, however great. On the day following the resignation of the Tory government he reluctantly consented to postpone for one week his motion on parliamentary reform. The attorney-generalship was offered to him and indignantly refused. He himself affirms that he desired to be master of the rolls, which would have left him free to sit in the House of Commons. But this was positively interdicted by the king, and objected to by Lord Althorp, who declared that he could not undertake to lead the House with so insubordinate a follower behind him. But as it was impossible to leave Brougham out of the ministry, it was determined to offer him the chancellorship. Brougham did not wish to lose his seat in the Commons, but finally yielded to the representations of Lord Grey and Lord Althorp. On Nov. 22 the great seal was delivered to him by the king, and he was raised to the peerage as Baron Brougham and Vaux. His chancellorship lasted exactly four years.

Lord Brougham took a most active and prominent part in all the great measures promoted by Grey's government, and the passing of the Reform Bill was due in a great measure to his brilliant defence in the Lords, although he was excluded from the cabinet committee of four which prepared the bill. Unfortunately Brougham's success developed his native arrogance. His manner became dictatorial and he exhibited a restless eccentricity, and a passion for interfering with every department of state, which alarmed the king. Lord Grey resigned, but very much by Brougham's exertions the cabinet was reconstructed under Lord Melbourne, and he expected that his own influence in it would be increased. But the extreme mental excitement under which he laboured at this time culminated during a journey to Scotland in a behaviour so extravagant that his fall became certain. Whether the stories circulated were true or not, it is certain that his correspondence with the king caused alarm at Windsor, and contributed to the destruction of the ministry.

Shortly after the meeting of parliament in November 1834 the king dismissed his ministers. The chancellor, who had dined at Holland house, called on Lord Melbourne on his way home, and learned the intelligence. Melbourne made him promise that he would keep it secret until the next day, but in the morning the occurrence was related in the *Times*, in a paragraph which added that "the queen had done it all." It was always supposed that Brougham gave the information to the *Times*, and this was the last act of his official life. The Peel ministry, prematurely and rashly summoned to power, was short-lived, and Brougham took an active part in overthrowing it. Lord Melbourne was summoned in April 1835 to reconstruct the Whig government with his former colleagues But the Whigs were determined that Brougham should not hold the great seal or any other office. The great seal was put in commission (April 1835) so that the way for his return was nominally left open. In the session of 1835 Hansard records no less than 221 speeches of his. But in Jan. 1835 Lord Cottenham was made lord chancellor. Brougham's spirit was quenched for a time, and during the year 1836 he never spoke in parliament. But in 1837 he advocated the establishment of a new department for the purpose of extending education. For more than 30 years after his fall Brougham continued to take an active part in the judicial business of the House of Lords and in its debates. His reappearance in parliament on the accession of Queen Victoria was marked by sneers at the court, and violent attacks on the Whigs for their enthusiastic attachment to the young sovereign; and upon the outbreak of the insurrection in Canada, and the miscarriage of Lord Durham's mission, he overwhelmed his former colleagues and especially Lord Glenelg, with a torrent of invective and sarcasm, equal in point of oratory to the greatest of his earlier speeches. Indeed Brougham estranged himself from the whole of his own party. But, in spite of the hostility of the Whigs and his own disappointed ambition, Brougham continued to render great public service by the genuine liberalism of his views, and by his great legal acumen in the judicial cases brought before the privy council, and the House of Lords. The privy council, especially when hearing appeals from the colonies, India, and the courts maritime and ecclesiastical, was his favourite tribunal; its vast range of jurisdiction, varied by questions of foreign and international law, suited his discursive genius. Colonial administration had been one of his earliest studies, and in colonial questions his learning was put to good use. Brougham had, as lord chancellor, remodelled the judicial committee in 1833, and it still remains one of the most useful of his creations.

In the year 1860 a second patent was conferred upon him by Queen Victoria, with a reversion of his peerage to his youngest brother, William Brougham (1795–1886). The preamble of this patent stated that this unusual mark of honour was conferred upon him by the Crown as acknowledgment of the great services he had rendered, more especially in promoting the abolition of slavery, and the emancipation of the negro race. The peerage was thus perpetuated in a junior branch of the family, Lord Brougham himself being without an heir. He had married in 1821 Mrs. Spalding (d. 1865), daughter of Thomas Eden, and had two daughters, the survivor of whom died in 1839. Brougham's last days were passed at Cannes, where he had built himself a house about the year 1838, when the place was little more than a fishing village. His choice and his example was the beginning of its vogue. He died there on May 7, 1868, in the 90th year of his age.

As chancellor, Brougham affected at first to treat the business of the court of chancery as a light affair, and his manner in court was desultory and dictatorial. As has been shown, his legal training was of considerable assistance to him in his parliamentary life, and he never ceased to advocate legal reforms, in particular the mitigation of the severity of the criminal code, the simplification of existing laws, and improvement in the methods of their administration. His ideals are amplified in his famous speech of 1828 on "the present State of Law." In his earlier career his tendency was to specialize in cases which had a political bearing, probably with a view to increasing his own political influence.

Although an able lawyer, Brougham's chief interest was in the political field, where he never gained the position which he thought to be his due. His failure appears to have been caused largely by the instability of his political beliefs, and by the fact that his actions were often influenced by his ambition and desire for position. He was throughout his life an enthusiastic advocate of improved education, and of other measures which had wide popular support. It is uncertain to what extent this policy was the result of conviction, or how far it was a means of obtaining popular support.

Brougham was one of the most powerful orators of his time, his command of language, audacity and well-stored memory enabling him to dominate the House. His striking and almost grotesque personal appearance added to the effect of his voice and manner—a tall, disjointed frame, with strong bony limbs and hands, that seemed to interpret the power of his address; strange angular motions of the arms; the modulations of his voice, now thundering in the loudest tones of indignation, now subdued to a whisper—all contributed to give him the magical influence excited by a great actor. His political personality, however, lacked the charm which appears to have been characteristic of him in private life.

Brougham's collected works were published in 11 volumes (Glasgow, 1855–61, and Edinburgh 1872–73, edited by himself). His speeches were published in 4 vols. (Edinburgh, 1838). A bibliographical list of his works by "the Author of the Handbook of Fictitious Names" appeared in 1873. His works include *An Enquiry into the Colonial Policy of the European powers* (2 vols. Edinburgh, 1803 and 1830); *A Concise Statement of the Question regarding the abolition of the Slave Trade* (1804); *An Enquiry into the State of the Nation at the commencement of the present administration* (1806); *An Enquiry into the causes and consequences of Continental alienation, written as a sequel to the Enquiry into the State of the Nation* (1808); *A letter to Sir Samuel Romilly upon the abuse of Charities* (1818); *Practical observations upon the education of the People* (1825 and 30 later editions, German trans., 1827). *Sketches of Statesmen of the Time of George III.* (1839–43). A novel entitled *Albert Lund* was attributed to him (1844 and 1872). His autobiography *Life and Times of Henry Lord Brougham* written by himself was published in 3 volumes in 1871. *See* Lord Campbell's account of Brougham in his *Lives of the Chancellors* (1869), a contemporary and not impartial record; W. Hunt's biography in the D.N.B. *See* also the *Greville Memoirs* (ed. H. Reeve, 8 vols. 1872); T. Creevy, *Papers* (ed. Sir Herbert Maxwell, 2 vols. 1904); S. Walpole, *History of England* (1890); J. A. Roebuck, *History of the Whig Ministry* (1852); Lord Holland, *Memoirs of the Whig Party* (1854); *Brougham and his early friends; Letters to James Loch, 1798–1809* (3 vols. 1908, privately printed. Ed. R. H. M. B. Atkinson and G. A. Jackson); A. Aspinall, *Lord Brougham and the Whig Party* (1927).

BROUGHTON, JOHN CAM HOBHOUSE, BARON (1786–1869), English writer and politician, the friend of Byron, was the eldest son of Sir Benjamin Hobhouse, Bart., by his wife Charlotte, daughter of Samuel Cam. Born at Bristol on June 27, 1786, he was educated at Westminster school and Trinity college, Cambridge, where he took the Hulsean prize in 1808 for his *Essay on the Origin and Intention of Sacrifices.* At Cambridge he founded the "Whig Club," and the "Amicable Society," and became very intimate with Byron, who accompanied him on a tour in Spain, Greece and Turkey in 1809. Hobhouse was present at the battle of Dresden in Aug. 1813, and, following the allied army into France, saw Louis XVIII. enter Paris in May 1814. He was again in Paris after the return of Napoleon from Elba, and showed his dislike of the Bourbons and his sympathy with Bonaparte by writing in 1816 a pamphlet entitled *The substance of some letters written by an Englishman resident in Paris during the last reign of the emperor Napoleon.* This caused some offence in England and more in France, and the French translation was seized by the Government and both translator and printer were imprisoned. A further period of travel with Byron followed, and at this time Hobhouse wrote some notes to the fourth canto of *Childe Harold.* In Feb. 1819 Hobhouse contested Westminster in the Radical interest but in this he was unsuccessful. He had already written in favour of reform, and in 1819 he issued *A defence of the People in reply to Lord Erskine's "Two Defences of the Whigs,"* followed by *A trifling mistake in Thomas, Lord Erskine's recent preface.* The House of Commons declared this latter pamphlet a breach of privilege; Hobhouse was arrested on Dec. 14, 1819, and remained in custody until February, 1820. His imprisonment increased his popularity, and at the general election of 1820 he was returned for Westminster. He served in the Grey government of 1832, in the Melbourne governments of 1834 and 1835, and in Lord John Russell's cabinet in 1846. He was created Baron Broughton in 1851, and took little part in politics after Russell's resignation in 1852. He died in London on June 3, 1869.

He had married in July 1828 Lady Julia Tomlinson Hay, daughter of George, 7th marquess of Tweeddale, by whom he had three daughters. Lord Broughton was a partner in Whitbread's brewery, a fellow of the Royal Society, and one of the founders of the Royal Geographical Society. He was responsible for the passing of the Vestry Act of 1831, and is said to have first used the phrase "his Majesty's opposition." He was a good classical scholar, and although not eloquent, an able debater. In addition to the works already enumerated he wrote *A journey through Albania and other provinces of Turkey in Europe and Asia to Constantinople during the years 1809 and 1810* (1813), revised edition (1855); and *Italy: Remarks made in Several Visits from the Year 1816 to 1854* (1859).

A collection of his diaries, correspondence and memoranda is in the British Museum.

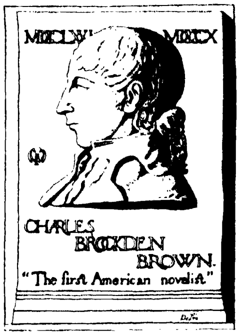
See T. Moore, *Life of Lord Byron* (1837–40); *The Times*, June 4, 1869; Spencer Walpole, *History of England* (1890); *Dictionary of National Biography* (1891), vol. xxvii.; *Greville Memoirs* (1896). Broughton also wrote *Recollections of a Long Life*, printed privately in 1865, and in 1909 published with additions in 2 vols. edited by his daughter, Lady Dorchester, with a preface by the earl of Rosebery.

BROUMOV or **BRAUNAU,** a small town of northeast Bohemia, Czechoslovakia, situated near the German frontier on the right bank of the Steine, has important historic associations as one of the two towns whose Protestant churches were closed by the Catholic Church authorities in 1618, from which resulted the violent expulsion of the ministers Martinic and Slavata which was the signal for the opening of the Thirty Years' War. The town shares in the textile industries of northeast Bohemia and has a considerable trade. Pop. (1930) 7,252. Its population is predominantly German, while its natural outlet is the German town of Glatz. In 1938 Broumov was annexed by Germany.

BROUSSAIS, FRANÇOIS JOSEPH VICTOR (1772–1838), French physician, was born at St. Malo on Dec. 17, 1772, the son of a physician. After much active service in the wars of the Revolution he returned in 1814 to Paris, and was appointed assistant-professor to the military hospital of the Val-de-Grâce, where he first promulgated his doctrines on the relation between "life" and "stimulus," and on the physiological interdependence and sympathies of the various organs. In 1816 he published his *Examen de la doctrine médicale généralement adoptée*, which drew down upon its author the hatred of the whole medical faculty of Paris; but by degrees his doctrines triumphed, and in 1831 he was appointed professor of general pathology in the academy of medicine. He died at Vitry-sur-Seine on Nov. 17, 1838. A statue in his honour was erected at the Val-de-Grâce hospital.

BROUWER or **BRAUWER, ADRIAN** (*c.* 1606–1638), Flemish painter, was born at Oudenarde (according to some authorities, at Haarlem), and died at Antwerp in Jan. 1638. He went to Amsterdam in 1626, in 1628 to Haarlem, where he was a pupil of Frans Hals, and in 1631 to Antwerp, where he came under the influence of Rubens. Brouwer painted scenes of peasant and tavern life, and was a colourist of great charm. His chief works are in the Munich and Dresden galleries. There are also examples in London galleries, the finest being "The Sleeping Peasant" in the Wallace collection. Sir Charles Holmes (*National Gallery*, vol. ii.) says that "Brouwer's little clusters of brawling peasants have the solidity of spirited statuettes, and their setting is arranged with a taste in avoiding the superfluous no less exigent than Vermeer's."

BROWN, CHARLES BROCKDEN (1771–1810), American novelist, was born of Quaker parents in Philadelphia, Jan. 17, 1771. Of delicate constitution, he early devoted himself to study; his principal amusement was the invention of ideal architectural designs, devised on the most extensive and elaborate scale. This talent for construction later assumed the shape of Utopian projects for perfect commonwealths, and of a series of novels distinguished by the ingenuity and consistent evolution of the plot. The transition between these intellectual phases is marked by a juvenile romance *Carsol*, which depicts an imaginary community, and shows how thoroughly the young American was inspired by Godwin and Mary Wollstonecraft. From the latter he derived the idea of his next work, *The Dialogue of Alcuin* (1797), an enthusiastic but inexperienced essay on the question of woman's rights and liberties. From Godwin he learned his terse style, and the art of developing a plot from a single psychological problem or mysterious circumstance. The novels which he rapidly produced are wild and weird in conception, with incidents bordering on the preternatural, yet never transgressing the limit of possibility. In *Wieland; or the Transformation* (1798), a seemingly inexplicable mystery is resolved into a case of ventriloquism. *Arthur Mervyn* (1798–1800) is remarkable for the description of the epidemic of yellow fever in Philadelphia, and *Edgar Huntly* (Philadelphia, 1801) for the effective use made of somnambulism, and for the introduction of the American Indian into fiction. *Ormond* (1799) contains one character, Constantia Dudley, which excited the enthusiastic admiration of Shelley. After a long illness, Brown died of consumption, Feb. 22, 1810.



THE MEMORIAL BY R. TAIT MACKENZIE IN THE FRANKLIN INN CLUB, PHILADELPHIA

Bibliography.—The life of Charles Brockden Brown was written by his friend William Dunlap (Philadelphia, 1815). His works, in six vols., were published at Philadelphia in 1857 with a "Life," and in a limited and more elaborate edition (1887). *See* also William H. Prescott, *Biographical and Critical Miscellanies* (New York, 1845); John Erskine, *Leading American Novelists* (1910); David Lee Clark, *A Critical Biography of Charles Brockden Brown* (1923).

BROWN, FORD MADOX (1821–1893), English painter, was born at Calais on April 16, 1821, the son of Ford Brown, and his wife Caroline Madox. His grandfather was Dr. John Brown of the Brunonian theory of medicine. He received his artistic training from Gregorius, a pupil of David, at Bruges, and from Wappers, at Antwerp. In 1840 he exhibited at the Academy "The Giaour's Confession," the subject of which was drawn from Byron. The first picture he painted after his return to London in 1846, "Lear and Cordelia," shows his individual characteristics. He was concerned with "truth of colour, of spiritual expression, and of historical character." Writing of the effect produced by "Lear and Cordelia" Richard Muther says: "It stood in such abrupt opposition to the traditional historical painting that perhaps nothing was ever so sharply opposed to anything so universally accepted. The figures stand out stiff and particoloured like card kings, without fluency of line or rounded and generalized beauty. And the colour is just as incoherent. The brown sauce, which every one had hitherto respected like a binding social law, had given way to a bright joy of colour, the half barbaric motley which one finds in old miniatures." On closer examination it was clear that every detail was conceived as part of a whole, and that the picture was a great work of tragic art, in which nothing was sacrificed to empty show or to pose. This character of sincerity was Madox Brown's great contribution to contemporary art. He was closely allied with the members of the Pre-Raphaelite Brotherhood, and especially with Dante Gabriel Rossetti. He never actually joined the brotherhood, but his works followed its principles very closely: instances are "Christ washing St. Peter's Feet" and "Work," a street scene at Hampstead.

Brown completed a number of historical pictures between 1850 and 1877, but he was a slow worker, and not all of his time was given to easel pictures. He was a member of the firm of art decorators, Morris, Marshall, Faulkner and Company, and produced a great number of designs for stained glass. From 1878 onwards he was engrossed by the decoration of the City hall at Manchester—twelve large wall paintings, some of them done in a modified form of the Gambier-Parry process, and others in oil on canvas applied to the wall surface. These present the history of Manchester and the district, from the building of the Roman camp at Mancunium to the experimental work of Dalton in elaborating the atomic theory. Among his best works, "Christ washing St. Peter's Feet" is in the Tate Gallery, London, "The Last of England," is at Birmingham, and the "Expulsion of the Danes from Manchester," and "Work," an original cartoon for a fresco, are in the Manchester Art gallery.

Brown died in London on Oct. 6, 1893. He was twice married —in 1841 to his cousin, Elizabeth Bromley, who died in 1846, leaving a daughter, Lucy, who became the wife of William M. Rossetti; and to Emma Hill, who served as model for many of his figures.

See a life of the artist written by his grandson, Ford M. Hueffer (afterwards Ford Madox Ford), *Ford Madox Brown* (1896). This volume contains some extracts from Brown's diary, extending in the whole from 1847 to 1865; and other lengthier extracts appear in two books ed by William M. Rossetti *Ruskin, Rossetti, Pre-Raphaelitism* (1899) and *Pre-Raphaelite Diaries and Letters* (1900). *See* also the *Preferences in Art*, etc, by Harry Quilter (1892), and a pamphlet, *Ford Madox Brown* (1901), by Helen Rossetti (Angeli).

BROWN, FRANCIS (1849–1916), American Semitic scholar, was born in Hanover (N.H.), Dec. 26, 1849, the son of Samuel Gilman Brown (1813–85), president of Hamilton College from 1867 to 1881, and the grandson of Francis Brown (1784-1820), a president of Dartmouth involved in the famous "Dartmouth College case" The younger Francis graduated from Dartmouth and from the Union Theological Seminary and then studied in Berlin. In 1879 he became instructor in biblical philology at the Union Theological Seminary, in 1881 an associate professor, in 1890 professor of Hebrew and cognate languages and in 1908 president of the seminary Brown's published works won him honorary degrees in both Great Britain and America; they were, with the exception of *The Christian Point of View* (1902; with Profs. A. C. McGiffert and G. W. Knox), almost purely linguistic and lexical, and include *Assyriology: its Use and Abuse in Old Testament Study* (1885), and the important revision of Gesenius, undertaken with S. R. Driver and C. A. Briggs, *A Hebrew and English Lexicon of the Old Testament* (1891–1905). In 1911 he was tried for heresy before the Presbyterian General Board but was exonerated He died in New York on Oct. 15, 1916.

BROWN, GEORGE (1818–1880), Canadian journalist and statesman, was born in Edinburgh, Scotland, on Nov. 29, 1818, and was educated in his native city. With his father, Peter Brown (d. 1863), he emigrated to New York in 1838; and in 1843 they removed to Toronto and began the publication of *The Banner*, a politico-religious paper in support of the newly formed Free Church of Scotland In 1844 he began, independently of his father, the issue of the Toronto *Globe*. This paper, at first weekly, became in 1853 a daily, and through the ability and energy of Brown came to possess an almost tyrannical influence over the political opinion of Ontario. In 1851 he entered the Canadian parliament as member for Kent county. Brown's repeated violent attacks upon the Roman Catholic Church and on the supposed domination in parliament of the French Canadian section made him very unpopular in lower Canada, but in upper Canada his power was great. Largely owing to his attacks, the clergy reserves were secularized in 1854. He championed the complete laicization of the schools in Ontario, but unsuccessfully, the Roman Catholic Church maintaining its right to separate schools. He also fought for the representation by population of the two provinces in parliament, the Act of Union (1841) having granted an equal number of representatives to each. This principle of "rep. by pop." was conceded by the British North America act (1867).

He was one of the earliest advocates of a federation of the British colonies in North America, and in 1864, to accomplish this end, entered into a coalition with his bitter personal and political opponent, Mr. (afterwards Sir) John A. Macdonald. Largely owing to Brown's efforts, Federation was carried through the House, but on Dec. 21 1865, he resigned from the Coalition government, though continuing to support its Federation policy, and in 1867 he was defeated in south Ontario and never again sat in the House. In great measure owing to his remarkable energy, the north-west territories were purchased by the new dominion. In Dec. 1873 he was called to the Canadian senate, and in 1874 was appointed by the imperial government joint plenipotentiary with Sir Edward Thornton to negotiate a reciprocity treaty between Canada and the United States. The negotiations were successful, but the draft treaty failed to pass the United States Senate. Soon afterwards Brown refused the lieutenant-governorship of Ontario, and on two subsequent occasions the offer of knighthood, devoting himself to the *Globe*. On March 25 1880, he was shot by a discharged employee and died on May 9.

See J. C. Dent, *Canadian Portrait Gallery* (Toronto, 1880). The official *Life*, by the Hon. Alexander Mackenzie, is decidedly partisan. A life by John Lewis is included in the *Makers of Canada* series (Toronto). (W. L. G.)

BROWN, HENRY KIRKE (1814–1886), American sculptor, was born in Leyden (Mass.) on Feb. 24, 1814. He began to paint portraits while a boy, studied painting in Boston under Chester Harding, learned a little about modelling, and in 1836–39 spent his summers working as a railroad engineer to earn enough to study further. He spent four years (1842–46) in Italy; but returning to New York he remained distinctively American, and was never dominated, as were so many of the early American sculptors, by Italian influence. He died on July 10, 1886, at Newburgh (N.Y.). His equestrian statues are excellent, notably that of Gen. Winfield Scott (1874) in Washington, D.C., and one of George Washington (1856) in Union square, New York city, which was the second equestrian statue made in the United States. Brown was one of the first in America to cast his own bronzes. Among his other works are: Abraham Lincoln (Union square, New York city); Nathanael Greene, George Clinton, Philip Kearny and Richard Stockton (all in the National Statuary hall of the Capitol, Washington, D.C.); De Witt Clinton and "The Angel of the Resurrection," both in Greenwood cemetery, New York city; and an "Aboriginal Hunter."

His nephew and pupil, Henry Kirke Bush-Brown (1857–1935), also became prominent among American sculptors, his "Buffalo Hunt," equestrian statues of Generals Meade and Reynolds at Gettysburg, and "Justinian" in the New York appellate courthouse, being his chief works. He completed also a portrait-bust of Henry Kirke Brown for the Hall of Fame of New York university.

BROWN, JACOB (1775–1828), American soldier, was born of Quaker ancestry, in Bucks county, Pa., on May 9, 1775. From 1796 to 1798 he was engaged in surveying public lands in Ohio; in 1798 he settled in New York city and during the period 1798–1800, when war with France seemed imminent, he acted as military secretary to Alexander Hamilton, then inspector general of the United States army. Subsequently he purchased a large tract of land in Jefferson county, N.Y., where he founded the town of Brownville. There he served as county judge, and attained the rank (1810) of brigadier general in the State militia. On the outbreak of the second war with Great Britain (1812) he was placed in command of the New York State frontier from Oswego to Lake St. Francis (near Cornwall, Ont.), and repelled the British attacks on Ogdensburg (Oct. 4, 1812) and Sacket Harbor (May 29, 1813). In July 1813, he was commissioned brigadier general in the regular army, and in Jan. 1814, he was promoted major general and succeeded Gen. James Wilkinson in command of the forces at Niagara. Early in the summer of 1814 he undertook offensive operations, and his forces occupied Ft. Erie, and, on July 5, at Chippawa, Ont., defeated the British under Gen. Phineas Riall. On July 25, with Gen. Winfield Scott, he fought a hotly contested, but indecisive, battle with the British under Gen. Gordon Drummond (1771–1854), at Lundy's Lane, where he was twice wounded. After the war he remained in the army, of which he was the commanding general from March, 1821, until his death at Washington, D.C., on Feb. 24, 1828.

BROWN, JOHN (1715–1766), British divine and author, was born at Rothbury, Northumberland, on Nov. 5, 1715, and was educated at St. John's college, Cambridge. He was senior wrangler in 1735, took holy orders, and was appointed minor canon and lecturer at Carlisle. His poem, entitled "Honour" (1743), was followed by the "Essay on Satire" which gained for him the friendship of William Warburton. In 1751 he wrote his *Essay on the Characteristics of Lord Shaftesbury*, containing an able defence of the utilitarian philosophy. In 1756 he received the living of Great Horkesley, in Essex. He was the author of two plays, *Barbarossa* (1754) and *Athelstane* (1756); Garrick played in both, and the first was a success. The most popular of his works was the *Estimate of the Manners and Principles of the Times* (1757–58), a bitter satire which pleased a public depressed by the ill-success in the conduct of the war. Other works are the *Additional Dialogue of the Dead between Pericles and Cosmo . . .* (1760), in vindication of Chatham's policy; and the *Dissertation on the Rise, Union and Power, etc., of Poetry and Music* (1763). Invited by Catherine II. of Russia to advise her on education, he prepared for the journey but relinquished the design on account of his gout.

Brown committed suicide on Sept. 23, 1766.

There is a detailed account of John Brown by Andrew Kippis in *Biographia Britannica* (1780). *See* also T. Davies, *Memoirs of . . . David Garrick* (1780), chap. xix.

BROWN, JOHN (1735–1788), Scottish physician, was born in 1735 at Lintlaws or at Preston, Berwickshire. As a student at Edinburgh he soon attracted the notice of William Cullen. In time, however, he quarrelled with Cullen, as with the professors of the university in general, and from about 1778 his public lectures contained vigorous attacks on all preceding systems of medicine and Cullen's in particular. In his *Elementa Medicinae* (1780), he expounds his own, or as it was then called the Brunonian, theory of medicine.

In 1786 Brown settled in London, and died there on Oct. 17, 1788.

See F. H. Garrison, *History of Medicine*, pp. 314–315 (1929).

BROWN, JOHN (1784–1858), Scottish divine, was born at Whitburn, Linlithgow, on July 12 1784, and died at Edinburgh on Oct. 13 1858. He belonged to the "Burgher" section of the "Secession" church, and held successively pastorates at Biggar, Lanarkshire (1806), Rose street (1822) and Broughton place, Edinburgh (1829). His most important work was done as professor in the theological hall of the Secession church, where he taught the exegetical method of the exposition of Scripture.

The part he took in the discussion on the atonement, which agitated all the Scottish churches, led to a formal charge of heresy against him by those who held the doctrine of a limited atonement In 1845, after a protracted trial, he was acquitted by the synod. From that time he enjoyed the thorough confidence of his denomination (after 1847 merged in "the United Presbyterian Church").

See *Memoir of John Brown, D.D.*, by John Cairns (1860).

BROWN, JOHN (1800–1859), American abolitionist, leader of the famous attack upon Harper's Ferry, in 1859, was born on May 9, 1800, at Torrington, Connecticut. He is said to have been descended from Peter Brown, who went to America in the *Mayflower*, and he was the grandson of Capt. John Brown, who served in the War of Independence. He was taken by his father, Owen Brown, to Hudson, O., in 1805. At the age of 18 he began to prepare himself for the Congregational ministry, but soon changed his mind and turned his attention to land surveying. He engaged successively in the tanning business, in sheep-raising, and in the wool trade, but met with small reward and in 1842, at Akron, O., became bankrupt. In 1849, after having lived in Ohio, Pennsylvania and Massachusetts, he removed to North Elba, N.Y., where he engaged in farming on part of the land which was being given in small tracts, by its owner, Gerrit Smith, to negro settlers. Long before this he had conceived a strong hatred for the institution of slavery, and had determined to do what he could to bring about its destruction.

In 1854 five of his sons removed to Kansas, where the violent conflict was beginning between the "free-state" and the pro-slavery settlers, and in the following year Brown, leaving the rest of his family at North Elba, joined them, settling near Osawatomie and immediately becoming a conspicuous figure in the border warfare. His name became particularly well known in connection with the so-called "Pottawatomie massacre," the killing in cold blood, on May 25, 1856, by men under his orders, of five pro-slavery settlers in retaliation for the murder a short time previously of five "free-state" settlers. He also, on June 2, at the head of about 30 men, captured Capt. H. C. Pate and 22 pro-slavery men at Black Jack, and on Aug. 30, 1856, with a small body of supporters, vigorously resisted an attack of a superior pro-slavery force upon Osawatomie. Brown then visited the Eastern States for the purpose of raising money to be used in the Kansas struggle and of arousing the people against slavery. After spending a short time in Kansas, in 1858–59 he proceeded to carry out a long-cherished scheme for facilitating the escape of fugitive slaves by establishing in the mountains of Virginia a stronghold in which such fugitives could take refuge and defend themselves against their pursuers. At Chatham, Canada, with 11 white and 35 negro associates, he adopted a "Provisional constitution and ordinance for the people of the United States." Brown was elected commander-in-chief, and from among this group a secretary of state, a secretary of war, a secretary of the treasury, and members of Congress were chosen.

Later, with only 22 men supplied with arms furnished by the Massachusetts-Kansas committee, and with funds contributed (in ignorance of Brown's plans) by his intimate associates, Theodore Parker, George L. Stearns, T. W. Higginson, and F. B. Sanborn, all of Boston, and Gerrit Smith, of Peterboro, N.Y., he removed to a farm near Harper's Ferry, the site of a Federal arsenal, which he intended to capture as a preliminary to the carrying out of the main part of his plan. On the night of Oct. 16, 1859, with only 18 men, five of whom were negroes, he made the attack, easily capturing the arsenal and taking about 60 of the leading citizens prisoners to be used as hostages. On the following morning Brown and his followers were vigorously attacked, and on the 18th—a small force of United States marines under Colonel Robert E. Lee having arrived—were overpowered, Brown being seriously wounded after he had surrendered. Of the 22 men who had participated in the raid, 10 were killed, seven were taken prisoners, and five escaped. On the other side five were killed and nine wounded. Brown was committed to the Charlestown, Va. (now W.Va.), gaol on Oct. 19; on the 27th his trial began; on the 31st he was convicted of "treason, and conspiring and advising with slaves and other rebels, and murder in the first degree"; and on Dec. 2. he was hanged at Charlestown. His fellow-prisoners were likewise hanged soon afterwards. Brown was buried at North Elba, New York. The attack upon Harper's Ferry created widespread excitement, particularly in the Southern States; and among the abolitionists in the North Brown was looked upon as a martyr to their cause. Shortly after his death a famous popular song became widely current in the North beginning:

> John Brown's body lies a-mouldering in the grave,
> But his soul goes marching on.

Intensely religious in his nature, Brown possessed something of the gloomy fanaticism of his Puritan ancestors. The secret of his whole career lies in his emphatic conviction, to use the words of Wendell Phillips, that he had "letters of marque from God"; that he had a Divine commission to destroy slavery by violent means. He scouted the "milk and water principles" of the milder abolitionists, advocated vigorous resistance to the slave power, and expressed his ideas by actions rather than by words. It now seems that this policy aided very little in making Kansas a free State, and that the attack on Harper's Ferry, while creating much feeling at the moment, had very little effect on the subsequent course of events.

Brown was twice married and was the father of 20 children, eight of whom died in early childhood. His sons aided him in all his undertakings, two of them being killed at Harper's Ferry.

See life (new ed. 1929) by O. G. Villard; F. B. Sanborn's *Life and Letters of John Brown* (Boston, 1885); R. J. Hinton's *John Brown and His Men* (1894); James Redpath's *Public Life of Captain John Brown* (Boston, 1860); Von Holst's essay, *John Brown* (Boston, 1889); and J. F. Rhodes, *History of the United States from the Compromise of 1850* (1890–1906); R. P. Warren, *John Brown* (1929).

BROWN, JOHN (1810–1882), Scottish physician and author, son of John Brown (1784–1858), was born at Biggar, Scotland, on Sept. 22, 1810. The two volumes of his essays, *Horae Subsecivae* (*i.e.*, "leisure hours") (1858, 1861), *John Leech and* *other Papers* (1882), *Rab and His Friends* (1859), and *Marjorie Fleming: a Sketch* (1863), were enormously popular in their day. The first volume of *Horae Subsecivae* deals chiefly with the equipment and duties of a physician, the second with subjects outside his profession He died on May 11, 1882.

See E. T. McLaren, *Dr. John Brown and his Sister Isabella* (4th ed., 1890); and *Letters of Dr. John Brown*, edited by his son and D. W. Forrest, with biography by E. T. McLaren (1907).

BROWN, SIR JOHN (1816–1896), English armour-plate manufacturer, was born at Sheffield on Dec. 6 1816, the son of a slater. He was apprenticed to a Sheffield firm who manufactured files and table cutlery. Brown invented in 1848 the conical steel spring buffer for railway wagons, and in 1860, after seeing the French ship "La Gloire" armoured with hammered plate, he determined to attempt the production of armour for the British Navy by a rolling process. The experiment was successful, and led to admiralty orders for armour plate sufficient to protect about three-quarters of the navy. In 1856 Brown had started the Atlas works in Sheffield, which covered 30 acres and employed eventually more than 4,000 workmen. Besides supplying iron to the Sheffield steel trade, Brown himself successfully developed the Bessemer process. He died at Bromley, Kent, on Dec. 27, 1896.

BROWN, JOHN GEORGE (1831–1913), American painter, was born in Durham, England, Nov. 11, 1831. He studied at Newcastle-on-Tyne, at Edinburgh academy, and after removing to New York city in 1853, at the schools of the National Academy of Design, of which he afterwards became a member. In 1866 he became one of the charter members of the Water-Colour Society, of which he was president from 1887 to 1904. He generally confined himself to representations of street child life, bootblacks, newsboys, etc.; his "Passing Show" (Paris Salon, 1877) and "Street Boys at Play" (Paris Exhibition, 1900) are good examples of his popular talent. He died in New York city, Feb. 8, 1913.

BROWN, ROBERT (1773–1858), British botanist, was born on Dec. 21 1773 at Montrose, and was educated at the grammar school of his native town, where he had as contemporaries Joseph Hume and James Mill. In 1787 he entered Marischal college, Aberdeen, but two years afterwards removed to Edinburgh university. In the year 1801 he was offered the post of naturalist to the expedition fitted out under Capt. Matthew Flinders for the survey of the then almost unknown coasts of Australia. In 1805 the expedition returned to England, having obtained, among other acquisitions, nearly 4,000 species of plants, many of which were new. Brown was almost immediately appointed librarian of the Linnean society (1805–22). In 1810 he published the first volume of his great work, in Latin, the *Prodromus Florae Novae Hollandiae et Insulae Van Diemen*, which did much to further the general adoption of A. L. de Jussieu's natural system of plant classification. With the exception of a supplement published in 1830, no more of the work appeared. In 1810 Brown became librarian to Sir Joseph Banks, who on his death in 1820 bequeathed to him the use and enjoyment of his library and collections for life. In 1827 an arrangement was made by which these were transferred to the British Museum, with Brown's consent and in accordance with Sir Joseph's will. Brown then became keeper of this new botanical department, an office which he held until his death on June 10, 1858, in London.

In 1825–34 his works up to that date were collected and published in four divisions by Nees von Esenbeck, in German, under the title of *Vermischte botanische Schriften*. In 1866 the Ray society reprinted his complete writings, the *Prodromus* alone excepted. *See* F. W. Oliver, *Makers of British Botany* (1913).

BROWN, SAMUEL MORISON (1817–1856), Scottish chemist, poet and essayist, born at Haddington on Feb. 23, 1817, studied at Edinburgh, Berlin and St. Petersburg. In 1850 he published a tragedy, *Galileo Galilei*, and two volumes of his *Lectures on the Atomic Theory and Essays Scientific and Literary* appeared in 1858, with a preface by his kinsman Dr. John Brown, the author of *Horae Subsecivae*. He died at Edinburgh on Sept. 20, 1856.

BROWN, THOMAS (1663–1704), English satirist, of "facetious memory" as Addison designates him, was born at Shifnal, in Shropshire, and was entered, in 1678, at Christ Church, Oxford, where he is said to have escaped expulsion by the famous lines beginning, "I do not love thee, Dr. Fell." He was for three years schoolmaster at Kingston-on-Thames, and afterwards settled in London. Under the pseudonym of Dudley Tomkinson he wrote a satire on Dryden, *The Reasons of Mr. Bays changing his Religion: considered in a Dialogue between Crites, Eugenius and Mr. Bays*, with two other parts having separate titles (1688–90, republished with additions in 1691). He was the author of a great variety of poems, letters, dialogues and lampoons. He died June 16, 1704.

His collected works were published in 1707–08. The second volume contains a collection of *Letters from the Dead to the Living*, some of which are translated from the French. His *Comical Romance done into English* (1772, the *Roman Comique* of Scarron) was reprinted in 1892.

BROWN, THOMAS (1778–1820), Scottish philosopher, was born at Kirkmabreck and educated in London and afterwards at Edinburgh university, where he attended Dugald Stewart's moral philosophy class. Later he turned to law, but in 1798 he settled on a medical course and in the same year produced his criticism of Darwin's *Zoonomia*. In the second number of the *Edinburgh Review*, to which he now began to contribute, appeared his criticism of the Kantian philosophy, based entirely on Villier's French account. His philosophical ability was further exhibited on the occasion of the clerical opposition to the appointment of Sir John Leslie, a follower of Hume, to the mathematical professorship (1805), for Brown undertook to defend Hume's doctrine of causality as in no way inimical to religion. His defence became in its third edition a lengthy treatise entitled *Inquiry into the Relation of Cause and Effect*. In 1806 he became a medical practitioner in partnership with James Gregory, but, though successful in his profession, preferred literature and philosophy. After twice losing a professorship in the university, he was invited, during an illness of Dugald Stewart in the session of 1808–09, to act as his substitute, and during the following session he undertook a great part of Stewart's work, being appointed in 1810 as colleague to Stewart, a position which he held for the rest of his life.

His friend and biographer, David Welsh, superintended the publication of his text-book, the *Physiology of the Human Mind*, and his successors, John Stewart and the Rev. E. Milroy, published his *Lectures on the Philosophy of the Human Mind*. The latter reached its 19th edition. Among Brown's many poems, which are modelled on Pope and Akenside and rather commonplace, may be mentioned: *Paradise of Coquettes* (1814); *Wanderer in Norway* (1815); *Warfiend* (1816); *Bower of Spring* (1817); *Agnes* (1818); *Emily* (1819); a collected edition appeared in 1820.

Brown's philosophy occupies an intermediate place between the earlier Scottish school and the later analytical or associational psychology. He retains a certain number of intuitive beliefs, which enables him to claim that our acknowledgment of cause and effect is not derived from experience and that mind and matter are sharply distinguished. On the other hand, he approaches sensationalism in his assertions that in perception we look immediately on a sensation in the mind and only reach externals by a process of inference, and that will is merely a prevailing desire. Brown's most valuable contributions include his excellent analysis of sensation, especially of touch, his eloquent exposition of the emotions, and his account of the succession of mental states.

For a severe criticism of Brown's philosophy, *see* Sir W. Hamilton's *Discussions* and *Lectures on Metaphysics*; and for a high estimate of his merits, *see* J. S. Mill's *Examination of Hamilton*. *See* also D. Welsh's *Account of the Life and Writings, etc.* (1825); M'Cosh's *Scottish Philosophy*, pp. 317–337.

BROWN, THOMAS EDWARD (1830–1897), British poet, scholar and divine, was born on May 5, 1830, at Douglas, Isle of Man. His father, the Rev. Robert Brown, held the living of St. Matthew's—a homely church in a poor district. His mother came of Scottish parentage, though born in the island. Thomas, the sixth of ten children, was but two years old when the family removed to Kirk Braddan vicarage, a short distance from Douglas, where his father (a scholar of no university, but so fastidious about composition that he would have some sentences of an English classic read to him before answering an invitation), took share with the parish-schoolmaster in tutoring the clever boy until, at the age of 15, he was entered at King William's college. Here his abilities soon declared themselves, and hence he proceeded to Christ Church, Oxford, where his position (as a servitor) cost him much humiliation, which he remembered to the end of his life. He won a double first, however, and was elected a fellow of Oriel in April 1854, Dean Gaisford having refused to promote him to a senior studentship of his own college, on the ground that no servitor had ever before attained to that honour. Although at that time an Oriel fellowship conferred a deserved distinction, Brown never took kindly to Oxford life, and, after a few terms of private pupils, returned to the Isle of Man as vice-principal of his old school. He had been ordained deacon, but did not proceed to priest's orders for many years. In 1857 he married his cousin, Miss Stowell, daughter of Dr. Stowell of Ramsey, and shortly afterwards became headmaster of the Crypt school, Gloucester—a position which in no long time he found intolerable. From Gloucester he was summoned by the Rev. John Percival (afterwards bishop of Hereford), who had recently been appointed to the struggling young foundation of Clifton college, which he soon raised to be one of the great public schools. Percival wanted a master for the modern side, and made an appointment to meet Brown at Oxford; "and there," he writes, "as chance would have it, I met him standing at the corner of St. Mary's Entry, in a somewhat Johnsonian attitude, four-square, his hands deep in his pockets to keep himself still, and looking decidedly volcanic. We very soon came to terms, and I left him there under promise to come to Clifton as my colleague at the beginning of the following term." At Clifton Brown remained from Sept. 1863 to July 1892, when he retired—to the great regret of boys and masters alike, who had long since come to regard "T.E.B.'s" genius, and even his eccentricities, with a peculiar pride—to spend the rest of his days upon the island he had worshipped from childhood, and often celebrated in song. His poem "Betsy Lee" appeared in *Macmillan's Magazine* (April and May 1873), and was published separately in the same year. It was included in *Fo'c's'le Yarns* (1881), which reached a second edition in 1889. This volume included at least three other notable poems "Tommy Big-eyes," "Christmas Rose," and "Captain Tom and Captain Hugh." It was followed by *The Doctor and other Poems* (1887), *The Manx Witch and other Poems* (1889), and *Old John and other Poems*—a volume mainly lyrical (1893). After his death all these and a few additional lyrics and fragments were published in one volume by Messrs. Macmillan under the title of *The Collected Poems of T. E. Brown* (1900). His familiar letters (edited in two volumes by an old friend, S. T. Irwin, in 1900) bear witness to the zest he carried back to his native country, although his thoughts often reverted to Clifton, where he died suddenly while on a visit. Brown's more important poems are narrative, and written in the Manx dialect, with a free use of pauses, and sometimes with daring irregularity of rhythm. A rugged tenderness is their most characteristic note; but the emotion, while almost equally explosive in mirth and in tears, remains an educated emotion, disciplined by a scholar's sense of language. They breathe the fervour of an island patriotism (humorously aware of its limits) and of a simple natural piety. In his lyrics he is happiest when yoking one or the other of these emotions to serve a philosophy of life, often audacious, but always genial. (A. T. Q.-C.)

BROWN, SIR WILLIAM, Bart. (1784–1864), British merchant and banker, founder of the banking-house of Brown, Shipley & Co., was born at Ballymena, Ireland, on May 30, 1784, the son of an Irish linen-merchant. At the age of sixteen he accompanied his father and brothers to Baltimore, Maryland, U.S.A., but in 1809 left America for Liverpool. Here he established a branch of the firm, which had now begun to deal largely in raw cotton as well as linen and soon afterwards developed into one of general merchants and finally bankers. The great financial crisis of 1837 seriously threatened the ruin of the firm, but the Bank of England agreed to advance him £2,000,000 to tide matters over. Brown found it necessary to apply for only £1,000,000, which he repaid within the next six months. His business, both mercantile and banking, continued to increase, and in 1844 he was in possession of a sixth of the trade between Great Britain and the United States. In 1856 the friction between the British and American governments due to the enlistment by British consuls of recruits for the Crimean War was largely allayed by the action of Brown, who in an interview with Lord Palmerston, then prime minister, explained the objections taken in America. From 1846 to 1850 he was Liberal M.P. for South Lancashire. In 1860 he presented Liverpool with a public library and museum, and in 1863 was made a baronet. He died at Liverpool in 1864.

See H. A. Fox Bourne's *English Merchants* (1886) and *Ceremonies connected with the opening of the free Public Library presented by William Brown to the Town of Liverpool* (Liverpool, 1861).

BROWN, WILLIAM HARVEY (1862–1913), American zoologist and Rhodesian pioneer, was born at Des Moines, Iowa, on Aug. 22, 1862. Following his graduation at the University of Kansas in 1887 he became a member of the zoological staff of the Smithsonian Institution at Washington and pursued further studies at Cornell and Georgetown universities. In 1889 he was naturalist on a U.S. Government eclipse expedition to the Congo region. At Cape Town in the same year he joined, as representative of the Smithsonian Institution, the original pioneer column sent by Cecil Rhodes to the region north of the Transvaal, later known as Rhodesia. After devoting four years to exploration and zoological collecting he resigned his scientific post and became a citizen of the new colony, in the early development of which he was an active figure. In the Mashona uprising of 1896 he joined the colonial forces and was severely wounded. He developed agricultural and mining properties and later served as mayor of Salisbury and as member of the legislative council. In 1899 he published *On the South African Frontier*, which contains valuable information on the early history of Rhodesia. His extensive zoological and ethnological collections are best represented in the museum at Cape Town, the National museum at Washington, the Carnegie museum at Pittsburgh, the museum of the University of Kansas and that of the New York Zoological society. He died at Salisbury on April 24, 1913.

BROWN BESS, a name given in the British army to the flint-lock musket with which the infantry were formerly armed. The term is applied generally to the weapon of the 18th and early 19th centuries, and became obsolete on the introduction of the rifle. The first part of the name derives from the colour of the wooden stock, for the name is found much earlier than the introduction of "browning" the barrel of muskets; "Bess" may be either a humorous feminine equivalent of the "brown-bill," the old weapon of the British infantry, or a corruption of the "buss," *i.e.*, box, in "blunderbuss."

BROWNE, SIR BENJAMIN CHAPMAN (1839–1917), British engineer, was born at Stout's Hill, Glos., on Aug. 26, 1839 and was apprenticed to the Elswick works near Newcastle-on-Tyne. He became an expert on harbour work and carried out harbour works at Tynemouth, Falmouth and in the Isle of Wight. In 1870 he took over the locomotive works of R. and W. Hawthorn at Forth Banks; which in 1886 he combined with those of Andrew Leslie and Co., and until 1916 was chairman of the combination. He was knighted in 1887. He died at Westacre, Newcastle-on-Tyne, on March 1, 1917.

BROWNE, CHARLES FARRAR: *see* Ward, Artemus.

BROWNE, EDWARD GRANVILLE (1862–1926), British orientalist, was born at Uley, Gloucestershire. Educated at Trinity college, Glenalmond, and then at Eton and Pembroke college, Cambridge, he studied medicine and oriental languages. In 1887 he was elected a fellow of his college, in the same year qualifying M.B. at St. Bartholomew's hospital, London, but he never practised as a doctor. In 1887–88 he travelled in Persia, becoming afterwards lecturer in Persian at Cambridge. In 1902 he was appointed Adams Professor of Arabic at Cambridge, a post he held until his death. Browne's published works include *A Traveller's Narrative* (1891), re-issued in 1926 under the title *A Year amongst the Persians; Literary History of Persia until the time of Firdawsi* (1902), continuations of which were published in 1906, 1920 and 1924; *The Persian Revolution, 1905–9* (1910); a translation of *Chahár Māgála;* with notes (1921); and *Arabian Medicine* (1921).

BROWNE, EDWARD HAROLD (1811–1891), was born at Aylesbury, and educated at Eton and Cambridge. He was Norrisian professor of divinity at Cambridge (1854), bishop of Ely (1864), bishop of Winchester (1873). His best-known book is his *Exposition of the Thirty-Nine Articles* (vol. i. 1850, vol. ii. 1854), long a standard authority.

BROWNE, HABLÔT KNIGHT (1815–1882), English artist, famous as "Phiz," was born at Lambeth in humble circumstances and was early apprenticed to the eminent engraver Finden, in whose studio his only artistic education was obtained. At the age of 19 he abandoned engraving in favour of other artistic work, and a meeting with Dickens two years later determined the form which this should take. Robert Seymour, the original illustrator of *Pickwick*, had just committed suicide, and the serial publication of the book was in danger from the lack of a capable successor. Browne applied for the post, and the drawings which he submitted were preferred by Dickens to those of a rival applicant—W. M. Thackeray. His pseudonym of "Phiz" was adopted in order to harmonize with Dickens's "Boz," and it was by his work for Dickens (especially in *Pickwick, David Copperfield, Dombey and Son, Martin Chuzzlewit* and *Bleak House*) that his reputation was made. He also illustrated the best-known novels of Lever and Harrison Ainsworth in their original editions, and his work was in constant demand by publishers until a stroke of paralysis, in 1867, permanently injured his powers. His early ambition to become famous as a painter was not realized, but he gained great popularity and was awarded an annuity by the Royal Academy in 1878.

BIBLIOGRAPHY.—*See* John Forster, *Life of Charles Dickens* (1871–74); F. G. Kitton, *"Phiz": A Memoir* (1882); D. Croal Thomson, *Hablôt Knight Browne, Phiz: Life and Letters* (1884); M. H. Spielmann, *The History of Punch* (1895); *Charles Dickens and His Illustrators* (1890).

BROWNE, ISAAC HAWKINS (1705–1760), English poet, was born on Jan. 21, 1705, at Burton-on-Trent, of which place his father was vicar, and died in London on Feb. 14, 1760. He was educated at Lichfield, at Westminster school, and at Trinity college, Cambridge. He was called to the bar, but never practised. He was the author of "Design and Beauty," a poem addressed to his friend Joseph Highmore, the painter; and of "The Pipe of Tobacco" which parodied Cibber, Ambrose, Philips, Thomson, Young, Pope and Swift, who were then all living. In 1754 he published his chief work, *De Animi Immortalitate*, a Latin poem much admired by the scholars of his time. Johnson calls him "one of the first wits of this country."

Two editions of his *Poems on Various Subjects, Latin and English*, were published in 1767 by his son Isaac Hawkins Browne (1745–1818), the author of two vols. of essays on religion and morals. A full account by Andrew Kippis in *Biographia Britannica* (1780) includes large extracts from his poems.

BROWNE, JAMES (1793–1841), Scottish man of letters, was born at Whitefield, Perthshire, and educated at Edinburgh and at the University of St. Andrews. He wrote a "Sketch of the History of Edinburgh," for Ewbank's *Picturesque Views* of that city, 1823–25. His works include a *Critical Examination of Macculloch's Work on the Highlands and Islands of Scotland* (1826); *Aperçu sur les Hiéroglyphes d'Égypte* (1827); and *History of the Highlands and Highland Clans* (1834–36). In 1829 he became sub-editor of the seventh edition of the *Encyclopædia Britannica*, to which he contributed many articles.

BROWNE, SIR JAMES (1839–1896), Anglo-Indian engineer and administrator, was the son of Robert Browne of Falkirk in Scotland. He was educated at the military college, Addiscombe, and received a commission in the Bengal Engineers in 1857. He served in the expedition against the Mahsud Waziris (1860), in the Umbeyla campaign (1863), in the Afghan War (1878–79) as political officer and in the Egyptian campaign (1882). In 1884 he was appointed engineer in chief of the Sind-Pishin railway. In 1888 he was made a K.C.S.I. and in 1889 quartermaster-general for India. In 1892 he was appointed agent to the governor-general in Baluchistan, in succession to Sir Robert Sandeman, his intimate experience of the Baluchis, gained during his railway work, having specially fitted him for this post. He died suddenly June 13, 1896.

See General McLeod Innes, *The Life and Times of Sir James Browne* (1905).

BROWNE, MAXIMILIAN ULYSSES, COUNT VON, BARON DE CAMUS AND MOUNTANY (1705–1757), Austrian field marshal, was born at Basle on Oct. 23, 1705. His father (Ulysses Freiherr v. Browne, d. 1731) was an Irish exile of 1690, who entered the imperial service and in 1716 was made a count of the Empire (*Reichsgraf*) by Charles VI. He was a lieutenant field marshal in command of the Silesian garrisons when in 1740 Frederick II. overran the province. His careful employment of such resources as he possessed materially hindered the king in his conquest and gave time for Austria to collect a field army (*see* AUSTRIAN SUCCESSION, WAR OF THE); he was wounded at the battle of Mollwitz. Browne took part in the Italian campaigns of 1746–49 and became commander-in-chief in Bohemia in 1751, and field marshal two years later. He was still in Bohemia when the Seven Years' War opened with Frederick's invasion of Saxony (1756). Browne's army, advancing to the relief of Pirna (*see* SEVEN YEARS' WAR), was met, and, after a hard struggle, defeated by the king at Lobositz (Oct. 1), but he drew off in excellent order, and soon made another attempt with a picked force to reach Pirna, by wild mountain tracks. He actually reached the Elbe at Schandau, but as the Saxons were unable to break out Browne retired, having succeeded, however, in delaying the development of Frederick's operations for a whole campaign. In the campaign of 1757 he voluntarily served under Prince Charles of Lorraine who was made commander-in-chief, and while leading a bayonet charge at the battle of Prague was wounded. He died on June 26, his last days embittered by the knowledge that he was unjustly held responsible for the failure of the campaign.

See *Zuverlässige Lebensbeschreibung U.M. Reichsgrafen*, v. B. K.-K. Gen.-Feldmarschall (Frankfurt and Leipzig, 1757); Baron O'Cahill, *Gesch. der grössten Herrführer* (Rastadt, 1785, v. ii. pp. 264–316).

BROWNE, PETER (1665?–1735), Irish divine, was bishop of Cork and Ross from 1710 until his death in 1735. His two most important works are the *Procedure, Extent, and Limits of the Human Understanding* (1728), a critique of Locke's essay, and *Things Divine and Supernatural conceived by Analogy with Things Natural and Human*, more briefly referred to as the *Divine Analogy* (1733). The doctrine of analogy was intended as a reply to the deistical conclusions that had been drawn from Locke's theory of knowledge.

BROWNE, ROBERT (1550–1633), a leader among the early Separatist Puritans (hence sometimes called Brownists), was born at Tolethorpe, near Stamford, and educated at Corpus Christi college, Cambridge. He went to Norwich, where he gathered a numerous congregation, the members of which became associated in a religious "covenant," to the refusing of "all ungodlie communion with wicked persons." He seems also to have preached in various parts of Norfolk and Suffolk, especially at Bury St. Edmunds, and denounced the episcopal form of government. Dr. Freake, bishop of Norwich, caused him to be imprisoned early in 1581, but he was released through the influence of his remote kinsman, the Lord Treasurer Burghley. After two more periods in prison he migrated, in 1582, with his whole company to Middelburg in Zealand, but his community broke up within two years owing to internal dissensions.

Browne issued at Middelburg in 1582 two important works, *A Treatise of Reformation without Tarying for Anie*, in which he asserts the inalienable right of the Church to effect reforms without the authorization of the civil magistrate; and *A Booke which sheweth the life and manners of all True Christians*, in which he enunciates the theory of Congregational independency (*see* CONGREGATIONALISM). In Jan. 1584 (probably after writing *A True and Short Declaration*, the main source of our knowledge of his life hitherto) Browne and some of his company went to Edinburgh. He remained some months in Scotland and then returned to Stamford where he seems to have spent most of the next two years, his residence being broken by visits to London and probably to the Continent (early in 1585), and by at least one imprisonment (summer, 1585). On Oct. 7, 1585, he was induced to make a qualified submission to the established order; and after further submission he was appointed, Nov. 1586, to the mastership of Stamford grammar school. His *A Reproofe of certaine schismatical persons and their doctrine touching the hearing and preaching of the word of God* (1587–88), which has recently been recovered, sheds a flood of light upon his later views.

In Sept. 1591 Browne accepted episcopal ordination and the rectory of Achurch-cum-Thorpe Waterville, in Northamptonshire. There he ministered for 42 years, with one lengthy interval, 1617–26, which is only partly accounted for. When over 80 years old he had a dispute with the parish constable about a rate, blows were struck, and before a magistrate he behaved so stubbornly that he was sent to Northampton gaol, where he died. Browne first formulated the ideal which subsequently became known as Congregationalism (*q.v.*). He held that every congregation, however small, constituted by common faith and the resolve to live according to God's word, was a complete church in itself; and that no secular government had any right to lay down rules for a State Church, or force conformity on them.

See H. M. Dexter, *The Congregationalism of the Last Three Hundred Years* (1880); C. Burrage, *The True Story of Robert Browne* (1906); *Congregational Historical Society's Transactions, passim* (1901–06).

BROWNE, SIR THOMAS (1605–82), English author and physician, was born in London. He was admitted as a scholar of Winchester college in 1616, and matriculated at Broadgates hall (Pembroke college), Oxford, in 1623, where he graduated B.A. in Jan. 1626. He took the further degree of M.A. in 1629, studied medicine, and practised for some time in Oxfordshire. Between 1630 and 1633 he left England, travelled in Ireland, France and Italy, and on his way home received the degree of M.D. at the University of Leyden. He returned to London in 1634, and, after a short residence at Shipden hall, near Halifax, settled in practice at Norwich in 1637. In 1642 a copy of *Religio Medici*, which he describes as "a private exercise directed to myself," was printed from one of his mss. without his knowledge, and reviewed by Sir Kenelm Digby in *Observations . . .* (1643). The interest aroused by this edition compelled Browne to put forth a correct version (1643) of the work, in which letters between Digby and Browne were included. The book was probably written as early as 1635, for he describes himself as still under 30. In 1646 he published *Pseudodoxia Epidemica; Enquiries into very many commonly received Tenents and commonly presumed Truths* (1646), and in 1658 *Hydriotaphia, Urne-Buriall; or, a discourse of the sepulchrall urnes lately found in Norfolk. Together with the Garden of Cyrus, or the quincunciall, lozenge, or net-work plantations of the ancients, artificially, naturally, and mystically considered. With Sundry observations* (1658). Several tracts, notably *Christian Morals* meant as a continuation of *Religio Medici*, were prepared for publication and appeared posthumously. In 1671 he received the honour of knighthood from Charles II. on his visit to Norwich. He began a correspondence with John Evelyn in 1658. Very few of the letters are extant, but the diarist has left an account of a visit to Browne (*Diary*, Oct. 17, 1671). He died in 1682 on his 77th birthday, and was buried at St. Peter's, Mancroft, Norwich.

The *Religio Medici* was a puzzle to his contemporaries, and it is still hard to reconcile its contradictions. A Latin translation appeared at Leyden in 1644, and it was widely read on the Continent, being translated subsequently into Dutch, French and German. In Rome the book was placed on the *Index Expurgatorius*. It is the confession of a mind keen and sceptical in some aspects, and credulous in others. Browne professes to be absolutely free from heretical opinions, but asserts the right to be guided by his own reason in cases where no precise guidance is given either by Scripture or by church teaching. The *Pseudodoxia Epidemica*, written in a direct and simple style, is a wonderful storehouse of out-of-the-way facts and scraps of erudition. That he himself was by no means free from superstition is proved by the fact that the condemnation of two unfortunate women, Amy Duny and Rose Cullender, for witchcraft at Norwich in 1664 was aided by his professional evidence. The *Garden of Cyrus* is a continued illustration of one quaint conceit. The whole universe is ransacked for examples of the *Quincunx*, and he discovers, as Coleridge says, "Quincunxes in heaven above, quincunxes in earth below, quincunxes in the mind of man, quincunxes in tones, in optic nerves, in roots of trees, in leaves, in everything!" But the whole strength of his genius and the wonderful charm of his style are to be sought in the *Urne-buriall*, the concluding chapter of which, for richness of imagery and majestic pomp of diction, can hardly be paralleled in the English language.

Bibliography.—In 1684 appeared a collection of *Certain Miscellany Tracts* (ed. Tenison), and in 1712 *Posthumous Works of the learned Sir Thomas Browne.* The first collected ed. of Browne's works appeared in 1686. Sir Thomas Browne's *Works, including his Life and Correspondence,* were carefully edited by Simon Wilkin in 1835–36. Among modern editions the most important are that for the English Library series, ed. by Charles Sayle (1904 *seq.*), and that by Geoffrey Keynes (6 vols. 1928 *seq.*). Browne's interest in bird-lore is noted by Evelyn, and some *Notes and Letters on the Natural History of Norfolk* were edited by T. Southwell (1902). G. L. Keynes prepared a *Bibliography of Sir Thomas Browne,* with portraits (1924); *see* also E. Gosse, *Life of Sir Thomas Browne* (1905), and R. Sencourt, *Outflying Philosophy . . . a literary study of the religious element in the works of Sir Thomas Browne* (1925).

BROWNE, WILLIAM (1591–1643), English pastoral poet, was born at Tavistock, Devonshire. He is said to have proceeded to Oxford *c.* 1603. He entered the Inner Temple in 1611. His elegy on the death of Henry, prince of Wales, and the first book of *Britannia's Pastorals* appeared in 1613; the *Shepherd's Pipe*, which contained some eclogues by other poets, in 1614; and the second book of the pastorals in 1616. The times were unfavourable to his tranquil talent, and he retired to private life.

Browne's Arcadia is localized in his native Devonshire. He was untiring in his praises of "Tavy's voiceful stream (to whom I owe more strains than from my pipe can ever flow)." He knew local history and traditions, and he celebrates the gallant sailors who "by their power made the Devonian shore Mock the proud Tagus" (*Brit. Past.* bk. ii., song 3). It is for his truthful, affectionate pictures of his country life and its surroundings that the stories of Marina and Celandine, Doridon and the rest are still read. A copy of Browne's pastorals with annotations in Milton's handwriting is preserved in the Huth library, and there are many points of likeness between Lycidas and the elegy on Philarete (Thomas Manwood) in the fourth eclogue of the *Shepherd's Pipe.* Keats also was a student of Browne.

The first two books of *Britannia's Pastorals* were re-issued in 1625. The third, though it had no doubt circulated in the author's lifetime, was edited from a ms. for the Percy Society by T. C. Croker in 1852. A collected edition of Browne's works was published in 1772 by John Davies. Some sonnets to Caelia, epistles, elegies and epitaphs, with miscellaneous poems, were printed for the first time by Sir S. E. Brydges in 1815; excellent modern complete editions of Browne include W. C. Hazlitt's (1868–69) for the Roxburghe library, and a more compact one (1894) by Mr. Gordon Goodwin, with an introduction by Mr. A. H. Bullen, for the "Muses' Library." For an elaborate analysis of Browne's obligations to earlier pastoral writers *see* F. W. Moorman, "William Browne," *Quellen und Forschungen zur Sprach- und Kulturgeschichte der Germanischen Völker* (Strassburg, 1897).

BROWNE, WILLIAM GEORGE (1768–1813), English traveller, was born at Great Tower Hill, London, on July 25 1768, and was educated at Oriel college, Oxford. He went out to Egypt in 1792. In May 1793 he set out for Darfur by the annual caravan. He was forcibly detained by the sultan of Darfur and was unable to effect his purpose of returning by Abyssinia. He was allowed to return to Egypt with the caravan in 1796. In 1799 he published his *Travels in Africa, Egypt and Syria, from the year 1792 to 1798.* In 1800 Browne again left England, and spent three years in visiting Greece, some part of Asia Minor and Sicily. In 1812 he once more set out for the East, proposing to penetrate to Samarkand. He spent the winter in Smyrna, and in the spring of 1813 travelled through Asia Minor and Armenia, made a short stay at Erzerum, and arrived on June 1 at Tabriz. About the end of the summer of 1813 he left Tabriz for Teheran, intending to proceed to Tartary, but was shortly afterwards murdered.

Robert Walpole published, in the second volume of his *Memoirs relating to European and Asiatic Turkey* (1820), from papers left by Browne, the account of his journey in 1802 through Asia Minor to Antioch and Cyprus; also, *Remarks written at Constantinople* (1802).

BROWNELL, WILLIAM CRARY (1851–1928), American critic, was born in New York on Aug. 30, 1851. He was educated at Amherst college. From 1879 to 1881 he served on the staff of *The Nation*, and after 1890 was literary adviser for Charles Scribner's Sons, New York publishers. His first two books, *French Traits* (1889) and *French Art* (1892), established a new and difficult standard for the American critic, but a standard which Brownell maintained for himself in all his succeeding books: *Newport* (1896), *Victorian Prose Masters* (1901), *American Prose Masters* (1909), *Criticism* (1914), *Standards* (1917), *The Genius of Style* (1924) and *Democratic Distinction in America* (1927). He died at Williamstown, Mass., on July 22, 1928.

BIBLIOGRAPHY.—*See* Stuart P. Sherman's introduction to the "Modern Students' Library" edition of *American Prose Masters*; George A. McLean, *John Morley and Other Essays* (1920); Russell Sturgis, "William Crary Brownell as Critic on Fine Art," *International Monthly*, vol. v. p. 445–467.

BROWNHILLS, urban district, Staffordshire, England, 6 mi. W. of Lichfield, on the L.M.S. railway, near the Essington canal. Pop. (est. 1938) 19,570. Area 9.8 sq.mi There are extensive coal mines, forming part of the Cannock Chase deposit. The town lies near the Roman Watling street, and remains of earthworks are seen at Knave's Castle, on the Street, and at Castle Old Fort, 2 mi. southeast. Ogley Hay, which gives its name to the civil parish covering Brownhills, is a large adjoining village.

BROWNIAN MOVEMENT. A liquid at rest, such as water in a glass, appears homogeneous, continuous and motionless throughout. If we put into the water a denser substance, such as a glass marble, it sinks, and we know that once it reaches the bottom it will not rise again of its own accord. If with the water we mix certain powder consisting of extremely minute particles, we shall see by observation of the powder that the motion of these different lots of water, which at first resolves itself into parallel currents, becomes less and less defined. Eventually the particles are diffused in all directions throughout the water until the whole appears to be quite motionless.

These familiar motions, which are based on the powers of the naked eye, are shown by microscopic investigation to be absolutely false. Many particles which are put in water (or into any fluid) instead of sinking steadily, are at once endowed with a very vigorous motion, which is quite haphazard and irregular. The particle continuously moves to and fro; it rotates and rises and sinks, showing no tendency to come to rest, and maintaining indefinitely the same average state of agitation. This wonderful phenomenon, which was anticipated by Lucretius and all but discovered by Buffon, was definitely established by Brown in 1827, and is generally described as *Brownian movement*.

The phenomenon is not peculiar to water, but is met with in all fluids, and is present in inverse proportion to the viscosity of the fluids. Thus it is scarcely perceptible in glycerine but is extremely active in gases. It can also be observed in the case of water globules supported by the "black spots" of soap bubbles, the size of the globules, as compared with the thickness of the film, being much the same as that of an orange compared with a sheet of paper; the Brownian movement, which is negligible in a direction at right angles to the film, is very lively in the plane of the film, being almost what it would be in a gas. In a given fluid the movement of the particles is more intense as the size of the particle diminishes. This property was pointed out by Brown when he first made his discovery. The nature of the particles is immaterial. In the same fluid two particles exhibit practically the same activity when they are of the same size, no matter of what substance they are composed, and no matter what is their density. The higher the temperature, the more rapid is the movement.

The motion cannot be due to vibration of the slide supporting the droplet under observation, because if such vibration be caused purposely there arise currents in the bulk of the liquid which are at once recognized to be merely superimposed on the irregular movements of the particles. Moreover, Brownian motion occurs in fluids supported by a rigid vessel at night in the country, just as unmistakably as it does in the daytime in a town, when the containing vessel rests on a table which is continually being shaken by the passing of heavy traffic. Similarly, the movement cannot be ascribed to general convection effects produced by variations of temperature. Such convection currents are easily recognizable and are totally unrelated to the characteristic irregular movement. Finally—and this is perhaps its strangest and most startling characteristic—Brownian movement *never ceases*, according to many authorities. It can be descried within a cell which has been closed so as to prevent evaporation, for days and even years. It can be seen in liquid occlusions in quartz, which have been sealed up for thousands of years. It is inherent and eternal.

All these features compel us to agree with Wiener (1863) that *"the movement does not originate in the particles themselves, nor in any cause exterior to the liquid, but must be attributed to internal movements characteristic of the fluid state"*; the smaller the particles are, the more readily do they respond to this motion. In this way we arrive at an essential property of what is commonly termed a fluid in equilibrium: the apparent quiescence of a fluid is an illusion due to the imperfection of our senses, and really represents a permanent *condition of violent irregular motion*. This is an experimental fact quite apart from any question as to theory.

MOLECULAR HYPOTHESIS

Motions of Liquid Particles.—A little consideration of Brownian movement leads us to still more profound and far-reaching conclusions. The really novel property of the movement is that it never ceases. This seems contrary to our everyday experience of friction effects. For instance, if we fling a bucket of soapy water into a washtub, we are justified in supposing that before long the movements of the liquid will disappear. But let us consider how this apparent equilibrium has been reached. All the water particles had at first velocities nearly equal and parallel. This uniformity is destroyed as soon as some of the particles, striking the sides of the washtub, rebound in different directions with changed velocity, and thus impair the uniformity of movement of the rest of the water. The result is that immediately after it falls in the tub, all parts of the water are in motion; but in assuming the velocity of the various particles to be equal and parallel, we must consider a very small volume of the liquid. The motion can easily be made evident by putting into the liquid coloured particles, which acquire increasingly irregular movements in relation to one another. What we observe, consequently, as far as we can observe anything, is not that the movements stop but that the energy of the initial mass movement is dissipated more and more irregularly among smaller and smaller portions of liquid.

On the other hand, more exact experiments which demonstrate the heating of bodies by friction enable us to state that when the soapy water has come to "rest," its temperature will be slightly higher than when it was moving as a whole before being stopped by the tub. Brownian movement in this quantity of liquid will therefore have become more vigorous, seeing that its activity increases with the temperature. If we could follow under the microscope the dissipation of the original mass movement among progressively smaller masses, we should see that an appreciable part of that original movement was conserved by the particles of soapy water. Now the latter are themselves merely "indicating" powders, and they show us that in the liquid itself, beside the mass movement which at each moment is being frittered away in all directions among smaller and smaller particles, there is a movement which at each moment automatically redistributes itself in such a way as to impart velocity to any particle which has come to rest. The permanent state which marks the final temperature becomes established when, at each moment, exactly as much motion is thus being re-distributed as is being dissipated.

Velocity Distribution.—Since the dissemination of the original movement in a liquid is not indefinite, but inherently limited, it follows that the liquids are composed of particles which can take up all possible motions with regard to one another, but within the interiors of which no dissipation of energy can occur. If such particles did not exist it would be difficult to understand how dissipation, once commenced, could stop. These particles are in unceasing movement, and by colliding with one another mutually alter their velocities in magnitude and direction, so that *their velocities vary with complete irregularity around a certain average, just as a marksman's bullets are scattered about the target.* (Maxwell's distribution law.)

Granting this complete irregularity, it follows, in particular, that in a cell which is large in comparison with the diameter of the particles the number of particles possessing a certain velocity, at any given moment, differs by an infinitesimal amount from the number of particles having the same speed but in the contrary direction. The velocity of the centre of gravity of all these particles is, at each instant, therefore, not absolutely zero, but becomes more and more negligible as the size of the cell increases. If the size of the cell diminishes, the mean velocity of the centre of gravity will increase and may be detected under the microscope. If an indicating powder be present in the cell it will acquire this velocity, which is nevertheless very small as compared with the mean velocity of the particles: this is the explanation of Brownian movement.

These particles have only to be called *molecules* to recall an ancient hypothesis already envisaged by Epicurus and Lucretius—the hypothesis of the discontinuous structure of matter. In this one instance, however, the hypothesis is the outcome of logical induction, prompted by observation of phenomena. Brownian movement as an experimental reality leads us to postulate molecules in perpetual motion, and it can then be readily understood that any particle immersed in a fluid is jostled incessantly by neighbouring molecules and from them receives impulses which, when added together, are the less likely to produce equilibrium the smaller the particle, so that the particle takes on a violently irregular course.

Study of Emulsions.—If the molecular agitation is indeed the cause of Brownian movement, and the latter forms a link between our ordinary scale of dimensions and that of molecules, then we should be able to arrive at the latter. This, however, depends on the link being properly understood. The study of the Brownian movement of particles in suspension in suitably selected liquids and the comprehension that the laws of dilute solutions applied to such emulsions have led to simple determinations—one of them very direct—of molecular magnitudes.

An *emulsion* is made by suspending in a fluid a great number of particles all of the same nature. This emulsion is stable if the particles in suspension do not cohere when the chances of Brownian movement bring them together and if they re-enter the liquid when these chances bring them against the containing vessel or to the surface. A stable emulsion of this kind is comparable to a solution in both of these respects. In addition, if the particles in suspension are of equal size (which can be effected by fractional centrifugation of emulsions of certain resins, as we shall see later), the laws applicable to solutions apply equally in the case of such emulsions.

EXTENSION OF THE GAS LAWS TO EMULSIONS

It should be borne in mind in the first place how, thanks to Van't Hoff, the Gas laws, and especially Avogadro's law, became recognized as applicable to dilute solutions. The pressure exerted by a gas on its containing walls becomes, in the case of a dissolved substance, the *osmotic pressure* exerted on *semi-permeable* walls which allow the solvent to pass, but stop the solute. A membrane of copper ferrocyanide separating aqueous sugar solution from pure water is an example.

Pfeffer's measurements show that equilibrium exists only when a definite excess pressure is established on the side where the sugar is, and Van't Hoff has pointed out that the amount of this excess pressure (osmotic pressure) is precisely the same as the pressure which would be exerted, in accordance with Avogadro's law, on the walls of the vessel containing the sugar solution, if the sugar contained therein could alone occupy the vessel in the gaseous state. Hence it is probable that the same thing will apply to any dissolved substance; and there is no need even to cite the thermodynamical arguments by which Van't Hoff supported this generalization, nor to make any other measurements of osmotic pressure, for Arrhenius showed that any substance which, in solution, obeys the well-known laws of Raoult as regards its freezing point and vapour pressure, will, as a necessary consequence, exert the pressure predicted by Van't Hoff on any boundary-wall which stops it without stopping its solvent. In short, Raoult's laws, which are founded on a very large number of measurements, are logically equivalent to Van't Hoff's laws; the latter embodies the extension of Avogadro's law to solutions, and we can now say: *equal numbers of molecules, of any kind whatever, either in the gaseous state or dissolved, exert (at the same temperature and in equal volumes) equal pressures on the walls which confine them.*

This law applies to heavy and to light molecules indiscriminately; thus the quinine molecule, which contains over 100 atoms, produces neither more nor less effect when it impinges against the walls than the light hydrogen molecule which contains only two atoms. Perrin suggests that this law may also apply to even the visible particles in stable emulsions, with the result that each of the particles agitated by Brownian movement may count as a molecule when it happens to strike a confining wall.

Let us then assume that we can measure the osmotic pressure exerted as a result of their Brownian movement by particles of equal size on any surface element which stops them but allows water to pass, *e.g.*, blotting paper. Suppose, also, that we can count the number of particles per unit volume in the immediate vicinity of the surface element, so as to know their concentration. This number, n, also designates the concentration of molecules in any gas (let us say hydrogen) which would exert the same pressure on the walls of the vessel in which it was contained. If, for instance, the osmotic pressure thus measured is the 100-millionth of a dyne per square centimetre, we know that, under normal conditions (when the pressure is one million dynes per square centimetre), one cubic centimetre of hydrogen will contain 100 million million times n molecules ($10^{11}n$). Also, one gram-molecule (22,412 cu.cm. in the gaseous state at N.T.P.) will contain 22,412 times this number of molecules; the product will be *Avogadro's Number.* This is quite simple; but how are we to measure the extremely minute osmotic pressure exerted by an emulsion?

As a matter of fact, this will not be necessary, any more (as we have just explained) than it is to measure the osmotic pressure of a solution in order to make sure that the solution obeys the gas laws. It will be quite sufficient to demonstrate, in the case of emulsions, some property which can be treated experimentally, and which is the logical outcome of these laws. Jean Perrin found such a property (1908) when he extended to certain emulsions the well-known law that in a vertical column of gas in equilibrium the density decreases as altitude increases.

LAW OF THE VERTICAL DISTRIBUTION OF A GAS

We all know that the air is rarer at the top of a mountain than at sea-level, and in general the atmospheric pressure must diminish as one mounts, because it is caused by a shorter and less dense column of the atmosphere than at sea-level. Each horizontal stratum of a gas in equilibrium is treated as if it were in a large vertical cylinder and imprisoned between two rigid pistons, which prevent any exchange of molecules between this stratum and neighbouring strata of the gas, and thus conserve equilibrium. The pistons are supposed to exert respectively the pressures prevailing at the lower and upper surface of the stratum; thus, per unit surface area, the difference between these pressures is equal to the weight of gas supported. If the thickness dh of the stratum be so small that there is only an infinitesimal difference between the molecular concentration n near the upper face and the concentration near the lower face, then dp, the difference between the pressure at these faces will be equal to $n\,\bar{\omega}\,dh$, where $\bar{\omega}$ represents the mass of a molecule, therefore $dp = n\,\bar{\omega}\,dh$.

This very simple equation expresses two important facts: first, since the concentration n of molecules is proportional to the pressure p at a given temperature, we see that in a column of some given gas (*i.e.*, $\bar{\omega}$ is given) at uniform temperature, the relative decrease of pressure $dp/_{p}$, or alternatively, the relative lowering of concentration $dn/_{n}$ which may be said to measure the degree of rarefaction, has always the same value for the same difference dh in level, whatever the level may be. For example, when climbing a staircase, the air pressure (or molecular concentration) falls by $\frac{1}{40000}$ of its value, for each step. Summing these effects step by step, we can see that from whatever level we start, in air at uniform temperature, whenever we ascend by the same degree, the pressure (or the density) always becomes divided by the same number; thus in oxygen at 0° C, the rarefaction will be doubled for each vertical rise of five kilometres.

The second point immediately resulting from our equation concerns the mass $\bar{\omega}$ of the molecule; for a given level dh, the rarefaction dp/p (or dn/n) varies inversely as the molecular weight. Here again, integrating the effect, we see that, in two different gases at the same temperature, elevations which cause the same degree of rarefaction are inversely proportional to the molecular weights. Thus the oxygen molecule weighs 16 times as much as the hydrogen molecule; in order to double the degree of rarefaction, therefore, it is necessary to rise 16 times as high in hydrogen as in oxygen, viz., 80 kilometres. We may assume that Avogadro's law holds good for short columns of emulsions, as it does for gases, if the particles are comparatively large.

AN EMULSION DISTRIBUTES ITSELF LIKE A GAS

Suppose a stable emulsion with comparatively large particles of uniform size has been made and left to stand at constant temperature solely under the influence of gravity. For a small depth we may apply the preceding argument without any appreciable change, other than that resulting from the fact that the particles are now separated, not by a vacuum, but by a liquid which exerts a thrust on each particle in the opposite direction to its weight, in accordance with Archimedes' principle. Hence, the effective weight of the particle, to which the argument applies, is its real weight less this thrust. If, then, our generalization is permissible, once the emulsion is in equilibrium it will act as a *miniature atmosphere with visible molecules*, in which equal increases of altitude will be accompanied by equal rarefaction. If, for instance, it is necessary to ascend 1,000 million times further in oxygen than in the emulsion in order to double rarefaction, it is because the effective mass of a particle in the emulsion is 1,000 million times the mass of the molecule of oxygen. It will, therefore, suffice to determine the effective mass of the visible particles (which form our link between ordinary and molecular dimensions) in order to find, by simple proportion, the mass of any molecule and hence Avogadro's number.

Perrin's Experiments.—Experiments have been carried out on these lines. First, stable emulsions were prepared, containing solid (transparent) spheres of various resins, suspended in a liquid (usually water). By a process of fractional centrifugation, the granules were successfully sorted out into definitely known sizes, so that suspensions of uniform granules resulted. It was also possible to determine the density of the substance of which these visible particles were composed. Everything necessary for calculating the effective mass of a particle in the emulsion was then available. The distribution of the emulsion under the influence of gravity was studied by means of instantaneous photography, a drop of liquid being confined in a carefully sealed cell suitable for microscopic observation. A limiting distribution with reversible variation of concentration according to the rise or fall of temperature became established.

It is easy to confirm that the distribution of the particles attains a permanent condition. All that is required is to note the value of the ratio, $n_0/_{n}$, of the concentrations at two levels, from hour to hour This ratio, at first almost unity, increases and tends to reach a limit. In a height of one-tenth millimetre, with water as the continuous medium, the distribution limit was practically attained in one hour. The values of the ratio $n_0/_{n}$ actually observed after three hours, and again at the end of a fortnight, were exactly the same. The distribution limit is a distribution in reversible equilibrium, for if it be exceeded the system automatically reverts to it. One method of exceeding this limit, that is, to cause too many particles to accumulate in the lower layers, is to cool the emulsion—this causes a higher concentration in these layers—and then to raise the temperature to its original figure, when the original disposition will be regained. The most careful measurements gave 68×10^{22} as the value of Avogadro's number N. (*See* ELECTRON, THE, for Millikan's value for N.)

THE LAWS OF BROWNIAN MOVEMENT

Displacement in a Given Time.—It is owing to Brownian movement that an equilibrium distribution is established in an emulsion, the more vigorous the movement the more rapid being the establishment of equilibrium. Variations in Brownian activity, however, do not affect the final distribution, which is always the same for particles of the same size and apparent density. Therefore the ultimate conditions can be studied without consideration of the mechanism by which they have been established. Detailed analysis of this mechanism was made by Einstein in his brilliant theoretical studies. Besides this, the tentative, but very suggestive, analysis of this same problem due to Smoluchowski certainly deserves mention, although published subsequently, because of the different method of attack. Einstein and Smoluchowski both defined the activity of Brownian movement in the same manner. Previous to this, a "mean speed of agitation" had to be determined by following the path of a particle as closely as possible. The values thus found were always a few microns per second for particles of the order of a micron in diameter (one micron is $\frac{1}{1,000}$ of a millimetre). Such values are seriously in error. The irregularities of the path are so numerous and so rapid that it is impossible to follow them, and the recorded path is far simpler and shorter than the true path. Further, the apparent mean speed of a particle during a given period varies enormously in magnitude and direction, with no tendency towards a limit as the time of observation diminishes; this may readily be seen by noting the successive positions of a particle in the camera lucida, first every minute, then, say, every five seconds, and better still, by photographing them every $\frac{1}{20}$ of a second.

Dismissing, therefore, the true velocity as immeasurable, and neglecting the extremely tangled path described by a particle in a given time, Einstein and Smoluchowski chose to define the magnitude of the movements in terms of a rectilinear segment connecting the starting and finishing points, which, on the average, will evidently be greater the more vigorous is the motion. This segment will represent the *displacement* of the particle during the time taken. The projection to a horizontal plane, observed directly in the microscope under ordinary experimental conditions, with the microscope vertical, will be the *horizontal displacement*.

Activity of Brownian Movement.—In accordance with the ideas suggested by qualitative observation, it will be granted that Brownian movement is quite irregular at right angles to the vertical. This is more than a mere hypothesis, and all the consequences following from it can be verified. Having granted this, it can be proved, without any other hypothesis, that the mean displacement of a particle is only doubled when the time of displacement is quadrupled, and increased only tenfold when the time is increased a hundredfold, and so on. More precisely, it is demonstrable that the mean square e^2 of the horizontal displacement during time t increases in direct proportion to that time.

The same applies, consequently, to one-half of this square, *i.e.*, to the mean square x^2 of the projection of the horizontal displacement on an arbitrary horizontal axis. Expressed in another way, x^2/t is constant for a given particle immersed in a given liquid. This ratio, which is obviously greater the more violently the particle moves, defines the *activity of the Brownian movement* of the particle.

Diffusion of Emulsions.—It is to be expected that if pure water were in contact with an aqueous emulsion of uniform particles, Brownian movement would cause *diffusion* of the particles in the water by a process analogous to that causing the true diffusion of dissolved substances. Further, such diffusion would be more rapid the more active the Brownian movement of the particles. Einstein's calculations, made entirely on the assumption that Brownian motion is completely irregular, show that an emulsion actually does diffuse like a solution, the coefficient of a diffusion D being just equal to half the number which expresses the activity of Brownian movement:—

$$D = \tfrac{1}{2} \cdot \frac{}{t}$$

In a vertical column of emulsion, the final permanent condition is created and maintained by the interplay of two opposing processes, gravity which is constantly attracting the particles downwards, and Brownian movement which is continually dispersing them. This idea can be more precisely stated in the following form: for each stratum, the loss through diffusion towards regions of low concentration balances the gain through gravitation towards regions of high concentration.

In the special case when the particles are spheres of radius a (to which an attempt can be made to apply Stokes' law which has been actually verified for spherules of microscopic dimensions), and assuming also that at equal concentrations particles and molecules produce the same osmotic pressure, it is found that:

$$D = \frac{RT}{N} \cdot \frac{1}{6\pi a\eta}$$

where η is the viscosity of the liquid, T its absolute temperature, and N is Avogadro's number. Seeing that the coefficient of diffusion is one-half of the activity of Brownian movement, this equation can be put in the form:

$$\frac{x^2}{t} = \frac{RT}{N} \cdot \frac{1}{3\pi a\eta}$$

Thus, *the activity of Brownian movement (and the rapidity of diffusion) must be proportional to the absolute temperature, and inversely proportional to the viscosity of the liquid and to the radius of the particles.*

Einstein immediately perceived that the order of magnitude of movement seemed to fit in with these conclusions. Smoluchowski reached the same result in a learned discussion of the data then available, which consisted of the nature and the density of the particles being immaterial; the qualitative observations of the increase of movement with rise of temperature and with diminution of particle size; and a rough evaluation of the displacements of particles of the order of a micron in size. Thence it became possible to state definitely that Brownian movement is certainly not more than five times as active as the predicted motion, nor less than one-fifth of it. This approximate agreement in the order of magnitude and in the qualitative properties of the phenomenon at once lent considerable force to the kinetic theory, and this was clearly indicated by the originators of that theory.

No support to these observations of Einstein and Smoluchowski was published until 1908, when an interesting, but only partial, verification appeared, by Seddig, who compared, at various temperatures, the displacements experienced by ultramicroscopic particles of cinnabar estimated to be nearly uniform in size. If Einstein's formula is correct, the mean displacements d and d at 17° C and 90° C must be in the ratio 2·05, allowing for the change in viscosity. Experiment gave 2·2. The discrepancy was much smaller than the possible experimental error.

Rotational Brownian Movement.—So far we have considered only the changes of position of particles, that is, their Brownian movement of *translation,* but the complete phenomenon includes irregular rotation of the particles. At the same time that they undergo displacement, Einstein succeeded in formulating, in the case of this Brownian movement of *rotation,* an equation comparable with the preceding, for spheres of radius a. If A^2 represents the mean square for a time t of the component of the angle of rotation around an axis, the ratio $\frac{A^2}{t}$, which is fixed for any particular particle, will represent the *activity* of the rotational Brownian movement and must satisfy the equation:—

$$\frac{A^2}{t} = \frac{RT}{N} \cdot \frac{1}{4\pi a^3\eta}.$$

Thus, as in the case of motion of translation, the activity of the rotational movement is proportional to the absolute temperature, and inversely proportional to the viscosity; but it varies inversely as the volume of the particle, and not inversely as its linear dimension. A spherule of diameter 10 will possess translational motion one-tenth of that of a spherule of unit diameter, whereas its rotational motion will be the $\frac{1}{1,000}$ part of that of the latter. While the method by which this equation was obtained cannot be indicated here, we may point out that, for a given particle, it implies *equality between the mean energy of translation and the mean energy of rotation,* as foreseen by Boltzmann.

PERRIN'S EXPERIMENTAL VERIFICATION OF BROWNIAN MOVEMENT LAWS

All these theories lend themselves to verification, as soon as spherules of measurable diameter can be prepared. The law of displacement is verified as follows: The successive horizontal displacements of a given particle are measured by observation in the camera lucida (with known magnification) of the successive positions of the particle at equal time intervals.

Three patterns have been reproduced on the adjoining diagram, on a magnified scale of 16 divisions to 50 microns; they were obtained by tracing the horizontal projections of the consecutive positions at half-minute intervals of a single particle of mastic, of radius 0·53 micron. It will be noticed that this diagram readily gives the projection on any horizontal axis (these will be abscissae, or ordinates, given by the use of squared paper). Incidentally, a diagram like this, giving a large number of displacements on an arbitrary scale, furnishes only an extremely inadequate idea of the extraordinary complexity of the actual path. If plottings were made at time-intervals 100 times shorter, each segment would be replaced by a zig-zag outline relatively as complicated as the whole diagram.

Perrin's measurements have shown that the expression

$$\frac{t}{x^2} \cdot \frac{RT}{3\pi a\eta}$$

which must be equal to Avogadro's number N in accordance with Einstein's equation, has a value 64 × 10²², which is independent of the nature of the emulsion. This approaches the value already found for N. Many different measurements were made, varying the experimental conditions within wide limits, especially the viscosity and the size of the particles. Finally, even the formula for *rotational* Brownian movement was verified, giving N equal to 65 × 10²². (*See* ELECTRON, THE, for Millikan's value)

Summarizing, Brownian movement is an experimental fact, which reveals evidence of the existence of molecules which are themselves inaccessible under the microscope. From the philosophic standpoint, emphasis must again be laid on the fact that Brownian movement proves to us that rest and equilibrium can only be an outward semblance which masks a state of disorder and unrest; it prepares us for a profound alteration in the aspect of the universe as soon as we alter the scale of our observations.

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See also E. F. Burton, "The Brownian Movement," *The Physical Properties of Colloidal Solutions*, bibl. (1921); A. W. Porter and J. J. Hedges, "The Law of Distribution of Particles in Colloidal Suspensions," *Phil. Mag.* (1922); A. Einstein *The Brownian Movement*, trans. by A. D. Cowper (1926).

BROWNING, ELIZABETH BARRETT (1806–1861), English poet, wife of the poet Robert Browning, was born Mar. 6, 1806, the daughter and eldest child of Edward Barrett Moulton, who added the surname of Barrett on the death of his maternal grandfather, whose large estates in Jamaica he inherited. His wife was Mary Graham Clarke, daughter of J. Graham Clarke of Fenton Hall, Newcastle-on-Tyne. Elizabeth's childhood was passed in the country, chiefly at Hope End, a house bought by her father in the beautiful country in sight of the Malvern Hills. Her country poems, such as "The Lost Bower," "Hector in the Garden" and "The Deserted Garden," refer to the woods and gardens of Hope End. Elizabeth Barrett was much the companion of her father, who pleased himself with printing fifty copies of what she calls her "great epic of eleven or twelve years old, in four books"—*The Battle of Marathon* (sent to the printer in 1819). The love of Pope's Homer, she adds, led her to the study of Greek, and of Latin as a help to Greek. In 1832, Mr. Barrett sold his house of Hope End and brought his family to Sidmouth, Devon, for some three years. There Elizabeth made a translation of the *Prometheus Bound* of Aeschylus, published with some original poems (1833). After that time London became the home of the Barretts until the children married and the father died. The temporary dwelling was at 74, Gloucester Place, Portman Square, and in 1838 the lease was taken of 50, Wimpole Street.

In the middle of the year 1836 Elizabeth Barrett made the acquaintance of R. H. Horne, afterwards famous for a time as the author of *Orion*, but perhaps best remembered as her correspondent (*Letters to R. H. Horne*, 2 vols., 1877). This acquaintance led to the appearance of poems by Miss Barrett in the *New Monthly Magazine*, edited by Bulwer (Lord Lytton), and in other magazines or annuals. But the publication of *The Seraphim and other Poems* (1838) was a graver step. Miss Barrett's volume was well reviewed, but not popular, and no second edition was required; of the poems afterwards famous it contained three, "Cowper's Grave," "My Doves," and "The Sea-Mew." In 1837 Elizabeth had made the memorable acquaintance of Wordsworth. With Landor, at the same date, a meeting took place that had long results. At this time, too, began another of Elizabeth's valued friendships—that with Miss Mitford, author of *Our Village*. Mr. John Kenyon also became at about this time a dear and intimate friend. He was a distant cousin of the Barretts, had published some verse, and was a warm and generous friend to men of letters. From the date of the birth of their child (1849) he gave the Brownings a hundred pounds a year, and when he died in 1856 he bequeathed to them £11,000. To him a great number of Elizabeth's letters are addressed, and to him in later years was *Aurora Leigh* dedicated. Elizabeth Barrett began also in London an acquaintance with Harriet Martineau. In early girlhood Elizabeth had a spinal affection and her lungs became delicate. She broke a blood-vessel in the beginning of the Barretts' life in town and was thereafter an invalid, and generally a recluse, until her marriage. In 1838 it was found necessary to remove her to Torquay, where she spent three years, accompanied by her brother Edward, the dearest of her eight brothers, and for a time by her father and sisters. During this time of physical suffering she underwent the greatest grief of her life by the drowning of her beloved brother in Babbacombe bay. The accident of Edward Barrett's meeting with his death through her residence at Torquay, and the minor accident of her having parted from him on the day of his death, as she said, "with pettish words," increased her anguish of heart to horror. With an impulse of self-protection she went to work as soon as her strength sufficed. One of her tasks was a part taken in the *Chaucer Modernized* (1841), a work suggested by Wordsworth, to which he, Leigh Hunt, Horne and others contributed. In 1841 she returned to Wimpole Street, and in that and the following year she was at work on two series of articles on the Greek Christian poets and on the English poets, written for the *Athenaeum*.

In 1842 we notice the name of Robert Browning in her letters: "Mr. Horne the poet and Mr. Browning the poet were not behind in approbation," she says in regard to her work on the poets. "Mr. Browning is said to be learned in Greek, especially the dramatists." In this year also she declares her love for Tennyson. To Kenyon she writes, "I ought to be thanking you for your great kindness about this divine Tennyson." In 1842, moreover, she had the pleasure of a letter from Wordsworth, who had twice asked Kenyon for permission to visit her. The visit was not permitted on account of Miss Barrett's ill-health. Now Haydon sent her his unfinished painting of the great poet musing upon Helvellyn; she wrote her sonnet on the portrait, and Haydon sent it to Rydal Mount. Wordsworth's commendation is rather cool. In August 1843 "The Cry of the Children" appeared in *Blackwood's Magazine*, and during the year she was associated with her friend Horne in a critical work, *The New Spirit of the Age*, rather by advice than by direct contribution. Her two volumes of poems (1844) appeared, six years after her former book, under the title of *Poems, by Elizabeth Barrett Barrett*. In the beginning of the following year came the letter from a stranger that was to be so momentous to both. "I had a letter from Browning the poet last night," she writes to her old friend Mrs. Martin, "which threw me into ecstasies—Browning, the author of *Paracelsus*, the king of the mystics." America was at least as quick as England to appreciate her poetry; among other messages thence came in the spring letters from Lowell and from Mrs. Sigourney. In the same year the letters first speak of the hope of a journey to Italy. The winters in London were lowering Elizabeth's strength of resistance against disease. She longed for the change of light, scene, manners and language, and the longing became a hope, until her father's prohibition doomed her, as she and others thought, to death, without any perceptible reason for the denial of so reasonable a desire.

Meanwhile the friendship with Browning had become the chief thing in Elizabeth Barrett's life. The correspondence, once begun, had not flagged. In the early summer they met. He became her frequent visitor and kept her room fragrant with flowers. He never lagged, whether in friendship or in love. We have the strange privilege, since the publication of the letters between the two, of following the whole course of this noble love-story from beginning to end, and day by day. Browning was six years younger than the woman he so passionately admired, and he at first believed her to be confined by some hopeless physical injury to her sofa. But of his own wish and resolution he never doubted. Her hesitation, in regard for his liberty and strength, to burden him with an ailing wife, she has recorded in the sonnets afterwards published under a slight disguise as *Sonnets from the Portuguese*. She refused him once "with all her will, but much against her heart," and yielded at last for his sake rather than her own. Her father's will was that his children should not marry, and the prohibition struck terror into the hearts of the three dutiful and sensitive girls. Robert Browning's addresses were, therefore, kept secret. Browning was reluctant to practise the deception; Elizabeth alone knew how impossible it was to avoid it. When she was persuaded to marry, it was she who insisted, in mental and physical terror, upon a secret wedding. Throughout the summer of 1846 her health improved, and on Sept. 12 the two poets were married in St. Marylebone Parish church. Elizabeth's two sisters had been permitted to know of the engagement but not of the wedding, so that their father's anger might not fall on them too heavily. For a week Mrs. Browning remained in her father's house. On Sept. 19 she left it, taking her maid and her little dog, joined her husband and crossed to the Continent.

For climate and cheapness they settled in Italy, choosing Florence in the spring of 1847, and remaining there, with the interruptions of a change to places in Italy such as Siena and Rome, and to Paris and England, until Mrs. Browning's death. It was at Pisa that Robert Browning first saw the *Sonnets from the Portuguese*, poems which his wife had written in secret and had no thought of publishing. He, however, resolved to give them to the world. "I dared not," he said, "reserve to myself the finest sonnets written in any language since Shakespeare's." The judgment, which the existence of Wordsworth's sonnets renders obviously absurd, may be pardoned. The sonnets were sent to Miss Mitford and published at Reading as *Sonnets by E. B. B.*, in 1847. In 1850 they were included, under their final title, in a new issue of poems. During the Pisan autumn appeared in *Blackwood's Magazine* seven poems by Mrs. Browning which she had sent some time before; at Pisa also she wrote and sent to America a poem, "The Runaway Slave at Pilgrim Point," which was published in Boston, in *The Liberty Bell*, in 1848, and separately in England in 1849. In the summer of 1847 the Brownings left their temporary dwelling in Florence and took the apartment in Casa Guidi, near the Pitti Palace, which was thenceforth their chief home. Early in their residence began that excited interest in Italian affairs which made so great a part of Mrs. Browning's emotional life. Mrs. Browning, by degrees, wrote *Casa Guidi Windows* on behalf of the Florentines and as an appeal to the always impulsive sympathies of England. In 1849 was born the Brownings' only child, Robert Wiedemann Barrett. After this event, Mrs. Browning prepared a new issue, with some additions of her poems (1850). *Casa Guidi Windows* followed in 1851. Visiting England in that year, the Brownings saw much of the Procters, and something of Florence Nightingale, Kingsley, Ruskin, Rogers, Patmore and Tennyson, and also of Carlyle, with whom they went to Paris where they saw George Sand, and where they passed the December days of their *coup d'état*. Mrs. Browning happened to take a political fancy to Napoleon III. whom she would probably have denounced if a tithe of his tyrannies had occurred in Italy, and the fancy became more emotional in after years.

A new edition of Mrs. Browning's poems was called for in 1853, and at about this time, in Florence, she began to work on *Aurora Leigh*. She was still writing this poem when the Brownings were again in England in 1855. After another interval in Paris they were in London again—Mrs. Browning for the last time. She was with her cousin Kenyon during the last months of his life. In October 1856 the Brownings returned to their Florentine home, Mrs. Browning leaving her completed *Aurora Leigh* for publication. The book had an immediate success; a second edition was required in a fortnight, a third a few months later. In the fourth edition (1859) several corrections were made.

In 1857 Mrs. Browning addressed a petition in the form of a letter, to the emperor Napoleon begging him to remit the sentence of exile upon Victor Hugo. In 1857 Mrs. Browning's father died, unreconciled. Henrietta Barrett had married, like her sister, and like her was unforgiven. In 1858 occurred another visit to Paris and another to Rome, where Hawthorne and his family were among the Brownings' friends. In 1859 came the Italian war in which Mrs. Browning's hasty sympathies were hotly engaged. Her admiration of Napoleon III. knew no bounds, and was not even destroyed by the peace of Villafranca. That peace, however, was a bitter disappointment, and her fragile health suffered. At Siena and Florence this year the Brownings were very kind to Landor, old, solitary and ill. Mrs. Browning's poem, "A Tale of Villafranca," was published in the *Athenaeum* in September and afterwards included in *Poems before Congress* (1860). Then followed another long visit to Rome, and there Mrs. Browning prepared for the press this, her last volume. The little book was judged with some impatience, *A Curse for a Nation,* being mistaken for a denunciation of England, whereas it was aimed at America and her slavery.

On June 29, 1861, Elizabeth Barrett Browning died. Her married life had been supremely happy. Something has been said of the difference between husband and wife in regard to "spiritualism," in which Mrs. Browning had interest and faith, but no division ever interrupted their entirely perfect affection and happiness. Browning buried his wife in Florence, under a tomb designed by their friend Frederick Leighton. On the wall of Casa Guidi is placed the inscription "Qui scrisse e morì Elizabetta Barrett Browning, che in cuore di donna conciliava scienza di dotto e spirito di poeta, e fece del suo verso aureo anello fra Italia e Inghilterra. Pone questa lapide Firenze grata 1861." In 1866 Robert Browning published a volume of selections from his wife's works.

The place of Elizabeth Barrett Browning in English literature is high, if not upon the summits. She had an original genius, a fervent heart, and an intellect that was, if not great, exceedingly active. She seldom has composure or repose, but it is not true that her poetry is purely emotional. It is full of abundant, and even over-abundant thoughts. It is intellectually restless. The impassioned peace of the greatest poetry, such as Wordsworth's, is not hers. Nor did she apparently seek to attain those heights. Her Greek training taught her little of the economy that such a poetic education is held to impose; she "dashed" not by reason of feminine weakness, but as it were to prove her possession of masculine strength. Her gentler work, as in the *Sonnets from the Portuguese*, is beyond praise. There is in her poetic personality a glory of righteousness, of spirituality, and of ardour that makes her name a splendid one in the history of an incomparable literature.

See the *Letters of Elizabeth Barrett Browning addressed to R. H. Horne, with Comments on Contemporaries*, edited by S. R. Townshend Mayer (1877); *The Poetical Works of Elizabeth Barrett Browning from 1826 to 1844*, edited with memoir by J. H. Ingram (1887); *Elizabeth Barrett Browning* (Eminent Women series), by J. H. Ingram, 1888. *Records of Tennyson, Ruskin and the Brownings*, by Anne Ritchie (1892); *The Letters of Elizabeth Barrett Browning*, edited with biographical additions by Frederick C. Kenyon (1897); *The Letters of Robert Browning and Elizabeth Barrett Barrett* (1899); *La vie et l'oeuvre d'Elizabeth Browning*, by Mlle. Germaine Marie Merlette (1906); *New Poems by Robert Browning and Elizabeth Browning*, ed. F. G. Kenyon (1914); L. Huxley, ed., *E. B. Browning, Letters to Her Sister, 1846–1850* (1929). (A. MEY.)

BROWNING, JOHN M. (1854–1926), American inventor, was born at Ogden, Utah, of Mormon parentage. In 1879 he secured a patent for a breech-loading, single-shot rifle, which he sold to the Winchester company. He designed many types of sporting fire-arms such as the Remington autoloading shot-guns and rifles; the Winchester repeating shot-guns, single-shot and repeating rifles; the Stevens rifles; and the Colt automatic pistols. In 1890 a machine-gun of his design, but known as the Colt, and in 1908 his automatic pistols were adopted by the U.S. army. He later developed two types of machine-guns, which were adopted by the United States in 1918 for use in World War I. He died in Belgium on Nov. 26, 1926.

BROWNING, OSCAR (1837–1923), English writer, was born in London Jan. 17 1837, and died in Rome Oct. 6 1923. He was educated at Eton and at King's college, Cambridge, of which he became fellow and tutor. He was for 15 years a master at Eton, resuming residence in 1876 at Cambridge, where he became university lecturer in history. He soon became a prominent figure in college and university life, encouraging especially the study of political science and modern political history, the extension of university teaching and the movement for the training of teachers.

He is well known to Dante students by his *Dante; Life and Works* (1891); and to the study of Italian history he has contributed *Guelphs and Ghibellines* (1903). His works on modern history include *England and Napoleon in 1803* (1887), *History of England* (1890), *Wars of the Nineteenth Century* (1899), *History of Europe 1814–1843* (1901), *Napoleon, the first Phase* (1905). In 1910 he published *Memories of Sixty Years at Eton, Cambridge and Elsewhere,* and *Memories of Later Years* in 1923.

BROWNING, ROBERT (1812–1889), English poet, was born at Camberwell, London, on May 7, 1812. He was the son of Robert Browning (1781–1866), who for 50 years was employed in the Bank of England. Earlier Brownings had been settled in Wiltshire and Dorsetshire, and there is no ground for the statement that the family was partly of Jewish origin. The poet's mother was a daughter of William Wiedemann, a German who had settled in Dundee and married a Scottish wife. His parents had one other child, a daughter, Sarianna, born in 1814. They lived quietly in Camberwell. The elder Browning had a sufficient income and was indifferent to money-making. He had strong literary and artistic tastes. He was an ardent book collector, and so good a draughtsman that paternal authority alone had prevented him from adopting an artistic career. He had, like his son, a singular faculty for versifying, and helped the boy's early lessons by twisting the Latin grammar into grotesque rhymes. He lived, as his father had done, to be 84, with unbroken health. The younger Robert inherited, along with other characteristics, much of his father's vigour of constitution. From the mother, who had delicate health, he probably derived his excessive nervous irritability; and from her, too, came his passion for music. The family was united by the strongest mutual affection, and the parents erred, if anything, on the side of indulgence. Browning was sent to a school in the neighbourhood, but left it when 14, and had little other teaching. He had a French tutor for the next two years, and in his 18th year he attended some Greek lectures at London university. At school he never won a prize, though it was more difficult to avoid than to win prizes. He was more conspicuous for the love of birds and beasts, which he always retained, than for any interest in his lessons. He rather despised his companions and made few friends. A precocious poetical capacity, however, showed itself in extra-scholastic ways. He made his schoolfellows act plays, partly written by himself. He had composed verses before he could write, and when 12 years old completed a volume of poems called *Incondita.* His parents tried unsuccessfully to find a publisher; but his verses were admired by Sarah Flower, afterwards Mrs. Adams, a well-known hymn-writer of the day, and by W. J. Fox, both of whom became valuable friends. A copy made by Miss Flower was in existence in 1871, but afterwards destroyed by the author. Browning had the run of his father's library, and acquired a very unusual amount of miscellaneous reading. Quarles's *Emblems* was an especial favourite; and besides the Elizabethan dramatists and standard English books, he had read all the works of Voltaire. Byron was his first master in poetry, but about the age of 14 he fell in accidentally with Shelley and Keats. For Shelley in particular he conceived an enthusiastic admiration which lasted for many years, though it was qualified in his later life.

The more aggressive side of Browning's character was as yet the most prominent; and a self-willed lad, conscious of a growing ability, found himself cramped in Camberwell circles. He rejected the ordinary careers. He declined the offer of a clerkship in the Bank of England; and his father, who had found the occupation uncongenial, not only approved the refusal but cordially accepted the son's decision to take poetry for his profession. For good or evil, Browning had been left very much to his own guidance, and if his intellectual training suffered in some directions, the liberty permitted the development of his marked originality. The parental yoke, however, was too light to provoke rebellion. Browning's mental growth led to no violent breach with the creeds of his childhood. His parents became Dissenters in middle life but often attended Anglican services; and Browning, though he abandoned the dogmas, continued to sympathize with the spirit of their creed. He never took a keen interest in the politics of the day but cordially accepted the general position of contemporary Liberalism His worship of Shelley did not mean an acceptance of his master's hostile attitude towards Christianity, still less did he revolt against the moral discipline under which he had been educated. He frequented literary and artistic circles, and was passionately fond of the theatre; but he was entirely free from a coarse Bohemianism, and never went to bed, we are told, without kissing his mother. He lived with his parents until his marriage. His mother lived till 1840, and his father till 1866, and his affectionate relations to both remained unaltered. Browning's first published poem, *Pauline*, appeared anonymously in 1833. He always regarded it as crude and destroyed all the copies of this edition that came within his reach. It was only to avoid unauthorized reprints that he consented with reluctance to republishing it in the collected works of 1868. Its indication of genius was recognized by W. J. Fox, who hailed it in the *Monthly Repository* as marking the advent of a true poet. *Pauline* contains an enthusiastic invocation of Shelley, whose influence upon its style and conception is strongly marked. It is the only one of Browning's works which can be regarded as imitative. In the winter of 1833, he went to St. Petersburg on a visit to the Russian consul-general, Mr. Benckhausen. There he wrote the earliest of his dramatic lyrics, "Porphyria's Lover" and "Johannes Agricola." In the spring of 1834 he visited Italy for the first time, going to Venice and Asolo.

Browning's personality was fully revealed in his next considerable poems, *Paracelsus* (1835) and *Sordello* (1840). With *Pauline,* however, they form a group. In an essay (prefixed to the spurious Shelley letters of 1851), Browning describes Shelley's poetry "as a sublime fragmentary essay towards a presentment of the correspondency of the universe to the Deity." The phrase describes his own view of the true functions of a poet, and Browning, having accepted the vocation, was meditating the qualifications which should fit him for his task. The hero of *Pauline* is in a morbid state of mind which endangers his fidelity to his duty. *Paracelsus* and *Sordello* are studies in the psychology of genius, illustrating its besetting temptations. Paracelsus fails from intellectual pride, not balanced by love of his kind, and from excessive ambition, which leads him to seek success by unworthy means. Sordello is a poet distracted between the demands of a dreamy imagination and the desire to utter the thoughts of mankind. He finally gives up poetry for practical politics and gets into perplexities only to be solved by his death. *Pauline* might in some indefinite degree reflect Browning's own feelings, but in the later poems he adopts his characteristic method of speaking in a quasi-dramatic mood. They are, as he gave notice, "poems, not dramas." The interest is not in the external events but in the "development of a soul"; but they are observations of other men's souls, not direct revelations of his own. Paracelsus was based upon a study of the original narrative, and Sordello was a historical though a very indefinite person. The background of history is intentionally vague in both cases. There is one remarkable difference between them. The *Paracelsus,* though full of noble passages, is certainly diffuse. Browning heard that John Sterling had complained of its "verbosity," and tried to remedy this failing by the surgical expedient of cutting out the usual connecting words. Relative pronouns henceforth become scarce in his poetry, and the grammatical construction often a matter of conjecture. Words are forcibly jammed together instead of being articulately combined. To the ordinary reader many passages in his later work are both crabbed and obscure, but the "obscurity" never afterwards reached the pitch of *Sordello* which is due to the vagueness with which the story is rather hinted than told, as well as to the subtlety and intricacy of the psychological expositions. The subtlety and vigour of the thought are indeed surprising and may justify the frequent comparisons to Shakespeare; and it abounds in descriptive passages of genuine poetry.

Still, Browning seems to have been misled by a fallacy. It was quite legitimate to subordinate the external incidents to the psychological development in which he was really interested, but to secure the subordination by making the incidents barely intelligible was not a logical consequence. We should not understand Hamlet's psychological peculiarities the better if we had to infer his family troubles from indirect hints. Browning gave more time to *Sordello* than to any other work, and perhaps had become so familiar with the story which he professed to tell that he failed to make allowance for his readers' difficulties. In any case it was not surprising that the ordinary reader should be puzzled and repelled, and the general recognition of his genius long delayed, by his reputation for obscurity. It might, however, be expected that he would make a more successful appeal to the public by purely dramatic work, in which he would have to limit his psychological speculation and to place his characters in plain situations. *Paracelsus* and *Sordello* show so great a power of reading character and appreciating subtler springs of conduct that its author clearly had one, at least, of the essential qualifications of a dramatist.

Before *Sordello* appeared Browning had tried his hand in this direction. He was encouraged by outward circumstances as well as by his natural bent. He was making friends and gaining some real appreciative admirers. John Forster had been greatly impressed by *Paracelsus.* Browning's love of the theatre had led to an introduction to Macready in the winter of 1835–36; and Macready, who had been also impressed by *Paracelsus,* asked him for a play. Browning consented and wrote *Strafford,* which was produced at Covent Garden in May 1837, Macready taking the principal part. Later dramas were *King Victor* and *King Charles,* published in 1842; *The Return of the Druses* and *A Blot on the 'Scutcheon* (both in 1843), *Colombe's Birthday* (1844), *Luria* and *A Soul's Tragedy* (both in 1846), and the fragmentary *In a Balcony* (1853). *Strafford* succeeded fairly, though the defection of Vandenhoff, who took the part of Pym, stopped its run after the fifth performance. The *Blot on the 'Scutcheon,* produced by Macready as manager of Drury Lane on Feb. 11, 1843, led to an unfortunate quarrel. Browning thought that Macready had felt unworthy jealousy of another actor, and had gratified his spite by an inadequate presentation of the play. He remonstrated indignantly and the friendship was broken off for years. Browning was disgusted by his experience of the annoyances of practical play-writing, though he was not altogether discouraged. The play had apparently such a moderate success as was possible under the conditions, and a similar modest result was attained by *Colombe's Birthday*, produced at Covent Garden on April 25, 1853. Browning, like other eminent writers of the day, failed to achieve the feat of attracting the British public by dramas of high literary aims, and soon gave up the attempt. It has been said by competent critics that some of the plays could be fitted for the stage by judicious adaptation. The *Blot on the 'Scutcheon* has a very clear and forcibly treated situation; and all the plays abound in passages of high poetic power. Like the poems, they deal with situations involving a moral probation of the characters, and often suggesting the ethical problems which always interested him. The speeches tend to become elaborate analyses of motive by the persons concerned, and try the patience of an average audience. For whatever reason, Browning, though he had given sufficient proofs of genius, had not found in these works the most appropriate mode of utterance.

The dramas, after *Strafford*, formed the greatest part of a series of pamphlets called *Bells and Pomegranates*, eight of which were issued from 1841 to 1846. The name, he explained, was intended to indicate an "alternation of poetry and thought." The first number contained the fanciful and characteristic *Pippa Passes*. The seventh, significantly named *Dramatic Romances and Lyrics*, contained some of his most striking shorter poems. In 1844 he contributed six poems, among which were "The Flight of the Duchess" and "The Bishop orders his Tomb at St. Praxed's Church," to Hood's *Magazine*, in order to help Hood, then in his last illness. These poems take the special form in which Browning is unrivalled. He wrote very few lyrical poems of the ordinary kind purporting to give a direct expression of his own personal emotions. But, in the lyric which gives the essential sentiment of some impressive dramatic situation, he has rarely been approached. There is scarcely one of the poems published at this time which can be read without fixing itself at once in the memory as a forcible and pungent presentation of a characteristic mood. Their vigour and originality failed to overcome at once the presumption against the author of *Sordello*. Yet Browning was already known to and appreciated by such literary celebrities of the day as Talfourd, Leigh Hunt, Procter, Monckton Milnes, Carlyle, and Landor. His fame began to spread among sympathetic readers. The *Bells and Pomegranates* attracted the rising school of "pre-Raphaelites," especially D. G. Rossetti, who guessed the authorship of the anonymous *Pauline* and made a transcript from the copy in the British Museum. But his audience was still select.

Another recognition of his genius was of incomparably more personal importance and vitally affected his history. In 1844 Miss Barrett (*see* BROWNING, ELIZABETH BARRETT) published a volume of poems containing "Lady Geraldine's Courtship," with a striking phrase about Browning's poems. He was naturally gratified, and her special friend and cousin, John Kenyon, encouraged him to write to her. She admitted him to a personal interview after a little diffidence, and a hearty appreciation of literary genius on both sides was speedily ripened into genuine and most devoted love. Miss Barrett was six years older than Browning and a confirmed invalid with shaken nerves. She was tenderly attached to an autocratic father who objected on principle to the marriage of his children. The correspondence of the lovers (published in 1899) shows not only their mutual devotion, but the chivalrous delicacy with which Browning behaved in a most trying situation. Miss Barrett was gradually encouraged to disobey the utterly unreasonable despotism. They made a clandestine marriage on Sept. 12, 1846. The state of Miss Barrett's health suggested misgivings which made Browning's parents as well as his bride's disapprove of the match. She, however, appears to have become stronger for some time, though always fragile and incapable of much active exertion. She had already been recommended to pass a winter in Italy. Browning had made three previous tours there, and his impressions had been turned to account in *Sordello* and *Pippa Passes*, in *The Englishman in Italy* and *Home Thoughts from Abroad*. For the next 15 years the Brownings lived mainly in Italy, making their headquarters at Florence in the Casa Guidi. A couple of winters were passed in Rome. In the summer of 1849 they were at Siena, where Browning was helpful to Landor, then in his last domestic troubles. They also visited England and twice spent some months in Paris. Their only child, Robert Wiedemann Browning, was born at Florence in 1849. Browning's literary activity during his marriage seems to have been comparatively small; *Christmas Eve and Easter Day* appeared in 1850, while the two volumes called *Men and Women* (1855), containing some of his best work, showed that his power was still growing. His position involved some sacrifice and imposed limitations upon his energies. Mrs. Browning's health required a secluded life; and Browning, it is said, never dined out during his marriage, though he enjoyed society and made many and very warm friendships. Among their Florence friends were Margaret Fuller Ossoli, Isa Blagden, Charles Lever, and others. The only breach of complete sympathy with his wife was due to his contempt for "spiritualists" and "mediums," in whom she fully believed. His portrait of Daniel Dunglas Home as "Sludge the Medium" only appeared after her death. This domestic happiness, however, remained essentially unbroken until she died on June 20, 1861. The whole love-story had revealed the singular nobility of his character, and, though crushed for a time by the blow, he bore it manfully. Browning determined to return to England and superintend his boy's education at home. He took a house at 19, Warwick crescent, Paddington, and became gradually acclimatized in London. He resumed his work and published the *Dramatis Personae* in 1864. The publication was well enough received to mark the growing recognition of his genius, which was confirmed by *The Ring and the Book*, published in four volumes in the winter of 1868–69. In 1867 the university of Oxford gave him the degree of M.A. "by diploma," and Balliol college elected him as an honorary fellow. In 1868 he declined a virtual offer of the rectorship of St. Andrews. He repeated the refusal on a later occasion (1884) from a dislike to the delivery of a public address. The rising generation was now beginning to buy his books; and he shared the homage of thoughtful readers with Tennyson, though in general popularity he could not approach his friendly rival. *The Ring and the Book* has been generally accepted as Browning's masterpiece. It was based on a copy of the *procès verbal* of Guido Franceschini's case discovered by him at Florence.

The audacity of the scheme is surprising. To tell the story of a hideous murder 12 times over, to versify the arguments of counsel and the gossip of quidnuncs, and to insist upon every detail with the minuteness of a law report, could have occurred to no one else. The poem is so far at the opposite pole from *Sordello*. Vagueness of environment is replaced by a photographic distinctness, though the psychological interest is dominant in both. Particular phrases may be crabbed, but nothing can be more distinct and vivid in thought and conception. If some of those "dramatic monologues" of which the book is formed fail to be poetry at all, some of them—that of Pompilia the victim, her champion Caponsacchi, and the pope who gives judgment—are in Browning's highest mood, and are as impressive from the ethical as from the poetical point of view. Pompilia was no doubt in some respects an idealized portrait of Mrs. Browning. Other pieces may be accepted as a background of commonplace to throw the heroic into the stronger relief, *The Ring and the Book* is as powerful as its method is unique.

Browning became gentler and more urbane as he grew older. His growing fame made him welcome in all cultivated circles, and he accepted the homage of his admirers with dignity and simplicity. He exerted himself to be agreeable in private society, though his nervousness made him invariably decline ever to make public speeches. He was an admirable talker, and took pains to talk his best. A strong memory supplied him with abundant anecdotes; and though occasionally pugnacious, he allowed a fair share of the conversation to his companions. Superficial observers sometimes fancied that the poet was too much sunk in the man of the world; but the appearance was due to his characteristic reluctance to lay bare his deeper feelings. When due occasion offered, the underlying tenderness of his affections was abundantly manifest. No one could show more delicate sympathy. He made many warm personal friendships in his later years, especially with women, to whom he could most easily confide his feelings. In the early years of this period he paid visits to country houses, but afterwards preferred to retire farther from the London atmosphere into secluded regions. He passed some holidays in remote French villages, Pornic, Le Croisic, and St. Aubyn, which have left traces in his poetry. *Gold Hair* is a legend of Pornic, and *Hervé Riel* was written at Le Croisic. At St. Aubyn he had the society of Joseph Milsand, who had shown his warm appreciation of Browning's poetry by an article in the *Revue des Deux Mondes*, which in 1852 had led to a personal friendship lasting till Milsand's death in 1886. Browning sent to him the proof-sheets of all his later works for revision. In 1877 Browning was at La Saisiaz on the Salève, near Geneva, where an old friend, Miss Egerton Smith, was staying. She died suddenly almost in his presence. She had constantly accompanied him to concerts during his London life. After her death he almost ceased to care for music. The shock of her loss produced the singular poem called *La Saisiaz*, in which he argues the problem of personal immortality with a rather indefinite conclusion. In later years Browning returned to Italy and passed several autumns at Venice. He never visited Florence after his wife's death there.

Browning's literary activity continued till almost the end of his life. He wrote constantly, though he composed more slowly. He considered 25 or 30 lines to be a good day's work. His later writings covered a very great variety of subjects, and were cast in many different forms. They show the old characteristics and often the old genius. Browning's marked peculiarity, the union of great speculative acuteness with intense poetical insight, involved difficulties which he did not always surmount. He does not seem to know whether he is writing poetry or when he is versifying logic; and when the speculative impulse gets the upper hand, his work suggests the doubt whether an imaginary dialogue in prose would not have been a more effective medium. He is analysing at length when he ought to be presenting a concrete type, while the necessities of verse complicate and obscure the reasoning. A curious example is the *Prince Hohenstiel-Schwangau* (1871), an *alias* for Louis Napoleon. The attempt to show how a questionable hero apologizes to himself recalls the very powerful "Bishop Blougram," and "Sludge the Medium," of earlier works, but becomes prolix and obscure. *Fifine at the Fair* (1872) is another curious speculation containing a defence of versatility in love-making by an imaginary Don Juan. Its occasionally cynical tone rather scandalized admirers, who scarcely made due allowance for its dramatic character. Browning's profound appreciation of high moral qualities is, however, always one main source of his power. In later years he became especially interested in stories of real life, which show character passing through some sharp ordeal. The *Red Cotton Nightcap Country* (1873), describing a strange tragedy which had recently taken place in France, and especially *The Inn Album* (1875), founded on an event in modern English society, are powerful applications of the methods already exemplified in *The Ring and the Book*. The *Dramatic Idyls* (1879 and 1880) are a collection of direct narratives, with less analytical disquisition, which surprised his readers by their sustained vigour. In the last volumes, *Jocoseria* (1883), *Ferishtah's Fancies* (1884), *Parleyings with Certain People* (1887) and *Asolando* (1889), the old power is still apparent but the hand is beginning to fail. They contain discussions of metaphysical problems, such as the origin of evil, which are interesting as indications of his creed, but can scarcely be regarded as successful either poetically or philosophically.

Another group of poems showed Browning's interest in Greek literature. *Balaustion's Adventure* (1871) includes a "transcript from Euripides," a translation, that is, of part of the *Alcestis*. *Aristophanes' Apology* (1875) included another translation from the *Heracles*, and in 1877 he published a very literal translation of the *Agamemnon*. This, it seems, was meant to disprove the doctrine that Aeschylus was a model of literary style. Browning shared his wife's admiration for Euripides, and takes a phrase from one of her poems as a motto for *Balaustion's Adventure*. In the *Aristophanes' Apology* this leads characteristically to a long exposition by Aristophanes of his unsatisfactory reasons for ridiculing Euripides. It recalls the apologies of "Blougram" and Louis Napoleon, and contains some interesting indications of his poetical theory. Browning was to many readers as much prophet as poet. His religious position is most explicitly, though still not very clearly, set forth in the *Christmas Eve and Easter day* (1850). Like many eminent contemporaries, he combined a disbelief in orthodox dogma with a profound conviction of the importance to the religious instincts of the symbols incorporated in accepted creeds. *Saul* (1845), *A Death in the Desert* (1864), and similar poems, show his strong sympathy with the spirit of the old belief, though his argumentative works have a more or less sceptical turn. It was scarcely possible, if desirable, to be original on such topics. His admirers hold that he shows an affinity to German metaphysicians, though he had never read their works or made any express study of metaphysical questions. His distinctive tendency is to be found rather in the doctrine of life and conduct which both suggest and is illustrated by his psychological analyses. A very characteristic thought emphatically set forth in the *Rabbi Ben Ezra* (1864) and the *Grammarian's Funeral* (1855) is that a man's value is to be measured, not by the work done, but by the character which has been moulded. He delights in exhibiting the high moral instinct which dares to override ordinary convictions, or which is content with discharge of obscure duties, or superior to vulgar ambition and capable of self-sacrifice, because founded upon pure love and sympathy for human suffering. Browning's limitations are characteristic of the poetry of strong ethical preoccupations. His strong idiosyncrasy, his sympathy with the heroic and hatred of the base, was hardly to be combined with the Shakespearean capacity for sympathizing with the most varied types of character. Though he deals with a great variety of motive with singularly keen analysis, he takes almost exclusively the moral point of view. That point of view, however, has its importance, and his morality is often embodied in poetry of surpassing force. Browning's love of the grotesque, sometimes even of the horrible, creates many most graphic and indelible portraits. The absence of an exquisite sense for the right word is compensated by the singular power of striking the most brilliant flashes out of obviously wrong words, and forcing comic rhymes to express the deepest and most serious thoughts. Though he professed to care little for motive as apart from human interest, his incidental touches of description are unsurpassably vivid.

The appreciation of Browning's genius became general in his later years, and zeal was perhaps a little heightened by the complacency of disciples able to penetrate a supposed mist of obscurity. The Browning Society, founded in 1881 by Dr. F. J. Furnivall and Miss E. H. Hickey, was a product of this appreciation, and helped to extend the study of the poems. Browning accepted the homage in a simple and friendly way, though he avoided any action which would make him responsible for the publications. He received various honours: LL.D. degree from Cambridge in 1879, the D.C.L. from Oxford in 1882, and LL.D. from Edinburgh in 1884. He became foreign correspondent to the Royal Academy in 1886. His son, who had settled at Venice, married in 1887, and Browning moved to De Vere Gardens. In the autumn of 1889 he went with his sister to visit his son, and stayed on the way at Asolo, which he had first seen in 1838, when it supplied the scenery of *Pippa Passes*. He was charmed with the place, and proposed to buy a piece of ground and to build upon it a house to be called "Pippa's Tower"—in memory of his early heroine. While his proposal was under consideration he went to his son at Venice. His health had been breaking for some time, and a cold, aggravated by weakness of the heart, brought on a fatal attack. He died on Dec. 12, 1889. He was buried in Westminster Abbey on Dec. 31. It was suggested that his wife's body should be removed from Florence to be placed beside him; but their son rightly decided that her grave should not be disturbed.

Browning's personal characteristics are so strongly stamped upon all his works that it is difficult to assign his place in contemporary thought. He is unique and outside of all schools. His style is so peculiar that he is the easiest of all poets to parody and the most dangerous to imitate. In spite of his early Shelley worship he is in certain respects more closely related to Wordsworth. Both of them started by accepting the poet's mission as quasi-prophetical or ethical. In other respects they are diametrically contrasted. Wordsworth expounded his philosophy by writing a poetical autobiography. Browning adheres to the dramatic method of which Wordsworth was utterly incapable. He often protested against the supposition that he put himself into his books. Yet there is no writer whose books seem to readers to be clearer revelations of himself. Nothing, in fact, is more characteristic of a man than his judgments of other men, and Browning's are keen and unequivocal. The revolutionary impulse had died out, and Browning has little to say either of the political questions which had moved Shelley and Byron, or of the social problems which have lately become more prominent. He represents the thought of a quieter epoch. He was little interested, too, in the historical or "romantic" aspect of life. He takes his subjects from a great variety of scenes and places—from ancient Greece, mediaeval Italy and modern France and England; but the interest for him is not in the picturesque surroundings, but in the human being who is to be found in all periods. Like Balzac, whom he always greatly admired, he is interested in the eternal tragedy and comedy of life. His problem is always to show what are the really noble elements which are eternally valuable in spite of failure to achieve tangible results. He gives, so far, another version of Wordsworth's doctrine of the cultivation of the "moral being." The psychological acuteness and the subtle analysis of character are, indeed, peculiar to himself. Like Carlyle, with whom he had certain points of affinity, he protests, though rather by implication than direct denunciation, against the utilitarian or materialistic view of life, and finds the divine element in the instincts which guide and animate every noble character. When he is really inspired by sympathy for such emotions he can make his most grotesque fancies and his most far-fetched analyses subservient to poetry of the highest order. It can hardly be denied that his intellectual ingenuity often tempts him to deviate from his true function, and that his observations are not to be excused because they result from an excess, instead of a deficiency, of intellectual acuteness. But the variety of his interests—aesthetic, philosophical, and ethical—is astonishing, and his successes are poems which stand out as unique and unsurpassable in the literature of his time. (L. S.)

The Life and Letters of Browning, by Mrs. Sutherland Orr (1891), one of his most intimate friends in later years, and *The Love Letters of Robert Browning and Elizabeth Barrett Browning*, 1845–46, published by his son in 1899, are the main authorities. The fullest *Life* is by W. Hall Griffin, completed by H. C. Minchin (1910). A collection of Browning's poems in 2 vols. appeared in 1849, another in 3 vols. in 1863, another in 6 vols. in 1868, and a revised edition in 16 vols. in 1888–89; in 1896 Augustine Birrell and F. G. Kenyon edited a complete edition in 2 vols.; another two-volume edition was issued in 1900. A centenary edition in 10 vols. was published in 1912 with introductions by F. G. Kenyon. Among commentaries on Browning's works, Mrs. Sutherland Orr's *Handbook to the Works of Browning* was approved by the poet himself. *See* also the Browning Society's *Papers;* T. J. Wise, *Materials for a Bibliography of the Writings of Robert Browning,* included in the *Literary Anecdotes of the Nineteenth Century* (1895), by W. Robertson Nicoll and T. J. Wise; Edmund Gosse, *Robert Browning: Personalia* (1890), from notes supplied by Browning himself. Among biographical and critical authorities may be mentioned: J. T. Nettleship, *Essays* (1868); Arthur Symons, *An Introduction to the Study of Browning* (1886); Stopford Brooke, *The Poetry of Robert Browning* (1902). G. K. Chesterton, *Browning* (1908) in the "English Men of Letters" series; and E. Berger, "Robert Browning" in the *Grands Écrivains étrangers* series (1912); Frances M. Sim, *Robert Browning* (1923).

BROWNLEE, JOHN (1868–1927), Scottish medical statistician. After holding various medical appointments, in 1914 he became statistician to the medical research committee. His best known works include the memoir on the epidemiology of phthisis, and his investigations of the laws governing the rise and decline of epidemic diseases, especially measles and influenza. He died on March 20, 1927.

BROWN-SÉQUARD, CHARLES EDWARD (1817–1894), British physiologist and neurologist, was born at Port Louis, Mauritius, on April 8, 1817 of mixed American-French parentage. After graduating in medicine at Paris in 1840 he held chairs at Harvard university and at Paris. Eventually he succeeded Claude Bernard in 1878 as professor of experimental medicine in the Collège de France. He died on April 2, 1894 at Sceaux. Brown-Séquard was the first scientist to work out the physiology of the spinal cord, demonstrating that the decussation of the sensory fibres is in the cord itself. He also did valuable work on the internal secretion of organs, the results of which have been applied with the most satisfactory results in the treatment of myxoedema. Unfortunately, in his extreme old age, he advocated the hypodermic injection of a fluid prepared from the testicles of sheep as a means of prolonging human life. It was known among scientists, derisively, as the Brown-Séquard elixir. His researches, published in about 500 essays and papers, especially in the *Archives de Physiologie*, which he helped to found in 1868, cover a very wide range of physiological and pathological subjects.

BROWN SHIRTS: see UNIFORMS.

BROWNSON, ORESTES AUGUSTUS (1803–1876), American writer, was born in Stockbridge (Vermont), Sept. 16, 1803. His changes in religion from Presbyterianism to Universalism, from Unitarianism to the Society for Christian Union and Progress, which he organized, and from that to Roman Catholicism; his philosophy, a modified intuitionalism in which he followed Comte and Victor Cousin, who in his *Fragments philosophiques*, praised him; his schemes for social reform, including establishment of the Workingman's party; his outpourings of opinion in his *Boston Quarterly Review* (1838–42) and *Brownson's Quarterly Review* (1844–64, 1873–75); and his rather mystical poetry all make him part of that strange combination of foreign philosophy, religious ecstasy, social uplift, and literary enthusiasm termed the transcendental movement. His chief books were *The American Republic: Its Constitution, Tendencies and Destiny* (1865), in which he based government on ethics, and those of an autobiographical nature including *Charles Elwood, or the Infidel Converted* (1840). He died in Detroit (Mich.) April 17, 1876.

After Brownson's death, his son, Henry F. Brownson, collected and published his *Works* (Detroit, 1882–87), of which a condensed summary appeared, also prepared by his son, entitled *Literary, Scientific, and Political Views of Orestes A. Brownson.* The son also published a biography (Detroit, 1898–1900). A doctor's dissertation by V. G. Michel, *The Critical Principles of Orestes A. Brownson* (Washington, D.C., 1918) contains a bibliography. Extracts from his writings appeared in 1910 and 1923.

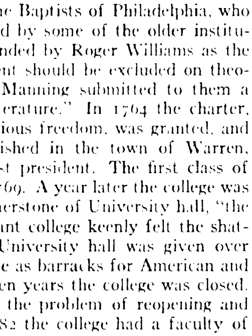
BROWNSVILLE, a city in the southern tip of Texas, U.S.A., 250 mi. S.E. of San Antonio, on the Rio Grande, about 22 mi. from its mouth, opposite Matamoros, Mexico; a port of entry and the county seat of Cameron county. It is served by the Southern Pacific and Missouri Pacific railroads; has an international airport served by Pan American, Braniff and Eastern airlines; has an inland deep water harbour served by coastwise and foreign shipping; and is reached by first class concrete highways.

There are two international toll bridges crossing the Rio Grande. Pop. (1940) was 22,083 by the Federal census. It has a considerable trade with northern Mexico, and is the financial and commercial centre of the rich lower Rio Grande valley, of which about half (715,000 acres) is under irrigation, and where the growing season lasts 365 days, and two or three crops a year on the same land are the rule. Citrus fruits, early vegetables, potatoes, cotton and corn are the leading products. Brownsville is an important tourist centre and enjoys a large winter tourist trade. There is a natural palm grove six miles from the city. Boca Chica, situated on the Gulf of Mexico 25 mi. away by paved highway, affords surf bathing and fishing. Fort Brown, a picturesque military reservation of 288 ac., with a garrison averaging 400 men, adjoins Brownsville on the east. Established by General Zachary Taylor in March 1846, and at first called Fort Taylor, it was renamed in honour of Major Jacob Brown, who was mortally wounded in its defence during the bombardment from across the river (May 3–10, 1846). At Palo Alto, 14 mi. N.E., and at Resaca de la Palma, 4 mi. N., General Taylor defeated the Mexicans under General Arista on May 8 and May 9, 1846. There was a small Mexican settlement on the site of Brownsville before the

Mexican War. The town was surveyed in 1848, and named after Major Brown. In 1849 it became an important outfitting-point for gold-seekers on their way to California. For several decades its fortunes fluctuated sharply, and it suffered from yellow fever, fires, Mexican revolutions, speculators, and the machinations of political parties. In 1850 it was captured by Mexican raiders. During the Civil War, until occupied by Federal forces in 1863, it was an active centre of operations by Confederate blockade-runners. The last engagement of the war took place at Palmetto Ranch, near the battlefield of Palo Alto, on May 13, 1865, more than a month after General Lee had surrendered. The present period of the city's development began when the railway from the north reached it in 1904, and is based on the agricultural possibilities of the valley. It has a city-manager form of government.

BROWN UNIVERSITY, in Providence, R.I., is the seventh of the nine colleges founded in America before the American revolution. It was projected by the Baptists of Philadelphia, who resisted the religious tests imposed by some of the older institutions and selected the colony founded by Roger Williams as the home of a college where no student should be excluded on theological grounds. In 1763 James Manning submitted to them a draft of a "seminary of polite literature." In 1764 the charter, a landmark in the growth of religious freedom, was granted, and Rhode Island college was established in the town of Warren, James Manning becoming the first president. The first class of seven students was graduated in 1769. A year later the college was moved to Providence and the cornerstone of University hall, "the college edifice" was laid. The infant college keenly felt the shattering force of the Revolution. University hall was given over to the colonial government to serve as barracks for American and French troops, and for nearly seven years the college was closed. Courageously Dr. Manning faced the problem of reopening and rebuilding, and at his death in 1782 the college had a faculty of seven teachers and a graduating class of 21. Nicholas Brown, a leading citizen of Providence, had for years given the enterprise steadfast support, and when he added a gift of $5,000 (subsequently increased to $160,000) in 1804, Rhode Island college became Brown university. A few courses for women, given outside the university gates, expanded into the Women's college in Brown university, which in 1897 was formally established as a separate, but co-ordinate institution.

The buildings of the university in 1928 numbered nearly 50, including the John Hay library, containing 350,000 volumes, and the well-known John Carter Brown library, containing rare Americana. Laboratories have been opened in the departments of biology, engineering, chemistry, physics, geology, psychology and botany, new dormitories acquired, and buildings erected for social and religious purposes. Athletic fields have been opened adjacent to the gymnasium, and a health service established with infirmary and medical staff. Provision has been made for moral and religious incentive and a student counsellor placed in charge of religious work. In 1928 the total university endowment was $9,500,000 and the value of the property over $5,000,000. The total disbursements for all purposes in that year were $1,800,000. The faculty had increased to 153 professors and instructors. The students numbered 2,176, in addition to the 2,407 enrolled in part-time or extension courses. While adjusting itself to the changing needs of modern life, the university has in general declined to open professional schools and still devotes its main energies to liberal education. (W. H. P. F.)


FIRST BAPTIST CHURCH, PROVIDENCE, R. I., OLDEST IN AMERICA. SCENE OF BROWN UNIVERSITY "COMMENCEMENTS"

BROWNWOOD, a city of Texas, U.S.A., county seat of Brown county, is almost in the exact centre of Texas. It is served by the Santa Fe railway. The population in 1930 was 12,789 and 13,398 in 1940 (95.2% native white) by federal census. Camp Bowie and the 8th army corps headquarters are in the neighbourhood. The city has a $2,500,000 lake and irrigation system, one brick yard, several manufacturing concerns; it ships large quantities of pecans, cattle, wool and turkeys. Howard Payne and Daniel Baker colleges are located there. Brownwood was settled about 1865. The city has a commission form of government.

BRUAY-EN-ARTOIS, town in northern France, department of Pas-de-Calais, on the Lawe, 19 mi. N.N.W. of Arras by road. Pop. (1936) 30,087. It is one of the large coal-mining centres of the north-eastern industrial area of France. There are also large breweries. Bruay was one of the most important mining centres left in French possession during the period 1914–18. By a decree of Jan. 4, 1924 its name was changed from Bruay to Bruay-en-Artois.

BRUCE, the name of an old Scottish family of Norman descent, taken from Bruis between Cherbourg and Vallonges. Variations of the name are Braose, Breaux, and Brus. The first Robert de Brus, a follower of William the Conqueror, was rewarded by the gift of many manors, chiefly in Yorkshire, of which Skelton was the principal. His son, the second Robert, received from David I., his comrade at the court of Henry I., a grant of the lordship of Annandale. The fourth Robert married Isabel, natural daughter of William the Lion, and their son, the fifth Robert, married Isabel, second daughter of David, earl of Huntingdon, niece of the same Scottish king. The most famous member of the family is the eighth Robert, "the Bruce," who became king of Scotland in 1306. (*See* ROBERT I, "THE BRUCE.")

BRUCE, JAMES (1730–1794), Scottish explorer in Africa, was born at Kinnaird House, Stirlingshire, on Dec. 14, 1730. He was educated at Harrow and Edinburgh University, and began to study for the bar; but he married a wine merchant's daughter and went into his father-in-law's business. His wife died in Oct. 1754, within nine months of marriage, and Bruce then travelled in Portugal and Spain. The examination of oriental mss. at the Escurial led him to the study of Arabic and determined his future career. In 1758 his father's death placed him in possession of the estate of Kinnaird. On the outbreak of war with Spain in 1762 he submitted to the British Government a plan for an attack on Ferrol, which was not adopted but which led to his appointment as British consul at Algiers, with a commission to study the ancient ruins in that country. In Aug. 1765, a successor in the consulate having arrived, Bruce began his exploration of the Roman ruins in Barbary. Having examined many ruins in eastern Algeria, he travelled from Tunis to Tripoli, and eventually reached Crete, and Syria, visiting Palmyra and Baalbek.

In June 1768 he arrived at Alexandria, having resolved to endeavour to discover the source of the Nile, which he believed to rise in Abyssinia. After visiting Thebes he crossed the desert to Kosseir, where he embarked in the dress of a Turkish sailor. He reached Jidda in May 1769, and after some stay in Arabia he recrossed the Red Sea and landed at Massawa, then in possession of the Turks, on Sept. 19. He reached Gondar, then the capital of Abyssinia, on Feb. 14, 1770. After two years in Abyssinia, on Nov. 14, 1770, he reached the long-sought source of the Blue Nile. Though admitting that the White Nile was the larger stream, Bruce claimed that the Blue Nile was the Nile of the ancients and that he was thus the discoverer of its source. The claim, however, was not well founded (*see* NILE: *Story of Discovery*). Setting out from Gondar in Dec. 1771, Bruce made his way, in spite of enormous difficulties, by Sennar to Nubia, being the first to trace the Blue Nile to its confluence with the White Nile. On Nov. 29, 1772, he reached Aswan. Bruce returned to Cairo in January 1773, and in March arrived in France, where he was welcomed by Buffon and other *savants*. He went to London in 1774, but, offended by the incredulity with which his story was received, retired to his home at Kinnaird. In 1790 he published *Travels to Discover the Source of the Nile in the Years 1768-73*, in five octavo volumes, lavishly illustrated. Bruce died on April 27, 1794.

He wrote an autobiography, part of which is printed in editions of his *Travels* published in 1805, and 1813, and accompanied by a biographical notice by the editor, Alexander Murray. The best edition of the *Travels* is the third (1813). Of the abridgments the best is that of Major (afterwards Sir Francis) Head, the author of a well-informed *Life of Bruce* (1830). The best account of Bruce's travels in Barbary is contained in Sir R. Lambert Playfair's *Travels in the Footsteps of Bruce* (1877).

BRUCE, MICHAEL (1746–1767), Scottish poet, was born at Kinnesswood, Kinross-shire, on March 27, 1746, the son of a weaver, and died at the age of 21 in his native place on July 5, 1767. His parents gave him a good education and he attended four winter sessions at Edinburgh university. In 1766 he wrote his last and finest poem, "Elegy Written in Spring."

His reputation has been spread, first through sympathy for his early death and, secondly, through the alleged theft by John Logan (*q.v.*) of several of his poems. Logan edited in 1770 *Poems on Several Occasions, by Michael Bruce*, in which the "Ode to the Cuckoo" appeared. In the preface he stated that "to make up a miscellany, some poems written by different authors are inserted." In a collection of his own poems in 1781, Logan printed the "Ode to the Cuckoo" as his own.

Bibliography.—Additions to *Poems on Several Occasions* were made by Dr. M'Kelvie in his 1837 edition, with a list of the poems not printed in Logan's selection and those that are lost. *See* the "Life" in Anderson's *British Poets* (1705); an admirable paper on Bruce in *The Mirror* (No. 36, 1770), said to be by William Craig, one of the lords of session; *The Poetical Works of Michael Bruce; with Life and Writings* (1895), by William Stephen, who, like Dr. A. B. Grosart, *The Works of Michael Bruce* (1865), adopts M'Kelvie's view; and *Life of Michael Bruce, Poet of Loch Leven, with Vindication of his Authorship of the "Ode to the Cuckoo" and other Poems*, etc. (1905), by James Mackenzie.

BRUCE, STANLEY MELBOURNE (1883–   ), Australian statesman, was born in Melbourne on April 15, 1883, and was educated at Melbourne grammar school, and Trinity hall, Cambridge. He was called to the bar by the Middle Temple in 1907, but shortly afterwards he inherited a partnership in the Melbourne firm of merchants, Paterson, Laing and Bruce. He was again in England when the World War began, received a commission in the Royal Fusiliers, took part in the landing at Suvla bay and was seriously wounded. Later he served in France, was again wounded, and in 1917, was invalided back to Australia. In that year, on the elevation of Sir William Ervine to the chief justiceship of Victoria, he was returned to the Commonwealth Parliament for Flinders. Bruce's political progress was extraordinarily rapid. In 1921 he represented Australia at the second Assembly of the League of Nations. Soon after, Bruce succeeded Sir Joseph Cook as treasurer in the cabinet led by W. M. Hughes (1921–23). In this office, which is second to that of the prime minister, Bruce's knowledge of commerce and law proved extremely useful, and he soon built up a reputation as an essentially sane and level-headed man of affairs rather than an orator or picturesque leader of men. These qualities appealed to a country burdened by heavy war debts and many problems arising out of the war. Bruce profited, too, by the growing dislike of the National Party formed by Hughes during the war. In Feb. 1923 the tottering Hughes ministry fell, and Bruce, as the leader of the Liberal wing of the National Party, succeeded in forming an alliance with the leader of the Country Party, Dr. Earle Page, who took office as treasurer. In 1925, a series of strikes led to a crisis in the shipping trade, and Bruce appealed to the country in a general election in November. The result was a decisive triumph for Bruce, and a heavy defeat for the Labour Party. In imperial affairs he might be described in Bagehot's phrase as an apostle of animated moderation, standing for as warm and close a relationship with Great Britain as is consistent with Australia's interests as a completely self-governing dominion. Under his leadership the Federal Parliament maintained the customs preference to British goods and agreed to a great migration scheme—though the fruits of this latter project were, owing to the difficulties of the states, rather disappointing; and at every opportunity, notably the Imperial Conferences in 1923 and 1926 (*see* British Empire), he showed himself to be a staunch believer in the future of a British commonwealth of nations with Great Britain as its head. Bruce was prime minister until 1929. In 1933 he became High Commissioner for Australia in London; and in 1936 was president of the Montreux conference which revised the Straits convention. He was created a Companion of Honour, 1927.

BRUCH, MAX (1838–1920), German composer, son of a city official and grandson of the Evangelical cleric, Dr. Christian Bruch, was born at Cologne on Jan. 6, 1838. From his mother (*née* Almenräder), a well-known musician of her time, he learnt the elements of music, and composition he studied under Breidenstein at Bonn. He was a precocious child, and at 14 produced a symphony. In 1853 he gained the Mozart Stipendium of 400 gulden per annum for four years at Frankfurt-on-Main, where he studied under Hiller, Reinecke and Breuning. From 1858 to 1861 he lived at Cologne, where his first opera (in one act), *Scherz, List und Rache*, was produced in 1858.

On his father's death, in 1861, Bruch began a tour of study at Berlin, Leipzig, Vienna, Munich, Dresden and Mannheim, where his opera, *Lorelei* (libretto by Geibel), was brought out in 1863. At Mannheim he lived till 1864, and there he wrote some of his best-known works, including the beautiful *Frithjof* (*Scenen* for male voices and orchestra). After a further period of travel he became musical-director at Coblenz (1865–67) and Hofkapellmeister at Sondershausen (1867–70), and then lived in Berlin (1871–73), where he wrote his *Odysseus*, his first violin concerto and two symphonies being composed at Sondershausen. After five years at Bonn (1873–78), during which he paid two visits to England, Bruch, in 1878, became conductor of the Stern Choral Union; and in 1880 of the Liverpool Philharmonic. He remained in England for three years. In 1892 he was appointed director of the composition branch of the Berlin Hochschule. From 1910 onwards he lived in retirement near Berlin, at Friedenau, where he died on Oct. 2, 1920.

Though Bruch himself regarded his works for choir with orchestra as his most important contribution to music, and not without justification, since they are of notable excellence, his popular reputation rests on his supremely grateful and effective solo works for the violin and the violoncello, and it is probably by these that he will be longest remembered. Among them are the famous violin concerto in G minor (op. 26), which stands second only to Mendelssohn's in melodiousness and charm, the Romance for violin and orchestra (op. 42), the *Kol Nidrei*, variations for violoncello and orchestra (op. 47), and the *Conzertstück*, for violin and orchestra (op. 84).

BRUCHSAL, a town of Germany, in the *Land* of Baden, 14m. N.E. of Karlsruhe, and an important junction where the Stuttgart line diverges from the main Frankfurt-Basle railway. Pop. (1939) 18,210. Bruchsal (mentioned in 937 as *Bruxolegum*) was originally a royal villa belonging to the emperors and German kings. Given to Otto, duke of Franconia, in 1002 it was inherited by the cadet line of Speyer, the head of which, the emperor Henry III., gave it to the see of Speyer in 1095. St. Peter's church was the burial-place of the bishops, whose summer residence (now used as a prison) lies in the vicinity. In 1190 the bishops bought the *Vogtei* (advocateship) from the counts of Calw, and the place rapidly developed into a town. By the treaty of Lunéville (1802) it was ceded, with other lands of the bishopric on the right bank of the Rhine, to Baden. The Peasants' War during the Reformation period first broke out in Bruchsal. In 1676 and 1698 it was burnt by the French. Bruchsal manufactures machinery, paper, soap, beer, wines and spirits.

BRUCINE, one of the alkaloids (*q.v.*) occurring with strychnine (*q.v.*) in various species of *Strychnos*, *e.g.*, in *S. Nux vomica*. (*See* Nux Vomica.) It has a bitter taste and its physiological action, when it is injected subcutaneously in animals, is similar to that produced by strychnine but much feebler; when administered internally it has very little effect owing to the rapidity of its elimination. The method of extraction of brucine is the same as that for strychnine; the brucine crystallizes out when the mixture of alkaloids is washed with dilute alcohol. It is purified by recrystallization from water or alcohol. The crystals form monoclinic prisms, losing their water (2 or 4 molecules) at 100° C, and melting at 105°. Anhydrous brucine, $C_{23}H_{26}O_4N_2$, melts at 178°, and is laevorotatory in alcohol or chloroform.

BRUCITE, a mineral consisting of magnesium hydroxide, $Mg(OH)_2$, and crystallizing in the rhombohedral system. It was first described in 1814 as "native magnesia" from New Jersey by A. Bruce, an American mineralogist, after whom the species was named. Brucite is usually found as platy masses, sometimes of considerable size, which have a perfect cleavage parallel to the surface of the plates. It is white, sometimes with a tinge of grey, blue or green, varies from transparent to translucent, and on the cleavage surfaces has a pronounced pearly lustre. In general appearance and softness (H = 2½) it is thus not unlike gypsum or talc, but it may be readily distinguished from these by its optical character, being uniaxial with positive birefringence. The specific gravity is 2·38–2·40.

Brucite is generally associated with other magnesian minerals, such as magnesite and dolomite, and is commonly found in serpentine, or sometimes as small scales in phyllites and crystalline schists; it has also been observed in metamorphosed magnesian limestone, such as the rock known as predazzite from Predazzo in Tirol. (L. J. S.)

BRUCKER, JOHANN JAKOB (1696–1770), German historian of philosophy, born at Augsburg on Jan. 22, 1696, died there on Nov. 26, 1770. He was educated at the University of Jena. In 1723 he became parish minister of Kaufbeuren. In 1731 he was invited to Augsburg as pastor and senior minister of the church of St. Ulrich. His chief work, *Historia Critica Philosophiae*, appeared at Leipzig (5 vols. 1742–44). Owing to its ample collection of material its success was such that a new edition was published in six volumes (1766–67; English trans. by W. Enfield, 1791). He superintended an edition of Luther's translation of the Old and New Testament, with a commentary extracted from the writings of the English theologians (Leipzig, 1758–70, completed by W. A. Teller).

BRUCKNER, ANTON (1824–1896), Austrian musical composer, was born on Sept. 4, 1824, at Ansfelden in Upper Austria. He successfully competed for the organistship for Linz cathedral in 1855. In 1867 he succeeded his former master of counterpoint Sechter, as organist of the *Hofkapelle* in Vienna, and also became professor in the conservatorium. In 1875 he was appointed to a lectureship in the university. He made a great impression by his extemporizations on the organ, and his success in an organ competition at Nancy in 1869 led to his playing in Paris and London (six recitals at the Albert hall, 1871). His permanent reputation, however, rests on his compositions.

At first church music was the medium in which he best expressed himself. Always humbly obedient to his priest, and never at ease among intellectuals and men of the world, he developed his talent in the composition of masses and other choral works that mark the not unworthy close of a classical (though provincially classical) epoch in Viennese church music—the church music that could not digest Beethoven, though it was not uncongenial to Schubert. The instrumental music of Bruckner's first period is so uncouth that its disinterment is an extraordinary tribute to the triumph of his later symphonies. His Mass in F minor, written in 1868, seems in comparison with his first symphony (produced in that year) like a metropolitan bishop compared with Dominie Sampson. But by 1884 (when he had settled in Vienna) the position is reversed. The grand *Te Deum* (1883–84) has one or two lapses into a style fairly describable as parochial, and seems to belong to a much more primitive art than the sixth symphony, which was finished in 1881. The seventh symphony, finished while the *Te Deum* was in hand, quotes the "*non confundar in aeternum*" in its slow movement, an elegy on the death of Wagner. The effect is almost as if the Wagner of *Parsifal* were to quote not *Lohengrin* (as he does) but *Rienzi*. Bruckner, in the last months of his life, feeling unable to write a finale to his ninth symphony, expressed the wish that this *Te Deum* should be performed in that position. Apart from the fact that Bruckner's ninth symphony has enough naïvely provocative resemblances to Beethoven's without the crowning external feature of a choral finale, conductors who seriously appreciate Bruckner's art find abundant reason for not carrying out this wish; the discrepancy of styles is grotesque. Yet the *Te Deum* is a fine work with a sledge-hammer Handelian power, alternating with pious meditative passages which have nothing in common with its few lapses into provinciality.

Nevertheless, Bruckner the Wagnerian symphonist is a composer remarkably different from Bruckner the writer of church music; even though he dedicates his ninth symphony *an meinen lieben Gott* the musical sources of his inspiration are two, or rather twin; the opening of Beethoven's ninth symphony and the openings and crescendos of Wagner's *Ring*. These "lapidary" materials (as Bruckner's partisans aptly called them) Bruckner builds into forms quite uncritically taken over from classical tradition, with results that blind many critics to the grandeur of style. But the reputation of Bruckner's symphonies has survived the hostilities provoked by his position as symphonic stalking-horse for the Wagnerians. (D. F. T.; X.)

BRUEGEL (or BRUEGHEL), **PIETER,** Flemish painter (1525?–1569), the son of a peasant of Bruegel, near Breda, was taught by Koek, whose daughter he married. He spent some time in France and Italy, and then went to Antwerp, where he was elected into the Academy in 1551. He finally settled at Brussels and died there on Sept. 5, 1569. The subjects of his pictures are chiefly humorous figures, like those of D. Teniers; and if he lacks the delicate touch and silvery clearness of that master, he has abundant spirit and comic power.

The best collection of Bruegel's work is in the Vienna gallery, but there is an excellent example, "The Adoration of the Kings," in the National Gallery, London. Sir Charles Holmes (*National Gallery*, vol. ii.) observes that Bruegel pointed the way to a more rapid and fluent brushwork, and is the connecting link between the early Netherlandish painters and the epoch of Rubens, Van Dyck and Jordaens.

His son PIETER, the younger (1564–1637), known as "Hell" Bruegel, was born in Brussels and died at Antwerp, where his "Christ bearing the Cross" is in the museum.

Another son, JAN (1568–1625), known as "Velvet" Bruegel, born at Brussels, first painted flowers and fruits, and afterwards landscapes and sea-pieces. Rubens made use of him in the landscape part of several of his small pictures—such as his "Vertumnus and Pomona," the "Satyr viewing the Sleeping Nymph," and the "Terrestrial Paradise."

See Van Bastelaer and de Loo, *Pieter Brueghel l'ancien, sa vie et son oeuvre* (1905–07).

BRUGES (Flemish *Brugge*, a name signifying the bridge or place of bridges) is situated on low-lying ground in the north-east of the Belgian province of West Flanders of which it is the capital. Pop. (1939) 51,827. It is about 6 mi. from the coast, to which it is connected at Zeebrugge and Blankenberghe by a series of canals. Bruges is said to have been a city in the 7th century, and the name Flanders was originally applied to it and not to the district. Baldwin II., count of Flanders, fortified it and made it his chief residence. Before 1180 Bruges was the recognized capital of Flanders and the new counts were proclaimed on the Vrijdagmarkt, near the present railway station. After 1180 the premier position was assumed by Ghent, but until access by sea was stopped by the silting up of the Zwyn, which was complete by the year 1490, Bruges was the equal in wealth and power of its neighbour. Bruges was a member of the Hanseatic League and did a considerable trade in wool, especially with England. In the 14th century it was the northern counterpart of Venice and its *bourse* regulated the rate of exchange in Europe. Bruges was again important during the 16th century when Spain's increasing trade with the New World demanded that she should have a market in "the main street" of European commerce. The cathedral of St. Sauveur and the church of Notre-Dame, both specimens of early Pointed Gothic, date from the 13th and 14th centuries. The cathedral was much injured by fire in 1839. The church of Notre-Dame contains a fine De Crayer ("The Adoration of the Magi"), and Michelangelo's marble group of the "Virgin and Child." The hospital of St. John contains the chief works of Memling, including the famous reliquary of St. Ursula. The market-hall was built in 1561–66 including portions of an older building. The belfry which rises in the centre of the façade dates from the end of the 13th century and has long been famous for its chime of bells.

The town hall is Gothic and was begun about 1376. The Chapel of the Holy Blood has two stories, the lower dating from 1150, while the upper was rebuilt in the 15th century, and there is a rich Flamboyant entrance with a stairway (1533). St. Jacques' church is 13th century, but has extensive additions of the close of the 15th and 17th centuries. The Law Courts, of the 18th century, on the site of the House of the Franc, contain a fine carved chimney-piece (1530). The house is supposed to have formed part of the residence of the counts of Flanders. The museum contains a representative gallery of early Flemish paintings.

Of the old fortifications three gates remain. The centuries following the struggle with Spain were times of trade depression for Bruges as well as for the rest of Belgium and Bruges lived on its past. At the end of the 19th century a great impetus was given to the trade of the city by the construction of new docks communicating with the sea by a canal 23ft. deep and by the general improvement of transport between the town and Zeebrugge during World War I. Bruges was distant some 20 mi. behind the German front at Dixmude and with the growth of submarine warfare and the abandonment of Ostend as a naval base it became a centre for assembling parts of submarines. By the spring of 1918 the various docks and concrete shelters could accommodate 35 destroyers and about 30 submarines. Little material damage was done to the town, except to the canal docks where enormous numbers of bombs were dropped. The town was in German occupation during both World War I and World War II.

The manufacture of lace gives employment to a great many persons in the town, and horticulture is carried on extensively in the suburbs. Commercial activity has been assisted by the new ship-canal to Zeebrugge and by direct steamship service from Hull to Bruges. The exports are iron, macadam, coke and patent fuel, while nitrates, timber and coal are imported.

BRUGSCH, HEINRICH KARL (1827-1894), German Egyptologist. He was sent to Egypt by the Prussian Government in 1853, where he met Mariette. He then worked in the Berlin museum. In 1860 he was sent to Persia; in 1864 he was consul at Cairo, and in 1868 he was professor at Göttingen. On the foundation by the khedive of the Cairo school of Egyptology (1870) he was appointed director, a post he held for nine years. He then returned to live in Germany, frequently visiting Egypt until his death. Brugsch's services to Egyptology are most important, particularly in the decipherment of demotic and the making of a vast hieroglyphic-demotic dictionary (1867–82).

BIBLIOGRAPHY.—*See* H. Brugsch, *Mein Leben und mein Wandern;* also article on EGYPT: *Language and Writing.*

BRÜHL, HEINRICH, COUNT VON (1700–1763), German statesman at the court of Saxony, was born on Aug. 13, 1700. He was placed as page with the dowager duchess of Weissenfels, and then at the court of Frederick Augustus the Strong, elector of Saxony and king of Poland. Brühl, who began as page and chamberlain, was largely employed in procuring money for his master. He was successively chief receiver of taxes and minister for the interior in 1731. During the whole of the thirty years of the reign of Frederick Augustus II. he was the real inspirer of his master and the practical chief of the Saxon court. After 1738 he was in effect sole minister. The title of prime minister was created for him in 1746. Brühl must therefore be held wholly responsible for the ruinous policy which destroyed the position of Saxony in Germany between 1733 and 1763. His indiscretion was repeatedly responsible for the king of Prussia's discoveries of the plans laid against him. But the confidence of his master survived the ignominious flight into Bohemia, into which he was trapped by Brühl at the time of the battle of Kesseldorf, and all the miseries of the Seven Years' War. The favourite abused the confidence of his master shamelessly. Not content with the 67,000 halers a month which he drew as salary for his innumerable offices, Brühl abstracted more than five million halers of public money for his private use, and left a fortune of 1½ million halers. He died on Oct. 28, 1763, having survived his master only a few weeks.

His youngest son, HANS MORITZ VON BRÜHL (d. 1811), was, before the Revolution of 1789, a colonel in the French service, and afterwards general inspector of roads in Brandenburg and Pomerania. His son, KARL FRIEDRICH MORITZ PAUL VON BRÜHL (1772–1837), the friend of Goethe, was intendant-general of the Prussian royal theatres, and in 1830 he was appointed intendant-general of the royal museums.

See J. G. H. von Justi, *Leben und Charakter des Grafen von Brühl* (Göttingen, 1760–61).

BRÜHL, a town in Rhenish Prussia, south of Cologne. Pop. (1939) 23,973. It is a centre for lignite and briquette and subsidiary industries, and also a resort for the people of Cologne, with a palace (1728) in beautiful grounds.

BRUMAIRE, the name of the second month in the republican calendar which was established in France by a decree of the National Convention on Oct. 5 in the year II. (1793), completed with regard to nomenclature by Fabre d'Églantine, and promulgated in its new form on the 4th of Frimaire in the year II. (Nov. 24 1793). The month of Brumaire began on the day which corresponded, according to the year, to Oct. 22 or 23 of the old calendar, and ended on Nov. 20 or 21. Its name alludes to the fogs and mists frequent at that time of the year.

On the republican calendar, *see* G. Villain, "Le Calendrier républicain," in *La Révolution française* for 1884–85.

BRUMMAGEM is an old local form of "Birmingham." The name was first applied to a counterfeit coin made in the city of Birmingham, England, in the 17th century, and later to the plated and imitation articles made there; hence cheap, showy or tawdry. The name was used of the supporters of the Exclusion Bill in 1680, with the meaning of "sham Protestant." Similarly the Tory opponents of the Bill were nicknamed "Anti-Birminghams" or "Anti-Brummagems."

BRUMMELL, GEORGE BRYAN (1778–1840), English man of fashion, known as "BEAU BRUMMELL," was born in London on June 7, 1778. His father was private secretary to Lord North from 1770 to 1782, and subsequently high sheriff of Berkshire; his grandfather was a shopkeeper in the parish of St. James, who let lodgings to the aristocracy. From his early years George Brummell paid great attention to his dress. At Eton, where he was sent to school in 1790, and was extremely popular, he was known as Buck Brummell, and at Oxford, where he spent a brief period as an undergraduate at Oriel college, he preserved this reputation, and added to it that of a wit. He returned to London, where the prince of Wales (afterwards George IV.), to whom he had been presented at Eton, gave him a commission in his own regiment (1794). Brummell soon became intimate with his patron, and in 1798, having then reached the rank of captain, he left the service, and next year succeeded to a fortune of about £30,000. Setting up a bachelor establishment in Mayfair, he became, thanks to the prince of Wales's friendship and his own good taste in dress, the recognized *arbiter elegantiarum.* For a time his sway was undisputed. But eventually gambling and extravagance exhausted his fortune, while his tongue proved too sharp for his royal patron. They quarrelled, and, though for a time Brummell continued to hold his place in society, his popularity began to decline. In 1816 he fled to Calais to avoid his creditors. There he struggled on for 14 years, always hopelessly in debt. From 1830 to 1832 he was British consul at Caen. In 1835 he was imprisoned for debt, but his friends once more came to the rescue, and provided him with a small income. He had now lost all his interest in dress; his personal appearance was slovenly and dirty. In 1837, after two attacks of paralysis, shelter was found for him in the charitable asylum of Bon Sauveur, Caen, where he died on March 30, 1840.

See Capt. William Jesse, *Life of Brummell* (1844, rev. ed. 1886); Percy H. Fitzgerald, *Life of George IV.* (1881); R. Boutet de Monvel, *Beau Brummel* (trans. 1908); Lewis Melville, *Beau Brummel, His Life and Letters* (1924).

BRUNCK, RICHARD FRANÇOIS PHILIPPE (1729–1803), French classical scholar, was born at Strasbourg, Dec. 30

1720, and died June 12, 1803. He was a military commissary during the Seven Years' War; and at the outbreak of the French Revolution was imprisoned. In 1772–76 he edited the *Anthologia Graeca* or *Analecta veterum Poetarum Graecorum*. Where it seemed to him that an obscure passage might be made intelligible by a change of text, he made the alteration, whether the new reading were supported by manuscript authority or not.

Other works include: Editions of Anacreon (1778), plays of Aeschylus and Euripides, Apollonius Rhodius (1780), Aristophanes, with an excellent Latin translation (1781–83), *Gnomici Poetae Graeci* (1784), Sophocles (1786) with Latin translation (his best work), editions of Virgil (1785), Plautus (1788) and Terence (1707).

See Sandys, *Hist. of Classical Scholarship* (1908), vol. ii. p. 395.

BRUNDISIUM (mod. BRINDISI, *q.v.*), an important harbour town of Calabria (in the ancient sense), Italy, on the east-southeast coast. The name is said to mean "stag's head" in the Messapian dialect, in allusion to the shape of the harbour. Fertile land made it the chief Messapian city; it became Roman after the conquest of the Sallentini in 266 B.C. The Romans founded a colony there in 245 B.C., and the Via Appia was perhaps extended through Tarentum as far as Brundisium at this period. After the Punic wars it became the chief point of embarkation for Greece and the East, via Dyrrachium or Corcyra, and was made a free port by Sulla. It suffered, however, from a siege conducted by Caesar in 40 B.C. and was again attacked in 42 and 40 B.C. Virgil died here in 10 B.C. on his return from Greece. Trajan constructed the Via Trajana, a more direct route from Beneventum to Brundisium. An ancient column 62ft. in height, with an ornate capital, still stands, and near it is the base of another, the column itself having been removed to Lecce. They are said to mark the end of the Via Appia.

BRUNE, GUILLAUME MARIE ANNE (1763–1815), marshal of France, the son of an advocate, was born at Brives-la-Gaillarde (Corrèze), on March 13, 1763. He was a member of the Cordeliers' club, and was appointed in 1703 to a superior command in the army direct from civil life. In 1700 he fought under Bonaparte in Italy, and was promoted general of division. In 1798 he commanded the French army which occupied Switzerland, and in 1700 the French troops in Holland when he defended Amsterdam against the Anglo-Russian expedition under the duke of York. In 1807 Brune, who had been promoted marshal in 1804, held a command in north Germany, but he was not afterwards employed during the First Empire. As commander of the army of the Var in 1815 he defended the south of France against the Austrians, and was murdered at Avignon on Aug. 2 1815.

See P. Marmoiton, *Le maréchal Brune* (1000); J. E. Gachot, *Les campagnes de 1700, Brune en Hollande* (1906); P. P. Vermeil de Conchard, *Études historiques sur le Maréchal Brune* (1918).

BRUNEAU, ALFRED (1857–1934), French musical composer, was born in Paris on March 3, 1857, and was educated at the Paris conservatoire, where he gained the 2nd Grand Prix for composition. He played the violoncello in Pasdeloup's orchestra, and soon began to compose. In 1884 his *Ouverture héroïque* was performed and this was followed by the choral symphonies, *Léda* (1884), *La Belle au Bois Dormant* (1886) and *Penthésilée*. But it is as a dramatic composer that Bruneau is best known. In 1887 his first opera, *Kérim*, was produced and in 1891 came his successful opera *Le Rêve*, with a libretto founded on Zola's story. This opera, a work of striking originality and power, may be said to have influenced to a great extent the subsequent development of the modern French school. Another subject from Zola resulted in the opera *L'attaque du Moulin* (1893) and thereafter Zola himself commenced to write libretti expressly for Bruneau. They produced together *Messidor* (1897), *L'Ouragan* (1901) and *L'Enfant Roi* (1905). After Zola's death Bruneau continued to draw on his works, making his own adaptations. Among Bruneau's other compositions may be mentioned his *Requiem* (1896), a notable work, and his two collections of songs, *Lieds de France* and *Chansons à Danser*. Although *Le Rêve* greatly divided critical opinion at first, its merits subsequently won general recognition, no less applying to *L'Attaque du Moulin*, one of the most powerful and effective war operas ever written. Bruneau, who was awarded the Decoration of the Légion d'Honneur in 1895, has written admirably on his art and was one of the foremost of French musical critics.

See Octave Séré, *Musiciens français d'aujourd'hui* (1911) and Arthur Hervey, *Alfred Bruneau* (1907).

BRUNEI, a British protected state, occupied by Japan in Dec. 1941, on the northwestern coast of Borneo, between 4° 2′ and 5° 3′ N. and 114° 4′ and 115° 22′ E. It is bounded on every side by the protectorate of Sarawak (*q.v.*). Its territory was reduced by successive transfers to Sarawak. Area 2,226 sq.mi.; pop. (1931) 30,135 (60 Europeans), 39,000 (est. of 1939). The capital is Brunei, nine miles from the mouth of the river of the same name and 758 nautical miles from Singapore.

Sultan Ahmed Tajudin Akhazul Khairi Wad-din became ruler in 1924. After 1906 actual governing authority was in the hands of a British resident, the constitutional authority being the sultan in council. The council consisted of nine members, of whom the British resident was one. The resident at the time of the Japanese invasion was Major E. E. Pengilly.

It was an established rule of administration in Brunei that the resident should be a member of the Malayan civil service. The heads of the police, agriculture, forestry, medical and public works departments were European officers of the same service.

The principal products of Brunei are crude oil, rubber, sago and mangrove extract. Revenue in 1940 was £181,574, expenditure was £170,587. Imports were valued at £453,502, exports at £1,122,680. Free education in the Malay vernacular language was provided in state schools. The police force consisted in 1941 of 87 noncommissioned officers and men. There was a government hospital at Brunei and a hospital maintained by the Malayan Petroleum company at Kuala Belait. Travelling dispensaries helped to serve the needs of the country districts. There is a central wireless station at Brunei. In normal times there is a weekly steamship service between the port of Labuan and Singapore. The administration of Brunei is similar to that of the Unfederated Malay States.

The climate of Brunei is typically tropical, hot and moist in the daytime with cool nights. The bulk of the population lives in and about the capital (pop. est. 1937, 10,453), which is situated on the river, with a background of cleared hills and forest-covered heights in the distance. A picturesque feature of the city of Brunei is that many houses are built over the river, resting on supports of nibong palm, which resist the action of the water for some years.

The natives of Brunei fall under several racial and tribal classifications and include Malays, Kadayans, Orang Bukits and a few Muruts. The sultan under British rule received an allowance of 12,000 Straits dollars (normally a little over $6,000 U.S.) from state funds, and each of his principal ministers received an allowance of 6,000 Straits dollars. The principal imports of the sultanate ordinarily are rice, tobacco, piece goods, sugar and kerosene. Some of the natives are skilled handicraft workers, the men being expert in the manufacture of brass articles, while the women specialize in the making of cloth, interwoven and embroidered with gold thread. (W. H. CH.)

The history of this ancient and decaying sultanate is of some interest. Brunei, or, as it is called by the natives Bruni or Darul-Salam (city of peace), possesses an historic tablet of stone upon which, in A.H. 1221 (1804), was engraved in Malay characters the genealogy of the sovereigns who have ruled over the country. The book of descent is kept in the palace by the sultan. The other heirlooms, which are also kept in the sultan's palace, and descend to each sultan in turn, are the "Nobab Nagara" (two royal drums) from Johore and Menang-Kabau, and the "Gunta Alamat" (bells of emblem), the gift of Sultan Bahkei of Johore or Malacca. The first sultan of Brunei was Alak-ber-Tata, who was probably of Bisaya stock, and governed the country before the introduction of Islam, in the 15th century. He assumed the name of Mohammed on his conversion to Islam, which was brought about during a visit to the Malay Peninsula. Brunei at this time was a dependency of Majapahit (Java), and paid a yearly tribute of a jar of areca juice of no monetary value. The Hindu kingdom of Majapahit was destroyed by the

Mohammedans in 1478, and Brunei is mentioned in the history of Java as one of the countries conquered by Adaya Mingrat, the general of Angka Wijaya. Sultan Berkat, an Arab sherif of high rank, from the country of Taif in Arabia, who had married a niece of Alak-bei-Tata, built a large mosque and enforced Mohammedan law, and with the assistance of the Chinese built the stone wall (which is still in existence between the islands of Kaya Orang and Chermin), by sinking 40 junks filled with rock across the mouth of the Brunei river. This work was completed before the arrival of Pigafetta in 1521. In the reign of Sultan Bulkeiah Magellan's squadron anchored off the mouth of Brunei river in August 1521, and Pigafetta makes mention of the splendid court and the imperial magnificence of the Borneo capital. Sultan Bulkeiah was otherwise known as Nakoda Ragam; he was the greatest warrior of Brunei and made military expeditions to Java, Malacca, Luzon and all the coasts of Borneo. His tomb, which is handsomely built of stone, is still to be seen in Brunei, and is constantly visited by Malays, who leave money and various articles on the tomb as offerings to his memory. Others, again, come and take away anything they can find, which they keep as charms and mementoes. The Spaniards captured Brunei in 1580, the reigning sultan and his court retiring to Suai in the Baram district. The invaders were compelled to evacuate the place, however. Brunei's golden age was nevertheless at an end. The East India Company started a factory in the town in the 18th century, but commerce had already decayed and the establishment was abandoned. In the early part of the 19th century Brunei was but a resort for pirates and a market for the slave trade. During the 'forties Admiral (then Captain) Keppel and other officers of the British navy suppressed piracy in the neighbourhood. Sarawak (*q.v.*) was handed over to Raja Brooke, and, after the capture and temporary occupation of Brunei by Sir Thomas Cochrane, Labuan was ceded to the British empire. From this island it was possible to exercise a certain control over the townspeople, and a consul was stationed there to watch affairs. In 1888 Brunei was placed under British protection. On January 2, 1906, a treaty was made whereby the Sultan agreed to hand over the administration to a British resident. Brunei, with Labuan, thus became a part of the British Empire, much in the position of an unfederated Malay State.

As Brunei had no military establishment, it fell an easy prey to the Japanese sweep southward in the first weeks of the war that began with the attack on Pearl Harbor. The British officials who did not escape were interned; the sultan apparently remained approximately in his old status as a puppet ruler.

BIBLIOGRAPHY.—*See* Sir Hugh Low, *Sĕlĕsilah (Book of the Descent) of the Rajas of Brunei; Journal of the Straits Branch of the Royal Asiatic Society*, June 1880. (C. H.; E. S.; X.)

BRUNEL, ISAMBARD KINGDOM (1806–1859), English engineer, the designer of the first transatlantic steamer, only son of Sir M. I. Brunel, was born at Portsmouth on April 9, 1806. At 14 he was sent to Paris, to study at the Collège Henri Quatre. In 1823 he entered his father's office as assistant-engineer, just at the time when the project of the Thames tunnel was beginning to take shape; and from 1825, when the work was begun, till 1828, when it was stopped by an irruption of the river, he was both nominal and actual resident engineer. He designed (1831) the suspension bridge over the Avon at Clifton, which was not completed until 1864, and in 1841–45, built the old Hungerford suspension bridge (London), displaced in 1862 by the Charing Cross railway bridge.

In March 1833 Brunel, at the age of twenty-seven, was appointed engineer of the newly-projected Great Western railway. The famous "battle of the gauges" arose out of his introduction of the broad (7ft.) gauge on that line. The last and greatest of Brunel's railway works was the Royal Albert bridge over the river Tamar at Saltash, constructed between 1853 and 1859.

Brunel took a leading part in the systematic development of ocean steam navigation. As early as October 1835 he had suggested to the directors of the Great Western railway, that they should "make it longer, and have a steamboat to go from Bristol to New York, and call it the Great Western." The project was then taken up and the "Great Western" steamship designed by Brunel, and built (1838) at Bristol under his superintendence, was the first steamship built to make regular voyages across the Atlantic. He then designed the "Great Britain," which was the first large iron steamship, the largest ship afloat at that time, and the first large ship in which the screw-propeller was used. She made her first voyage from Liverpool to New York in 1845. Brunel's conception of a "great ship" was realized in the gigantic vessel, the "Great Eastern," put afloat on Jan. 31, 1858, but her engineer, overworked and worn out with worry, broke down and did not see her begin her first voyage on Sept. 7, 1859. On Sept. 15 he died at his house in Westminster.

Brunel was employed in the construction of many docks and piers, as at Monkwearmouth, Bristol, Plymouth, Briton Ferry, Brentford and Milford Haven. He was a zealous promoter of the Great Exhibition of 1851, and was a member of the committee on the section of machinery and of the building committee. He paid much attention to the improvement of large guns, and designed a floating gun-carriage for the attack on Kronstadt in the Russian War (1854); he also designed and superintended the construction of the hospital buildings at Erenkeui on the Dardanelles (1855).

See *The Life of I. K. Brunel, C.E.* (1870), by his son, Isambard Brunel.

BRUNEL, SIR MARC ISAMBARD (1769–1849), inventor and engineer, was born at Hacqueville, Normandy, on April 25, 1769. He served for six years in the navy. When his ship was paid off in 1792 and he returned to France, he found the Revolution at its height, and owing to his pronounced royalist opinions he was obliged to leave the country. Reaching New York in Sept. 1793 he began to practise as an architect and civil engineer. He designed and superintended the construction of the Bowery theatre, New York, burnt down in 1821. He fitted novel and ingenious machinery in the arsenal and cannon factory which he was commissioned to erect in New York. In 1799 he sailed for England to submit to the British government his plans for the mechanical production of ships' blocks in substitution for the manual processes then employed. After the usual difficulties and delays his proposals were adopted, largely through the recommendation of Sir Samuel Bentham, and about 1803 the erection of his machines was begun at Portsmouth dockyard. They formed one of the earliest examples of a complete range of machine tools, each performing its part in a long series of operations. Brunel devised improved machines for sawing and bending timber, and in the years 1811 and 1812 he was employed by the government in erecting saw-mills at Woolwich and Chatham. He also interested himself in steam navigation on the Thames between London and Ramsgate, and spent much time and money in an attempt to use liquefied gases as a source of motive-power. His round stocking-frame or *tricoteur* was patented in 1816, and among his other inventions were machines for winding cotton-thread into balls, for copying drawings, for making small wooden boxes such as are used by druggists, and for the manufacture of nails, together with processes of preparing tinfoil for decorative purposes and improvements in stereotype plates for printing.

In 1821 he had financial difficulties and was thrown into prison for debt, only regaining his freedom through a grant of £5,000 which his friends obtained for him from the government. In 1820 he had prepared plans of bridges for erection in Rouen and St. Petersburg and in the island of Bourbon. In 1823 he designed swing-bridges, and in 1826 floating landing-stages, for the port of Liverpool. A company was formed in 1824 to carry out his scheme for boring a tunnel under the Thames between Wapping and Rotherhithe. The work was completed in 1843. Brunel died in London on Dec. 12, 1849. He received the order of the Legion of Honour in 1829 and was knighted in 1841.

See Richard Beamish, *Memoirs of Sir Marc Isambard Brunel* (1862).

BRUNELLESCHI or **BRUNELLESCO, FILIPPO** (1377–1446), Italian architect, the reviver of the Roman or Classic style, was born at Florence in 1377. His father, a notary, observing the boy's talent for all sorts of mechanism, placed him in the gild of goldsmiths. Filippo quickly perfected himself in the knowledge of sculpture, perspective and geometry. In 1401 he was one of the competitors for the design of the gates of the baptistery of San Giovanni. He was unsuccessful, though his work obtained praise, and he soon afterwards set out for Rome. He studied hard, and was one of the first to apply the scientific laws of perspective to his work. In 1407 he returned to Florence, just at the time when it was resolved to attempt the completion of the cathedral church of Santa Maria del Fiore. Brunelleschi's plan for effecting this by a cupola was approved, but it was not till 1419 that the work was finally entrusted to him. He did not live to see the completion of the great cupola, one of the triumphs of architecture exceeding in some measurements that of St. Peter's at Rome, and has a more massive and striking appearance. His other masterpieces are the Pitti palace at Florence, on the pattern of which are based the Tuscan palaces of the 15th century, the churches of San Lorenzo and Spirito Santo, and the still more elegant Capella dei Pazzi. The beautiful carved crucifix in the church of Santa Maria Novella in Florence is also the work of Brunelleschi. He died in Florence on April 16 1446, and was buried in the cathedral church of his native city.

See Manetti, *Vita di Brunelleschi* (Florence, 1812); Guasti, *La cupola di Santa Maria del Fiore* (Florence, 1857); von Fabriczy, *Filippo Brunelleschi* (Stuttgart, 1892).

BRUNET, JACQUES CHARLES (1780–1867), French bibliographer, was born in Paris. He was the son of a bookseller, and in 1802 he printed a supplement to the *Dictionnaire bibliographique de livres rares* (1790) of Duclos and Cailleau. In 1810 there appeared the first edition of his *Manuel du libraire et de l'amateur des livres.* Brunet published successive editions of his great bibliographical dictionary, which rapidly became the standard work on the subject. Among his other works are *Nouvelles Recherches bibliographiques* (1834), *Recherches . . . sur les éditions originales de Rabelais* (1852) and an edition of the French poems of J. G. Alione d'Asti, dating from the beginning of the 16th century (1836).

See a notice by Le Roux de Lincy, prefixed to the catalogue (1868) of his own valuable library. A supplement to the 5th ed. (1860–65) of the *Manuel du libraire* was published (1878–80) by P. Deschamps and G. Brunet.

BRUNETIÈRE, FERDINAND (1849–1906), French critic and man of letters, was born at Toulon and educated at Marseilles and the Lycée Louis-le-Grand. He became connected with the *Revue des Deux Mondes*, first as contributor, then as secretary and sub-editor, and finally, in 1893, as principal editor. In 1886 he was appointed professor of French language and literature at the École Normale, a singular honour for one who had not passed through the academic mill. He became a member of the Academy in 1893. His published works include six series of *Études critiques* (1880–98) on French history and literature; *Le Roman naturaliste* (1883); *Histoire et Littérature*, three series (1884–86); *Questions de critique* (1888; second series, 1890). The first volume of *L'Évolution de genres dans l'histoire de la littérature*, lectures in which a formal classification, founded on the Darwinian theory, is applied to the phenomena of literature, appeared in 1890; and his later works include a series of studies (1894) on the evolution of French lyrical poetry during the 19th century, a history of French classic literature begun in 1904, a monograph on Balzac (1906) and various polemical pamphlets. Brunetière was an orthodox Roman Catholic, and his political sympathies were in the main reactionary. He possessed two prime qualifications of a great critic, vast erudition and unflinching courage. He was never afraid to diverge from the established critical view, his mind was closely logical and intensely accurate, and he rarely made a trip in the wide field of study over which it ranged.

His *Manual of the History of French Literature* was translated into English in 1898 by R. Derechef. Among critics of Brunetière *see* J. Lemaitre, *Les Contemporains* (1887, etc.), and J. Sargeret, *Les Grands Convertis* (1906).

BRUNHILD, the name of a mythical heroine of various versions of the legend of the Nibelungs. The name means "the warrior woman in armour," and in the Norse versions of the Nibelung myth, which preserve more of the primitive traditions than the *Nibelungenlied*, Brunhild is a valkyrie, the daughter of Odin, by whom, as a punishment, she has been cast under a spell of sleep on Hindarfjell, a lonely rock, until the destined hero shall penetrate the wall of fire by which she is surrounded, and wake her. This is a variant of the widespread myth which survives in the popular fairy-story of "the sleeping beauty." In the *Volsungasaga* Brunhild is the heroine of a tragedy of passion and wounded pride; it is she who compasses the death of Sigurd, who has broken his troth plighted to her, and then immolates herself on his funeral pyre in order that in the world of the dead he may be wholly hers. In the *Nibelungenlied,* on the other hand, she plays a comparatively colourless rôle. She still possesses superhuman attributes: like Atalanta, she can only be won by the man who is able to overcome her in trials of speed and strength; but, instead of a valkyrie sleeping on a lonely rock, she is (when Sigfrid goes to woo her on behalf of Gunther) queen of Islant (Îsenlant), living in a castle called the Isenstein. The poet of the *Nibelungenlied* evidently knew nothing of the tale of her self-immolation; for, though he has nothing definite to say about her after Sigfrid's death, he keeps her alive in a sort of dignified retirement. (*See* further under NIBELUNGENLIED.)

BRUNHILDA (Brunechildis), queen of Austrasia (d. 613), was a daughter of Athanagild, king of the Visigoths. In 567 she was asked in marriage by Sigebert, who was reigning at Metz. She now abjured Arianism and was converted to the orthodox faith. Chilperic, brother of Sigebert, and king of the west Frankish kingdom, jealous of the renown which this marriage brought to his elder brother, married Brunhilda's sister, but soon assassinated her at the instigation of his mistress Fredegond. Sigebert was anxious to avenge his sister-in-law, but accepted the compensation offered by Chilperic, namely the cities of Bordeaux, Cahors and Limoges, with Béarn and Bigorre.

This treaty did not prevent war soon again breaking out between Sigebert and Chilperic. So long as her husband lived, Brunhilda played a secondary part, but having been made captive by Chilperic after her husband's assassination (575), she escaped, after a series of extraordinary adventures, by means of a marriage with Merovech, the son of her conqueror. From this time on, she took the lead; in Austrasia she opposed the nobles, who wished to govern in the name of her son Childebert II.; but she was worsted and had to seek refuge in Burgundy. After the death of Childebert II. (597) she aspired to govern Austrasia and Burgundy in the name of her grandsons Theudebert and Theuderich II. She was expelled from Austrasia, and then stirred up Theuderich II. against his brother, whom he defeated and put to death. Theuderich II. died shortly after this victory, and Brunhilda caused one of her great-grandchildren to be proclaimed king. The nobles of Austrasia and Burgundy, however, summoned Clotaire II., son of Fredegond, to help them against the queen. Brunhilda was given up to him, and put to death (613).

Brunhilda seems to have had political ideas and to have wished to attain to the royal power. She was a protectress of the Church, and Pope Gregory I. (590–604) addressed a series of letters to her, in which he showered praises upon her. She took it upon herself, however, to supervise the bishoprics and monasteries, and came into conflict with Columban, abbot of Luxeuil.

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BRUNI, LEONARDO (1369–1444), Italian scholar, author of a history of Florence, was born at Arezzo, and is generally known as Leonardo Aretino. Bruni advanced the study of Greek literature by many literal translations from the Greek classics. He was secretary to the papal chancery (from 1405) under Innocent VII. and John XXII. From 1427 to his death (Mar. 9, 1444) he was chancellor to the republic of Florence. He was the first to free the history of Florence from its fabulous elements, but his book, on which he was engaged in 1415, though not unintelligent, only repays very laborious study. The only Latin edition is *Historiarum Florentinarum libri xii. . . . exempto in lucem edit. stud. et op. Sixti Brunonis* (Argentor. 1610, fol.). A translation into Tuscan was published by Donato Acciajuoli in 1476 at Venice, was republished at Florence in 1492, and again with Sansovino's continuation, at Venice in 1561. He also wrote lives of Petrarch and Dante in the vernacular.

BRÜNN: *see* BRNO.

BRUNNER, HENRY (1840–1915), German historian, was born at Wels, Upper Austria, June 22 1840, and died at Bad Kissingen Aug. 11 1915. He became professor at the University of Lemberg (Lwow) in 1866, then at Prague, at Strasbourg and in 1873 at Berlin. From 1872 Brunner devoted himself especially to studying the early laws and institutions of the Franks and kindred peoples of western Europe and on these subjects his researches have been of supreme value. He also became a leading authority on modern German law. In 1886 after the death of G. Waitz, he undertook the supervision of the *Leges* section of the *Monumenta Germaniae historica.*

His most important works are: *Deutsche Rechtsgeschichte* in vols. i. and ii. of Bindung's *Handbuch der deutschen Rechtswissenschaft* (1887–92); and *Grundzüge der deutschen Rechtsgeschichte* (1901, 6th ed. 1917).

BRÜNNOW, FRANZ FRIEDRICH ERNST (1821–1891), German astronomer, was born in Berlin on Nov. 18 1821. After graduating as Ph.D. at Berlin in 1843, he worked at the Berlin observatory, under J. F. Encke, contributing numerous important papers on the orbits of comets and minor planets to the *Astronomische Nachrichten.* In 1847 he was appointed director of the Bilk observatory, near Düsseldorf, and in the following year published the *Mémoire sur la comète elliptique de De Vico.* In 1851 he succeeded J. G. Galle as first assistant at the Berlin observatory, and accepted in 1854 the post of director of the new observatory at Ann Arbor (Mich.) U.S.A. Here he published, 1858–62, a journal entitled *Astronomical Notices,* while his tables of the minor planets Flora, Victoria and Iris were severally issued in 1857, 1859 and 1869. In 1860 he went, as associate director of the observatory, to Albany (N.Y.); but returned in 1801 to Michigan. In 1863 he returned to Germany; then, on the death of Sir W. R. Hamilton in 1865, he accepted the post of Andrews professor of astronomy in the university of Dublin and astronomer-royal of Ireland. His first undertaking at the Dublin observatory was the erection of an equatorial telescope to carry the fine object-glass presented to the university by Sir James South; and on its completion he began an important series of researches on stellar parallax. The first, second and third parts of the *Astronomical Observations and Researches made at Dunsink* contain the results of these labours, and include discussions of the distances of the stars α Lyrae, σ Draconis, Groombridge 1830, 85 Pegasi, and Bradley 3077, and of the planetary nebula H. iv. 37. In 1874 he retired to Basle. He died at Heidelberg on Aug. 20 1801. His *Lehrbuch der sphärischen Astronomie* was widely appreciated. In 1860 part i. was translated into English by Robert Main, the Radcliffe observer at Oxford; Brünnow himself published an English version in 1865. A fifth edition of the original was published in 1881, and it was also translated into French, Russian, Italian and Spanish.

See *Month. Notices Roy. Astr. Soc.*, lii. 230: J. C. Poggendorff's *Biog. Lit. Handwörterbuch,* Bd. iii.; *Nature,* xliv. 449.

BRUNO, SAINT, founder of the Carthusians, was born in Cologne about 1030; he was educated there and afterwards at Reims and Tours, where he studied under Berengarius (*q.v.*). He was ordained at Cologne, and in 1057, recalled to Reims to become head of the cathedral school and overseer of the schools of the diocese. He was made also canon and diocesan chancellor. Having protested against the misdoings of a new archbishop, he was deprived of all his offices and had to fly for safety (1076). On the deposition of the archbishop in 1080, Bruno was presented by the ecclesiastical authorities to the pope for the see, but Philip I. of France successfully opposed the appointment. After this Bruno retired, with six companions, to the mountains near Grenoble, and there founded the Carthusian order (1084). After six years Urban II. called him to Rome and offered him the archbishopric of Reggio; but he refused it, and withdrew to a desert in Calabria, where he established two other monasteries. He died in 1101. His Commentaries on the Psalms and the Pauline Epistles are to be found in Migne, *Patr. Lat.* clii. and cliii.

See his *Life* in the Bollandists' *Acta Sanctorum* (Oct. 6), also Hermann Löbbel, *Der Stifter des Karthäuser-Ordens,* 1899 (vol. v. of "Kirchengeschichtliche Studien," Münster).

BRUNO or **BRUN** (925–965), archbishop of Cologne, third son of the German king, Henry I., the Fowler, was educated for the church at Utrecht. In 940 his brother, King Otto, afterwards Emperor Otto the Great, appointed him chancellor, and under his leadership the chancery was reformed and became a training ground for capable administrators. He helped his brother Otto to suppress the risings which marked the earlier part of his reign, services which were rewarded in 953 when Bruno was made archbishop of Cologne, and about the same time duke of Lorraine. Bruno consorted eagerly with learned foreigners, tried to secure a better education for the clergy, and was mainly instrumental in making his brother's court the centre of intellectual life in Germany. He built many churches, and, aided by the tendency of the time, sought to purify monastic life. He died at Reims, Oct. 11, 965, and was buried in the church of St. Pantaleon at Cologne.

See Ruotger, "Vita Brunonis archiepiscopi Coloniensis," in Migne, *Patrol. Lat.* v. 134; E. Meyer, *De Brunone I. Archiepiscopo Coloniensi* (1867); J. P. Pfeiffer, *Historisch-Kritische Beiträge zur Geschichte Bruns I.* (Cologne, 1870); K. Martin, *Beiträge zur Geschichte Brunos I. von Köln* (Jena, 1878).

BRUNO, GIORDANO (*c.* 1548–1600), Italian philosopher, was born near Nola. In 1563 he became a Dominican at Naples, but later, on account of his views on transubstantiation and on the Immaculate Conception, he was forced to leave Italy. In 1579 he reached Geneva, the home of Calvinism. Finding himself out of harmony there he wandered on through Toulouse, where he lectured on philosophy, arriving at Paris in 1581. There he delivered lectures on the logical system of Raymund Lully and wrote the *De Umbris Idearum, Ars Memoriae, De compendiosa architectura et complemento artis Lullii, Cantus Circaeus* and the satiric comedy, *Il Candelajo.* In 1583 Bruno travelled to England where, in spite of his disgust with English manners and the pedantry of Oxford, he produced his best works: *Cena de la Ceneri* (a criticism of English social life and an exposition of the Copernican theory), *Della Causa, Principio ed Uno* and *Del' Infinito, Universo e Mondi* (metaphysical works), *Eroici Furori, Cabala del Cavallo Pegaseo* and *Spaccio della Bestia Trionfante.* The *Spaccio* is an allegory treating of moral philosophy and expressing his opposition to religion; it exalts truth, prudence, wisdom, law and judgment, and at the same time scoffs at the mysteries of faith and places the Jewish record on a level with Greek myths.

In 1585–86 Bruno returned to Paris but wandered on to Marburg and Wittenberg, the headquarters of Lutheranism, where he wrote a number of logical treatises. The Calvinists proving too much for him, in 1588 he went to Prague, then to Helmstadt and Frankfurt, where in 1590 he published three important metaphysical works: *De Triplici Minimo et Mensura; De Monade, Numero, et Figura; De Immenso et Innumerabilibus.* We find him next at Zürich, whence he accepted an invitation to Venice. This led to the emissaries of the Inquisition bringing him to Rome in 1593, where he was imprisoned for seven years before he was excommunicated and burnt at the stake on Feb. 17, 1600.

Apart from his disdainful, boasting nature and his attack on contemporary Christianity, the chief causes of Bruno's downfall were his rejection of the Aristotelian astronomy for that of Copernicus, which allowed for the possibility of innumerable worlds, and his pantheistic tendencies. Inspired by the Stoics, the Neoplatonists, and above all by Nicholas of Cusa, Bruno asserted that amid all the varying phenomena of the universe there is something which gives coherence and intelligibility to them and this something is God, the universal, unifying substance, from which all things come of necessity. As a manifestation of God, the universe must be infinite and animated, but being itself difficult to comprehend it gives no true knowledge of God, who is far removed from His effects. As the unity in all things, God may be called the *monas monadum,* every other thing being a *Monas* or self-existent, living nature, a universe in itself. The human soul is a thinking monad whose highest function is the contemplation of the Divine unity and whose destiny is immortality as a portion of the Divine life. In the later Latin treatises these pantheistic tendencies are moderated, the universe appearing as the realization of the Divine mind.

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See also J. L. McIntyre, *Giordano Bruno* (1903); W. Boulting, *Giordano Bruno* (1916); C. Bartholmess, *J. Bruno* (Paris, 1846–47); V. Spampanato, *Vita di G. Bruno,* 2 vols. (Messina, 1921); Berti, *Giordano Bruno da Nola* (2nd ed., 1889); H. Brunnhofer, *Giordano Bruno Weltanschauung* (Leipzig, 1883); F. J. Clemens, *Giordano Bruno und Nicolaus von Cusa* (Bonn, 1847); A. Riehl, *G. Bruno* (1900; Eng. trans. Agnes Fry, 1905); Atanassievitch, *La doctrine métaphysique et géométrique de Bruno* (Belgrade, 1923); E. Namer, *Les Aspects de Dieu dans la Philosophie de Bruno* (1926); J. R. Charbonnel, *L'Ethique de G. Bruno* (1919); R. Adamson, *Development of Modern Philosophy* (1903); G. Gentile, *Giordano Bruno nella Storia della cultura* (1907).

BRUNO, PAUL (1874–   ), German architect and painter, born Jan. 19 1874, at Seifhennerstorf in Saxony, first made a name as an artist by his drawings for *Simplizissimus.* Later his designs for the Münchner Werkstätts (Fine arts industry) attracted attention. In 1900 he received the Grand Prix in Paris; in 1902 the highest distinction at Turin; in 1904, the Grand Prix at St. Louis; and in 1906 the highest distinction at Dresden. In 1907 he was appointed director of instruction at the State Museum of Applied Arts in Berlin. He wrote a pamphlet on *The Education of Artists at State Schools* (1919), which has become a classic.

BRUNO OF QUERFURT, SAINT (Bonifacius) (975?–1009), German missionary bishop and martyr, belonged to the family of the counts of Querfurt in Saxony. He was educated at the famous cathedral school at Magdeburg, and at the age of 20 was attached to the clerical household of the emperor Otto III. In 997 he accompanied the emperor to Rome, but there entered the monastery of S. Alexius taking "in religion" the name of Bonifacius. When the news reached Rome of the martyrdom of Adalbert, bishop of Prague (997), Bruno determined to take his place, and in 1004, after being consecrated by the pope as archbishop of the eastern heathen, he set out for Germany to seek aid of the emperor Henry II. The emperor, however, being at war with Boleslaus of Poland, opposed his enterprise, and he went first to the court of St. Stephen of Hungary, and, finding but slight encouragement there, to that of the grand prince Vladimir at Kiev. He was so successful in converting the pagan Pechenegs who inhabited the country between the Don and the Danube that they made peace with the grand prince and were for a while nominally Christians. In 1008 Bruno went again to the court of Boleslaus, and, after a vain effort to persuade the emperor to end the war between Germans and Poles, determined at all hazards to proceed with his mission to the Prussians. With 18 companions he set out; but on the borders of the Russian (Lithuanian) country he and his company were massacred by the heathens (Feb. 14, 1009).

During his stay in Hungary (1004) Bruno wrote a life of St. Adalbert, the best of the three extant biographies of the saint (in Pertz, *Mon. Germ. Hist. Scriptores*, iv. pp. 577, 596–612).

A life of St. Bruno was written by Dietmar, bishop of Merseburg (976-1019). This, with additions from the life of St. Romuald, is published in the Bollandist *Acta Sanctorum* (Feb. 14). *See* further U. Chevalier, *Répertoire des sources historiques;* D. H. Voigt, *Brun von Querfurt* (Stuttgart, 1907).

BRUNSBÜTTEL and **BRUNSBÜTTELKOOG,** a seaport of Germany, in the Prussian province of Schleswig-Holstein, on the northern bank of the Elbe, 60m. N.W. of Hamburg. Combined population (1933) 7,639. Brunsbüttel is the western terminus of the Kiel canal. Because of its importance as a naval base, it was bombed several times by the British R.A.F. in World War II.

BRUNSWICK, KARL WILHELM FERDINAND, Duke of (1735–1806), German general, was born on Oct. 9, 1735, at Wolfenbüttel. He received an unusually wide and thorough education, and travelled in his youth in Holland, France and various parts of Germany. His first military experience was in the North German campaign of 1757, under the duke of Cumberland. At the battle of Hastenbeck he won great renown by a gallant charge at the head of an infantry brigade; and upon the capitulation of Kloster Zeven he was easily persuaded by his uncle, Ferdinand of Brunswick, who succeeded Cumberland, to continue in the war as a general officer. After the close of the Seven Years' War, the prince visited England with his bride, the daughter of Frederick, prince of Wales, and in 1766 he went to France, being received both by his allies and his late enemies with every token of respect. After visiting Switzerland, Rome and Naples he returned to Paris, and thence to Brunswick. With the assistance of the minister, Féronce von Rotenkreuz, he rescued the state from the bankruptcy into which the war had brought it. His popularity was unbounded, and when he succeeded his father, Duke Karl I., in 1780, he was a model sovereign. He was perhaps the best representative of the benevolent despot of the 18th century—wise, economical, prudent and kindly. He strove to keep his duchy from all foreign entanglements, and at the same time he continued to render important services to the king of Prussia, for whom he had fought in the Seven Years' War; he was a Prussian field-marshal, and was at pains to make the regiment of which he was colonel a model one, and he was frequently engaged in diplomatic and other state affairs. He resembled his uncle, Frederick the Great, in many ways, but he lacked the supreme resolution of the king, and in civil as in military affairs was prone to excessive caution. As an enthusiastic adherent of the Germanic and anti-Austrian policy of Prussia he joined the *Fürstenbund,* in which, as he now had the reputation of being the best soldier of his time, he was the destined commander-in-chief of the federal army.

Between 1763 and 1787 his only military service had been in the brief War of the Bavarian Succession; in the latter year, however, the duke, as a Prussian field-marshal, led the army which invaded Holland. His success was rapid, complete and almost bloodless. Five years later he was appointed to the command of the allied Austrian and German army assembled to crush the French Revolution. He was so far in acknowledged sympathy with French hopes of reform that when he gave an asylum in his duchy to the "comte de Lille" (Louis XVIII.) the Revolutionary Government made no protest. Indeed, earlier in this year (1792) he had been offered supreme command of the French army. As the king of Prussia took the field with Brunswick's army, the duke felt bound as a soldier to treat his wishes as actual orders. (For the events of the Valmy campaign French Revolutionary Wars.) The result of Brunswick's cautious advance on Paris was the cannonade of Valmy followed by the retreat of the allies. The following campaign of 1793 showed him perhaps at his best as a careful and exact general. But when Brunswick became unable to move or direct his army without interference from the king, he laid down his command and returned to govern his duchy. He did not, however, withdraw entirely from Prussian service, and in 1803 he carried out a successful and diplomatic mission to Russia. In 1806, at the personal request of Queen Louise of Prussia, he consented to command the Prussian army, but here again the presence of the king of Prussia and the conflicting views of numerous advisers of high rank proved fatal. At the battle of Auerstedt the old duke was mortally wounded. He died on Nov. 10, 1806, at Ottensen, near Hamburg.

His son and successor, Friedrich Wilhelm (1771–1815), who was one of the bitterest opponents of Napoleonic domination in Germany, took part in the war of 1809 at the head of a corps of partisans. He fled to England after the battle of Wagram, and returned to Brunswick in 1813, where he raised fresh troops. He was killed at the battle of Quatre Bras on June 16, 1815.

See Lord Fitzmaurice, *Charles W. F., duke of Brunswick* (1901); memoir in *Allgemeine deutsche Biographie*, vol. ii. (Leipzig, 1882); and A. Chuquet, *Les Guerres de la Révolution,* vol. i. (1887).

BRUNSWICK, ***Land*** **and former duchy of N. Germany,** proclaimed a republic on Nov. 8, 1918, as Freistaat Braunschweig. It comprises three larger and six smaller portions of territory. The principal or northern part, containing the towns of Brunswick, Wolfenbüttel and Helmstedt, is situated between the Prussian provinces of Hanover and Saxony. The western part, containing Holzminden and Gandersheim, extends eastward from the river Weser to Goslar. The Blankenburg, or eastern portion, lies south-east of the latter, between Anhalt and the Prussian province of Hanover. The six small enclaves, lying in the Prussian provinces of Hanover and Saxony, are: Thedinghausen, Harzburg and Kalvörde, Bodenburg, Olsburg and Ostharingen. A portion of the Harz mountains was, down to 1874, common to Brunswick and Prussia (Hanover) and known as the Communion Harz. In 1874 a partition was effected, but the mines are still worked in common, four-sevenths of the revenues derived from them falling to Prussia and the remainder to Brunswick.

The northern portion of Brunswick is mostly arable and has little forest. The other two principal portions are intersected by the Harz mountains, the higher parts of which are covered with forests of fir, oak and beech. Brunswick, though so scattered, belongs almost entirely to the basin of the river Weser. The area of Brunswick is 1,417 sq.mi.; about one-half is arable, while forests cover large areas. Pop. (1939) 599,208. Hildesheim is the seat of the Roman Catholic bishopric of North Germany, but Brunswick is mainly Lutheran.

The land devoted to agriculture is excellently farmed, and cereals, beet (for sugar), potatoes and garden produce of all kinds, particularly fruit, obtain the best market prices. The pasture land rears fine horses, cattle and sheep. Timber cutting, in the forests of the Harz, employs a large number of hands. The mining industry, chiefly in the Harz, yields coal (bituminous), iron, lead, copper, sulphur, alum, marble, alabaster, lime, building-stone and salt; and by-products, particularly chemicals and asphalt, are important.

The manufactures include beet-sugar, concrete, preserves and sausages; jute-spinning and weaving are carried on.

HISTORY

When, in 1181, Henry the Lion, the great duke of Saxony, was placed under the imperial ban and his duchy dismembered, he was allowed to retain his hereditary possessions, which consisted of a large part of Brunswick and Lüneburg. The bulk of these lands passed to Henry's grandson, Otto, and in 1235 the emperor Frederick II., anxious to be reconciled with the Welfs, recognized Otto's title and created him duke of Brunswick and Lüneburg. In 1252 Otto was succeeded by his sons Albert and John, who, in 1267 divided the duchy, Albert becoming duke of Brunswick, and John duke of Lüneburg. The Lüneburg line died out in 1369 and, after a long contest, the duchy was annexed to that of Brunswick-Wolfenbüttel (1388). In 1285 the duchy of Brunswick had been divided between Duke Albert's three sons, who founded the lines of Wolfenbüttel, Göttingen and Grubenhagen. The Wolfenbüttel branch died out in 1292, but was refounded in 1345 by Magnus I., (d. 1369) a younger member of the Göttingen family and ancestor of the later dukes of Brunswick. His grandsons, Frederick, Bernard and Henry, secured Lüneburg in 1388, but in 1428 Bernard, the only survivor, was forced to divide the duchy, he himself receiving Lüneburg, while his nephews, William and Henry, obtained Brunswick, which in 1432 they divided into Calenberg and Wolfenbüttel. In 1473, however, William, who had added Göttingen to his possessions in 1463, united these lands; but they were again divided from 1495 to 1584. In 1584 Brunswick was united by Duke Julius, and in 1596 Grubenhagen was added to it. Duke Frederick Ulrich, however, was obliged to cede this territory to Lüneburg in 1617, and when he died in 1634 his family became extinct, and Brunswick was divided between the two branches of the Lüneburg family.

The duchy of Lüneburg, founded by Bernard in 1428, was divided in 1520 between the three sons of Duke Henry. Two of the branches thus founded soon died out; and in 1569, after the death of Ernest I., the representative of the third branch, his two sons agreed upon a partition which is of considerable importance in the history of Brunswick, since it established the lines of Dannenberg and of Lüneburg-Celle, which divided the duchy of Brunswick-Wolfenbüttel in 1635. The dukes of Lüneburg-Celle subsequently took the name of Hanover, and were the ancestors of the later electors and kings of Hanover. After the acquisition of 1635 the family of Dannenberg took the title of Brunswick-Wolfenbüttel and ruled in the direct line until 1735. It was then followed by the family of Brunswick-Bevern, which had split off from the parent line in 1666, and ruled until 1884.

The constant partitions of its territories and the quarrels of its separate lines of princes prevented Brunswick from playing a great part in German politics. During the Thirty Years' War, indeed, Christian, bishop of Halberstadt, younger brother of Frederick Ulrich of Brunswick-Wolfenbüttel, a notable cavalry leader, distinguished himself as "one of the most brutal condottiere of the war and a foul-mouthed censor of would-be peacemakers," while the astute conduct of Duke George of Brunswick-Lüneburg made possible the future greatness of the House of Hanover. But after the peace of 1648 Brunswick began to be overshadowed by the power of Brandenburg. Of its later dukes the most famous was Charles William Ferdinand, who succeeded his father, Charles I., in 1780, and was held to be the greatest captain of his age (*see* BRUNSWICK, KARL WILHELM FERDINAND, DUKE OF). After 1800 Brunswick was included by Napoleon in the Kingdom of Westphalia, but in 1814 was restored to Duke Frederick William, who fell at Quatre Bras in 1815. During the minority of his son, Charles II., the duchy was ruled by George, Prince Regent of Great Britain, through Count Münster. On coming of age, Duke Charles made himself very unpopular and, during the revolutionary upheaval of 1830, was forced to leave the country for good. His brother William, who was formally proclaimed his successor in 1831, proved an able and popular ruler.

The Brunswick Succession Question.—After 1866 the question of the succession became acute. William was unmarried, and the next heir was the ex-King George of Hanover, whose territories had been annexed to Prussia. The attitude of Prussia being prohibitive, Duke William, with the consent of the Brunswick parliament, arranged in 1879 for a council of regency to take over the government on his death and, in the event of the heir being unable to succeed, to appoint a regent. On William's death (Oct. 18, 1884) Ernest, duke of Cumberland, son of George V. of Hanover, claimed the succession; but, since he had not formally renounced his claim to Hanover, the Federal Council declared that his accession would endanger the peace of the Empire, and the council of regency therefore ignored his claim and elected Prince Albert of Prussia regent. After his death, in 1906, the Brunswick diet elected Duke John Albert of Mecklenburg-Schwerin regent (May, 1907). The question was settled in 1913, when Prince Ernest Augustus of Cumberland, after renouncing his claim to Hanover, was recognized as Duke of Brunswick and married (May 24) to the Princess Victoria Louise, only daughter of the Emperor William II. After 1919 the duchy became a separate state of the republic and, under Hitler, a *Land*.

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BRUNSWICK, a city in southeastern Georgia, U.S.A., on Oglethorpe bay, 8 mi. from the ocean; a port of entry and the county seat of Glynn county. It is on federal highways 17, 84 and 341, and is served by the Atlanta, Birmingham and Coast, the Atlantic Coast Line, and the Southern railways, and by air, bus and coastwise and ocean-going steamers. The population in 1930 was 14,022, of whom 6,049 were Negroes, and was 15,035 in 1940 by the federal census.

It has an easily accessible landlocked harbour with controlling depths of 30 ft. over the bar and 27 ft. in the inner harbour. The annual water-borne commerce from 1930–40 averaged 748,055 tons per annum, valued at $22,806,518, and included considerable exports of rosin and lumber products.

Besides seven sea-food packing plants (chiefly shrimp), there are several industries manufacturing naval stores, pulp, veneer, crossties, a large creosoting plant and other lumber products.

An equable climate and romantic subtropical scenery make Brunswick a delightful resort in both winter and summer. The city is connected with St. Simons and Sea Islands by causeways and bridges extending across the intervening marshes and streams. Jekyll Island, just east of the city, is owned by a club. On St. Simons Island, where Oglethorpe founded the town of Frederica and in 1742 defeated the Spaniards in the battle of Bloody Marsh, are remains of the fort he built in 1736 of "tabby" (a mixture of sand and oyster shells); ruins of the much older Spanish mission; and the giant oak under which Charles Wesley sang and John Wesley preached. The beauties of the salt marshes east of the city are immortalized in Sidney Lanier's poems, especially "The Marshes of Glynn" and "Sunrise."

Brunswick was laid out by the council of the royal province of Georgia in 1771, and was named after the seat of the reigning House of Hanover. The city was incorporated in 1856.

BRUNSWICK, a city of Germany, capital of the *Land* and former duchy of that name (*Braunschweig*), situated in a fertile and undulating country, on the Oker, 53 mi. N.W. of Magdeburg, on the main railway from Berlin. Pop. (1939) 201,306. Brunswick is said to have been founded about 861 by Bruno, son of Duke Ludolf of Saxony, from whom it takes its name. Afterwards fortified and improved by Henry the Lion, it became one of the most important cities of northern Germany. For a long time its constitution was rather peculiar, as it consisted of five separate townlets, each with its own walls and gates, its own council and Rathaus. In the 13th century it ranked among the first cities of the Hanseatic league. It later declined in prosperity in consequence of the divisions of territory, the jealousy of the neighbouring states, the Thirty Years' War, and more recently the French occupation, under which it was assigned to the kingdom of Westphalia. During the Reformation the sympathies of the citizens were with the new teaching, and the city was a member of the League of Schmalkalden. In 1830 it was the scene of a violent revolution, which led to the removal of the reigning duke. It attained municipal self-government in 1834.

The fortifications, dismantled in 1797, have given place to a circle of gardens and promenades. Within them lies the old town, with somewhat narrow and crooked streets, remarkable for its numerous ancient houses, with high gables and quaintly carved exteriors, as at Lübeck. The cathedral, St. Blasius, is Romanesque (1173–94). The chancel is decorated with 12th century frescoes by Johannes Gallicus, and contains the tombs of the founder, Henry the Lion, and his consort, and also that of the emperor Otto IV. In the vault beneath rest the remains of the Guelphs of the Brunswick line (since 1681). The Magnikirche was consecrated in 1031, the present edifice being built between the 13th and 15th centuries and restored in 1877. The Martinikirche was originally a Romanesque basilica (1180–90), enlarged in the 13th century in Gothic, and remarkable further for the splendid late Gothic Annenkapelle (1434) and three magnificent portals. The Katharinenkirche, with a fine tower, was begun by Henry the Lion in 1172, and finished in 1500. Of the 13th, 14th and 15th centuries are the Andreaskirche and the Aegidienkirche.

The town hall of Brunswick is a gem of Gothic architecture (14th and 15th centuries). In front stands a beautiful leaden fountain of the early 15th century. Near the cathedral are the cloth merchants' hall (*Gewandhaus*) of the 13th century, with a richly ornamented façade in Renaissance style, now occupied by the chamber of commerce and the restored Huneborstelsche Haus with its beautiful oak carving of the 16th century. The ducal palace is a fine modern structure, erected since 1865. The scientific and art collections of Brunswick are numerous. The educational institutions include the Collegium Carolinum, founded in 1745, the technical high school, with 375 students in 1938, and an academy of forestry. The industries of the town are very varied. Especially important are the manufacture of metal work and small machinery, boilers, gasometers, preserves, sugar, chocolate, chemicals, beer and sausages. Jute-spinning is also carried on and asparagus widely exported. Brunswick is a leading centre of the book trade.

BRUNSWICK, a village of Cumberland county, Maine, U.S.A., on the Androscoggin river and the Maine Central railroad, 27 mi. N.E. of Portland. The population in 1940 was 7,003. Abundant water-power from the river is utilized by paper, pulp and rayon mills. On a 40 ac. campus at the head of the principal street is Bowdoin college, which was incorporated in 1794, while Maine was still a part of Massachusetts, and was named after James Bowdoin, a distinguished governor of Massachusetts. The total number of resident students is limited to about 600, and high academic standards are maintained. Among the graduates have been many men of prominence in American letters and public life, including Henry Wadsworth Longfellow, Nathaniel Hawthorne, Franklin Pierce, Melville W. Fuller, Oliver Otis Howard, Thomas B. Reed and Robert Edwin Peary.

Brunswick was settled by fishermen in 1628, and was at first called Pejepscot.

A township was established under the present name in 1717, and the village was incorporated in 1738.

BRUNSWICK-BEVERN, AUGUST WILHELM, DUKE OF (1715–1781), Prussian soldier, son of Ernst Ferdinand, duke of Brunswick-Bevern, entered the Prussian army in 1731. He commanded a wing in the battle of Lobositz in 1756, and defeated the Austrians under Marshal Konigsegg at Reichenberg on April 21, 1757. He took part in the battles of Prague and Kolin and the retreat to Görlitz, and subsequently commanded the Prussians left behind by Frederick in the autumn of 1757 when he marched against the French. Bevern conducted a defensive campaign against overwhelming numbers with great skill, but he soon lost the valuable assistance of Gen. Winterfeld, who was killed in a skirmish at Moys; and he was eventually brought to battle and suffered a heavy defeat at Breslau on Nov. 22. He fell into the hands of the Austrians on the following morning, and remained prisoner for a year. On Aug. 11, 1762, he inflicted defeat at Reichenbach on an Austrian army endeavouring to relieve Schweidnitz. Bevern retired, after the Peace of Hubertusburg, to his government of Stettin, where he died in 1781.

BRUNSWICK BLACK, a useful black varnish used in Great Britain for painting stoves, grates, fenders, and all inside ironwork. It possesses excellent anti-corrosive and preservative properties, and thus effectively prevents the rusting of all metal surfaces on which it is applied, while at the same time imparting to them a highly lustrous black finish.

The process of manufacture consists in melting asphaltum in large iron pans set in brickwork over a fire. When the fusion is complete and the molten mass is in a thin fluid condition, the fires are withdrawn and sufficient turpentine or turpentine substitute is added to thin the mass to a consistency which renders it easily applicable.

A proportion of common rosin is frequently added to the asphaltum in order to increase the lustre of the Brunswick black, but if too much is added the denseness of the black is impaired. The best varieties of Brunswick black contain a proportion of boiled linseed oil which is incorporated with the asphaltum during the melting process and serves to toughen the black, and thus prevent it chipping or powdering off.

The following are two representative formulae for the manufacture of Brunswick black:—

(1)	(2)
Asphaltum 112lb.	Gilsonite 112lb.
Dark Rosin 50lb.	Boiled Linseed Oil 2gal.
Turpentine 22gal.	Turpentine 25gal.

Brunswick black dries in about 2–3 hours. It is only suitable for inside use and should not be used on exterior work, as owing to its composition it lacks durability and if exposed to weathering influences would rapidly deteriorate and powder off. In painting exterior ironwork only black varnishes specially manufactured for outside use should be used.

BRUNTON, MARY (1778–1818), Scottish novelist, was born Nov. 1, 1778, in the island of Varra, Orkney, and died at Edinburgh Dec. 10, 1818. She was the daughter of Capt. Thomas Balfour of Elwick. At the age of 20 she married Alexander Brunton, minister of Bolton in Haddingtonshire and afterwards professor of oriental languages at Edinburgh. She was the author of two novels, popular in their day, *Self-control* (1810) and *Discipline* (1814; 1832 edition with memoir); and of a posthumous fragment, *Emmeline* (1819).

BRUNTON, SIR THOMAS LAUDER (1844–1916), Scottish physician, was born at Hiltonshill, Roxburghshire, on March 14, 1844. He was educated at Edinburgh university, and after three years of medical work in continental cities, was appointed in 1870 as lecturer in materia medica and pharmacology at Middlesex hospital, London. In 1871 he went in the same capacity to St. Bartholomew's hospital where, three years later, he became assistant physician and in 1895 physician, a post which he resigned in 1904. He was knighted in 1900, and in 1908 was created a baronet.

Brunton specialized in the problems of circulation, his papers on his early work on the use of digitalis, nitrates, enzymes, etc., being included in *Collected Papers on Circulation and Respiration* (1906).

See F. H. Garrison, *History of Medicine* pp. 653–654 (1929).

BRUSA or **BURSA,** the capital of the Bursa (Khudavendikiar) vilayet of Turkey. The city stretches along the lower slopes of the Mysian Olympus or Kechish Dagh, occupying a position above the valley of the Nilufer (Odrysses) not unlike that of Great Malvern above the vale of the Severn. It is divided by ravines into three quarters, and in the centre, on a bold terrace of rock, stood the ancient *Prusa.*

The modern town of Brusa has clean streets and good roads made by Ahmed Vefyk Pasha when Vali, and it contains mosques and tombs of great historic and architectural interest; the more important are those of the sultans Murad I, Bayezid (Bajazet) I, Mohammed I, and Murad II (1403–1451), and the Ulu Jami'.

The mosques show traces of Byzantine, Persian and Arab influence in their plan, architecture and decorative details. The circular church of St. Elias, in which the first two sultans Osman and Orkhan, were buried, was destroyed by fire and earthquake, and rebuilt by Ahmed Vefyk Pasha. Silk-spinning is an important industry, and there are also manufactories of silk stuffs, towels, carpets, burnús, and felt prayer-carpets embroidered in silk and gold.

The hot iron and sulphur springs near Brusa, varying in temperature from 112° to 178° F, are still much used. The town is connected with its port, Mudania, by a railway and a road. Pop. (1940) 77,598.

But for the comparative proximity to the sea this ancient and beautiful city would probably have become the capital of the new Turkish republic. During the Greco-Turkish conflict (1919–22) Brusa and neighbourhood was the scene of severe fighting. In April 1920 the sultan's force under Anzavur Bey, when advancing on Brusa, was defeated by the Nationalists, who in their turn were defeated and driven out of the city in August by the northern army of the advancing Greeks. When the final rout of their main forces took place, in 1922, the Greeks offered a stubborn resistance at Brusa, and did not finally withdraw until Sept. 12. Before this retirement a commission of Allied officers arrived to prevent any wanton damage being done to the architectural masterpieces in the city.

Prusa, founded, it is said, at the suggestion of Hannibal, was for a long time the seat of the Bithynian kings. It continued to flourish under the Roman and Byzantine emperors till the 10th century, when it was captured and destroyed by Saif-addaula of Aleppo. Restored by the Byzantines, it was again taken in 1327 by the Ottomans after a siege of ten years, and continued to be their capital till Murad I. removed to Adrianople. In 1402 it was pillaged by the Tatars; in 1413 it resisted an attack of the Karamanians; in 1512 it fell into the power of Ala ed-Din; and in 1607 it was burnt by the rebellious Kalenderoghlu. In 1883 it was occupied by the Egyptians under Ibrahim Pasha, and from 1852–1855 afforded an asylum to Abd-el-Kader.

See L. de Laborde, *Voyage de l'Asie Mineure* (1838), and C. Texier, *Asie Mineure* (1839).

BRUSASORCI (DOMENICO DEL RICCIO) (*c.* 1516–1567), Italian painter of the Veronese school, pupil of Giovanni Francesco Caroto. He was a colourist, according to Berenson, "the first purely pictorial artist in Italy." His importance in art history is mainly due to his being the predecessor of Paolo Veronese. There are pictures by him which resemble those of his great follower, both in design and colour; among these are the altarpieces in the churches of S. Eufemia and San Lorenzo, and some single, well-preserved figures in his frescoes in the archbishop's palace at Verona. His principal works are in Verona; there are very few elsewhere. In 1551 he painted frescoes on the façade of the Casa Garavaglia in Via San Marco at Trent, representing Midas and Apollo, and a battle with Norsemen. His altarpiece at Mantua cathedral is dated 1552. There is a picture of the Last Supper in the collection of Henry White Cannon at the Villa Doccia, Fiesole.

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BRUSH, CHARLES FRANCIS (1849–1929), American physicist, inventor and manufacturer, was born in Euclid, O., on March 17, 1849. He graduated in mining engineering at the University of Michigan in 1869, and from 1870 to 1873 he practised as an analytical chemist in Cleveland, O. For the next four years he was a commission merchant, dealing in iron and ores. In 1878, after successful experimentation with electric lighting, he produced the electric arc light which bears his name. This was the outstanding achievement of his earlier life as an inventor. In 1880 he founded the Brush Electric Company which became the owner of his numerous patents in the field of electric lighting. The American Academy of Arts and Sciences awarded him the Rumford medal in 1899 for "the practical development of electric arc lighting" and in 1913 the Institute of Electrical Engineers conferred upon him the Edison medal. In addition to his research in electricity, he gave much study to gravitation and molecular physics. He died at Cleveland, O., on June 15, 1929.

BRUSH, GEORGE DE FOREST (1855–1941), American painter, was born at Shelbyville (Tenn.), on Sept. 28, 1855. He was a pupil of J. L. Gérôme at Paris, and became a member of the National Academy of Design, New York, and of the American Academy of Arts and Letters. From 1883 onwards, he attracted much attention by his paintings of North American Indians, his "Moose Hunt," "Aztec King" and "Mourning her Brave" achieving great popularity and showing the strong influence of Gérôme. These were followed by picture portraits, particularly of mother and child, largely suggestive of the work of the Dutch, Flemish and German masters, carefully arranged as to line and mass, and worked out in great detail with consummate technical skill. Several of his paintings had for subject his own children and his wife; one of these is in the Boston Museum of Fine Arts. His "In a Garden" is in the Metropolitan Museum, New York city, "Mothers and Children" in the Pennsylvania Academy, Philadelphia, and "Mother and Child" in the Corcoran Art Gallery, Washington (D.C.). He received gold medals from the Pennsylvania Academy of Fine Arts, 1897, and Paris Exposition, 1900.

BRUSH, a tool used for moving, distributing, collecting, or removing materials of a powdery, granular, or linty nature—either dry, such as dust, or liquid, or combined with a liquid, or semi-plastic, such as paint or mud, also a device to transmit electricity to or from moving parts. The derivation is from O. Fr. *broce,* brushwood; Fr. *brosse.* One of the first types of known brushes is the besom, a bundle of twigs or brushwood tied to a wooden handle by means of cane, from which developed the corn broom and whisk, and now the fibre broom so popular in America. A *broom* may be said to be a brush with a long handle.

The range of materials available for brushmaking is now very great, as the hair from many animals and the fibrous materials, derived from many varieties of vegetable growth, as well as the recently developed synthetic (plastic) materials such as exton, are now called into use by the manufacturer. The more important materials employed are the hairs of the pig, boar, horse, badger, goat, bear, skunk, ox; protective hairs plucked from the fur of the sable, marten, squirrel, etc., sometimes called camel hair, and vegetable products such as piassava (bass), palmyra fibre, tampico, palmetto, bassine, kittool, Mexican fibre, whisk or broom-root, broom corn, coco, cane, and whalebone. A great amount of cotton is used also particularly in twisted-in-wire brushes.

The selection of the brush material depends upon the use to which the brush is to be put, extending all the way from the stiffer brush material for moving foundry slag, down to bristle for removing the finest dust on a polished floor, and from the artist's application of his water colours to the picture (frequently called a pencil), to the removal of thick mud in the gutters. In the case of personal brushes, it ranges from the stiffness necessary to penetrate a healthy head of hair or to take the grime from a mechanic's hands to the softness to remove excess face powder from milady's cheeks.

To make use of the available materials for these purposes, they must be held securely in a handle, which may be long or short, depending upon the use of the brush, and may be made from any wood, metal, hard rubber, or the numerous comparatively recently developed plastics, such as pyroxylin and bakelite, or materials of animal origin, such as ivory, bone, and tortoise shell. Although stiff brush material is frequently designated by the general term "bristle," the correct use of this word should be confined to the stiff hair obtained from the hog, pig, or boar, the best and stiffest of which come from the colder and wilder districts of Europe and Asia, being marketed through Russia, Japan, China, and India. Horsehair, which is used very extensively for dust brushes, comes mainly from countries where labour cost in preparing material for the market is low enough to meet competition.

Among the fibres are piassava, obtained from the leaf-stalk and trunk of the palm *Attales Funifera* which grows in the Brazilian forests, taking its name from the principal port of shipment, Bahia, and also from leaf-stalks of the African palm. Both Bahia and African piassava are known as bass, the latter being a much stiffer and coarser fibre than Bahia piassava. Another Brazilian fibre known as Para, but more commonly as monkey bass, is used where a softer material is required. There are several sorts of Mexican fibre (locally known as Istle) and obtained from *Agave Heteracantha*, the best known being called "Tampico," as it is largely exported from that Mexican port.

Kittool is obtained from the Indian palm *Caryota Urens;* and bassine (also an Indian product) from the Palmyra palm (*Borassus Flabelliformis*). Whisk is obtained from Mexico, France, and Italy.

All these materials are bleached, dyed, and processed, even to the extent of imitating the natural bristle "flag" or split end in fibre.

Brush Manufacture.—Methods of manufacture are here described, and one or more of them apply to each type of brooms and brushes.

(a) Pitch or Cement Setting. In the case of set brushes, the material is made into knots (almost the only way to make a bristle brush with the flags out) of the required size, dipped into boiling pitch, then bound by means of a thrum, again dipped into boiling pitch and then inserted into the hole in the back, which has been previously bored either by hand or by machine. Sometimes they are pegged into place.

(b) Machine Filling.—Machines are now playing a large part in the manufacture of brushes, and are replacing hand-drawing and pitch-setting except for the very expensive brushes. By means of machines the knots are punched into holes in the solid backs and are secured by a staple in the same operation. Automatic drilling and tufting machines produce large quantities of brushes at very low cost.

(c) Hand Drawing.—In the case of hand-drawn brushes, the knots or tufts of brush material are drawn into the holes from the back of the brush with wire. When all the holes of the brush are filled, the brush is completed by means of a veneer which is glued or screwed on the back and then finished by the brush finisher. Afterwards the bristles or other materials are levelled by means of shears and the brush is ready for use. One of the principal uses of this method is the metal back hair brush in which bristle tufts are drawn into the holes in die cast aluminium backs. In the finished brush, the wire lies neatly in open grooves in the back which serve as a decoration.

Another method of hand-drawing is known as trepanned work. The holes are bored only to a certain depth and connected at the bottom with a long hole running the length of the brush stock. In the latter hole, the thread with which the brush is drawn is placed and secured at one end, the thread is drawn out of the hole in a loop and the knot is placed in the loop and drawn in from the end of the brush. This is the only method which can be used for hand-drawn ivory brushes and at one time was also used for ebony brushes, although the latter are now also staple set. Bone-handled tooth brushes were made in this way.

(d) Twisted-in-Wire.—The bristle or other material is secured by means of two wires between which it is twisted. In some cases the ends of the twisted wire are inserted into a handle of wood, celluloid or Fullerex This makes a brush with material all around the centre wires. They are frequently bent into a loop to make a brush with a substantial face, and this type represents a very large proportion of the brushes used in the home.

(e) Rolled in Metal or Steelgript.—The most recent and possibly the most far-reaching development in brush construction that has taken place in a great many years is the rolling of brush material into a metal channel. The metal channel folds over a wire, holding brush material in place, and its grip permits greater freedom from shedding or dropping out of brush material than any other type, except possibly the twisted-in-wire. This makes it invaluable for a number of uses, particularly in the food industry and in rubber manufacture where shedding is troublesome.

Such construction enables brushes to be made in strips, of lengths limited only by the length of metal strip and wire that can be fed to the automatic machine which forms the strip into a channel. This machine likewise feeds the brush material uniformly under the wire, and clamps it into a solid brush strip, and may even trim the ends of the brush material to the desired uniform length, and automatically cut it off to the strip length required to meet the numerous uses to which it is to be put.

The brush consists of metal and brush material only, no wood or other backing which might split and release the tufts being used. After the brushes are made in strip form they may be wound into spiral form for use as rotary brushes on many types of industrial machines. These cylindrical brushes can be made practically any length and diameter, in this way improving both the machine and the product.

Types of Brooms and Brushes.—The following are the various types of brooms and brushes manufactured.

(1) Household Brooms and Brushes.—These consist of sweeping brooms, carpet brooms, yard brooms, scrubbing brushes, stove brushes hearth brushes, shoe brushes, etc., all materials and methods of manufacture being used.

(2) Toilet Brushes.—Tooth brushes are almost entirely staple set in celluloid handles, white bristle having been mainly used, but there is a recent movement to use natural coloured and black bristle, owing to its superior wearing qualities. Tooth brushes with synthetic materials are also now being marketed in small quantities.

Other Sorts.—In this section may be included hair brushes, clothes brushes, hat brushes, shaving brushes, etc. These are manufactured by pitch setting, stapling, hand-drawing, and twisted-in-wire. The materials used consist of wood stocks and twisted wire handles for clothes and hat brushes and other brushes of this type. Wood, ivory, tortoiseshell, and plastics are used for the handles of hair brushes, also for shaving brushes. Shaving brushes are made like string bound sash tools, the only difference being in the handle, which is very much shorter. Badger or bristle is used mostly for shaving brushes; for the other types of brushes, bristle, horsehair, and in the cheaper kinds, either fibre alone or a mixture containing fibre. Certain laws, however, prohibit the use of shaving brushes using horsehair and all brushes using animal materials must be sterilized by approved methods.

(3) Painters' and Decorators' Brushes. (See *Art Brushes*, below.) —Nearly all patterns of painting brushes are composed of three parts, the bristles or similar materials, ferrules—or other binding, and handles. In this class are sash tools, distemper and paint brushes, stock brushes, varnish brushes, etc. They may be either hand or machine-made.

(4) Artists' Brushes. (*See* below, and AIRBRUSH.)

(5) Wire Brushes.—Using metal wire for the brush material, these include flue brushes, brushes for cleaning butchers' blocks and the steel surfaces of boilers, as well as castings in the foundry. These may be hand-drawn, staple set, or twisted-in-wire, or steelgript.

Maple and birch are chiefly used for the backs, galvanized steel wire for the twisted-in-wire handles and also different gauges of wire for filling the wooden handles or stocks.

(6) Other Kinds of Brushes.—Among the numerous other kinds of brushes are those made for special industries and those made for use in special machinery processes and known as machine brushes. Most industries use special brushes of some sort.

(T. M. T.; X.)

ART BRUSHES

History.—The brush, like many other hand tools, is simply an improvement on what the fingers can do. No attempt will be made to trace its exact origin, but among the remains of the Cro-Magnon race are found pictures on the walls of Dordogne that certainly required brushes in painting them. As civilization advanced and wider uses were found, the crude brush, made possibly with reeds, was supplanted by a bunch of bristles tied to a stick; from then the brush developed rapidly. From the proficiency of the Egyptians and Greeks, we know very little basic improvement has been made in the paint brush since 3000–2000 B.C. A greater variety of uses in the art of painting, as well as specialization in industry, has brought about every conceivable form of the brush, every kind of hair and setting, as might be expected when one considers that its use varies from that of painting miniatures to washing railroad cars.

Material.—In selecting the hair or bristle for a brush, the manufacturer uses that of many different animals and depends upon various countries to furnish such material. The most popularly used type of bristles for the stiffer paint and art brushes are the French bristles. These are pulled from hogs of central Europe, are white, range from 1½ in. to 4 in. in length, and form one of the best known types of the bristle brush. Russia also furnishes bristles, which are longer and heavier, and greyish in colour. The most plentiful of all, however, are the black bristles of China, which are divided into two groups: those coming from the northern part of China, and called Tientsin bristles; those coming from the southern part of China, and called Hankow bristles. Naturally in a cold climate, such as that of northern China, animals grow longer and finer coats, while the bristles of the animals of the warmer climate are found to be shorter and stiffer. Hankow stock comes from colder mountainous regions and is heavier and stiffer than Tientsin which comes from warmer climates even though, geographically Tientsin is farther north. The Tientsin bristles are used largely for varnishing brushes, and the Hankow bristles for paint brushes, a stiff bristle being needed to push a heavy pigment along. Besides bristle, other varieties of hair are used. Red sable is perhaps the most sought after. Sable is cut from the tail of the kolinsky, an animal whose habitat is Siberia and Russia. The pelts are used in fur coats. The hair is reddish yellow, does not exceed 1½ in. in length, and is noted for its remarkable springiness and fineness. It is employed mostly in the manufacture of fine water colour and oil colour brushes. Camel-hair is very important because of its wide use. The term is a misnomer, however, the commercial material that is generally known as camel's hair being taken from a species of squirrel that is also an inhabitant of cold countries like Siberia and Russia. The best grade of camel-hair comes from the Province of Kazan in Russia; it is the softest of all the hairs employed in brush making. Its extreme length runs to about 3 in. and in colour it ranges through red, blue, grey and black. Badger hair is a popular type, used in fine finishing and varnishing brushes. It comes from the animal of that name, and has the distinction of being the only hair taken from the pelt of animals; all others are taken from the tails. It is greyish in colour, with a black band about ½ in. from the tip. Fitch hair is like badger and meets similar uses. Brownish black, it is taken from a skunk.

Amongst the hairs that are not so popular are Russian sable, similar in length and quality to red sable, but dark grey in colour; bear hair, which looks very much like fitch; and black sable, which resembles fitch but is taken from a South American civet. Several types of Chinese brushes are made of goat hair.

Manufacturing.—In manufacturing paint brushes of hair, the brush-maker generally considers that the tanning of the skin is enough preparation. Bristle is treated quite differently. Chinese bristles are shipped to England and America, cased and sorted according to their native province only. The brush-maker must remove these, and sterilize and sort them before they can be utilized in making brushes. Every bristle or hair, with the exception of some that are adulterants in brush-making (like horsehair) has a flag end and a butt end. The flag is the tip that has grown out of the animal; the butt is the root. A bristle is similar to an elongated cone in shape, and the brush-makers test adulterations of horsehair by rolling a bristle between the thumb and forefinger; if it is genuine bristle, it will slowly roll out of the fingers at the flag end. Each bristle has a natural curve, and to remove this two bundles of bristles are bound end to end and tied with cord. They are then boiled for three hours, which action also sterilizes them. Copper screens are used with meshes of varying thicknesses to sort out the thick and thin bristles. The long and short ones are then sorted, the long ones being much more valuable than the short, after which the bristles are ready to be set.

Settings.—For every kind of brush, a slightly different process is used for setting. The leather-bound, metal-bound, cord and wire-bound, and wire-drawn brushes are the most common, and there are those set in rubber, cement, glue and pitch. Each has its purpose. The popular type of floor-sweeper and dust brush is an example of a pitch-set brush, the setting being a great timesaver for the brush-maker, and just as good for the purpose as a rubber setting would be unless brush is washed as it sometimes is. Pitch settings drop out (except in wire drawn construction) if block expands or contracts due to moisture. Brushes used in water, as calcimine brushes, and water colour brushes for art purposes, are quite often set in cement, as rubber settings expand when wet and are liable to burst the metal ferrule surrounding the setting. Glue set brushes, while generally considered a cheap type of setting, are as serviceable where the brush is not to be used in water or anything that would dissolve the glue. Some brushes used in painting automobile bodies are glue set

Process.—In making the average varnish brush, the brush-maker proceeds as follows: He takes up a handful of loose bristle and lays it on a scale, removing or adding bristles until it meets the proper weight. This bristle is then picked up and rolled out with both hands, the rolling being done by the thumbs with the finger tips held together. To straighten the bristle, it is constantly passed through a metal comb fastened upright on his bench. After a few seconds of rolling and combing, his adept fingers have made all the flag ends point upward, the convex side of the bristle lying on his palms and fingers. With a quick movement the portion in the right and left hands are folded on one another, so that all the flag ends point inward. This end of the bristle is then inserted in a brass cup which has just the shape on the inside that the brush will have on the outside when finished. The bottom of this cup is V-shaped, the V being covered with emery cloth. This aids the bristle in standing up straight. The thumbs and forefingers are then used in shaping the butt end, while the lower end of the cup is pounded vigorously on the bench, to make the bristles range along the emery cloth in a two-sided chisel shape.

All brushes of any quality are cupped in this manner and not cut, as is the popular idea. This cupping preserves the flag or soft end of the bristle which does the most work in painting. The brush-maker now clips the butt end that is sticking out of the cup until it is level or even. When two or three turns are taken with a fine piece of thread around the bristles, they are released from the cup into the metal ferrule, which will be their final resting place.

The glue, pitch, cement or whatever "set" is used, is poured in the ferrule in the space where the handle will go and allowed to settle down through the bristle and dry. If the brush is to be rubber set, the ferrule is pulled up, exposing the butt end of the brush about three-quarters of an inch. The brushes are then stood on the butt end in a tray with a perforated bottom. This tray is laid in another tray which contains pure gum rubber in solution with benzol. This submersion in the rubber is timed with great accuracy and the specific gravity of the rubber watched carefully, as capillary attraction is depended upon to raise the rubber up the bristle. If the bristles are left too long in the solution, the rubber will creep too far up and stiffen it against correct use.

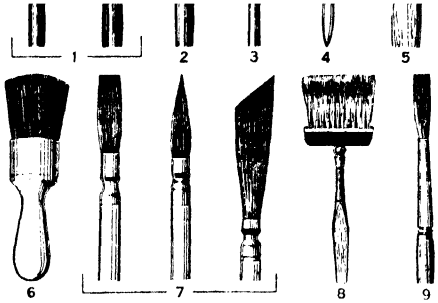
The brushes are now removed from the gum, allowed to dry, and then laid in trays containing sulphur powder, whence they go to vulcanizing ovens. Vulcanization takes longer with brushes than with any other article because a heat great enough to vulcanize rapidly would injure the bristle. When the brushes are removed from the ovens, nothing remains but to pull the ferrule down in place and fasten the handles on. They are then put in a centrifugal machine which holds them by the handles and swings the bristle end around. This removes loose bristles, which were too short to catch in the vulcanizer.

Brushes of hair are shaped and cupped in a manner similar to those of bristle, with the exception of some very small art brushes that are shaped almost entirely with the fingers and lips. Art brushes require more rigorous rules as to the length and shape of the setting. There are one-stroke brushes, so named because their long stock and squared end permit a letterer to make Roman, Old English and script letters with one stroke. Designers, show card, letterers and retouchers are the names of some other typical art brushes.

Brushes set for water colour are generally fuller and longer than those set for oil, having a light liquid to deal with and the other a heavy pigment and oil. The metals in which art brushes are set must also be taken into consideration. Copper, because of its non-corrosive quality is favoured for water colour, as is albata (an alloy of copper and nickel), while oil colour brushes need no such favouring.

Through France and central Europe, the setting of brushes in quills has prevailed for years. This industry is handed down from father to son, and bids fair to remain in France because of the availability of the quills.

In some of the larger types of brushes, and particularly in leather-bound brushes, a wedge is set in the centre of the bristle. This leaves a V-shaped space between the two sides of the brush that has a tendency to hold more paint and prevent so much dipping of the brush. The longer stocks are much sought after in bristle buying, an added inch in length sometimes meaning twice the price. A long stock brush wears down to the length of a cheap brush through use



1. ROUND AND FLAT FRESCO PAINTING BRUSHES; 2. WATER COLOUR BRUSH; 3. QUILL STRIPER. 4 SWORD STRIPER; 5. OIL PAINTING BRUSH; 6. STENCIL BRUSH, 7. THREE STYLES OF QUILL BRUSHES; 8. BADGER BLENDER; 9 RIGGER

Types.—The illustrations show some specialized brushes. Fig. 1 shows round and flat fresco painting brushes. As these are used in water colour and sometimes on ceilings the stock is extra long to give a light touch, hold plenty of the thin liquid and prevent dripping. Fig. 2 is a typical water colour brush. It assumes this shape only when it is wet. Two types of liners or stripers are shown in figs. 3 and 4. Fig. 3 is a quill striper and fig. 4 a sword striper. The entire length of the hair in these brushes used in coach striping is laid flat to take up any tendency to wobble and leave a jagged line. Fig 5 is a "brights" brush used in oil painting and set to make short crisp strokes. Fig. 6 is a stencil brush, while fig. 7 shows different styles of quill brushes. Fig. 8 is a badger blender for softening harsh lines in a painting and for graining and marblizing Fig. 9 is a squared-end lettering brush called a rigger.

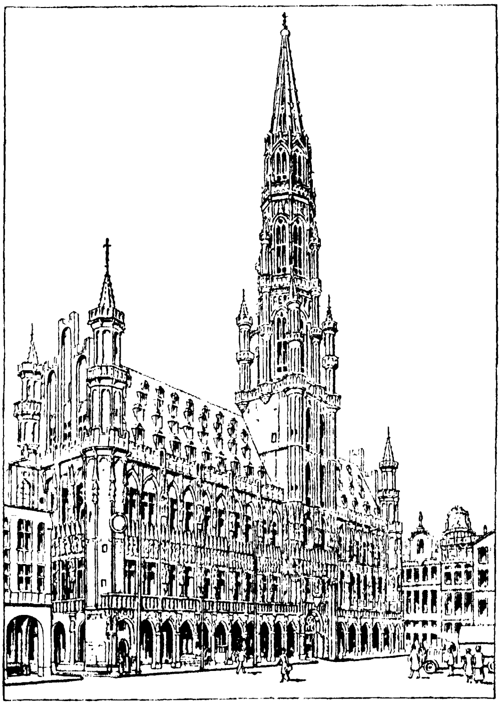
(B. Ch.)

BRUSILOV, ALEXEI ALEXEIEVICH (1853–1926), Russian soldier, was born Aug. 10 1853, of an old family. He began his military career as a cavalry officer in the Caucasus, and in the Russo-Turkish War of 1877–78 he distinguished himself by his courage and resource. From this time onwards he held important commands, and on the outbreak of the World War took command of the VIII Army, which participated in the invasion of Galicia from the east. By Sept. 1915, after varying fortunes, his army had secured possession of Rovno, and was in temporary occupation of Lutsk. In April 1916 Brusilov succeeded Ivanov as commander of the Russian armies (VII., VIII., IX., XI.) south of the Pripet Marshes. A great offensive was launched during the summer of 1916 which brought much-needed relief to the Italian armies by compelling the withdrawal of considerable enemy forces to face the crisis of Lutsk, but, owing to the lack of artillery munitions, this relief involved heavy Russian losses.

After the Lvov Coalition cabinet was formed in May 1917, Brusilov was given supreme command of the Russian armies, which, however, he did not long retain. During the fighting in Moscow in November, he was wounded by a chance bullet, though not himself actively engaged. He died in Moscow, March 17, 1926.

BRUSILOV OFFENSIVE, THE: *see* LUCK, BATTLES OF.

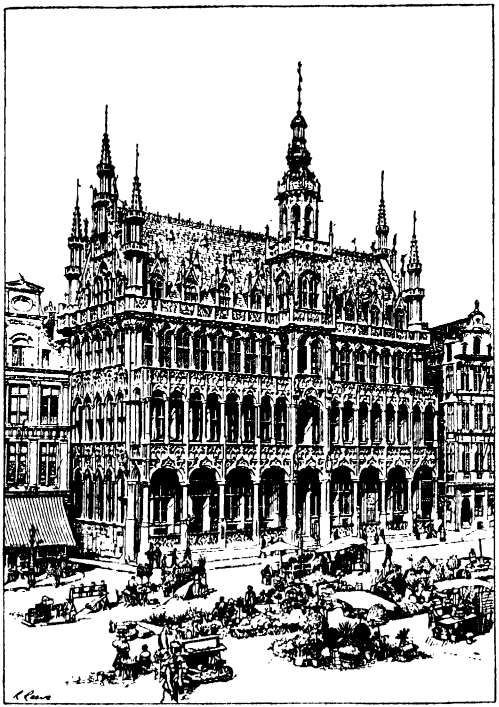
BRUSSELS, the capital of the kingdom of Belgium (Fr. *Bruxelles*, Flem. *Brussel*) and of the province of Brabant, in a central position about 70m. from the North sea at Ostend. It occupies the valley of the Senne, a small tributary of the Schelde, and the surrounding hills on the east, south-east and west. The earliest inhabited site in the area is thought to have been what is now the eastern suburb of Anderlecht, a favourable natural clearing in the primitive forest. Foundations of an important Roman villa and Frankish cemeteries have been discovered; and the columns of the villa seem to have been utilized in constructing the crypt of the old church, St. Guidon, at Anderlecht. The Gallo-Roman population, dispersed by the Franks, sought refuge in the islands among the vast marshes of the Senne, and the Franks themselves later followed them. Brussels, *Bruocsella*, *Broekzele*, "the village of the marsh," thus took its origin. In the 6th–7th centuries the evangelization of the region began, and Saint Géry founded an oratory in the main island, thenceforth known as "Ile Saint Géry." The name St. Géry occurs in the centre of the old town to-day, and reminds one of its early history.



HÔTEL DE VILLE, THE CITY HALL OF BRUSSELS, ONE OF THE MOST BEAUTIFUL BUILDINGS IN EUROPE

The building continues, after more than four centuries, to be the centre of civic administration and the official headquarters of the Burgomaster

At the fall of Charlemagne's empire, the small isles of the Senne were fortified and alongside the chapel a walled enclosure was built. In the 10th century, after the Norman incursions, there came comparative security and prosperity. Commerce and industry developed side by side with the establishment of the merchant road linking Cologne, the Rhine metropolis, with the Flemish towns of Ghent and Bruges; and especially in those spots where it crossed north-flowing rivers, colonies of merchants and artisans grew up. The road crossed the Senne by Ile St. Géry and the adjacent islands and then climbed towards the Brabançon plateau on the right bank of the stream. Its course was marked by the old street called "Montagne de la Cour" now the Mont des Arts. The merchants of the new industrial town, free from the authority of an overlord, created a market, the origin of the *grande place*, and a house, the forerunner of the *hôtel de ville*, where they met. While the commercial town flourished and gradually formed the nucleus of the "low town" which is still the business quarter of Brussels, Henry I., duke of Brabant and count of Louvain, built a residence and, about the year 1200, the abbey of Saint Jacques on the Coudenberg, on the eastern edge of the plateau bordering the Senne valley. This was the beginning of the ducal agglomeration and of the "high town," still the aristocratic quarter with the king's palace.


"LA MAISON DU ROI" OR BROODHUIS, BRUSSELS, COMPLETED IN 1877
Facing the Hôtel de Ville in the Grande Place, it stands on the site of the house where Egmont and Horn, regarded as martyrs of Flemish freedom, spent their last night before execution in 1568

In the first half of the 13th century new ramparts, including eight gates and 24 towers, were constructed to protect the industrial city. In 1312, Duke John II. of Brabant granted the citizens their charter, distinguished from others as that of Cortenberg. This charter, with the Golden Bull of the emperor, Charles II. (1349), was confirmed by the famous "Joyous Entry" of Duke Wenceslas into Louvain (1356). This established the early constitution of the South Netherlands, which remained almost intact till the Brabant Revolution in the reign of Joseph II. The 13th-century wall was soon outgrown, and in 1357 Duke Wenceslas ordered a new wall to be built, enclosing a much greater area. The modern boulevards follow its course. It included 74 towers and eight gates, and survived until 1830. In 1383 the dukes of Brabant transferred their capital from Louvain to Brussels, although residing for some time in their castle at Vilvorde, half-way between the two turbulent cities. Brussels is supposed to have then had 50,000 people, one-fifth the number of Ghent. In 1420 a further charter was granted recognizing the gilds of Brussels as the Nine Nations, a division still existing. The dukes of Brabant built a castle and place of residence on the Coudenberg, and this eventually became the famous palace of the Netherlands whence Charles V. abdicated in 1555. In 1430 the duchy was merged in the possessions of the duke of Burgundy.

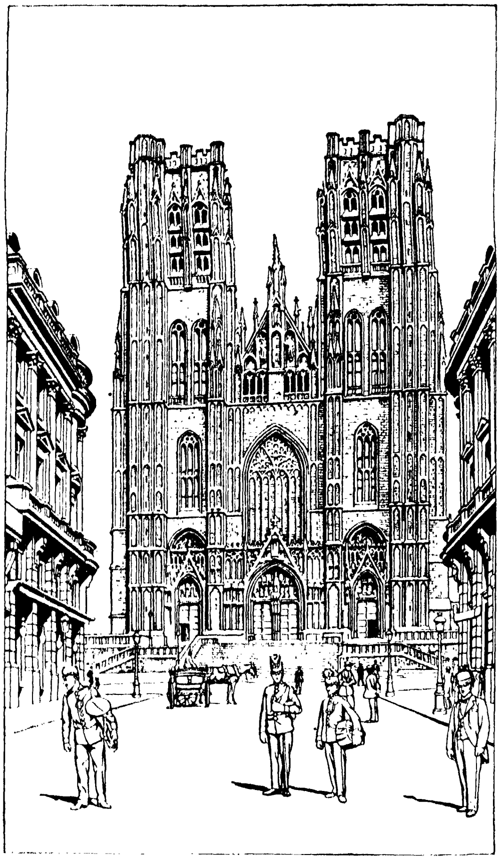
Seventeenth-century Brussels was described as "one of the finest, largest and best-situated cities of Europe." It suffered severely, however, from the bombardment of the French under Villeroi (1695). Sixteen churches and 4,000 houses were burnt down, and the historic buildings on the *Grande Place* were seriously injured, the houses of the Nine Nations on the eastern side being completely destroyed. In 1731 the famous palace of the Netherlands was practically destroyed by fire, some ruined arches and walls alone remaining.

Buildings.—The church of Ste. Gudule, also dedicated to St Michael, is built on the side of the hill originally called St. Michael's Mount. Begun about 1220 and completed save for the two towers, in 1273, it is considered to be one of the finest specimens of pointed Gothic. The stained glass of the 13th–15th centuries is very rich. In many of the windows there are figures of leading members of the houses of Burgundy and Habsburg. The curious oak pulpit came originally from the Jesuit church at Louvain, and is considered the masterpiece of Verbruggen. The church of the Sablon is said to have been founded in 1304 by the gild of crossbowmen to celebrate the battle of Woeringen. In a side chapel is a fine monument to the princely family of Thurn and Taxis, which had the monopoly of the postal service in the old empire. La Chapelle is 13th century, but much restored.

The *Grande Place* is by its associations one of the most interesting public squares in Europe, and contains two of the finest and most ornate buildings in Belgium. The *Hôtel de Ville* occupies the greater part of the south side of the square. The older half of the façade dates from 1410, while the shorter and less ornate portion was begun in 1443. The fine tower, 360ft. in height, is crowned by a golden copper figure of St. Michael, 16ft. in height, erected as early as 1454. Opposite the town hall is the smaller but extremely ornate *Maison du Roi,* in which the royal address was read to the States General. It was almost entirely rebuilt after Villeroi's bombardment. The principal buildings of the 18th century are the king's palace and the house of parliament or *Palais de la Nation.* The palace occupies part of the site covered by the old palace burnt down in 1731. It was built in the reign of the empress, Maria Theresa, but has been greatly altered and enlarged since. The *Palais de la Nation* was constructed between 1779 and 1783. During the French occupation the law courts sat there, and from 1817 to 1830 it was assigned for the sittings of the States General. It is now divided between the senate and the chamber of representatives.

The improvements effected in Brussels during the 19th century completely transformed the city. The removal of the old wall was followed by the creation of the *quartiers Léopold* and *Louise* in the upper town. In the lower, the Senne was bricked in, and the fine *boulevards du Nord, Anspach, Hainaut* and *Midi* took the place of slums. The Bourse and the post office are two fine modern buildings in this quarter of the city. The Column of the Congress (*i.e.*, of the Belgian representatives who founded the kingdom of Belgium) surmounted by a statue of King Leopold I., was erected in 1859. The *Palais de Justice* was erected between 1866 and 1883, from the design of Poelaert, in the style of Karnak and Nineveh, but surmounted with a dome. It is conspicuously placed on the brow of the hill at the southern extremity of the *rue de la Régence,* which contains the new picture gallery with an excellent collection of pictures, the palace of the count of Flanders, and the garden of the *Petit Sablon.* Immediately above this garden is the *Palais d'Arenberg,* one of the Renaissance *hôtels* (showing Spanish influence), which was, in the 16th century, the residence of Count Egmont.

In the early years of the 20th century new and spacious avenues were driven into the suburban woods, and below the *Place Royale* the old tortuous street called the "Montagne de la Cour" gave place to a *Mont des Arts*. The ridge on the west and north-west of the Senne valley, from which Villeroi bombarded the city, is built over from south to north by the suburbs of Anderlecht, Molenbeek and Koekelberg, while Laeken with its royal château and park forms the northern part of the Brussels conglomeration. The communes of Laeken, Haeren and Neder Overheembeek, with parts of Molenbeek and Schaerbeek were incorporated in the city by a law of April 2, 1921, in order to facilitate the construction of the new outer port.



THE CHURCH OF ST. GUDULE IN BRUSSELS, BUILT ON THE SITE OF THE ORIGINAL ST MICHAEL'S MOUNT

This Gothic structure was begun about A.D. 1220, but its towers were not added until the 14th or 15th century. It has rich stained glass windows of the 13th and 15th centuries

The University.—In 1788 the faculties of law, medicine and philosophy were removed from Louvain to Brussels, which in 1834 was constituted a free and independent university with the addition of a faculty of natural science. The university includes a school of political and social science, a school of commerce and an educational section. By the institution of chairs in special subjects, such as Flemish history and literature, colonial jurisprudence and international law, the intimacy of theoretical discipline and practical economic and political conditions was admirably maintained. The Germans closed the university in Dec. 1941.

Although mainly a court city and a residential centre, Brussels has numerous industries among which the manufactures of lace, carpets, curtains and furniture stand out. It is also an educational centre: the university had 3,000 students in 1937–38, while the *école militaire* trains students for the professions as well as for the army. The period after 1910 saw many transformations in Brussels. In World War I, the German occupation extended from Aug. 1914 to Nov. 1918. Gen. Sixt von Armin's troops entered on Aug. 20, and on Sept. 2 F. M. von der Goltz was appointed governor-general of Belgium. He was succeeded by Gen. von Bissing in 1915. Numerous social relief movements were instituted; among them the Comité National de Secours had its headquarters at Brussels, and with American aid organized the feeding of the Belgian population. The executions of Philippe Baucq and of Edith Cavell took place here. The Belgian army reoccupied Brussels on Nov. 18, 1918, and the king and queen re-entered the city in state on Nov. 22. Many old quarters of the "low town" had been demolished, and new arterial roads constructed. The palace of the count of Flanders became the Banque de Bruxelles, and in Nov. 1918 the city acquired the palace of the duke of Arenberg and gave it again its old name of Palais d'Egmont. The British monument commemorating the brotherhood of the two nations during World War I was unveiled in 1923. The foundation stone of new buildings for the university was laid in Nov. 1924 by Prince Leopold. A large sum was provided towards these by the American relief commission.

In World War II, Brussels fell to the Germans May 17, 1940. The city did not suffer extensive physical damage, but was subjected to harsh terms of occupation. The burgomaster and many of the aldermen were removed from office.

The terminus of the London-Brussels air service, previously at Evere, later was moved to the suburb of Haeren. Brussels is also connected by air with the other principal European cities. The town administration is directed by a burgomaster and aldermen at the head of a town council, whose headquarters are in the hôtel de ville. In the Brussels agglomeration are 16 suburbs or communes and parts of two others, each self-governing, with burgomaster and aldermen located in a Maison Communale. The suburban communes are: Anderlecht, Etterbeek, Forest, Ixelles, Jette, Koekelberg, Molenbeek St. Jean, St. Gilles, St. Josse-ten-Noode, Schaerbeek, Uccle, Woluwe St. Lambert, Woluwe St. Pierre, Laeken, Haeren and Neder Overheembeek with parts of Molenbeek and Schaerbeek. Recent enlargements of boundaries have greatly extended the area of the city proper, which covered 12½ sq.mi. in 1921. The population, with suburbs, was 912,774 in 1938. In 1856 the population of the city alone was 152,828; 200,433 in 1930 and was estimated at 191,678 in 1938 and 189,036 in 1939. The great increase has been in the suburbs. The effective increase of population has not, therefore, been so large as the figures for the administrative unit would imply.

The Port of Brussels.—The harbour works planned in 1896 were completed in 1908, and the Willebroek canal, constructed in the 16th century, and giving access to the Rupel and the Schelde, was enlarged to provide a waterway for steamers drawing 24 ft. The basins built were later found to be inadequate and were filled in (1910) and the outer port between Laeken and Vilvorde, with a canal 18½ mi. long leading to the Rupel and the Schelde, taking vessels drawing 19 ft., was opened in 1922. Brussels is thus only about 33 mi. farther from the sea than Antwerp. The port in 1939 had four docks: the Vertoge, the Beco, the Aug. Gobert and the Avant Port, with a total length of about 13,500 ft.

Imports include timber and colonial goods, while exports comprise plate and window glass, iron, sugar, marble, coal, candles and nails.

BRUSSELS SPROUTS, a botanical variety of cabbage (*Brassica oleracea* var. *gemmifera*). In its seedling stage and early life it closely resembles the common cabbage, but later the axillary buds along the erect stem, about 2 ft. to 3 ft. high, develop into very small heads or "sprouts," similar to a head of cabbage but only about an inch in diameter. The origin of this variant of the cabbage is obscure but there are records indicating its sale in the markets of Belgium as early as the year 1213. It is a popular vegetable in England and on the Continent but in the United States it is only sparingly grown, commercial production being limited to a few districts, of which Long Island, N.Y., and parts of California are the most important. Brussels sprouts may be steamed or boiled, but if the delicate flavour is to be preserved, should be cooked only until tender. They are at their best when served with a butter sauce to which a little garlic has been added. Cream sauce and cheese sauce are also used (*see* CABBAGE).

BRUT, BRUTE or BRUTUS THE TROJAN, a legendary British character, who, according to Geoffrey of Monmouth and others, was the eponymous hero of Britain. He was reputed to be grandson of Aeneas, and the legend was that he was banished from Italy and made his way to Britain, where he founded New Troy (London). The name is an obvious confusion between Bryt (a Briton) and the classical name Brutus.

For the romance literature of the subject *see* WACE and BARBOUR.

BRUTTII, an ancient tribe of lower Italy. This tribe, called *Bruttii* and *Brittii* in Latin inscriptions, and *Brettioi* on Greek coins and by Greek authors, occupied the southwestern peninsula of Italy in historical times, the *ager Bruttius* (wrongly called *Bruttium*) corresponding almost exactly to the modern Calabria. It was separated from Lucania on the north by a line drawn from the mouth of the river Lāus on the west to a point a little south of the river Crathis on the east. To part or the whole of this peninsula the name *Italia* was first applied. In alliance with the Lucanians the Bruttii made war on the Greek colonies of the coast and seized on Vibo in 356 B.C., and held it until it became a Latin colony at the end of the same century. The Bruttii were at the height of their power during the 3rd century B.C. Their chief towns were Consentia (Cosenza), Petelia (near Strongoli), and Clampetia (Amantea). To this period (about the time of the Roman war against Pyrrhus) belongs the series of their coins, and they appear to have retained the right of coinage even after their final subjugation by the Romans. Objects of Greek origin are found in their tombs and they spoke the Greek language as well as their own (*bilingues* in Ennius).

The Bruttii first came into collision with the Romans during the war with Pyrrhus, to whom they sent auxiliaries; after his defeat they submitted and were deprived of half their territory in the Sila forest, which was declared state property. In the war with Hannibal they were among the first to declare in his favour after the battle of Cannae, and it was in their country that Hannibal held his ground during the last stage of the war (at Castrum Hannibalis on the gulf of Scylacium). They spoke Oscan as well as Greek, and two or three Oscan inscriptions in Greek alphabet still testify to the language spoken in the town in the 3rd century B.C. The Bruttians, though at this date speaking the same language (Oscan) as the Samnite tribe of the Lucani, were not actually akin to them. The name *Bruttii* was used by the Lucanians to mean "runaway slaves," but it is considerably more likely that this signification was attached to the tribal name of the Bruttii from the historical fact that they had been conquered and expelled by the Samnite invaders. The evidence of tradition (especially Aristotle, *Pol.* 4 [7] 10) shows that the customs of the Bruttii had a certain affinity with those of the pre-Hellenic inhabitants of Greece, and it has been argued that a tradition made it probable that they were called Πέλασγοι. On this evidence they were part of what is now generally called the Mediterranean race. Many Indo-European elements appear in their place-names (*e.g.*, *Sila*—Latin *silva*, Greek ὕλη; *Temesa*, cf. Gr. Τέμενος, or Sanskrit *tamas*, darkness, shadow), and none that suggest a non-Indo-European origin. They may have been akin to the Siceli.

History.—The Bruttii entirely lost their separate existence at the end of the Hannibalic war; in 194 B.C. colonies of Roman citizens were founded at Tempsa and Croton, and a colony with Latin rights at Hipponium, called Vibo Valentia. In 132 B.C. the consul P. Popillius built the great road from Capua through Vibo and Consentia to Rhegium. Spartacus held out a long time in the Sila (71 B.C.). Vibo was the naval base of Octavian in the conflict with Sextus Pompeius (42–36 B.C.).

The most important products of the district were the wood from the forests of the Sila and the pitch produced from it. The coast plains were in parts very fertile, especially the lower valley of the Crathis. Under the empire the Sila was state domain, and most of the rest in the hands of large proprietors. Augustus joined it with Lucania to form the third region of Italy. Diocletian placed Lucania and Brittii (as the name was then spelt) under a *corrector*, whose residence was at Rhegium. From the 6th century A.D., after the fall of the Ostrogothic power and the establishment of that of Byzantium, the name Calabria was applied to the whole of the south Italian possessions of the Eastern empire, and the name of the Brittii entirely disappeared. After the eastern peninsula (the ancient Calabria) had been taken by the Lombards, about A.D. 668, the western retained the name and still keeps it.

BIBLIOGRAPHY.—*See* Strabo vi., p. 253–265; Dion. Halic. xx. 1, 4, 15; Pliny, *Nat. Hist.* iii. 71–74; Justin xii. 2, xxiii. 1; C. Hülsen in Pauly-Wissowa's *Realencyklopädie*, iii. pt. i. (1897); R. S. Conway, *The Italic Dialects* (1897), for Bruttian inscriptions and local and personal names; J. E. Sandys, *Companion to Latin Studies* (1921), with useful bibliography.

BRUTUS (originally an adjective meaning "heavy," "stupid," kindred with Gr. *βαρύς*, *cf.* Eng. "brute," "brutal"), the surname of several distinguished Romans belonging to the Junian gens.

(1) LUCIUS JUNIUS BRUTUS, one of the first two consuls, 509 B.C. According to the legends his father and elder brother had been put to death by the reigning family. Brutus took a leading part in the expulsion of the Tarquinii, and was elected consul, or rather praetor, the original title (Livy i. 59), with Collatinus. When the two sons of Brutus joined in a conspiracy for the restoration of the Tarquins, he himself sentenced them to death (Livy ii. 3). Brutus fell in single combat with Tarquin's son, during a battle with the Etruscans, who were trying to restore the dynasty (Livy ii. 6; Dion. Halic. v. 14).

(2) DECIMUS JUNIUS BRUTUS, consul 138, surnamed Gallaecus from his victory over the Gallaeci (136) in the north-west of Spain (Plutarch, *Tib. Gracchus*, 21). He was a patron of literature, and a friend of the poet Accius (Livy, *Epit.* 55; Appian, *Hisp.* 71–73; Vell. Pat. ii. 5; Cicero, *Brutus*, 28).

(3) MARCUS JUNIUS BRUTUS, a jurist of high authority, was considered as one of the founders of Roman civil law (Cicero, *De Oratore*, ii. 33, 55).

(4) His son, of the same name, made a great reputation at the Bar, and from the vehemence of his speeches became known as "the Accuser" (Cicero, *De Officiis*, ii. 15).

(5) DECIMUS JUNIUS BRUTUS (Albinus), born about 84 B.C., first served under Caesar in Gaul, and afterwards commanded his fleet. Caesar made him his master of the horse and governor of Gaul, and, in case of Octavian's death, nominated him as one of his heirs. Nevertheless he joined in the conspiracy against his patron, and was one of his assassins. He then went to his province of Cisalpine Gaul, which he held for the Republicans against Antony until, deserted by his soldiers and betrayed by a native chief, he was put to death by Antony's orders (43), while attempting to escape to Brutus and Cassius in Macedonia. He figures in Cicero's correspondence. (*See* Appian, *B.C.* iii. 97; Dio. Cassius, xlvi. 53; Caesar, *B.G.* iii. 11, *B.C.* i. 36, 45.)

(6) MARCUS JUNIUS BRUTUS (85, according to some, 79 or 78–42 B.C.), supported the cause of Pompey against Caesar, but was pardoned by the latter after the victory of Pharsalus, and subsequently appointed governor of Cisalpine Gaul (46), a post which he apparently filled with credit. In 44 he was city praetor, and Caesar promised him the governorship of Macedonia at the expiration of his term of office. But at the prompting of Cassius he became leader of the conspiracy against the dictator, and was himself one of the assassins. But the republicans had no programme, and in 44 he fled to the East with Cassius, seized Macedonia and raised forces against Antony. But at Philippi (42) they were defeated by Antony and Octavian, and Brutus committed suicide.

Brutus was generally friendly with Cicero, who dedicated several works to him, but there were disagreements between them, and Cicero frequently speaks of his lack of enthusiasm. Probably the Romans admired him for his respectability, the old-fashioned *gravitas*. He was slow in decision, amazingly obstinate and in his financial dealings with the provincials, both extortionate and cruel (Cic. *ad Att.* vi. 1. 7). Shakespeare's portrait of him is far too flattering. He wrote philosophical treatises and poetry, but nothing has survived. We possess part of his correspondence with Cicero (two books out of an original nine), which are now regarded as genuine with two possible exceptions. The Greek letters of Brutus are probably the composition of some rhetorician.

See J. L. Strachan-Davidson, *Cicero* (1894); G. Boissier, *Cicero and his Friends* (Eng. trans. 1897); E. T. Bynum, *Das Leben des M. J. Brutus* (1898); Tyrrell and Purser's edition of Cicero's Letters (refs. in index vol. *s.v.* "Iunius Brutus," especially introductions to vols. iii. and v.); other authorities under CAESAR, GAIUS JULIUS; CICERO.

BRÜX: *see* MOST.

BRY, THEODORUS (DIRK) **DE** (1528–1598), German engraver and publisher, born in Liége in 1528 and died at Frankfort-on-Main, March 27, 1598. He established an engraving and publishing business at Frankfort, and also visited London in or before 1587. Here he became acquainted with the geographer, Richard Hakluyt, with whose assistance he collected materials for a finely illustrated collection of voyages and travels, *Collectiones Peregrinationum in Indiam Orientalem et Indiam Occidentalem* (25 parts, 1590–1634). Among other works he engraved a set of 12 plates illustrating the Procession of the Knights of the Garter in 1576, and a set of 34 plates illustrating the Procession at the Obsequies of Sir Philip Sidney; plates for T. Hariot's *Briefe and True Report of the new found Land of Virginia* (Frankfort, 1595); the plates for the first four volumes of J. J. Boissard's *Romanae Urbis Topographia et Antiquitates* (1597–98), and a series of portraits entitled *Icones Virorum Illustrium* (1597–99). De Bry had been assisted by his eldest son, Johannes Theodorus de Bry (1561–1623), who carried on the *Collectiones* and the illustration of Boissard's work, and also added to the *Icones*.

BRYAN, WILLIAM JENNINGS (1860–1925), American politician and orator, was born in Salem, Ill., on March 19, 1860. He graduated from Illinois college in 1881 and from the Union college of Law, Chicago, in 1883. He practised his profession at Jacksonville, Ill. from 1883 to 1887, when he removed to Lincoln, Neb. There he soon became conspicuous both as a lawyer and as a politician, attracting particular attention by his speeches during the presidential campaign of 1888 on behalf of the candidates of the Democratic Party. From 1891 to 1895 he represented the First Congressional district of Nebraska, nominally Republican, in the national House of Representatives. He soon attracted attention as a conscientious worker and became widely known for his ability in debate. His first great speech (March 16, 1892) was against the policy of protection, and on Aug. 16, 1893 he made a remarkable speech against the repeal of the silver purchase clause of the Sherman Act. Although the immediate loser in this contest, he attained a national reputation as the leader of the "free-silver" movement. In 1894 he was a candidate for the U.S. Senate but was defeated in a campaign largely restricted to the silver question. From 1894–96 he edited the Omaha *World Herald*, in which he championed the cause of bimetallism.

Although defeated in all elections in which he subsequently appeared as candidate, he was the recognized leader of his party for the next 30 years. His panacea for the industrial, and especially the agrarian evils of the day was "free-silver." In 1896 he was sent as delegate to the Democratic National convention at Chicago, and there easily captured control of the convention, wrote the party platform, which contained a plank providing for bimetallism, and in defence of his proposition delivered a celebrated speech containing the passage, "You shall not press down upon the brow of labour this crown of thorns; you shall not crucify mankind upon a cross of gold." As leader of the "silver" majority he became the Democratic nominee for president. Subsequently, he received the nominations of the Populists and the National Silver Parties. In the ensuing presidential campaign he travelled over 18,000m., and made altogether 600 speeches in 27 different States—an unprecedented number. In the election, however, he was defeated by William McKinley, the Republican candidate, receiving 176 electoral votes to 271. During the Spanish-American War he was colonel in the 3rd Nebraska Volunteers, but saw no active service. Even though he lent his support to the ratification of the peace treaty, he opposed the permanent acquisition of the Philippines and in 1900 was again nominated for the Presidency on a platform that declared against "imperialism" and for "free-silver." He was a second time defeated by McKinley, receiving 155 electoral votes to 292. After the 1900 election Bryan established and edited at Lincoln a weekly political journal *The Commoner*, which attained a wide circulation.

Although not an active candidate for the Democratic nomination in 1904, he was in attendance and assisted materially in framing the platform. The conservative element of the party had once more resumed control and nominated Judge Alton B. Parker of New York. In 1905–06 he made a trip around the world, and in London was cordially received as a great American orator. He was again nominated for the Presidency by the Democratic Party at its National convention at Denver in 1908. The free-silver theory was now dead, and while the chief issue was over the formulation of a trust policy, the campaign was confused by personal issues, Roosevelt himself intervening in favour of Taft, the Republican nominee. Bryan was again defeated, receiving 162 electoral votes to 321 for Taft. In 1912, Bryan announced that he was not a candidate for the Democratic presidential nomination, but he attended the convention, dictated the platform, and inspired the general tone of proceedings at Baltimore, and it was largely owing to his influence that the nomination went to Woodrow Wilson, instead of to Champ Clark. In recognition of this service Wilson appointed him secretary of State in 1913.

As secretary of State he devoted much attention to the negotiation of peace treaties with foreign nations, whereby the signatory powers were bound to submit all disputes to impartial inquiry and delay a full year for arbitration before going to war. These were agreed to in principle by 31 nations. The World War interrupted the movement. In 1913 he was sent to California, where he urged, unsuccessfully, that the State legislature and the governor should delay action on the proposed Webb anti-alien land ownership bill, so displeasing to the Japanese Government. In 1914 he supported the repeal of the Panama Canal tolls bill, which excluded American coastwise shipping from the payment of fees.

From the outbreak of the World War, Bryan was deeply interested in attempts to restore peace. He opposed foreign war loans to belligerents, but as vigorously opposed an embargo on the shipment of arms as contrary to international law. After the sinking of the "Lusitania" (May 7, 1915) he signed the first strong note of protest to Germany. When the President wrote his second "Lusitania" note, Secretary Bryan resigned (June 8, 1915), saying in his letter of resignation, "You have prepared for transmission to the German government a note in which I cannot join without violating what I deem to be an obligation to my country." He continued, after his resignation, to work in the interest of peace; opposed the Anglo-French war loan; attacked the Navy League and the National Security League; and tried to resist the growing demands for preparedness in America. However, when war was actually declared he asked to be enrolled as a private, though then 57 years of age; he urged loyal support of the President's war measures, and in his own paper, *The Commoner*, strongly condemned obstruction of the selective draft.

In 1916 Bryan was defeated in Nebraska as candidate for delegate-at-large to the Democratic National convention, but went as a reporter and gave full support to the re-nomination of Wilson. He was sent as a delegate to the 1920 convention at San Francisco, but when his motion for the introduction of a "dry" plank in the platform was defeated, he took no further interest in the proceedings. The same year he refused the presidential nomination of the Prohibition Party, although he had been a tireless worker for the cause for the past ten years. In 1921 he moved to Miami, Fla., and in 1924 attended the Democratic National convention in New York as a delegate from Florida, but he exercised very little influence in the party councils. As a politician his work was completed. Bryan laboured earnestly for the most important "progressive" measures adopted by the United States in recent years, the popular election of senators, an income tax, the requirements of publication of ownership and circulation of newspapers, the creation of the department of labour, national prohibition and woman suffrage, and their adoption was due in part to his popular persistent appeal.

His last public appearance was in 1925 at the trial of J. T. Scopes, a school teacher of Dayton, Tenn., who was arrested on a charge of violating the State law prohibiting the teaching in public schools of any theories that deny the divine creation of man as taught in the Bible. Scopes was a biologist and had been teaching evolution. Bryan, a firm believer in the literal interpretation of the Bible, went to Dayton to assist the prosecution. Widespread popular interest was manifested in the case, which in the hands of Bryan and Clarence Darrow, chief defence counsel, assumed the form of a contest between fundamentalism and modernism The outcome was that on July 21, after a hearing extending over three weeks, Scopes was found guilty and fined $100, though Bryan was prevented, through the tactics of Darrow, from delivering the elaborate speech which he had prepared in refutation of Darwin's theories. On the conclusion of the trial he was taken ill, and died at Dayton, Tenn., on July 26, 1925.

See *Life and Speeches of William Jennings Bryan* (Baltimore, 1900); Wayne C. Williams, *William Jennings Bryan* (1923); W. J. and Mary Baird Bryan, *Memoirs of William Jennings Bryan* (1925); Charles E. Merriam, *Four American Party Leaders* (1926); J. C. Long, *Bryan, The Great Commoner* (1928); and Paxton Hibben, *The Peerless Leader, William Jennings Bryan* (1929).

BRYAN, an incorporated city near the northwest corner of Ohio, U.S.A., served by the New York Central railroad; the county seat of Williams county. Pop. (1930) 4,689; (1940) 5,404. The agricultural products are grain, sugar beets, tomatoes, potatoes, dairy products, poultry, fat hogs and cattle. The manufactures are toys, art metal products, condensed milk, canned tomatoes, small furniture, gasoline station equipment, automobile and aeroplane parts, furnace and oil-burning heaters. Bryan was settled in 1840; incorporated in 1849.

BRYAN, a city of Texas, U.S.A., 85mi. N.E. of Austin, served by the Missouri Pacific and the Southern Pacific railways, the county seat of Brazos county. The population in 1930 was 7,814 and in 1940 it was 11,842. It is in a fertile region, producing cotton, corn, alfalfa and poultry; the city has a variety of manufacturing industries. At College Station, 4 mi. S.E. on a tract of 5,000ac., is the Agricultural and Mechanical college of Texas, established in 1871 and opened in 1876, which has an enrolment of about 6,500 men, exclusive of the summer session. The college has one of the largest units of the Reserve Officers' Training Corps established under the National Defence act of June 3, 1916. A basic course in military training is required of all students, with certain exceptions, and there are extensive advanced courses in military science and tactics for infantry, field artillery, signal corps, cavalry and air corps. The discipline of the institution is administered by the commandant, an officer of the U.S. army. Bryan has a commission-manager form of government.

BRYANSK (BRIANSK), a town and province in the Russian S.F.S.R. (1) The province which is fused (1944) with the region of Orel and does not exist as an independent administrative unit had an area of 15,802 sq.mi. The boundaries were: N.W., Smolensk; N.E., Kaluga; E., Orel; S.E., Kursk; S.W., Chernigov; W., Gomel. Pop. 1,994,565; urban 179,438, rural 1,815,127. Sands and tenacious clays predominate, with marshy land, and there is much deciduous forest. Beekeeping, timber trade, tar and pitch industries are carried on in the forest areas, and in the sown areas the crops include rye, oats, barley, wheat, hemp, potatoes, hops, vegetables, tobacco and fruit. Industries are increasing and there are factories for iron goods, machinery, ropes (especially at Karachev), leather, soap, tobacco and chemical produce.

(2) The town of Bryansk, Lat. 53° 13′ N., Long. 34° 25′ E., pop. (1939) 87,473, is at the limit of navigation of the Desna river, in the centre of a lowland plain with branching valleys carved out of the plateau by the Desna and its tributaries, especially the Bolva. It is a railway junction (six lines) and north of the town are the Maltsov iron works, glass factories and rope works, employing thousands of workers. There are also sawmills, flour mills and timber factories. It trades in timber, tar pitch, hemp and cattle. It is an old city, mentioned in 1146 as Debryansk, afterwards forming a separate principality, which ended in 1356. After the Mongol invasion of 1241, it was in the power of Lithuania and did not become Russian till the 17th century.

BRYANT, JACOB (1715–1804), English antiquarian and writer on mythological subjects, was born at Plymouth, and held a post in the ordnance department. He was a great collector of books, and left his library to King's college, Cambridge, having, however, previously made some valuable presents from it to the king and the duke of Marlborough. Bryant was the author of many works on ancient history and on theology, the best known at the time being his *New System*, or *An Analysis of Ancient Mythology* (1774–1776), now forgotten, and his *Observations* (1781) on the poems of Thomas Rowley, which played a considerable part in the Rowley controversy.

BRYANT, SOPHIA (1850–1922), English educationalist, daughter of the Rev. W. A. Willock, was born in Dublin, Feb. 15, 1850, and was educated at Bedford college, London. She was from 1875 to 1895 form mistress at the North London Collegiate School for Girls. In 1881 she graduated B.Sc. with honours in mathematics and moral science and was the first woman admitted D.Sc. (1884). From 1895 to 1918 she was headmistress of her school and served on many important educational committees. In 1904 the hon degree of Litt.D. was conferred on her at Dublin university. She met her death in a mountaineering accident near Chamonix in 1922. She published many educational works and several books on early Irish history.

BRYANT, WILLIAM CULLEN (1794–1878), American poet and journalist, was born at Cummington, a farming village in the Hampshire hills of western Mass., on Nov. 3, 1794. He was the second son of Peter Bryant, a physician and surgeon and a man of scholarship. Peter Bryant was the great-grandson of Stephen Bryant, an English Puritan emigrant to Massachusetts about 1632. The poet's mother, Sarah Snell, was a descendant of "Mayflower" pilgrims. Bryant's early education was limited. After the village school he received a year of exceptionally good training in Latin under his mother's brother, the Rev. Dr. Thomas Snell, of Brookfield, followed by a year of Greek under the Rev. Moses Hallock, of Plainfield, and at 16 entered the sophomore class of Williams college. Here he was an apt and diligent student through two sessions, and then, because of the straitness of his father's means, he withdrew without graduating and studied classics and mathematics for a year in the vain hope that his father might yet be able to send him to Yale college. But the length of his school and college days would be a misleading measure of his training. He possessed many traits which often are established only by books and institutional regimen, as well as an impulse toward scholarship and citizenship. It is his own word that, two months after beginning with the Greek alphabet, he had read the entire New Testament. On abandoning his hope of entering Yale, he studied law under private guidance at Worthington and at Bridgewater. At 21 he was admitted to the bar, opened an office in Plainfield, presently withdrew from there, and at Great Barrington settled for nine years in the attorney's calling, for which he had an aversion that he never lost. His first book of verse, *The Embargo, or Sketches of the Times; A Satire by a Youth of Thirteen,* had been printed at Boston in 1808.

At the age of 26 Bryant married, at Great Barrington, Miss Frances Fairchild, with whom he enjoyed a happy union until her death nearly half a century later. In 1825 he removed to New York city to assume a literary editorship. Here for some months his fortunes were precarious, until in the next year he became one of the editors of the *Evening Post*. In 1829, he came into undivided editorial control, and became also chief owner. He died in 1878, in the month of his choice, as indicated in his poem "June."

Bryant was a man of retiring and contemplative nature, and in his journalistic capacity and in daily debate was a counsellor rather than a leader. He stood for principles more than for measures.

His renown as a poet antedated the appearance of his first volume by about four or five years. "American poetry," says Richard Henry Stoddard, "may be said to have commenced in 1817 with . . . (Bryant's) 'Thanatopsis' and 'Inscription for the entrance of a wood.'" He wrote "Thanatopsis" at Cummington in his 18th year, and it was printed in 1817 in the *North American Review;* the "Inscription" was written in his 19th, and in his 21st while at Bridgewater, he composed "To a Water-fowl."

His gift for language made him a frequent translator, and among his works of this sort his rendering of Homer is the most valuable. His poems, characterized by the equal purity of their artistic and their moral beauty, are, on the ethical side, more than pure; they are—it may be said without derogation—Puritan He never commerced with unloveliness for any loveliness that may be plucked out of it, and rarely discovered moral beauty under any sort of mask. Free from effeminacy and indelicacy Bryant possessed a self-restraint that never permitted emotional transports in his works, which contain scarcely a distempered utterance or a passionate exaggeration. Even when he essayed to speak for spirits unlike his own he never portrayed any overmastering passion. The nearest he ever came to mirth was in "Robert of Lincoln," and the nearest to sorrow in writing of his young sister, "The Death of the Flowers."

Bryant published volumes of *Poems* in 1821 (Cambridge) and 1832 (New York), and many other collections were issued under his supervision, the last being the *Poetical Works* (1876). Among his volumes of verse were *The Fountain and other poems* (1842); *The White-Footed Deer and Other Poems* (1844); *Thirty Poems* (1864); and blank verse translations of *The Iliad of Homer* (Boston, 1870) and of *The Odyssey of Homer* (Boston, 1871). His *Poetical Works* and his *Complete Prose Writings* (1883 and 1884) were edited by Parke Godwin, who also wrote *A Biography of William Cullen Bryant, with Extracts from his private Correspondence* (1883). *See* also J. Grant Wilson, *Bryant and his Friends* (1886); John Bigelow, *William Cullen Bryant* (Boston, 1800), in the "American Men of Letters" series; W. A Bradley, *Bryant,* in the "English Men of Letters" series (1905); E. C. Stedman, *Poets of America* (1885); and biographical and bibliographical introductions by Henry C. Sturges and Richard Henry Stoddard to the "Roslyn edition" of his *Poetical Works* (1903). For more recent critical estimates, *see* Norman Foerster, "Nature in Bryant's Poetry," *So. Atlantic Quart.,* vol. xvii., pp. 10–17 (Durham, N. C., 1918); F. L. Pattee, *Side Lights on American Literature* (1922); W. L. Phelps, *Howells, James, Bryant and Other Essays* (1924); and E. W. Gage, "William Cullen Bryant," *Jour. of Am. Hist.,* vol. xix., pp. 279–286 (Greenfield, Ind., 1925).

BRYAXIS, one of the four great sculptors who worked on the mausoleum at Halicarnassus, about 350 B.C. His work on that monument cannot be separated from that of his companions, but a basis has been discovered at Athens bearing his signature and adorned with figures of horsemen in relief. He is said to have made a great statue of Serapis for Sinope, but as to this there are grave historic difficulties. He also made a great statue of Apollo, set up at Daphne near Antioch.

See E. A. Gardner, *Handbook of Greek Sculpture,* ii. 374.

BRYCE, JAMES BRYCE, 1ST VISCOUNT (1838–1922), British statesman, jurist and author, was born at Belfast on May 10, 1838, of a Scottish family. His father, James Bryce (d. 1877), was a schoolmaster, and moved in 1846 to Glasgow, where James attended the high school and then the university. In 1857 Bryce went to Trinity College, Oxford, where he had an extraordinarily brilliant record, and in 1862 was elected a fellow of Oriel. When he began to read for the Bar he had already published his *Holy Roman Empire* (1864), the brilliant piece of historical work which had won the Arnold Historical Essay prize in 1863, and which is still indispensable to the student.

Bryce was called to the Bar at Lincoln's Inn in 1867; in the next year he began to lecture on law at Owen's college, Manchester, and in 1870, became Regius Professor of Civil Law at Oxford, a position which he held until 1893. "Bryce, who had sat at the feet of Van Vangerow in Heidelberg, conceived it," says Mr. H. A. L. Fisher, "to be part of his duty to awaken an interest in the civil law not as an antiquarian curiosity, but as a great power in the moulding of European thought and history." He practised at the Bar until 1882. In 1870 he had made the first of a series of visits to America, in which he laid the foundations of his knowledge of American institutions and American life, and in 1876 a visit to Caucasus, Armenia and Constantinople, the beginning of his lifelong interest in the Armenians. He founded the Anglo-Armenian Society, and after he entered the House of Commons (for Tower Hamlets), he constantly urged their cause.

Bryce's learning and firsthand knowledge of many countries made him indispensable in the councils of the Liberal party, but he never carried in the House of Commons the weight of less able men with the true "parliamentary gift." He had much in common with Mr. Gladstone, not least on the literary side. In the autumn of 1885 he went to his native town of Belfast to tell Ulster Liberals of the coming proposals for Irish Home Rule, and in the Gladstone Government of Jan.–Aug. 1886 he was under-secretary for foreign affairs. The next year was spent on *The American Commonwealth* (published 1888) on which he had been working since 1883. This book was the first important work on the subject, and is still the classic in its field. Bryce brought to his task not only historical knowledge, but the trained mind of the jurist, and the sympathy of a friend of the American people and an admirer of their institutions. In the Gladstone Government of 1892 he was chancellor of the Duchy of Lancaster, and in the reconstructed Rosebery cabinet of 1894 president of the Board of Trade. He presided over the important commission on secondary education in 1894 which laid the foundation of the English system.

After the defeat of the Liberal Government he travelled (1895) in South Africa, visiting the outlying territories as well as the Cape and the Boer republics; his book *Impressions of South Africa* appeared in 1897. He protested against the handling of the negotiations with the Boer republics in the following years, and in the split in the Liberal party which followed the outbreak of war in 1899 Bryce ranged himself with Campbell-Bannerman in the campaign against Mr. Chamberlain and his policy. Throughout the war Bryce was an uncompromising fighter on the unpopular side. In the Campbell-Bannerman cabinet of 1905 Bryce was chief secretary for Ireland, and in 1907 the prime minister sent him as ambassador to Washington. For six years Bryce was the interpreter of Great Britain to the American people. The appointment of a politician, outside the diplomatic service, was criticized at the time, but it was a most happy one. Bryce had many friends in political, learned and literary circles in America, and he was known throughout the States as the author of the classic work on the American Commonwealth, on its institutions, its laws, and its structure. He had already paid seven visits to America, the last being in 1904 when he had delivered an address at the St. Louis Exhibition and the Godkin lectures at Harvard and Columbia. While Bryce was at Washington the difficulty between Amerca and Newfoundland about fisheries was referred to The Hague Tribunal for final settlement. Most of the questions with which he had to deal related to the relations between the United States and Canada, and in this connection he paid several visits to Canada to confer with the governor-general and his ministers. He was criticized, both in England and in Canada, for forwarding, in 1911, in the course of his duties as ambassador, an arrangement or reciprocity between the two North American States; but the general election, which substituted Sir R. Borden as prime minister of Canada for Sir W. Laurier, put an end to the negotiations. At the close of his embassy he told the Canadians that probably hree-fourths of the business of the British embassy at Washingon was Canadian, and of the 11 or 12 treaties he had signed nine iad been treaties relating to the affairs of Canada. "By those nine reaties," he said, "we have, I hope, dealt with all the questions hat are likely to arise between the United States and Canada—questions relating to boundary; questions relating to the disposal nd the use of boundary waters; questions relating to the fisheries n the international waters where the two countries adjoin one another; questions relating to the interests which we have in sealing in the Bering Sea, and many other matters." He could boast that he left the relations between the United States and Canada on an excellent footing.

For his services he was created a viscount in 1913, and in 1914 his old university, Oxford, gave him an honorary degree. He was extremely reluctant in the last days of July 1914 to contemplate the possibility of war with Germany; but the violation of Belgian neutrality and the outrages committed in Belgium by German troops turned the scale for him. He was chairman of the committee to consider the evidence of such outrages not only in Belgium but in France. He welcomed warmly the entrance of the Americans into World War I in the spring of 1917.

He presided over a committee set up in that year to consider the reconstruction of the house of lords, and spent much labour in a task which all parties were disposed to shirk. During these latter years he was largely engaged on the composition of his book on *Modern Democracies*, a comparative study of a certain number of popular governments in their actual working, for which he had been gathering material for several years before the war. Lord Bryce married, in 1880, Elizabeth Marion, daughter of Thomas Ashton, of Hyde, and sister of the 1st Lord Ashton of Hyde. He received the Order of Merit in 1907 and a G.C.V.O. in 1918. His last speech in the house of lords was on the Irish treaty in Dec. 1921, and his last public address (apart from addresses to learned societies) was an appeal on behalf of the Armenians at the Mansion House, London. He died at Sidmouth on Jan. 22, 1922.

Bryce's works are *The Holy Roman Empire* (1864); *Trade Marks, Registration Act and Trade Mark Law* (1877); *Transcaucasia and Ararat* (1877); *The American Commonwealth* (1888); *Impressions of South Africa* (1897); *Studies in History and Jurisprudence* (1901); *Studies in Contemporary Biography* (1903); *South America* (1912); *University and Historical Addresses* (1913); *Modern Democracies* (1921); *International Relations* (1922). *See* H. A. L. Fisher, *James Bryce* (1927).

BRYCE, LLOYD STEPHENS (1851–1917), U.S. author, editor and diplomat, was born in Flushing, L.I., N.Y., Sept. 20, 1851. He was educated at the Jesuit college of Georgetown university, Washington, D.C., at Oxford university and at the law school of Columbia university. In 1886 the governor of New York appointed him paymaster-general of the state and the next year he was elected to congress as a representative from New York, serving one term. When the editor of the *North American Review* died in 1889, Bryce inherited from him a controlling share of the publication's stock, of which he at once purchased the remainder. He became editor of the *Review* the same year and retained the position until 1896. In 1911, President William Howard Taft appointed him United States minister to the Netherlands and Luxembourg, which office he retained until 1913. He died in Flushing, April 2, 1917.

In addition to numerous magazine articles, Bryce wrote *Paradise; A Dream of Conquest; The Romance of an Alter Ego; Friends in Exile; The Literary Duet; Lady Blanche's Salon;* and *After Christianity, What?*

BRYCE CANYON, a scenic tract comprising originally about 11 sq.mi. in Garfield county, south central Utah, U.S.A., which in 1923 was set apart as a national monument. In 1928 the canyon with the area around it was created a national park which in 1931 was enlarged to about 55 sq.mi. The canyon contains striking examples of erosion, especially rock pinnacles of brilliant colouration which have been worn into fantastic shapes. More than 100,000 tourists annually visit the park.

The canyon was named for Ebenezer Bryce, an early settler in the region.

BRYDGES, SIR SAMUEL EGERTON (1762–1837), English genealogist and miscellaneous writer, was born on Nov. 30, 1762. He studied at Queens' college, Cambridge, and was entered at the Middle Temple in 1782, being called to the bar in 1787. In 1789 he persuaded his elder brother that their family were the heirs to the barony of Chandos (*see* CHANDOS, BARONS AND DUKES OF), being descended from a younger branch of the Brydges who first held the title. The case was tried and lost, but Brydges never gave up his claim, and used to sign himself *Per legem terrae* B.C. of S. (*i.e.*, Baron Chandos of Sudeley). He re-edited Collins' *Peerage*, inserting a statement about his supposed right. He sat in parliament for Maidstone from 1812–18. In 1814 he was made a baronet and in 1818 he left England. He died at Genevá, Sept. 8, 1837.

He was a prolific author and is said to have written 2,000 sonnets in one year. His numerous works include *Poems* (1785); *Censura Literaria* (1805–09); *The British Bibliographer* (4 vols., 1810–14), with J. Haslewood; *Restituta* (4 vols., 1814–16), containing accounts of old books; and *Autobiography, Times, Opinions and Contemporaries of Sir S. E. Brydges* (1834). In 1813 Brydges began to supply material to a private printing press established at Lee Priory, Kent, by a compositor and a pressman, who were to receive any profits which might arise from the sale of the works published. In this way Brydges published various Elizabethan texts at considerable expense to himself, which increased the services he had already rendered to the study of Elizabethan literature by his bibliographical works.

See W. T. Lowndes, *Bibliographer's Manual* (ed. H. G. Bohn, 1857–64).

BRYENNIOS, PHILOTHEOS (b. 1833), eastern theologian, was born in Constantinople in 1833. He was educated at Chalcis, Greece, and at the universities of Berlin, Munich and Leipzig. In 1861 he became a professor at Chalcis and in 1863 director of the school there. He was made head of the Great School of the Nation in Constantinople in 1867 and kept that position until 1875, when he was selected metropolitan of Seres, Greece. In 1877 he became metropolitan of Nicomedia, Turkey.

Bryennios discovered in Constantinople in 1875 manuscripts containing the two epistles of Clement to the Corinthians, the *Didachē* or *Teaching of the Apostles*, and other important religious documents. He published from these the first complete text of Clement's Epistle (1875) and the *Teaching of the Twelve Apostles* (1883), both with valuable notes of his own. The discovery and publication of the manuscripts and Bryennios' commentaries on them are regarded by theologians as important contributions to theological literature and scholarship.

BRYENNIUS, NICEPHORUS (1062–1137), Byzantine soldier, statesman, and historian, was born at Orestias (Adrianople). He gained the favour of Alexius I (Comnenus) and the hand of his daughter Anna, with the titles of Caesar (then ranking third) and *Panhypersebastos* (one of the new dignities introduced by Alexius). Bryennius successfully defended Constantinople against Godfrey of Bouillon (1097); conducted the peace negotiations between Alexius and Bohemund, prince of Antioch (1108); and played an important part in the defeat of Malik-Shah, Seljuk sultan of Iconium (1116). After the death of Alexius, he refused to enter into the conspiracy set on foot by his mother-in-law and wife to depose John, the son of Alexius, and raise himself to the throne. His wife attributed his refusal to cowardice, but it seems from certain passages in his own work that he really regarded it as a crime to revolt against the rightful heir; the only reproach that can be brought against him is that he did not nip the conspiracy in the bud. He was friendly with the new emperor John, whom he accompanied on his Syrian campaign (1137), but was forced by illness to return to Byzantium, where he died the same year.

At the suggestion of his mother-in-law he wrote a history (called by him Ὕλη Ἱστορίας, materials for a history) of the period from 1057–81, from the victory of Isaac I (Comnenus) over Michael VI to the dethronement of Nicephorus Botaniates by Alexius. The work has been described as a family chronicle rather than a history, the object of which was the glorification of the house of Comnenus. In addition to information derived from older contemporaries (such as his father and father-in-law) Bryennius made use of the works of Michael Psellus, Johannes Scylitza and Michael Attaliata.

As might be expected, his views are biased by personal considerations and his intimacy with the royal family, which at the same time, however, afforded him unusual facilities for obtaining material. His model was Xenophon, whom he imitated with a tolerable measure of success; he abstained from an excessive use of simile and metaphor, and his style is concise and simple.

Editio princeps, P. Possinus, 1661; *see* also J. Seger, *Byzantinische Historiker des 10. und 11. Jahrhunderts* (1888), and C. Krumbacher, *Geschichte der byzantinischen Litteratur* (1897).

BRYMNER, DOUGLAS (1823–1902), Canadian archivist, was born in Greenock, Scotland, July 3, 1823. He was educated in Greenock and then began a career in business, but in 1856 his health failed and he was unable to continue his work. In 1857 he left Scotland for Canada, where he settled in the province of Quebec. He soon turned his attention to journalism, accepting the editorship of the *Presbyterian*, the official publication of the Canadian section of the Church of Scotland. Later he was made associate editor of the Montreal *Herald*. In 1872, when the archives branch of the Canadian government was established, Brymner was chosen to head it, and he served as dominion archivist until his death in 1902. His collection of Canadian historical documents proved invaluable to students of Canadian history. He also translated Horace's *Odes* into Scottish dialect. He died at Victoria, B.C., June 18, 1902.

BRYMNER, WILLIAM (1855–1925), Canadian painter, was born in Greenock, Scotland, Dec. 14, 1855, the son of Douglas Brymner (*q.v.*). He went to Canada while he was still a small child and was educated in the province of Quebec. In 1878 he went to Paris, where he studied under Adolphe William Bouguereau and Tony Robert-Fleury. He subsequently exhibited his work at the Paris salon, the Royal academy in London and at a number of expositions in the United States, where he frequently won prizes.

He was elected president of the Royal Canadian academy in 1909 and held the office until 1917. He died June 18, 1925, in England.

BRYNMAWR, an urban district and the largest town in Breconshire, Wales. Pop. (1938) 6,622. Area 2.3 sq.mi. It is in the extreme south of the county and marks the northern limit of the south Wales industrial area. It owes its origin to the rapid development of the iron smelting industry early in the 19th century, when the success of the Cyfarthfa furnaces at Merthyr Tydfil led to the reopening of old ironworks in Ebbw Vale, Nantyglo, Beaufort and the surrounding districts. In 1831 a tramway was built to carry limestone to the furnaces at Nantyglo: this crossed the Merthyr to Abergavenny coach road near the Prince of Wales hotel. Later, a road was built linking the Monmouthshire valleys with the old east and west road just mentioned. In the triangle thus formed Brynmawr grew up. In this, unlike most of the mining centres of south Wales, Brynmawr is not a straggling village in the valley bottom, but is situated, as its name implies (bryn = hill; mawr = great), on high ground, surrounded by open moorland, which gives the town an exposed and bleak appearance.

Owing to its proximity to the agricultural area, the town has grown as a market centre, although it is primarily industrial. With the passing of the importance of iron smelting, the town relied more and more on coal mining and the large steel works at Ebbw Vale, but this led to dire distress in the depression of the 1930s, Brynmawr having a higher percentage (74.1%) of unemployment among the insured population in May 1934, than any other of the south Wales industrial towns.

BRYN MAWR COLLEGE, situated in the suburbs of Philadelphia at Bryn Mawr, Pa., was founded in 1885 in order to establish and maintain an institution of advanced learning for women, by the will of Dr. Joseph W. Taylor, a member of the Society of Orthodox Friends. The government of the college is vested in a corporation which includes 13 life trustees, the president of the college, two directors-at-large and five alumnae directors nominated by the Alumnae association to the board of directors. The college is nonsectarian.

The campus of exceeding beauty, with its buildings of gray stone in collegiate Gothic architecture, covers 60 ac. and overlooks a broad expanse of rolling country. The buildings include the main administrative hall with classrooms, the library (containing in 1943 about 180,000 volumes) designed to be primarily a library for special study, a science building, a gymnasium, an infirmary, a students' building containing an auditorium seating over 1,000 with a wing for the department of music, and seven halls of residence.

The classes of students admitted to the college are graduate, undergraduate and hearers. Graduate students must present a diploma from a college of acknowledged standing. The most distinguished place among the graduate students is held by the fellows and graduate scholars. Many European fellowships, resident and non-resident fellowships and scholarships ordinarily are awarded annually. In 1917 a scholarship was founded which annually pays the tuition of a Chinese student at the college.

Undergraduate students are admitted only by college entrance board examinations and cannot have a matriculation condition. Hearers must be at least 25 years of age; they are admitted without examination; they cannot reside in the college nor be candidates for degrees; they are admitted to courses only with the consent of the instructor. The degrees of bachelor of arts, master of arts and doctor of philosophy are conferred.

In the academic year 1942–43, there were 87 members of the faculty and 576 full-time students. In the previous year the college received $50,406 in gifts and grants. Bryn Mawr's total endowment in 1942 was $7,160,332. (M. E. Pa.; X.)

BRYONY (*Bryonia dioica*), a twining plant of the gourd family (Cucurbitaceae), native to Europe and western Asia and common in England. It has a large white root, large palmate leaves, pale yellow flowers in axillary clusters and red berries. The black bryony (*Tamus communis*), a climbing plant of the yam family (Dioscoreaceae), of similar range, bears a black root, shining, heart-shaped leaves and scarlet berries. Both plants are poisonous but yield useful drugs.

BRYOPHYTA, the botanical name of a division of the vegetable kingdom, usually placed between the algae and ferns. The plants in this group are all small, some, indeed, so minute that only the most careful observer is aware of the great variety of form and structure shown by them. It is quite common for liverworts, mosses, and even small plants of much higher groups to be indiscriminately classed together and popularly called "mosses." The Bryophyta do, however, form a well-defined class, easily recognizable with a little care, and it is equally easy to distin-

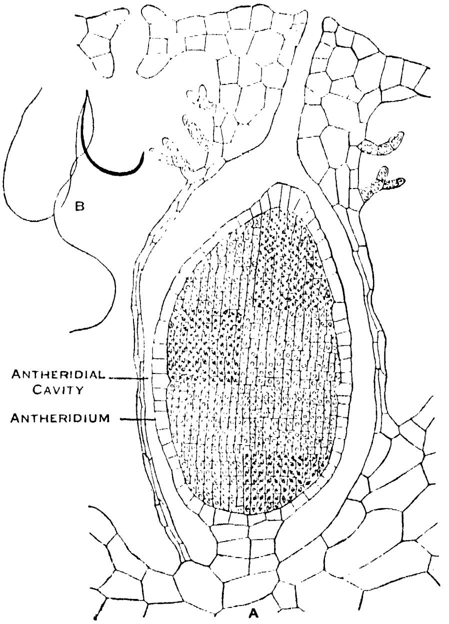
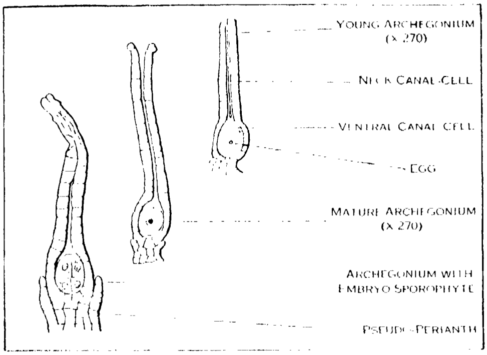


FIG. 1.—MARCHANTIA. A. IMMATURE ANTHERIDIUM, WITH ADJOINING PARTS OF THE MALE DISK IN WHICH IT IS BORNE. B. AN ANTHEROZOID, VERY MUCH ENLARGED

guish the broad sub-groups into which they naturally fall. Their study necessarily entails minute observation, yet such observation shows them to be of great scientific interest, presenting as they do a special type of life history and affording in some of their groups graphic evidence of their evolutionary trend in spite of the complete absence of reliable evidence from fossil remains of any antiquity.

Speaking generally, Bryophyta grow only under moist conditions, being commonly found along the sides of ditches, banks of streams and similar places. Some can certainly grow in even what would appear to be quite dry situations, though it would be more correct to say that such forms can exist through more or less prolonged dry periods, but grow actively only when conditions are comparatively moist. Even fewer are those forms which can thrive only in or on water. Liverworts and mosses are widely distributed throughout the world and with careful search it is possible to find representatives of a wide range of forms in almost any district. Usually they occupy a subordinate place in the general vegetation but occasionally, as with bog mosses and some arctic mosses, they dominate the vegetation.


YOUNG ARCHEGONIUM (× 270)
NECK CANAL-CELL
VENTRAL CANAL CELL
EGG
MATURE ARCHEGONIUM (× 270)
ARCHEGONIUM WITH EMBRYO SPOROPHYTE
PSEUDO-PERIANTH

FROM STRASBURGER, "TEXT-BOOK OF BOTANY"

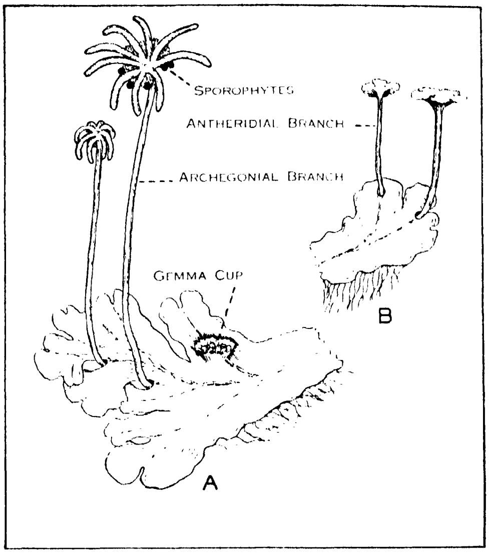
FIG. 2.—MARCHANTIA POLYMORPHA, SHOWING THE ARCHEGONIUM, WHICH ENCLOSES THE OVUM OR EGG

The Bryophyta play several important roles in the economy of nature; they colonize surfaces of rocks and logs and may aid in their reduction to soil by retention of moisture and by chemical reactions. As colonizers on denuded soils, they may retard erosion.

The peat or bog mosses (*Sphagnum* sp.) are of greatest importance economically, serving as material for surgical dressings, and upon being compressed in nature, forming peat. In nurseries, they are used as an absorbent packing on the roots of plants being shipped, and if used as litter, they keep stables virtually odourless. Other mosses (*Polytrichum* sp.) have been used by the peasants of Europe in construction of brooms, brushes and mattresses.

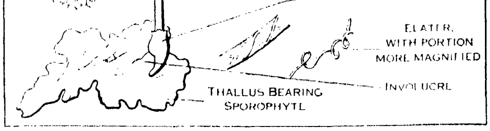
General Structure.—Mosses and most liverworts, with all their variety of form, are similar in that the plant usually seen consists of a stem bearing leaves (*see* figs. 7, 10). Some liverworts show no differentiation into stem and leaf, but appear as flat structures closely pressed to the substratum on which they grow (figs. 3, 4). Such a habit we describe as thalloid; the plant is a thallus (*i.e.*, a structure showing no differentiation into leaf and stem) in contradistinction to the leafy shoot of the remaining liverworts and mosses; though few in number of forms, those with this thalloid habit are very widely spread and are exceedingly interesting and significant in their form and structure.

The small plant, whether leafy shoot or thallus, is self-supporting, possessing chlorophyll as do other plants and rhizoids—elongated cells resembling root hairs which grow from the underside of the plant and not only attach it to the soil but convey necessary salt solutions therefrom. Most interesting of all is the fact that the liverwort and moss plant bear the reproductive organs called antheridia and archegonia. The *antheridium* when mature has a shorter or longer stalk supporting a spherical or more usually an ovoid body which consists of a wall of flattened cells enclosing a densely packed mass of very small cubical cells (fig. 1). In all cases examined, each of these cubical cells gives rise by division to two motile bodies called spermatozoids or antherozoids which function as the male element in sexual reproduction. Each antherozoid consists of a more or less spirally coiled, club-shaped body, pointed at its anterior end and bearing there two long flagella whose movements are responsible for the motility of the sperm. These antherozoids are liberated from the antheridium by degeneration of the walls enclosing them or by an apical opening. The *archegonium* also usually has a stalk and takes the form of a minute, long-necked flask (fig. 2). The wall of the flask consists of a layer of cells enclosing the ovum or egg,



FROM WEATHERWAX, "PLANT BIOLOGY," (W. B. SAUNDERS COMPANY)

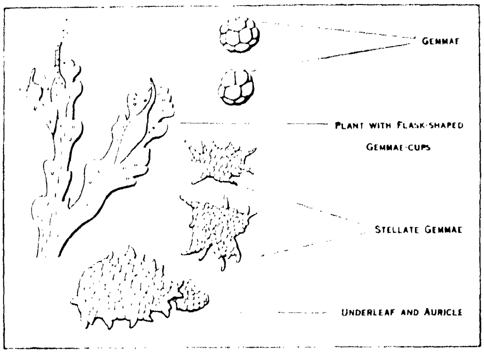
FIG. 3.—SOME COMMON LIVERWORTS. A. B. MARCHANTIA THE ANTHERIDIA ARE PRODUCED IN CAVITIES IN THE UPPER SURFACE OF THE DISC ON THE MALE PLANT; THE ARCHEGONIA ARE BORNE ON THE LOWER SIDES OF THE FINGER-LIKE RAYS OF THE STAR-SHAPED STRUCTURE OF THE FEMALE PLANT


TRANSVERSE SECTION OF THALLUS
CAPSULE
LONGITUDINAL SECTION
MALE TUBERCLE, EPIDERMIS COVERING AN ANTHERIDIUM
SETA
CALYPTRA
ELATER, WITH PORTION MORE MAGNIFIED
INVOLUCRE
THALLUS BEARING SPOROPHYTE

FROM "THE STUDENT'S HANDBOOK OF BRITISH HEPATICS"

FIG. 4.—GENERAL STRUCTURE OF THE PELLIA EPIPHYLLA, THE COMMONEST GENUS OF THE SIMPLE ANACROGYNAE

the ventral canal cell and a row of neck canal cells. The ovum or egg, the female element in sexual reproduction, occupies the lower part and most of the space of the body of the flask, the remaining upper part being occupied by the ventral canal cell, while the space within the neck of the flask is filled by a row of cells, the neck-canal cells, the whole being closed by a lid of cells continuous with those of the wall. When mature the lid is burst open by the mucilaginous degeneration of the neck-canal and ventral canal cells, and fertilization is brought about by the passage of the motile antherozoids via the mucilage to the egg. In all probability the antherozoids are attracted to the open neck of the archegonium by some chemical stimulus; in any case one antherozoid fuses with the egg and fertilization is brought about. The antheridia and archegonia arise by division of a single cell, and though almost identical in mature form throughout liverworts and mosses, the development differs in detail in the two groups. These differences may be found in literature cited in the bibliography.



FROM "THE STUDENT'S HANDBOOK OF BRITISH HEPATICS"

FIG. 5. BLASIA PUSILLA, A LIVERWORT WHICH PRODUCES TWO TYPES OF GEMMAE, ONE OF WHICH GROWS INTO A NEW PLANT

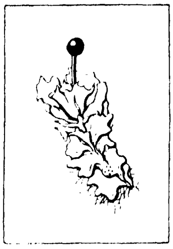
The fertilized egg (*zygote*), two nuclei fused together, is the beginning of a new and very different stage in the life history of these plants. This stage when completely developed varies considerably in structure in the various groups, but in general it consists of a capsule containing spores, sometimes borne upon a stalk, and throughout its whole life borne upon and nourished by the plant on which it arose (*see* figs. 4, 10). In spite of the variation in structure, the end of this stage of the life history is in all cases the production of spores which are shed and germinate in course of time. In mosses the spore gives rise to a branched filament of cells, the *protonema*, upon which the new moss plant arises. In liverworts a protonema is scarcely recognizable, the spore growing directly into the new plant.

Life History.—Here then, as in all plants higher in the scale of botanical classification, the life history is divisible into two stages which follow each other with regular alternation.

The plant we usually see in the field is the *gametophyte* which begins its life with the spore and eventually produces antheridia and archegonia. By the fusion of an antherozoid with an egg the *sporophyte* is initiated from this gametophytic phase. The fertilized egg develops into the sporophyte consisting of a capsule sometimes stalked, and attached to the gametophyte by a foot. The sporophytic phase ends with the production of spores. The *life history* of a liverwort and moss then consists of the *regular alternation* of gametophyte and sporophyte. In this life history the interest lies in the fact that the plant as we see it is *the gametophyte, the sporophyte dependent* upon it and commonly *recognized* as the moss "fruit" being the subordinate phase in this sense. In all other plants higher in the scale of evolution, the reverse is the case, the independent self-supporting plant is the sporophyte, the gametophyte being the subordinate partner in the life cycle, and though not always dependent upon the sporophyte, always comparatively inconspicuous.

(*See* PTERIDOPHYTA and CYTOLOGY for discussion of the fundamental nuclear difference between haploid gametophyte and diploid sporophyte.)

The Bryophyta, according to their form and structure, can be subdivided into the Hepaticae (liverworts), Anthocerotae (hornworts) and Musci (mosses). The first and last of these classes are further divisible into smaller groups: the Hepaticae into the Marchantiales, Sphaerocarpales and Jungermanniales; the Musci into the Sphagnales, Andreaeales and Bryales.



FROM "THE STUDENT'S HANDBOOK OF BRITISH HEPATICS"

FIG. 6.—FOSSOMBRONIA PUSILLA IN WHICH THE THALLUS RESEMBLES A LEAFY STEM

HEPATICAE

The Hepaticae may be separated from the other classes of the Bryophyta by the relative simplicity of their sporophyte. The capsules exhibit no stomata and elaters usually comprise the internal sterile tissue.

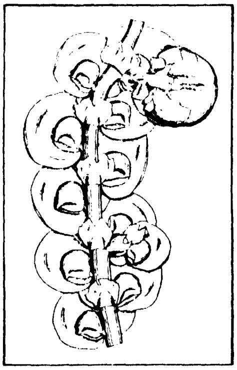
The three groups into which liverworts are botanically divided show among their several members much variation in structure, and are distinguished chiefly by their morphological characteristics.

Marchantiales.—Members of this group are characterized by a thalloid gametophyte differentiated into several distinct layers of tissue and usually including air chambers. The upper surface often is provided with pores and the lower with ventral scales. Rhizoids are of two types: smooth and those with internal papillae on the walls. The sporophytes vary from merely capsules to those with well-developed stalks and feet.

Riccia, a world-wide genus, exhibits the simpler type of gametophyte and sporophyte. The thallus forms no specialized branches or well-organized air chambers and pores. Archegonia and antheridia are immersed in cavities of the dorsal surface. The sporophyte lacks a stalk or foot and elaters are absent. *Marchantia* (fig. 3) at the other extreme, exhibits more highly specialized structures. The gametophyte is provided with well-developed air chambers with cactus-like, chloroplast-containing filaments arising from the floor. Pores are bordered by four superimposed layers of four specialized cells each. Archegonia and antheridia are borne on erect, highly differentiated branches (*archegoniophores* and *antheridiophores*) of the thallus. The sporophytes develop under the umbrella-like tip of the archegoniophore and consist of a foot, short seta and capsule containing well-developed elaters among the spores. In addition to reproduction by sexual means, multiplication of gametophytes may occur by the germination of discoid *gemmae* from the specialized cups on the dorsal surface of the thalli.

Whether the simple type, illustrated by *Riccia*, represents a primitive or derived form is a moot question and the discussion may be followed in the literature cited.

Sphaerocarpales.—This small group exhibits delicate gametophytes with each antheridium and archegonium (and subsequently each sporophyte) borne in a special envelope or sac.



FROM EVANS, "NORTH AMERICAN SPECIES OF FRULLANIA." (TRANSACTIONS OF CONNECTICUT ACADEMY OF ARTS AND SCIENCES, 1897)

FIG. 7.—FRULLANIA BRITTONIAE, WITH A PORTION OF EACH LATERAL LEAF FOLDED INTO A SAC

Jungermanniales.—Most of the liverworts belong to this group which has gametophytes of both thalloid and leafy types. The thalloid forms are never differentiated into distinct layers of tissue; ventral scales and pores are absent. Both thalloid and leafy forms exhibit smooth rhizoids and well-developed sporophytes with feet, stalks and capsules containing both spores and elaters.

This group may be further separated into the Anacrogynae or Metzgerineae and Acrogynae or Jungermannineae.

The Anacrogynae, represented by *Pellia* (fig. 4) a common genus, are mostly thalloid with only a few species exhibiting leaf-like structures (fig. 6). The archegonium arises behind the apical cell and consequently the sporophytes are always dorsal, even when apparently terminal. Capsules are long-stalked in contrast to those of the Marchantiales and Sphaerocarpales. Some species, such as *Blasia pusilla* (fig. 5), reproduce not only sexually but also asexually by gemmae borne either on the thallus or in special receptacles.

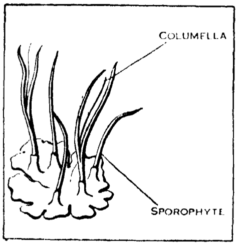
The Acrogynae are aptly described by their common name, leafy or foliose liverworts. They are further distinguished in that the archegonium arises apically and thus terminates the stem or branch, additional growth of the shoot being dependent upon the formation of ventral branches.

The leaves are usually arranged in three rows (fig. 7), two being dorsilateral and the third, ventral. The ventral or underleaves are called *amphigastria* and are smaller in size and different in shape from the others. Amphigastria are absent in a few genera, *e.g.*, *Scapania*, *Diplophyllum* and *Radula*. The other leaves vary widely, from broad expanded forms with various shapes to the finely dissected leaves of *Trichocolea*, and even some may be variously folded and convoluted until they or some portion of them form cups or pouches, as in *Frullania* (fig. 7).

The sporophyte is similar in many respects to that of the Anacrogynae. The evolutionary trends in the Jungermanniales, as in the case of the other Hepaticae, is a controversial subject, a discussion of which may be found in the literature cited.

ANTHOCEROTAE

Anthocerotales.—The hornworts possess a simple thallus undifferentiated in either texture or habit, but are sharply separated from the remaining liverworts by reason of their sporophyte (fig. 8). There are very few genera in the group, the most noted being *Anthoceros*, *Dendroceros* and *Notothylas*. The thallus is dark green and its cells contain a single large chloroplast. On the under surface occur small slits filled with mucilage, which often also fills intercellular spaces in the thallus, and colonies of *Nostoc*, an alga, are constantly found inhabiting some of the mucilage slits. The group is specially noteworthy on account of its reproductive organs. Antheridia often occur in groups in chambers beneath the epidermis and are endogenous, in contrast to all other antheridia. The archegonia are superficial, but after fertilization become covered over by thallus growth and through this the sporogonium has to burst in its growth. The sporophyte is a remarkable structure. It often reaches a length of an inch or more and consists of a wall several cells thick enclosing a spore sac and a sterile column of cells within, the columella. The spore sac overarches the columella, and besides spores, elaters of irregular shape are produced. The most peculiar feature, however, is that although there is no seta, a zone of tissue between the capsule and the foot remains actively growing and is adding new capsule tissues continuously from below during the life of the sporophyte. When mature, the capsule opens in two valves by splitting from the apex, and as spores are shed new ones are being added from the base.



FROM STRASBURGER, "TEXT-BOOK OF BOTANY"

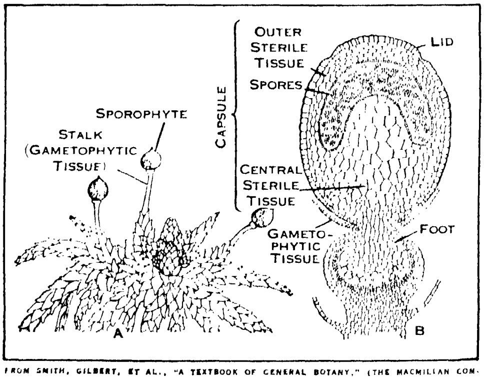
FIG. 8.—ANTHOCEROS LAEVIS, A DARK GREEN LIVERWORT, ONE OF THE BEST KNOWN MEMBERS OF THE GROUP ANTHOCEROTAE

Other features of interest are that the wall of the sporogonium contains stomata and chlorophyll and so can assimilate, and the foot buried in the thallus is irregular in outline. There are slight variations in details of structure between the few forms in this group, yet all are sufficiently peculiar in their structures to warrant the great interest they arouse.

MUSCI

Musci or mosses, are on the whole more xerophytic (*i.e.*, suited to live under drier conditions) than liverworts and do not offer the same degree of variation in form and structure. All mosses consist of a distinct stem and leaves and almost all of them are radial in construction and not dorsiventral as are liverworts; in fact, apart from differences in smaller details all mosses are fundamentally the same in form (figs. 9, 10). The stems have a single apical cell, the leaves, too, grow by a two-sided apical cell and do not show any trace of forking as was the case in the leafy liverworts. There is present the possibility of a good deal of differentiation in the tissues, for some mosses (*Polytrichum* for instance) reveal a structure almost analogous to the conducting strands of higher plants. The sexual organs, antheridia and archegonia, in mature form much like those of liverworts but differing in development, occur in groups at the apex of the main or lateral branches of the stem, with the exception of the antheridia of *Sphagnum*. They both occur in groups intermixed with peculiar hairs or paraphyses. The sporophyte developing from the fertilized egg has the usual capsule, stalk and foot, and is protected during its immature stages by the developing venter of the archegonium, the calyptra. As the sporophyte stalk elongates, the calyptra becomes torn, the upper half with the remains of the archegonium neck being carried up on top of the capsule, the lower half remaining as a frill round the base of the stalk. It is the sporophyte which at once clearly separates the mosses into three sub-groups, the Sphagnales, Andreaeales and the Bryales.

Sphagnales.—In the Sphagnales, with its single genus *Sphagnum*, the long stalk, the pseudopodium, bearing the capsule is not sporophytic but is a leafless prolongation of the axis of the gametophyte, embedded in the apex of which is the foot of the sporogonium (fig. 9). The seta is practically nonexistent. The capsule consists of a wall a few cells thick enclosing a dome-shaped spore sac which overarches a sterile column of cells, the columella, which projects into the capsule from its base. Furthermore there is a lid or cap to the capsule, marked off by a ring of large cells, the *annulus*. This cap or *operculum* is thrown off at maturity by the activity of the cells of the annulus whereby the spore sac is opened. There are no elaters in this or any other moss, and the spores in *Sphagnum* give rise to an unusual thalloid protonema. *Sphagnum* is a typical bog-forming moss and has leaves with very peculiar structure. These are one cell thick and consist of large, colourless empty cells open to the exterior by



FROM SMITH, GILBERT, ET AL., "A TEXTBOOK OF GENERAL BOTANY," (THE MACMILLAN COMPANY)

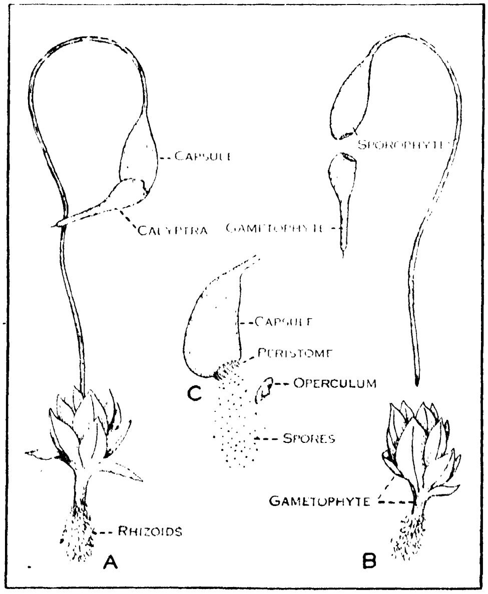
FIG. 9.—A. APICAL PORTION OF A LEAFY SHOOT OF SPHAGNUM BEARING SPOROPHYTES. B. LENGTH-WISE SECTION OF A NEARLY MATURE SPOROPHYTE. THE SPORES ARE IN GROUPS OF FOUR, EACH GROUP DERIVED FROM ONE SPORE MOTHER CELL

pores, and surrounded by the comparatively small narrow chlorophyll-containing cells. The presence of these empty cells renders *Sphagnum* very absorbent, whence its use in surgical dressings.

Andreaeales.—In the Andreaeales, with its two genera *Andreaea* and *Neuroloma*, again the sporophyte is borne aloft on a pseudopodium and the dome-shaped spore sac overarches the columella as in *Sphagnum*. Here, however, there is no operculum, the mature capsule opening by four parallel and equidistant slits down the side.

Bryales.—The Bryales have the most complicated sporophytes of the Bryophyta. Here the capsule is, with very few exceptions, borne on a long seta at whose base, sunk in the apex of the stem of the gametophyte, is the foot. The capsule is remarkable in many respects (fig. 10). The wall is several cells thick, and there is a well-defined operculum delimited by an annulus. Within the capsule running from base to apex is a sterile column of cells, the columella, which is surrounded by the cylindrical spore sac. Surrounding the spore sac is an air chamber, the spore sac being connected with the wall by means of strands of cells or trabeculae. The wall of the capsule possesses stomata and its cells contain chlorophyll, so that the sporophyte is nutritionally independent to some extent. At the apex of the seta, adjoining the capsule, is a region highly developed in some forms (*Splachnum luteum*) which has abundant air spaces and stomata in its epidermis, a region known as the apophysis. More remarkable, however, is the *peristome* of the capsule. This consists of one or two layers of small teeth attached to the wall of the capsule just beneath the annulus at one end, but free elsewhere. When the capsule is mature and the operculum thrown off, these teeth close the now hollow spore-containing capsule when conditions are moist and so retain the spores, but curl back in dry weather and allow their discharge.

This structure of the capsule is fairly uniform throughout the Bryales with the exception of the condition seen in the Polytrichaceae where peristome teeth are multicellular and connected at the tip to a circular diaphragm. It is not necessary to stress the obvious fact that in the capsule of the Bryales we have a very highly organized structure.



FROM WEATHERWAX, "PLANT BIOLOGY," (W. B. SAUNDERS COMPANY)

FIG. 10.—A MATURE MOSS PLANT (A) AND A DISSECTION OF THE SAME (B) TO SHOW THE TWO GENERATIONS. C. MATURE SPORE CAPSULE

Space does not permit even mention of the many points of theoretical interest in the Bryophyta, or many unusual but interesting forms to be met with. These questions, with others which add to the interest of the group, may be followed in the literature cited. The Bryophyta play their part in questions of broader interest.

Many mosses and liverworts are epiphytic on the stems or leaves of other plants and it is interesting that many of them are very specific in their choice of substratum. Therein lies an unsolved problem and there is need for careful recording of observations in this respect.

As to the origin of the Bryophyta as a whole, opinion is divided. We have little or no positive evidence from living or fossil forms, neither can we say definitely which, if any, of the higher groups of plants arose from them. Within themselves they do show series of morphological forms, although it is debatable as to whether these series are ones of progression or reduction; discussion of the problem may be found in the literature cited. Between the Hepaticae, Anthocerotae, Sphagnales, Andreaeales and Bryales there are no connecting forms known, and it must be left as an open question whether Bryophyta are a monophyletic group or not.

With regard to the relationship between Bryophyta and Pteridophyta the article on the latter group should be consulted. Although the alternating generations in the two are strictly comparable, no evidence of actual relationship is yet advanced.

For further information consult: Campbell, *Mosses and Ferns* (1918); Evans, "*Classification of the Hepaticae*," *Bot. Rev.* 5:49–96 (1939); Smith, *Cryptogamic Botany*, vol. II (1938); Verdoorn, *Manual of Bryology* (Leiden, 1932).

For identification of American species of Bryophyta:—Grout, *Mosses with a Handlens* (1924); Grout, *Moss Flora of North America* (1928-40); Frye and Clark, *Hepaticae of North America* (I, 1937; II, 1943); MacVicar, *The Student's Handbook of British Hepatics* (Eastbourne and London, 1926). (F. How.; A. J. Sh.)

BRYOZOA, a name for the Polyzoa (*q.v.*).

BRYTHONIC DIALECTS: *see* CELTIC LANGUAGES.

BRYUSOV, VALERY YAKOVLOVICH (1873–1924), Russian poet, was born in Moscow Dec. 13, 1873, and died in the same town on Oct. 9, 1924. His early verses are decadent in style, but they brought him a certain notoriety. The influence of Balmont is seen in his earlier work, and of Verhaeren in his poems of the town and in his revolt against social evils, *e.g.*, *The Stonemason*. His later poems, however, are more scholarly and rhetorical in subject and style. He also wrote prose, his most interesting work being the historical novel of 16th century Germany, *The Flaming Angel* (1909), and was a great student of Pushkin. After the October revolution in 1917 he joined the Communist party. His poetical works include: *Tertia Vigilia* (1901); *Urbi et Orbi* (1903); *Stephanos* (1905).

He translated into Russian the works of Verhaeren, Verlaine, Maeterlinck, d'Annunzio and Wilde. In 1912 a 25 volume edition of Bryusov's complete works was published. A book of stories, *The Republic of the Southern Cross,* was translated into English in 1918.

BRZEŻANY, a city of Poland in the voivodship of Tarnopol, district of Galicia. It is located on the Złota Lipa river, a tributary of the Dniester, about 50 mi. S.E. of Lwów, the Galician capital. Population 11,723. The name Brzeżany is derived from the Polish *brzoza*, birch.

Brzeżany's principal industries are the tanning of leather and the distilling of alcohol. There is a 16th century castle in the town.

In 1939, when eastern Poland fell to Russia, Brzeżany became a part of the U.S.S.R.

BRZOZOWSKI, THADDEUS (d. 1820), nineteenth general of the Jesuits, was appointed in succession to Gabriel Gruber on Sept. 2, 1805. In 1801 Pius VII gave the Jesuits liberty to reconstitute themselves in north Russia (*see* JESUS, SOCIETY OF), and in 1812 Brzozowski secured the recognition of the Jesuit college of Polotsk as a university, though he could not obtain permission to go to Spain to agitate for the recognition of the Spanish Jesuits. In 1814 Pius VII, in accordance with the bull *Sollicitudo* *omnium ecclesiarum,* gave to Brzozowski among others full authority to receive those who desired to enter the society. The Russian government, however, soon began to be alarmed at the growth of the Jesuits, and on Dec. 20, 1815, published an edict expelling them from St. Petersburg. Brzozowski, having vainly requested to be allowed to retire to Rome, died on Feb. 5, 1820. His main interest and importance lie in the fact that he was general of the society at the time of its restoration throughout Europe.

BUACHE, PHILIPPE (1700–1773), French geographer, was born in Paris, Feb. 2, 1700. Louis XV made him chief geographer in 1729 and in the next year he became a member of the Academy of Sciences. His theory of geography was that the earth, including both land and water, was divided into basins separated by chains of mountains. It is thought that he may have been the first to speculate on the possibility that Asia and America were once connected at the Bering strait. He died in Paris, Jan. 27, 1773.

Buache's most important work was *Considérations géographiques et physiques sur les nouvelles découvertes au nord de la grande mer* (1753). He also wrote *Atlas physique* (1754) and *Parallèle des fleuves de toutes les parties du monde.*

His nephew, Jean Nicolas Buache de la Neuville (1741–1825), was also a geographer. He was a member of the Academy of Sciences and the French king's chief geographer. He was the author of *Géographie élémentaire ancienne et moderne.*

BUBASTIS, an ancient city of Egypt, near the modern Zagazig; the Pa-Bast of the hieroglyphics, and the Pibeseth of the prophet Ezekiel. It is now a heap of mounds called Tell Basta, which were carefully excavated in 1886–87. The ancient city was probably built on made ground, over the level of the surrounding country. Remains were found, dating from as far back as the 14th dynasty, and Seti restored monuments in it which had been erected under the 18th dynasty. His son Rameses II is believed to have laid out a canal which ran from the Tanitic branch of the Nile here to the Bitter Lakes and the Gulf of Suez. In the period of decline about 1000 B.C., the descendant of a Libyan adventurer seized the title of Pharaoh and set up his throne here: this was Shashanq I, the Shishak of the books of Kings and Chronicles, and the founder of the 22nd or Bubastite dynasty. About 350 B.C. the city was captured by the Persians, and from the destruction which they inflicted it never recovered.

Bubastis is the Graecized name of the Egyptian goddess Ubasti, meaning "she of [the city] Bast" (*B', s-t*), a city better known by its later name, P-ubasti, "place of Ubasti"; thus the goddess derived her name Ubasti from her city (Bast), and in turn the city derived its name P-ubasti from that of the goddess; the Greeks, confusing the name of the city with that of the goddess, called the latter Bubastis, and the former also Bubastis (later Bubastos).

Ubasti was one of many feline goddesses, figured with the head of a lioness. The domestic cat was especially the animal of Bubastis, although it had also to serve for all the other feline goddesses. Her hieratic and most general form was still lioness-headed, but a popular form, especially in bronze, was a cat-headed woman, often holding in her right hand a lion aegis, *i.e.,* a broad semicircular pectoral surmounted by the head of a lioness, and on the left arm a basket. The cat cemetery on the west side of the town consisted of numbers of large brick chambers, crammed with burned and decayed mummies, many of which had been enclosed in cat-shaped cases of wood and bronze. The festival of Bubastis was attended by thousands from all parts of Egypt and was a very riotous affair.

There were two festivals of Bubastis, the great and the lesser: perhaps the lesser festival was held at Memphis, where the quarter called Ankhto contained a temple to this goddess. Her name is found on monuments from the 3rd dynasty onwards, but a great stimulus was given to her worship by the 22nd (Bubastite) dynasty and generally by the increased importance of Lower Egypt in later times. Her character seems to have been essentially mild and playful. The Greeks equated Ubasti with their Artemis, confusing her with the leonine Tafne, sister of Shöou (Apollo). The name of her son Iphthimis (Nfr-tm), pronounced Eftēm, may mean "All-good," and, in the absence of other information about him, suggests why he was identified with Prometheus.

BUBNA, FERDINAND, Count of (1768–1825), Austrian field marshal, was born in Zámrsk, Bohemia, Nov. 26, 1768. He joined the army while he was still a young man, his first campaign being that against Turkey in 1788. In 1792 Austria declared war on France, and Bubna was with the Austrian army from that date until Napoleon's final defeat in 1815, except for the years 1812–13 which he spent in Paris as Austria's representative. He fought at Austerlitz (1805) and at Wagram (1809), and after Austria's defeat in the latter battle was one of the ambassadors who travelled to Vienna to negotiate the Peace of Schönbrunn. He took part in the battles of Lützen, Bautzen, Dresden and Leipzig in 1813, and in 1814 was commander of an army which was to invade France by way of Switzerland, a manoeuvre which proved unsuccessful. During the Piedmont uprising of 1821, Bubna led the Austrian troops which put down the insurrectionists. He died in Milan, June 6, 1825.

BUBONIC PLAGUE: *see* Plague.

BUCARAMANGA, a city of Colombia, capital of the department of Santander, about 185 mi. N.N.E. of Bogotá. Population of the city was 41,714 in 1938. The city is situated on the Lebrija river, 2,850 ft. above sea-level, in a mountainous country rich in gold, silver and iron mines and having superior coffee-producing lands in the valleys.

BUCCANEERS, the name given to a group of English, French, Dutch and Portuguese piratical adventurers united in their opposition to Spain, who maintained themselves chiefly in the Caribbean sea during the 17th century. They must not be confused with the earlier adventurers and privateers of whom Sir Francis Drake was an outstanding example, nor with the outlawed pirates of the 18th century.

By the early part of the 17th century the oppressive colonial policy of Spain had almost depopulated the island of Hispaniola, the modern Santo Domingo. Thinned of its former inhabitants, the island became the home of immense herds of wild cattle and pigs, and consequently an excellent place to provision the ships of smugglers. The natives still left were skilled in preserving flesh without the use of salt, an article both scarce and costly. The meat was cured in the sun and then smoked over a fire of green wood—a process termed "boucanning." The adventurers and smugglers, who were soon called buccaneers, learned boucanning from the natives; and gradually Hispaniola became the scene of an extensive and illicit provision trade. As the Spaniards would not recognize the right of other nations to make settlement, or even to trade in the West Indies, the governments of France, England and Holland would do nothing to control their subjects who invaded the islands. Out of such conditions arose the buccaneer, alternately sailor and hunter, even occasionally a planter—roving, bold, unscrupulous, often savage, with an intense detestation of Spain.

Early Settlements.—Both England and France contributed bands of colonists for a settlement made on the island of St. Kitts or St. Christopher, in the West Indies. The English and French were, however, not very friendly; and in 1629, after the retirement of several of the English to an adjoining island, the remaining colonists were surprised and partly dispersed by the arrival of a Spanish fleet. But on the departure of the fleet the scattered bands returned, and were soon of sufficient strength to give assistance to their countrymen in Santo Domingo. As buccaneering had developed into a profitable employment, it was thought expedient to build a storehouse secure from the attack of the Spaniards. The small island of Tortuga was seized for this purpose in 1630, and converted into a magazine for the goods of the smugglers, Santo Domingo still continuing their hunting ground. A purely English settlement directed by a company in London was made (1630) at Old Providence, an island in the Caribbean sea, but it was suppressed by the Spaniards in 1641. About the same time, the Spaniards attacked Tortuga and massacred every settler they could seize. The few who escaped returned, and the buccaneers, now in open hostility to the Spanish arms, began to receive recruits from every European trading nation, and for three-quarters of a century became the scourge of the Spanish-American trade and dominions. This roving community had to maintain itself as best it could—now mainly on the sea. However, in 1655 fortune turned their way when, with their assistance, the navy of the English Commonwealth succeeded in capturing the island of Jamaica. Its ample harbours, for many years, furnished the buccaneers with havens in their operations against the Spaniards.

Their history now divides itself into three epochs. The first extends from the period of their rise to the capture of Panama by Morgan in 1671, during which time they were hampered neithe by Government aid nor, till near its close, by Government restriction. The second, from 1671 to the time of their greatest power 1685, when the scene of their operations was no longer merely the Caribbean, but principally the whole range of the Pacific from California to Chile. The third and last period extends from that year onwards; it was a time of disunion and disintegration, when the independence and rude honour of the previous periods had degenerated into vice and brutality.

The Period of Henry Morgan.—It is chiefly during the firs period that those leaders flourished whose names and doings have been associated with all that was really influential in the exploit of the buccaneers—the most prominent being Mansfield and Morgan. In 1654 the first great expedition on land made by the buccaneers, though attended by considerable difficulties, was completed by the capture and sack of New Segovia, on the mainland of America. The Gulf of Venezuela, with its towns of Maracaibo and Gibraltar, were attacked and plundered under the command of a Frenchman named L'Ollonois, who performed, it is said, the office of executioner upon the whole crew of a Spanish vessel manned with 90 seamen. Such successes removed the buccaneers further and further from the pale of civilized society. Mansfield in 1664, conceived the idea of a permanent settlement upon a small island of the Bahamas, named New Providence, and Henry Morgan, a Welshman, intrepid and unscrupulous, joined him. But the untimely death of Mansfield nipped in the bud the only rational scheme of settlement which seems to have animated this wild community at any time; and Morgan, now elected commander, swept the whole Caribbean, and from his headquarters in Jamaica led triumphant expeditions to Cuba and the mainland. He was leader of the expedition which surprised and plundered Porto Bello, one of the best-fortified ports in the West Indies.

This was too much for even the adverse European powers; and in 1670 a treaty was concluded between England and Spain, proclaiming peace and friendship among the subjects of the two sovereigns in the New World. The treaty was very ill observed in Jamaica, where the governor, Thomas Modyford (1620–79), was in close alliance with the "privateers," which was the official title of the buccaneers. He had already granted commissions to Morgan and others for a great attack on the Isthmus of Panama, the route by which the bullion of the South American mines was carried to Porto Bello, to be shipped to Spain. The buccaneers to the number of 2,000 began by seizing Chagres, and then marched to Panama in 1671. The city was taken, and, accidentally or not, it was burnt; but the Spaniards had removed the treasure, the booty was small, and many died of starvation on the way back to Jamaica. Modyford was recalled, and in 1672 Morgan was called home and imprisoned in the Tower. In 1674 he was allowed to return to the island as lieutenant-governor with Lord Vaughan. During his later years he was active in suppressing the buccaneers who now had inconvenient claims on him.

On the Pacific.—From 1671 to 1685 was the time of the great daring, prosperity and power of the buccaneers. Notwithstanding their many successes in the Caribbean and on land, they pictured the South sea as a far wider and more lucrative field for the display of their united power. In 1680 a body of marauders over 300 strong, well armed and provisioned, landed on the shore of Darien and struck across the country to the Pacific. With John Coxon as commander they entered the Bay of Panama, where the Spaniards had hastily prepared a small fleet to meet them. But the valour of the buccaneers won for them another victory; within a week they took possession of four Spanish ships, and now successes flowed upon them. Coxon and 70 men returned as they had gone, but the others, under Sawkins, Sharp and Watling, roamed north and south on islands and mainland, and remained for long ravaging the coast of Peru. Again, in 1683, numbers of them under John Cook departed for the South sea by way of Cape Horn. On Cook's death his successor, Edward Davis, undoubtedly the greatest and most prudent commander who ever led the forces of the buccaneers at sea, met with a certain Captain Swan from England, and the two began a cruise which was disastrous to the Spanish trade in the Pacific. In 1685 they were joined in the Bay of Panama by large numbers of buccaneers who had crossed the isthmus under Townley and others. At this period the power of the buccaneers was at its height. But the combination was too extensive for its work, and the different nationality of those who composed it was a source of growing discord.

The Final Epoch.—The separation of the English and French buccaneers, who together presented a united front to the Spanish fleet in 1685, marks the beginning of the third and last epoch in their history. They hung doggedly along the coasts of Jamaica and Santo Domingo, but their day was nearly over. Only once again—at the siege of Carthagena—did they appear great; but even then the expedition was not of their making, and they were mere auxiliaries of the French regular forces. The French and English buccaneers could not but take sides in the war which had arisen between their respective countries in 1689. Thus was broken the bond of unity which had for three-quarters of a century kept the subjects of the two nations together in schemes of aggression upon a common foe.

The importance of the buccaneers in history lies in the fact that they opened the eyes of the world to the whole system of Spanish-American Government and commerce—the former in its rottenness, and the latter in its possibilities in other hands. From this, then, along with other causes, dating primarily from the helplessness and presumption of Spain, there arose the West Indian possessions of Holland, England and France.

A work published at Amsterdam in 1678, entitled *De Americaensche Zee Roovers*, from the pen of a buccaneer named Exquemelin, was ranslated into several European languages, receiving additions at the hands of the different translators. The English edition is entitled *The Bucaniers of America.* Other works are Raynal's *History of the Settlements and Trade of the Europeans in the East and West Indies*, book x., English translation 1782; Dampier's *Voyages;* and L. Wafer, *Voyage and Description of the Isthmus of America* (1699). A reliable narrative is Capt. James Burney's *History of the Buccaneers of merica* (1816). The *Calendar of State Papers*, Colonial Series London, 1860 *et seq.*), contains much evidence for the history of the buccaneers in the West Indies. Popular works are J. Masefield, *On he Spanish Main* (1906) and A. H. Verrill, *In the Wake of the Buccaneers* (1923).

BUCCARI (Serbo-Croatian *Bakar*), a town of Yugoslavia on a small bay of the Adriatic Sea. Pop. (1931) 2,074. The railway from Zagreb to Fiume terminates 2½m. from Buccari. The harbour, though sometimes dangerous to approach, owing to the readed bora, or northeast wind, affords good anchorage to small vessels, but competition from Fiume destroyed most of its trade during the 19th century. The staple industry is boat-building, but there is an active coasting trade in wine, wood, coal and fish, the tunny fishery being of some importance. The old castle of Buccarica is not far off, and farther south is the flourishing little port of Porto Ré or Kraljevica. In 1941 Buccari was occupied by Italy.

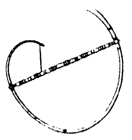


PHOTO BY BROGI

UCCINA, USED IN HE ROMAN ARMY TO OUND NIGHT WATCHES

BUCCINA, a brass wind instrument extensively used in the ancient Roman army. It consisted of a brass tube bent into he shape of a broad C, measuring some 11 to 12ft. in length, of narrow cylindrical bore, and played by means of a cup-shaped mouthpiece. After the fall of the Roman empire the art of bending metal tubes was gradually lost, and although the buccina survived in Europe both in name and in principle of construction uring the middle ages, it lost its characteristic curved form. Although we regard the buccina as essentially Roman, an instrument of the same type and of kindred name, but probably straight, was widely known and used in Persia, Arabia, and among the Semitic races. After a lapse of years during which records are almost wanting, the buccina reappeared all over Europe as the busine, buisine, pusin, busaun, pusuń, posaun, busna (Slav), etc.; but whether it was a Roman survival, or a re-introduction through the Moors of Spain in the West, and the Byzantine empire in the East, there are no records to show.

The history of the development of the trumpet, the sackbut, and the trombone from the buccina will be found more fully treated under those headings.

BUCCLEUCH, DUKES OF. The substantial origin of the ducal house of the Scotts of Buccleuch dates back to the large grants of land in Scotland to Sir Walter Scott of Kirkurd and Buccleuch, a border chief, by James II., in consequence of the fall of the 8th earl of Douglas (1452); but the family traced their descent back to a Sir Richard le Scott (1240–85). The estate of Buccleuch is in Selkirkshire. Sir Walter Scott of Branxholm and Buccleuch (died 1552) distinguished himself at the battle of Pinkie (1547), and furnished material for his later namesake's famous poem, *The Lay of the Last Minstrel;* and his great-grandson Sir Walter (1565–1611) was created Lord Scott of Buccleuch in 1606. An earldom followed in 1610. The second earl's daughter Anne (1651–1732), who succeeded him as a countess in her own right, married in 1663 the famous duke of Monmouth (*q.v.*), who was then created 1st duke of Buccleuch; and her grandson Francis became 2nd duke. The latter's son Henry (1746–1812) became 3rd duke, and in 1810 succeeded also, on the death of William Douglas, 4th duke of Queensberry, to that dukedom as well as its estates and other honours, according to the entail executed by his own great-grandfather, the 2nd duke of Queensberry, in 1706. The wife of the 6th duke was mistress of the robes to Queen Victoria. Lady Alice Montagu-Douglas-Scott, 3rd daughter of the 7th duke (1864–1935), was married in 1935 to the duke of Gloucester, 3rd son of King George V.

See Sir W. Fraser, *The Scotts of Buccleuch* (1878).

BUCENTAUR, the State galley of the doges of Venice, on which, every year on Ascension day up to 1789, they put into the Adriatic in order to perform the ceremony of "wedding the sea." The name *bucintoro* is derived from the Ital. *buzino d' oro*, "golden bark," and seems to have been given to any sumptuous Venetian galley. The last and most magnificent of the bucentaurs, built in 1729, was destroyed by the French in 1798 for the sake of its golden decorations. Remains of it are preserved at Venice in the Museo Civico Correr and in the Arsenal.

The "Marriage of the Adriatic," or more correctly "of the sea" (*Sposalizio del Mar*) was a ceremony symbolizing the maritime dominion of Venice, established about A.D. 1000 to commemorate the doge Orseolo II.'s conquest of Dalmatia. The form it took was a solemn procession of boats, headed by the doge's *maesta nave*, afterwards the Bucentaur (from 1311), out to sea by the Lido port. To this ancient ceremony a sacramental character was given by Pope Alexander III. in 1177, in return for the services rendered by Venice in the struggle against the emperor Frederick I. The pope drew a ring from his finger and, giving it to the doge, bade him cast such a one into the sea each year on Ascension day, and so wed the sea. Henceforth the ceremonial, instead of placatory and expiatory, became nuptial. Every year the doge dropped a consecrated ring into the sea and with the words *Desponsamus te, mare* (We wed thee, sea) declared Venice and the sea to be indissolubly one.

BUCEPHALUS, the favourite Thracian horse of Alexander the Great (Gr. βουκέφαλος), which died in 326 B.C. In commemoration Alexander built the city of Bucephala, whose site may be identified with a mound opposite the modern Jhelum.

BIBLIOGRAPHY.—*See* especially Arrian v. 20; other stories in Plutarch, *Alex.*, 6; Curtius vi. 8. For the identification of Bucephala, *see* Vincent A. Smith, *Early Hist. of India*, p. 65, 66 note (2nd ed., 1908).

BUCER (or BUTZER), **MARTIN** (1491–1551), German Protestant reformer, was born at Schlettstadt in Alsace. In 1506 he entered the Dominican order, and was sent to study at Heidelberg. There he became acquainted with the works of Erasmus and Luther, and was present at a disputation of the latter on the doctrine of free will. Withdrawing from his order in 1521, Bucer entered the service of the Elector Palatine, but in 1522 became pastor of Landstuhl where he married Elizabeth Silbereisen, a former nun. After his excommunication in 1523 he made his headquarters at Strasbourg. On the question of the Eucharist, Bucer's opinions in some degree approached the Zwinglian position, but he was anxious to secure unity with the Lutheran party and constantly endeavoured, especially after Zwingli's death (1531), to find a compromise that would unite Lutheran, south German and Swiss reformers. Hence the charge of ambiguity and obscurity which has been laid against him. In 1529 he had succeeded in arranging a conference at Marburg between Luther and Zwingli, but no agreement was reached on the main question. He helped to draft the declaration known as the *Confessio Tetrapolitana*, presented to the Diet of Augsburg in 1530 by the towns of Strasbourg, Memmingen, Constance and Lindau. He met Luther at Coburg in 1530, and Melancthon at Cassel in 1534, but agreement on the question of the real presence in the Eucharist was reached only when he met Luther at Wittenberg in May 1536. But even so agreement was rather apparent than real, for Bucer had gone farther than the Swiss were prepared to go. He then sought in vain to arrange an understanding between the Catholics and the Reformers. In 1548 he was sent to Augsburg to sign the agreement, called the *Interim*, between the Catholics and Protestants. His stout opposition to this project exposed him to many difficulties; Strasbourg was almost alone in declining assent, and eventually he had to seek leave of absence, gladly accepting Cranmer's invitation to make his home in England. On his arrival in 1549 he was appointed regius professor of divinity at Cambridge. Edward VI. and the protector Somerset showed him much favour and he was consulted as to the revision of the Book of Common Prayer. Bucer died on Feb. 27, 1551. His name is familiar in English literature from the use made of his doctrines by Milton in his divorce treatises.

BIBLIOGRAPHY.—A collected edition of his writings has never been published. A volume known as the *Scripta Anglicana* or *Tomus Anglicanus* (Basle, 1577) contains those written in England. His correspondence with Philip of Hesse, whose "second" marriage, accepted by the reformers, created a scandal, was edited by Lenz (1880–91). *See* J. W. Baum, *Capito and Butzer* (Strasbourg, 1860), which contains in an appendix a full list of his work; J. Ficker, *Martin Bucer* (1917); A. Erickson, *Zur 400-Jährigen Geburtsfrier Martin Butzers* (Strassburg, 1891), and the articles in the *Dict. Nat. Biog.* (by A. W. Ward), and in Herzog-Hauck's *Realencyklopädie* (by Paul Grünberg).

BUCEROTIDAE: *see* HORNBILL.

BUCH, CHRISTIAN LEOPOLD VON, BARON (1774–1853), German geologist and geographer, a member of an ancient and noble Prussian family, was born at Stolpe in Pomerania on April 26 1774. In 1790–93 he studied at the mining school of Freiberg under Werner, one of his fellow-students there being Alexander von Humboldt. He completed his education at the universities of Halle and Göttingen. In 1797 he met Humboldt at Salzburg, and with him explored the geological formations of Styria and the adjoining Alps. A visit to Italy in 1798 shook his faith in the Neptunian theory. In 1799 he paid his first visit to Vesuvius, and again in 1805 he returned to study the volcano, accompanied by Humboldt and Gay Lussac, when they witnessed an eruption which supplied von Buch with data for refuting many erroneous ideas then entertained regarding volcanoes. In 1802 he had explored the extinct volcanoes of Auvergne. The scientific results of his investigations he embodied in his *Geognostische Beobachtungen auf Reisen durch Deutschland und Italien* (Berlin, 1802–09). Von Buch spent two years among the Scandinavian islands; he showed that many of the erratic blocks on the North German plains must have come from Scandinavia. He also established the fact that the whole of Sweden is slowly but continuously rising above the level of the sea from Frederikshald to Åbo. The details of these discoveries are given in his *Reise durch Norwegen und Lappland* (Berlin, 1810). In 1815 he visited the Canary islands in company with Christian Smith, the Norwegian botanist. The physical description of the Canary islands was published at Berlin in 1825. After leaving the

Canaries, von Buch proceeded to the Hebrides and the coast of Scotland and Ireland. He published in 1832 the magnificen *Geological Map of Germany* (42 sheets, Berlin). His geologic excursions were continued without interruption till his 78th yea He died at Berlin on March 4, 1853 Humboldt pronounced him the greatest geologist of his time.

A complete edition of his works was published at Berlin (1867–85 edited by Ewald and others.

BUCHAN, EARLS OF. The earldom of Mar and Buchan was one of the seven original Scottish earldoms; later, Buchan wa separated from Mar, and among the early earls of Buchan were Alexander Comyn (d. 1289), John Comyn (d. *c.* 1313), bot constables of Scotland, and Henry Beaumont (d. 1340), who ha married a Comyn. John Comyn's wife, Isabel, was the countes of Buchan who crowned Robert the Bruce king at Scone in 1306 and was afterwards imprisoned at Berwick; not, however, in cage hung on the wall of the castle. About 1382 Sir Alexande Stewart (d. *c.* 1404), the "wolf of Badenoch," a son of King Robert II., became earl of Buchan, and the Stewarts appear t have held the earldom for about a century and a half, although not in a direct line from Sir Alexander. Among the most celebrated of the Stewart earls were the Scottish regent, Robert, duke of Albany, and his son John, who was made constable of France and was killed at the battle of Verneuil in 1424. In 1617 the earldom came to James Erskine (d. 1640), a son of John Erskine, 2nd (or 7th) earl of Mar, whose wife Mary had inherited it from her father, James Douglas (d. 1601), and from that time it has been retained by the Erskines.

Perhaps the most celebrated of the later earls of Buchan was the eccentric David Steuart Erskine, 11th earl (1742–1829), son of Henry David, 10th earl (d. 1767), and brother of Henry Erskine (*q.v.*), and of Thomas, Lord Erskine (*q.v.*). His pertinacity was instrumental in effecting a change in the method of electing Scottish representative peers, and in 1780 he succeeded in founding the Scottish Society of Antiquaries. Among his correspondents was Horace Walpole, and he wrote an *Essay on the Lives of Fletcher of Saltoun and the Poet Thomson* (1792), and other writings. He died at his residence at Dryburgh in April 1829, leaving no legitimate children, and was followed as 12th earl by his nephew Henry David (1783–1857), the ancestor of the present peer. The 11th earl's natural son, Sir David Erskine (1772–1837), who inherited his father's unentailed estates, was an antiquary and a dramatist.

BUCHAN, ELSPETH (1738–1791), founder of a Scottish religious sect known as the Buchanites, the daughter of a Banffshire innkeeper. Having quarrelled with her husband, she settled in Glasgow where she persuaded a small group of people that she was a saint with a special mission, that in fact she was the woman described in Revelation xii. Her sect, which ultimately numbered 46 adherents, was expelled by the magistrates in 1784, and settled in a farmhouse known as New Cample in Dumfriesshire. Robert Burns, in a letter dated Aug 1784, describes the sect, which broke up on the death of its founder, as idle and immoral.

See J. Train, *The Buchanites from First to Last* (Edinburgh, 1846).

BUCHAN, JOHN (1875–1940), British author and statesman, was born at Perth, Scotland, Aug. 26, 1875. Educated at Glasgow university and Brasenose college, Oxford, he was called to the bar at the Middle Temple in 1901. In the same year he became private secretary to Lord Milner, then high commissioner for South Africa. In 1903 he returned to England, and soon became a member of the publishing firm of Thomas Nelson and Sons, Edinburgh. During the World War he served on the staff at British headquarters, and in 1917 became director of information under Mr. Lloyd George. He was member of parliament for the Scottish Universities from 1927 till 1935, when he was appointed governor-general of Canada and was raised to the peerage, taking the title of Baron Tweedsmuir of Elsfield. He was created a Companion of Honour in 1932 and G.C.M.G. in 1935, and in 1937 was sworn a member of the privy council. He was Lord High Commissioner to the Assembly of the Church of Scotland, 1933 and 1934, and in 1937 was elected chancellor of Edinburgh university. As a novelist he was known for such brilliant tales of adventure as *The Thirty-Nine Steps* (1915); *Greenmantle* (1916); and *Mr. Standfast* (1919); and he also wrote *A History of the Great War* (1921–22); *Augustus* (1937), etc. He died Feb. 11, 1940.

BUCHAN, PETER (1790–1854), Scottish editor, was born at Peterhead, Aberdeenshire, and started in business as a printer there in 1816. His *Ancient Ballads and Songs of the North of Scotland* (1828) contained a large number of hitherto unpublished ballads and newly discovered versions of existing ones. Another collection made by him was published by the Percy Society, under the title *Scottish Traditional Versions of Ancient Ballads* (1845). Two unpublished volumes of Buchan's ballad collections are in the British Museum. He died on Sept. 19, 1854.

See *Peter Buchan, etc.*, by W. Walker (1915).

BUCHANAN, CLAUDIUS (1766–1815), English divine, was born at Cambuslang, near Glasgow, and educated at the universities of Glasgow and Cambridge. He was Calcutta chaplain and vice-principal of the college of Fort William, and translated the gospels into Persian and Hindustani. His book *Colonial Ecclesiastical Establishment* (London, 1813) helped on the establishment of the Indian episcopate, and the appointment of the first English bishop of Calcutta.

BUCHANAN, GEORGE (1506–1582), the greatest of the Scottish humanists of the 16th century, was born at Killearn, Stirlingshire, in Feb. 1506. He had already spent two years as a tudent at Paris, and had served in a strenuous campaign with Albany's French troops in Scotland when he heard the lectures of John Mair or Major at Aberdeen in 1524. Mair took him to Paris next year. Buchanan lived the hard life of the Paris student of those days, and after concluding his course stayed on n Paris and the neighbourhood until 1536. To this period belongs his *Somnium*, directed against the Franciscans. After his return o Scotland the king asked him to satirize the friars, and there is o doubt that his *Franciscanus et Fratres* helped on the Reformaion. But James was not prepared to defend the satirist against he clergy and Cardinal Beaton procured Buchanan's imprisonnent. He escaped to Bordeaux, where he taught Latin for three ears; there he composed his four tragedies, *Baptistes*, *Medea*, *ephthes* and *Alcestis*, to be acted by the students, among whom vas Montaigne, who always kept a kindly feeling for his tutor. At this period he also wrote many amatory Latin verses. He eturned to Paris in the late '40s and then to Coimbra in Portugal, o be head of the newly established college. But the report of is attacks on the Franciscans had preceded him, and he was gain imprisoned, this time in a monastery, in the hope that he night be reclaimed for orthodoxy. He occupied his enforced isure by preparing a Latin verse translation of the Psalms. fter his release he visited Scotland, but soon returned to Paris. t is almost certain that during this last stay in France, Buchanan anged himself definitely on the side of the Calvinists.

In 1560 or 1561 he returned to Scotland, and in April 1562 as installed as tutor to the young Queen Mary. Buchanan then penly joined the Reformed Church, and in 1566 was appointed y the earl of Moray principal of St. Leonard's college, St. Anrews. His great reputation for learning and administrative apacity led to his appointment as moderator of the general ssembly in 1567. He had sat in the assemblies from 1563. uchanan accompanied Moray to England as secretary to the ommission which was to meet the English commissioners at York n the business of the guilt of Mary, Queen of Scots. Part of he Casket Letters (*q.v.*) were exhibited at this meeting, and Buchanan declared, with Lethington, that they were in Mary's andwriting. The conference was then transferred to Westinster. Accusations were afterwards brought against Buchanan having forged the documents found in the casket. Of this there no proof, and the charge is inherently improbable, but it must e admitted that Buchanan was a willing agent in Moray's disgenuous handling of the case against the queen. Buchanan's *etectio*, printed in Latin in 1571, was based on the Book of rticles handed in by Moray to the conference in Dec. 1568, in hich the charges against Mary were first formulated. When the work was brought to Mary's notice she justly described it as a "defamatory book," and remarked that she had expressly desired that he should not be near her son. Buchanan had been appointed one of the preceptors of the young king James VI. in 1570. He was director of chancery, and then became lord privy seal, a post entitling him to a seat in the parliament, which he held at least till 1579. He died on Sept. 28, 1582.

His last years had been occupied with two of his most important works. In the *De Jure Regni apud Scotos* (1579) Buchanan lays down the doctrine that the source of political power is the people, that the king is bound by those conditions under which the supreme power was first committed to his hands, and that it is lawful to resist, even to punish, tyrants. This work was condemned by Act of parliament in 1584, and again in 1664; and in 1683 it was burned by the University of Oxford. His history of Scotland, *Rerum Scoticarum Historia*, was completed in 1579 and published in 1582. Buchanan's purpose was to "purge" the national history "of sum Inglis lyis and Scottis vanite" (*Letter to Randolph*), but he exaggerated his freedom from partisanship.

Buchanan wrote Latin as if it had been his mother tongue. His translations are more than versions; the smaller satirical poems abound in wit and in happy phrase; his two tragedies, *Baptistes* and *Jepthes*, have an undiminished European reputation for academic excellence. In addition to the works already named, Buchanan wrote in prose *Chamaeleon*, a satire in the vernacular against Maitland of Lethington, first printed in 1711; a Latin translation of Linacre's Grammar (Paris, 1533); *Libellus de Prosodia* (Edinburgh, 1640); and *Vita ab ipso scripta biennio ante mortem* (1608), ed. by R. Sibbald (1702). Other poems are *Fratres Fraterrimi*, *Elegiae*, *Silvae*, two sets of verses entitled *Hendecasyllabon Liber* and *Iambon Liber;* three books of *Epigrammata;* a book of miscellaneous verse; *De Sphaera* (in five books), suggested by the work of Joannes de Sacrobosco, and intended as a defence of the Ptolemaic theory against the new Copernican view.

Buchanan's works were edited by Ruddiman (1715) and by Burman (1725). The *Vernacular Writings*, consisting of the *Chamaeleon* (*u.s.*), a tract on the Reformation of St. Andrews university, *Ane admonitioun to the Trew Lordis*, and two letters, were edited for the Scottish Text Society by P. Hume Brown. The principal biographies are: David Irving, *Memoirs of the Life and Writings of George Buchanan* (1807 and 1817); P. Hume Brown, *George Buchanan, Humanist and Reformer* (1890) and *George Buchanan and his Times* (1906); Rev. D. Macmillan, *George Buchanan, a Biography* (1906). Buchanan's quatercentenary was celebrated at different centres in Scotland in 1906, and was the occasion of several encomia and studies. A verse translation of the *Baptistes*, entitled *Tyrannicall-Government Anatomized* (1642), has been attributed to Milton; its authorship is discussed in the *Glasgow Quatercentenary Studies* (1906). The records of Buchanan's trial, discovered by the Portuguese historian, G. J. C. Henriques, were published by him under the title *George Buchanan in the Lisbon Inquisition. The Records of his Trial, etc.* (1906). On the *Detectio, see* R. H. Mahon, *The Indictment of Mary Queen of Scots.*

BUCHANAN, JAMES (1791–1868), fifteenth president of the United States, was born near Foltz, Franklin county, Pa., on April 23, 1791. Both parents were of Scottish-Irish Presbyterian descent. He graduated at Dickinson college, Carlisle, Pa., in 1809 and studied law at Lancaster for two years. He was admitted to the bar in 1812 and served in the lower house of the State legislature, 1814–16. From 1821 to 1831 he was a representative in Congress where as chairman of the judiciary committee he conducted the impeachment trial (1830) of Judge James H. Peck, led an unsuccessful movement to increase the number of Supreme Court judges and to relieve them of their circuit duties, and succeeded in defeating an attempt to repeal the 25th section of the Judiciary Act of 1789, which gave the Supreme Court appellate jurisdiction by writ of error to the State courts in cases where Federal laws and treaties were in question. After the dissolution of the Federalist Party, of which he had been a member, he came to be definitely associated with the Democrats. He represented the United States at the court of St. Petersburg from 1832 to 1833 and there negotiated an important commercial treaty. He was a Democratic member of the U.S. Senate from Dec. 1834 until March 1845, ardently supporting President Jackson, and was secretary of State in the cabinet of President Polk from 1845 to 1849—a period marked by the annexation of Texas, the Mexican War and negotiations with Great Britain relative to the Oregon question. After four years of retirement, following his failure to secure the Democratic nomination for president, he was appointed by President Pierce minister to Great Britain in 1853. By this time Buchanan had changed his attitude of 1819 on the slavery question. He felt that the institution was morally wrong, but held that Congress could not interfere with it in the States in which it existed, and ought not to hinder the natural tendency toward territorial expansion through a fear that the evil would spread. He voted for the bill to exclude anti-slavery literature from the mails and for the Compromise of 1850 and disapproved of the Wilmot Proviso. Fortunately for his career he was abroad during the Kansas-Nebraska debates, hence did not share in the unpopularity which attached to Stephen A Douglas as the author of the bill and to President Pierce as the executive who was called upon to enforce it. At the same time, by joining with J. Y. Mason and Pierre Soulé in issuing the Ostend Manifesto in 1854, he retained the good will of the South. This "manifesto" which was bitterly attacked in the North, was agreed upon (Oct. 18, 1854) by the three ministers after several meetings at Ostend and at Aix-la-Chapelle, arranged in pursuance of instructions to them from President Pierce to "compare opinions, and to adopt measures for perfect concert of action in aid of the negotiations at Madrid" on the subject of reparations demanded from Spain by the United States for alleged injuries to American commerce with Cuba. In the manifesto the three ministers asserted that "from the peculiarity of its geographical position, and the considerations attendant upon it, Cuba is as necessary to the North American republic as any of its present members"; spoke of the danger to the United States of an insurrection in Cuba; asserted that "we should be recreant to our duty, be unworthy of our gallant forefathers, and commit base treason against our posterity, should we permit Cuba to be Africanized"; and recommended that "the United States ought, if practicable, to purchase Cuba as soon as possible." The most startling declaration of the manifesto was that if Spain should refuse to sell "after we shall have offered a price for Cuba far beyond its present value," and if Cuba, in the possession of Spain, should seriously endanger "our internal peace and the existence of our cherished Union," then "by every law, human and divine, we shall be justified in wresting it from Spain if we have the power."

On his return from England in 1856 he was nominated by the Democrats as a compromise candidate for president and was elected, receiving 174 electoral votes to 114 for J. C. Frémont, Republican, and 8 for Millard Fillmore, American or "Know-Nothing." Buchanan's character, the breadth of his legal knowledge, and his experience as congressman, cabinet member and diplomat, would have made him an excellent president in ordinary times; but he lacked the soundness of judgment, the self-reliance and the moral courage needed to face the slavery crisis. His idea of saving the Union was to prevent Northern agitation and to enforce the fugitive slave law. At the beginning of his administration he appointed Robert J. Walker, of Mississippi, Territorial governor of Kansas, and Frederick P. Stanton, of Tennessee, secretary, and assured them of his determination to adhere to the popular sovereignty principle, but soon began to use his influence to force the admission of Kansas into the Union under the pro-slavery Lecompton constitution, contrary to the wishes of the majority of the settlers. Stanton was removed from office for opposing the scheme, and Walker resigned in disgust. This change of policy was doubtless the result of timidity and his inability to realize the strength and determination of the Abolitionists; after every slavery crisis he considered the issue settled. Under the influence of Howell Cobb of Georgia, secretary of the Treasury, and Jacob Thompson, of Mississippi, secretary of the interior, the president was convinced that his action was the only way to avoid civil war. Federal patronage was freely used to advance the Lecompton measure and the compromise English bill, and to prevent Douglas's election to the Senate in 1858. Some of these facts were brought out in the famous but partisan and possibly unconstitutional Covode investigation conducted by a committee of the House of Representatives in 1860.

The call issued by the South Carolina legislature just after the election of Lincoln for a State convention to decide upon the advisability of secession brought forward the most serious matter in Buchanan's administration. The part of his annual message of Dec. 4, 1860, dealing with it, argued that a State had no legal right to secede, but denied that the Federal Government had any power forcibly to prevent it. At the same time it was the duty of the president to call out the army and navy of the United States to protect Federal property and to enforce Federal laws. Soon after the secession movement began the Southern members of the cabinet resigned, and the president gradually came under the influence of Black, Stanton, Dix and other Northern leaders but continued to work for a peaceful settlement, supporting the Crittenden Compromise and the work of the Peace Congress. He disapproved of Major Anderson's removal of his troops from Ft. Moultrie to Ft. Sumter in Dec. 1860, though the removal itself probably was not in violation of a pledge given by the president to preserve the *status quo* in Charleston harbour until the arrival of the South Carolina commissioners in Washington. The assertion that the president was prevented from ordering Anderson back to Ft. Moultrie only by the threat of four members of the cabinet to resign was unfounded.

On the expiration of his term of office (March 4, 1861) Buchanan retired to his home at Wheatland, near Lancaster, Pa., where he actively supported the Union until his death on June 1, 1868. His mistakes as president have been so emphasized as to obscure the fact that he was a man of unimpeachable honesty, of the highest patriotism and of considerable ability.

BIBLIOGRAPHY.—G. T. Curtis's *The Life of James Buchanan* (1883) is the standard biography; Curtis, however, was a close personal and political friend, and his work is too eulogistic. More trustworthy is the account given by J. F. Rhodes in the first two volumes of his *History of the United States since the Compromise of 1850* (1902 07). J. B. Moore has edited *The Works of James Buchanan, comprising his Speeches, State Papers, and Private Correspondence* (1908 10). J. B. Ranch's study of Buchanan's attitude on slavery in the *Pennsylvania Magazine of History and Biography* (April, 1927) is interesting. *See* also Louis M. Sears, "August Belmont, Banker in Politics" in the *Historical Outlook* (April, 1924) and the *Quarterly Journal of the New York State Historical Association* (Oct., 1926).

BUCHANAN, ROBERT WILLIAMS (1841–1901), British poet, novelist and dramatist, son of Robert Buchanan (1813–66), Owenite lecturer and journalist, was born at Caverswall, Staffordshire, and was educated at the high school and the University of Glasgow. After a period of struggle and disappointment in London Buchanan published *Undertones* in 1863.

The article which, under the *nom de plume* of Thomas Maitland, he contributed to the *Contemporary Review* for Oct. 1871, entitled "The Fleshly School of Poetry," is chiefly remembered by the replies it evoked from D. G. Rossetti in a letter to the *Athenaeum* (Dec. 16, 1871), entitled "The Stealthy School of Criticism," and from Swinburne in *Under the Microscope* (1872). Buchanan himself afterwards regretted the violence of his attack, and the "old enemy" to whom *God and the Man* is dedicated was Rossetti. In 1876 appeared *The Shadow of the Sword*, the first and one of the best of a long series of novels. Buchanan was also the author of many successful plays, among which may be mentioned *Lady Clare*, produced in 1883; *Sophia* (1886), an adaptation of *Tom Jones; A Man's Shadow* (1890); and *The Charlatan* (1894). In collaboration with Harriet Jay he wrote the melodrama *Alone in London*. He died at Streatham on June 10, 1901.

See his *Complete Poetical Works* (1901); Harriet Jay, *Robert Buchanan; some Account of his Life* (1903); and A. Symons, *Some Studies in Prose and Verse* (1904).

BUCHAREST, the capital of Rumania, and chief town of the department of Ilfov had a population (1939) of 648,162, including a large number of Jews. Population by the census of 1930 was 631,228. With its outlying parts, Bucharest covers more than 20 square miles. It lies in a slight hollow, traversed from north-west to south-east by a small river, the Dimbovita, most of the city lying on the left bank. A range of low hills extends to the west and south-west; on all other sides there are flat plains, only recently drained. The city is thus very exposed, and the extremes of climate are severe; great summer heats being followed by exceedingly cold winds in autumn and winter. Bucharest is not an old town. According to one tradition, it was founded by a shepherd named Bucur, commemorated in the name of a church, the Biserica Bucur. Another tradition connects it with the word *bucurie*, Rumanian for "pleasure," and with a victory gained by Prince Mircea of Walachia (*c.* 1383–1419) over the Turks. More likely it was first built as a fortress, on the site of the Daco-Roman Thyanus, to command the passes into Transylvania. It was burnt by the Turks in 1595; but in the next century was already the seat of the Metropolitan of Walachia, and in 1698 was chosen for his capital by Constantine Brancovan, Hospodar of Walachia. In the 18th and early 19th centuries, during which it was frequently disputed by the Turks, Russians and Austrians, it was Phanariot Greek and Jewish rather than Rumanian. It then began to seek the implications in its name. It was already notorious for its gaiety and luxury, although still small and in many respects primitive. The houses were mostly of wood, paving very rough and lighting scanty; fires were frequent, earthquakes not uncommon. The plague visited it in 1718, 1738, 1793 and 1813, in which year 70,000 persons died in six weeks. It was occupied by Russian troops in 1828, 1848 and 1853–54 and by Austrians in 1854–57. In 1861 it was made the capital of the new Rumania (*see* RUMANIA: *History*) and with the accession of Prince Charles, in 1866, a gradual reform began. The river was enclosed within embankments; sewerage and pure water were supplied, gas and electric light installed, and electric or horse tramways laid down in the principal streets, which were paved with granite or wood. The wooden houses gave way to edifices of brick, overlaid with white or tinted plaster and ornamented with figures or foliage in terra-cotta. In the poorer quarters on the outskirts, the one-storied Walachian peasant cottage survived; but slums, in the strict sense, there were none. In the war of 1916–18 some damage was done by the German occupation; but the city was thoroughly cleansed. After the war, the population increased immensely. German troops again occupied the city during World War II, though Rumania kept at least the semblance of an independent nation after joining the axis.

The main street of Bucharest is the Calea Victorei, named in honour of the Rumanian success at Plevna (1877). Starting from the Băneasa racecourse, outside and north of the city (the favourite fashionable drive), this thoroughfare, here called the Chaussée Soșea, traverses a public garden, the Kisilev park, laid out in imitation of the Parisian *Champs Élysées*, passes under an *Arc de Triomphe* and, leaving on its left the ethnographical and natural history museums, enters the city. The boulevards, known as Independentei, Elisabetei, Universitei, Caroli I. and Protopesco, run in a practically straight line east and west. Starting in the Cotroceni and botanic gardens, they cross the river, leave on the left the pleasant Cisimigiu garden, cross the Calea Victorei, and proceed past the university and City Hall. Of the four sectors formed by these two intersecting thoroughfares, the outer portions of those in the north-west and south-west are largely occupied by the railway stations, arsenal and barracks; the north-east-north is residential, but the Obor, or popular market, lies on its extremity. The south-east is the business quarter, containing the Lipscani, or principal merchants' quarter, named after the annual Leipzig fair whence goods were formerly obtained. The wealthy portion of the town is the centre. The fortifications, which surround the town at a mean distance of four miles were constructed in 1885–96 from plans drafted by the Belgian engineer General Brialmont in 1883. Their perimeter is about 48 miles. They were considered the strongest in Europe, but it proved impossible to hold them against the Germans in 1916.

Bucharest contains a great number of churches, usually small, in the Byzantine style. The metropolitan church, which stands on an eminence south of the city, was built 1656–65. It has the form of a Greek cross, and is surrounded by a cloister, with four main entrances, each surmounted by a turret. The churches of Spiridion the New (1768), the Doamna Balasa (1751), with its rich carving and frescoes, and the ancient Biserica Bucur are also noteworthy. There is a Roman Catholic cathedral, synagogues, and Protestant, Armenian and Lipovan churches.

Bucharest is a great educational centre. Besides the ordinary ecclesiastical seminaries, lyceums, gymnasia and elementary schools, it possesses schools of commerce, science and art institutes, and training colleges, for engineers and veterinary surgeons; while the university, founded in 1864, has faculties of theology, philosophy, literature, law, science, medicine and pharmacy. Students pay no fees except for board. The national library, containing many precious Oriental documents, and the meeting-hall of the Rumanian senate, are both included in the university buildings. Other libraries are those of the Nifon seminary, of the Charles University Foundation (*Fundatiunea universitara Carol*), which endows research, and rewards literary or scientific merit; the central library, and the library of the academy, which also contains a museum of natural history and antiquities. There are numerous philanthropic institutions.

There are a number of theatres, one, the national, state-conducted. Minor places of amusement abound; as also do clubs—political, social and sporting—hotels and restaurants. The suburbs are still national and picturesque; the centre of the city is extremely elegant.

Bucharest is the winter residence of the royal family, the meeting-place of parliament and the seat of an appeal court (*Curtea de Apel*), of the supreme court (*Curtea de Casatie*), of the ministries, the national bank, the bank of Rumania, many lesser credit establishments and a chamber of commerce. The railway lines which meet on the western limit of the city give access to all parts. Bucharest has a very large transit trade in petroleum, timber and agricultural produce; above all, in wheat and maize. Its industries include petroleum-refining, extraction of vegetable oils, cabinet-making, brandy-distilling, tanning, and the manufacture of machinery, wire, nails, metal-ware, cement, soap, candles, paste, starch, paper, cardboard, pearl buttons, textiles, leather goods, ropes, glucose, army supplies, preserved meat and vegetables, and confectionery. An important fair is ordinarily held for seven days in each year.

BUCHER, LOTHAR (1817–1892), German publicist, was born on Oct. 25, 1817, at Neu Stettin, in Pomerania. Elected a member of the National Assembly in Berlin in 1848, he was an active leader of the extreme democratic party. With others of his colleagues he was in 1850 brought to trial for having taken part in organizing a movement for refusal to pay taxes; he was condemned to 15 months' imprisonment in a fortress, but fled to London. He acted as special correspondent of the *National Zeitung*, and gained a great knowledge of English life; and he published a work, *Der Parliamentarismus wie er ist*, a criticism of parliamentary government, which shows a marked change in his political opinions. In 1864 he was offered by Bismarck a position in the Prussian foreign office. He acted as Bismarck's secretary, and was the man who probably enjoyed the greatest amount of his confidence. It was he who drew up the text of the constitution of the North German Confederation; in 1870 he was sent on a confidential mission to Spain in connection with the Hohenzollern candidature for the Spanish crown; he assisted Bismarck at the final negotiations for the treaty of Frankfurt, and was one of the secretaries to the Congress of Berlin; he also assisted Bismarck in the composition of his memoirs. Bucher's influence was directed against the economic doctrines of the Liberals; in 1881 he published a pamphlet criticizing the influence and principles of the Cobden Club. He died at Glion, in Switzerland, on Oct. 12, 1892.

See Heinrich v. Poschinger, *Ein 48er: Lothar Buchers Leben und Werke* (1890); Busch, *Bismarck: some Secret Pages of his History* (1898).

BUCHEZ, PHILIPPE BENJAMIN JOSEPH (1796–1865), French author and politician, was born at Matagne-la-Petite, now in Belgium, then in the French department of the Ardennes. In 1825 he graduated in medicine, and about the same time he became a member of the Saint-Simonian Society presided over by Bazard, Barthélemy Prosper Enfantin, and Olinde Rodrigues, and contributed to its organ, the *Producteur*. He left it in consequence of aversion to the strange religious ideas developed by its "Supreme Father," Enfantin, and founded a periodical called *L'Européen* for the advocacy of his theory of Christian socialism. In 1833 he published an *Introduction à la science de l'histoire* (2nd ed., improved and enlarged, 1842). Next he edited, with M. Roux-Lavergne (1802–74), the *Histoire parlementaire de la Révolution française* (1833–38; 40 vols.). It was reviewed by Carlyle (*Miscellanies*), parts of whose own history of the French Revolution are mainly drawn from it. The editors saw in the French Revolution an attempt to realize Christianity. In the *Essai d'un traité complet de philosophie au point de vue du Catholicisme et du progrès* (1839–40) Buchez endeavoured to co-ordinate in a single system the political, moral, religious and natural phenomena of existence. Denying the possibility of innate ideas, he asserted that morality comes by revelation, and is therefore not only certain, but the only real certainty. In 1848 he became president of the Constituent Assembly, but only retained the position for a very short time. A *Traité de politique* (published 1866), which may be considered as the completion of his *Traité de philosophie*, was the most important of the productions of the last period of his life.

See A. Ott, "P. B. J. Buchez," in *Journal des économistes* for 1865.

BUCHHOLZ, a town in Saxony, 1,700ft. above sea, among the Erzgebirge, 18m. S. of Chemnitz, near Annaberg. Pop. 9,052. The Gothic church of St. Catherine has some paintings of the school of Wohlgemuth (1434–1519). Lace-making, the chief industry, dates from 1589. Chenille, cardboard boxes, etc., are also made.

BUCHNER, EDUARD (1860–1917), German chemist, was born at Munich May 20 1860. He was professor at Berlin (1898), at Breslau (1909) and Würzburg (1911). Buchner devoted himself to researches in connection with fermentation and enzyme action. In 1903 he was able to confirm Traube's theory by demonstrating that the active cause of alcoholic fermentation is due to the action of different enzymes contained in yeast and not to the yeast cell itself. Concerning the physiological nature and meaning of fermentation he showed that a ferment (zymase) can be extracted from yeast cells which causes sugar to break up into carbon dioxide and alcohol.

Buchner, who gained the Nobel Prize for chemistry in 1907, was killed in the World War on Aug. 24 1917.

BÜCHNER, LUDWIG (1824–1899), German philosopher and physician, was born at Darmstadt. He studied at Giessen, Strasbourg, Würzburg and Vienna. In 1852 he became lecturer in medicine at the University of Tübingen, where he published his great work *Kraft und Stoff* (1855). The extreme materialism of this work excited so much opposition that he was compelled to give up his post at Tübingen. He retired to Darmstadt, where he practised as a physician and contributed regularly to pathological and physiological magazines. He continued his philosophical work in defence of materialism, and published *Natur und Geist* (1857), *Aus Natur und Wissenschaft* (vol. i., 1862; vol. ii., 1884), *Fremdes und Eigenes aus dem geistigen Leben der Gegenwart* (1890), *Darwinismus und Socialismus* (1894). He died at Darmstadt on May 1, 1899. *Im Dienste der Wahrheit* (1899), a collection of selected essays from his works, contains a notice of him by his brother, Alexander Büchner.

BUCHU or **BUKA LEAVES,** the produce of several shrubby plants belonging to the genus *Barosma* (family Rutaceae), natives of the Cape of Good Hope. The principal species are *B. betulina*, *B. crenulata,* and *B. serratifolia*. (*See* CAMPHORS.)

BUCK, CARL DARLING (1866–   ), American philologist, was born Oct. 2, 1866, at Orland, Maine. He graduated at Yale in 1886, and was a post-graduate student there, at the American school of classical studies in Athens, and in Leipzig. In 1892 he became assistant professor and in 1900 professor of Sanskrit and Indo-European comparative philology in the University of Chicago; but it is in the narrower field of the Italic dialects that his important work lies, including *Der Vocalismus der Oskischen Sprache* (1892); *The Oscan-Umbrian Verb-System* (1895), and *Grammar of Oscan and Umbrian* (1904). He also wrote *Introduction to the Study of the Greek Dialects* (1909).

BUCK, DUDLEY (1839–1909), American musical composer, was born in Hartford, Connecticut, on March 10, 1839. He studied at Leipzig, Dresden and Paris. After assisting Theodore Thomas as conductor of the renowned New York orchestral concerts (1875), he became organist of the Church of the Holy Trinity, Brooklyn (1877–1903). He was well known as a composer of church music cantatas (*Columbus*, 1876; *Golden Legend*, 1880; *Light of Asia*, 1885, etc.), a grand opera, *Serapis;* a comic opera, *Deseret* (1880); a symphonic overture, *Marmion*, and a symphony in E flat. He died on Oct. 6, 1909.

BUCK. (1) The male of the American and fallow deer and of goats, hares and rabbits. [O.E. *buc*, a he-goat.] In the 18th century the word was used of a spirited, reckless young man of fashion. (2) The bleaching of clothes in lye, also the lye itself, and the clothes to be bleached, so a "buck-basket" means a basket of clothes for the wash (*cf.* the Ger. *Bauch*, Fr. *buée*). (3) Possibly from an obsolete word meaning "body," now found only in compound words, as "buck-board," a light, four-wheeled vehicle originally having one or more seats on a springy board serving both as springs and body; a "buck-wagon" (Dutch *bok-wagen*) is a South African cart with a frame projecting over the wheels, used for transport of heavy loads. (4) A verb meaning "to leap," from "buck," a he-goat (or *cf.* Ger. *bücken*, and Eng. "bow," to bend). Seen in the compound "buck-jumper," a horse which leaps clear off the ground, with feet tucked together and arched back, descending with fore-feet rigid and head down.

BUCK-BEAN or **BOG-BEAN** (*Menyanthes trifoliata*, a member of the *Gentianaceae*), a bog-plant with a creeping stem, alternately arranged large leaves each with three leaflets, and spikes of white or pink flowers. The stout stem is bitter and has tonic and febrifuge properties. The plant is widely distributed through the north temperate zone.

BUCKBOARD, a horse-drawn, four-wheel vehicle without springs. Long elastic boards are fastened securely to the front and rear axles and two or more seats are mounted thereon. This primitive type of vehicle was originally devised for use in the rough and hilly districts of the United States.

BÜCKEBURG, town, north-west Germany, capital of the *Land* of Schaumburg-Lippe, 6m. east of Minden. Pop. (1933) 6,023. It arose around the castle in the 14th century, but was not walled until the 17th century. A ring of promenades has since replaced the walls.

BUCKET-SHOP, a term applied to the "business" of a sham stock-broker who does not deal in securities, but who conducts a gambling office in which, in effect, he bets with his clients upon unfair terms. His usual method is to encourage speculators to gamble for a rise in price which he confidently predicts to them, promising large profits quickly harvested. No "buying" is done, and the bucket-shop keeper carefully guards himself from stating in direct terms that he has bought. He asks for a margin or "cover" from his client, and makes great play with the statement that not more than the cover can be lost. As this cover amounts to little, if anything, more than the difference between the buying and selling prices of the stock or share gambled in, the unfortunate speculator often loses his bet as soon as he makes it. The bucket-shop keeper sometimes opens his dealings, however, by sending a small cheque to the speculator for pretended winnings to induce him to plunge more deeply in a further deal.

The bucket-shop keeper carefully words his order-forms to avoid the meshes of the law. Thus, in an actual case, the circular inviting to a gamble in a certain industrial share included an order-form running as follows:—

"I hereby instruct you to open on my account . . . shares and enclose £ . . . being 1s. per share deposit, which is my sole liability on this transaction."

The cover of one shilling per share in this case is the difference between the buying and selling price of the share, so that the deposit is run off upon the signing of the form.

It is quite unfair to apply the term "bucket-shop" to the business of every stock-broker who is not a member of an official stock-exchange, for there are perfectly honest "outside" stock-brokers who conduct a legitimate business.

The origin of the term is American. According to the *New English Dictionary*, it is supposed to have arisen in Chicago. The Board of Trade there forbade dealings in "options" in grain of less than 5,000 bushels. An "Open Board of Trade" or unauthorized exchange was established for the use of small gamblers, in a neighbouring street below the rooms of the Board of Trade. The lift used by members of the Board of Trade would be sent down to bring up from the "Open Board" what was known as a "bucketful" of the smaller speculators when business was slack.

BUCKFASTLEIGH, urban district, Devonshire, England, coextensive with the parish of East Buckfastleigh. Pop. (1938) 2,452. Area 2.1 sq.mi. It lies on the river Dart, 7 mi. N.W. of Totnes by the G.W.R. Buckfast abbey, originally Benedictine, was refounded by the Cistercians in 1137. It fell into ruin after the Dissolution, but was purchased in 1882 by a Benedictine community, whose lay brethren rebuilt it. It was consecrated again in 1932. Buckfastleigh manufactures navy serge and blankets. The river Dart here provides salmon and trout fishing.

BUCKHANNON, a city near the centre of West Virginia, U.S.A., on the Buckhannon river, at an elevation of 1,400 ft.; the county seat of Upshur county. It is served by the Baltimore and Ohio railroad. The population in 1940 was 4,450. It has natural gas and several manufacturing plants, and is the seat of West Virginia Wesleyan College, established here in 1890. Buckhannon occupies the site of the first permanent settlement west of the Alleghenies. Neither the city nor the county has ever licensed a saloon.

BUCKHOLDT (properly BEUKELSZ, or BOCKELSZOON), **JOHANN** (*c.* 1508–1536), Dutch Anabaptist fanatic, better known as JOHN OF LEYDEN, from his place of birth, was the illegitimate son of Bockel, burgomaster of Soevenhagen, who afterwards married his mother. He was born about 1508, apprenticed to a tailor, became influenced by the opinions of Thomas Münzer, travelled in pursuit of his trade (being four years in London), married a widow, became bankrupt, and in Sept. 1533 joined the Anabaptist movement under Johann Matthysz (Matthyszoon), baker of Haarlem. He had little education, but some literary faculty, and had written plays. On Jan. 13, 1534, he appeared in Münster as an apostle of Matthysz. Good-looking and fluent, he fascinated women, and won the confidence of Bernard Knipperdollinck, a revolutionary cloth merchant, who gave him his daughter in marriage. The Münster Anabaptists took up arms on Feb. 9, 1534 (*see* ANABAPTISTS). On the death of Matthysz (1534), Buckholdt succeeded him as prophet, added his widow to the number of his wives, and organized a new constitution for Münster, with 12 elders (suggested by the tribes of Israel) and other officers of a theocracy, but soon superseded these, making himself king of the new Zion. His arbitrary rule was marked by pomp and severity. Münster was retaken (June 25, 1535) by its prince-bishop, Franz von Waldeck. Buckholdt, after many indignities, was barbarously executed on Jan. 22, 1536; his body and those of his companions were hung in cages to the tower of the Lamberti church. His portrait is in *Grouwelen der Hooftketteren* (Leyden, 1607; an English edition is appended to Alexander Ross's *Pansebeia*, 2nd ed., 1655); a better example of the same is given by Arend.

See Arend, *Algemeene Geschiedenis des Vaderlands* (1846), ii., iii., 6–9; Van der Aa, *Biographisch Woordenboek der Nederlanden* (1853); E. Belfort Bax, *Rise and Fall of the Anabaptists* (1903). (A. Go.)

BUCKIE, fishing town and small burgh, Banffshire, Scotland, on the Moray Firth, at the mouth of Buckie burn, about 17 mi. W. of Banff, with a station on the L.N.E.R. Pop. (est. 1938), 8,481. Area, 1.6 sq.mi. It is the centre of a fishery district and for one of the largest Scottish fleets in the herring season, and is also the chief seat of line fishing in Scotland. The harbour, with an outer and inner basin, covers an area of 30 ac. It was considerably extended in 1921. Besides the fisheries and fish-curing trade there are net and rope factories, sawmills and a distillery. The burn divides the town into Buckie and Buckpool. Portgordon, 2 mi. W. of Buckie, is a thriving fishing village; the harbour was enlarged in 1909. Rathven, some 2 mi. E., lies in a fertile district, where there are several antiquities.

BUCKINGHAM, EARLS, MARQUESSES AND DUKES OF. The origin of the earldom of Buckingham (to be distinguished from that of Buckinghamshire, *q.v.*) is obscure.

According to Mr. J. H. Round (in G. E. C.'s *Peerage, s.v.*) there is some charter evidence for its existence under William Rufus; but the main evidence for reckoning Walter Giffard, lord of Longueville in Normandy, who held 48 lordships in the county, as the first earl, is that of Odericus Vitalis, who twice describes Walter as "Comes Bucchingehamensis," once in 1097, and again at his death in 1102. After the death of Walter Giffard, 2nd earl, in 1164, the title was assumed by Richard de Clare, earl of Pembroke ("Strongbow"), in right of his wife, Rohais, sister of Walter Giffard I.; and it died with him in 1176. In 1377 Thomas of Woodstock (duke of Gloucester) was created earl of Buckingham at the coronation of Richard II. (July 15), and the title of Gloucester having after his death been given to Thomas le Despenser, his son Humphrey bore that of earl of Buckingham only. On Humphrey's death, his sister Anne became countess of Buckingham in her own right. She married Edmund Stafford, earl of Stafford, and on her death (1438) the title of Buckingham passed to her son Humphrey Stafford, earl of Stafford, who in 1444 was created duke of Buckingham. This title remained in the Stafford family until the attainder and execution of Edward, 3rd duke, in 1521 (*see* BUCKINGHAM, HENRY STAFFORD, 2nd duke of).

In 1617 King James I. created George Villiers earl, in 1618 marquess, and in 1623 duke of Buckingham (*see* BUCKINGHAM, GEORGE VILLIERS, 1st duke of). The Marquessate and dukedom became extinct with the death of the 2nd (Villiers) duke in 1687; but the earldom was claimed, under the special remainder in the patent of 1617, by a collateral line of doubtful legitimacy claiming descent from John Villiers, 1st Viscount Purbeck. The title was not actually borne after the death of John Villiers, styling himself earl of Buckingham, in 1723. The claim was extinguished by the death of George Villiers, a clergyman, in 1774.

In 1703 John Sheffield, marquess of Normanby, was created "duke of the county of Buckingham and of Normanby." He was succeeded by his son Edmund who died in Oct. 1735 when the titles became extinct.

The title of marquess and duke of Buckingham in the Grenville family (to the holders of which the remainder of this article applies) was derived, not from the county, but from the town of Buckingham. It originated in 1784, when the 2nd Earl Temple was created marquess of Buckingham "in the county of Buckingham," this title being elevated into the dukedom of Buckingham and Chandos for his son in 1822.

GEORGE NUGENT TEMPLE GRENVILLE, 1st marquess of Buckingham (1753–1813), the second son of George Grenville, was born on June 17, 1753. Educated at Eton and Christ Church, Oxford, he was M.P. for Buckinghamshire from 1774–79. In the House of Commons he was a sharp critic of the American policy of Lord North. In Sept. 1779 he succeeded his uncle as 2nd Earl Temple; in July 1782 he became a member of the privy council and lord-lieutenant of Ireland in the Rockingham ministry. On his advice the Irish Judicature Act of 1783 was passed, which supplemented the legislative independence granted to Ireland in 1782. By royal warrant he created the order of St. Patrick in Feb. 1783, with himself as the first grand master. Temple left Ireland in 1783, and again turned his attention to English politics. He enjoyed the confidence of George III., and having opposed Fox's East India bill, he was authorized by the king to say that "whoever voted for the India bill was not only not his friend, but would be considered by him as an enemy," a message which ensured the defeat of the bill. He was appointed a secretary of state when the younger Pitt formed his ministry in Dec. 1783, but resigned two days later. In Dec. 1784 he was created marquess of Buckingham "in the county of Buckingham." In Nov. 1787 he was appointed lord-lieutenant of Ireland under Pitt, but his second tenure of this office was hardly as successful as the first. He was denounced by Grattan for extravagance; was censured by the Irish houses of parliament for refusing to transmit to England an address calling upon the prince of Wales to assume the regency; and he could only maintain his position by resorting to bribery on a large scale. He resigned in Sept. 1789, and subsequently took very little part in politics, although he spoke in favour of the union with Ireland. He died at Stowe House, Buckingham, on Feb. 11 1813.

His elder son, RICHARD GRENVILLE, 1st duke of Buckingham and Chandos (1776–1839), was M P. for Buckinghamshire from 1797 to 1813, and, as Earl Temple, took an active part in politics. In Feb. 1813 he succeeded his father as marquess of Buckingham; and having married the only child of the 3rd duke of Chandos, he was created duke of Buckingham and Chandos in 1822. Owing to financial embarrassments, the duke lived out of England for some time, and in 1862 an account of his travels was published, as *The Private Diary of Richard, Duke of Buckingham and Chandos.*

He was succeeded by his only child, RICHARD GRENVILLE, 2nd duke of Buckingham and Chandos (1707–1861). Educated at Eton and Oriel college, Oxford, he was known as Earl Temple and subsequently as marquess of Chandos. He was M.P. for Buckinghamshire from 1818 to 1839, and was responsible for the "Chandos clause" in the Reform bill of 1832. He was lord privy seal from Sept. 1841 to Jan. 1842, and partly owing to his opposition to the repeal of the corn laws was known as the "Farmers' Friend." In 1847 his residences were seized by his creditors, and the duke left England for a time. He died in London, on July 29, 1861. He wrote: *Memoirs of the Court and Cabinets of George III.* (London, 1853–55); *Memoirs of the Court of England, 1811–1820* (London, 1856); *Memoirs of the Court of George IV.* (London, 1859); and *Memoirs of the Court and Cabinets of William IV. and Victoria* (London, 1861).

RICHARD GRENVILLE, 3rd duke of Buckingham and Chandos (1823–1889), the only son of the 2nd duke, was educated at Eton and Christ Church, Oxford, and, as marquess of Chandos, was M.P. for Buckingham from 1846 to 1857. After succeeding to the dukedom he became lord president of the council, and subsequently secretary for the colonies in the Conservative Government of 1866–68. From 1875 to 1880 he was governor of Madras, and in 1886 was chosen chairman of committees in the House of Lords. As he left no son the dukedom became extinct on his death.

BUCKINGHAM, GEORGE VILLIERS, 1ST DUKE OF (in the Villiers line) (1592–1628), English statesman, born on Aug. 20, 1592, was a younger son of Sir George Villiers of Brooksby. He could dance well, fence well, and talk a little French, when in August 1614 he was brought before the king's notice in the hope that he would take a fancy to him. The moment was favourable. The king was tiring of Robert Carr, Earl of Somerset, though for some little time still his pre-eminence was maintained. But on April 23, 1615, Villiers, in spite of Somerset, was promoted to be gentleman of the bedchamber; the charge of murdering Overbury, brought against Somerset in September, completed his downfall, and Villiers at once stepped into the vacant place. Honours were heaped upon him, and on Jan. 5, 1617, he was made earl, and on Jan. 1, 1618, marquess of Buckingham. With the exception of the earl of Pembroke he was the richest nobleman in England.

On Jan. 19, 1619, James made him lord high admiral of England, hoping that the ardent, energetic youth would reform the fleet which had been almost ruined by the peculation and carelessness of the officials. But Buckingham was too ready to fill up appointments with men who flattered him, and too reluctant to dismiss them, if they served their country ill, to effect any permanent change for the better.

At this time all England was talking of the revolution in Bohemia in the year before, and sympathy with the Continental Protestants was increased when it was known that James's son-in-law had accepted the Crown of Bohemia, and that in the summer of 1620 a Spanish force was preparing to invade the Palatinate. Buckingham at first had thrown himself into the popular movement. Before the summer of 1620 was at end, incensed by injuries inflicted on English sailors by the Dutch in the East Indies, he had swung round and was in close agreement with Gondomar, the Spanish ambassador. He had now married Lady Katherine Manners, the daughter of the earl of Rutland, who was at heart a Roman

Catholic, though she outwardly conformed to the English Church; and this alliance may have had something to do with the change.

The parliament which met in 1621, angry at discovering tha no help was to be sent to the Palatinate, broke out into a lou outcry against the system of monopolies, from which Buckingham's brothers and dependants had drawn a profit, which wa believed to be greater than it really was. At a conference of th Commons with the Lords, Buckingham acknowledged that his tw brothers had been implicated, but declared that his father ha begotten a third who would aid in punishing them. In the impeachment of Bacon which soon followed, Buckingham, who owe much to his wise counsels, gave him that assistance which wa possible without injury to himself, but afterwards, when the cr rose louder against the chancellor, joined in the attack, though h sought to mitigate the severity of the charges against him Nevertheless, he took advantage of Bacon's need of assistance t wring from him the possession of York House.

In the winter of 1621, and the succeeding year, Buckingham was entirely in Gondomar's hands; and it was only with some difficulty that in May 1622 Laud argued him out of a resolution to declare himself a Roman Catholic. There can be little doubt tha when the Spanish ambassador left England the following May he had come to an understanding with Buckingham on the project of the marriage of the prince of Wales to the infanta Maria. Buckingham and the prince reached Madrid on March 7, 1623. Each party had been the dupe of the other. Charles and Buckingham hoped for the restitution of the Palatinate to James's son-in-law as a marriage gift to Charles; while the Spaniards counted on the conversion of Charles to Roman Catholicism and other extreme concessions (*see* CHARLES I.). The political differences were soon accentuated by personal disputes between Buckingham and Olivares and the grandees, and when the two young men sailed together from Santander in September it was with the final resolution to break entirely with Spain.

In his absence James had raised him to a dukedom. But the splendour which now gathered round Buckingham was not due to James's favour. He had put himself at the head of the popular movement against Spain, and when James, unwillingly convinced that the Palatinate could only be recovered by force, summoned the parliament which met in Feb. 1624, Buckingham, with the help of the heir apparent, took up an independent political position. James was half driven, half persuaded to declare all negotiations with Spain at an end. For the moment Buckingham was the most popular man in England.

The Commons would have been content with sending some assistance to the Dutch, and with entering upon a privateering war with Spain. James believed that the Palatinate could only be recovered by a Continental alliance, in which France took part. Negotiations were therefore opened for a marriage between Charles and the sister of Louis XIII., Henrietta Maria. Buckingham, impatient to begin the war as soon as possible, persuaded Charles, and the two together persuaded James to throw over the promises to the Commons and to accept the French terms, which included concessions to the English Catholics.

Buckingham now prepared to throw 12,000 Englishmen, under a German adventurer, Count Mansfeld, through France into the Palatinate. The French insisted that he should march through Holland. It mattered little which way he took. Without provisions, and without money to buy them, the wretched troops sickened and died in the winter frosts. Buckingham's first military enterprise ended in disastrous failure. Buckingham had offered to send aid to Christian IV., king of Denmark, who was proposing to make war in Germany, and had also a plan for sending an English fleet to attack Genoa, the ally of Spain, and a plan for sending an English fleet to attack Spain itself. But before these schemes could be carried into operation James died on March 27, 1625.

The new king and Buckingham were at one in their aims and objects. Buckingham was sent over to Paris to urge upon the French court the importance of converting its alliance into active co-operation. The Huguenots of La Rochelle were in rebellion, and James had promised the aid of English ships to suppress that rebellion. Buckingham desired to save Charles from compromising himself with his parliament by the appearance of English ships in an attack upon Protestants. When he returned his main demands were refused, but hopes were given him that peace would be made with the Huguenots. On his way through France he had the insolence to make love to the queen of France.

Soon after his return parliament was opened. Charles had entered into engagements involving an enormous expenditure, and these engagements involved a war on the Continent, which had never been popular in the House of Commons. The Commons, too, suspected that the marriage treaty contained engagements of which they disapproved. They asked for the full execution of the laws against the Roman Catholics, and voted but little money in return. Before they reassembled at Oxford on Aug. 1, the English ships had found their way into the hands of the French, to be used against La Rochelle. The Commons met in an ill-humour. They had no confidence in Buckingham, and they asked that persons whom they could trust should be admitted to the king's council before they would vote a penny. Charles stood by his minister, and on Aug. 12 he dissolved his first parliament.

Buckingham and his master then threw over their engagements o France on behalf of the English Roman Catholics. On the other hand they sent out a large fleet to attack Cadiz, and to seize the Spanish treasure-ships. Buckingham went to The Hague to raise an immediate supply by pawning the Crown jewels, to place England at the head of a great Protestant alliance, and to enter into fresh obligations to furnish money to the king of Denmark. It all ended in failure. The fleet returned from Cadiz, having effected nothing. The Crown jewels produced but a small sum, and the money for the king of Denmark could only be raised by an ppeal to parliament. In the meanwhile the king of France was deeply offended by the treatment of the Roman Catholics, and by he seizure of French vessels on the ground that they were engaged n carrying goods for Spain.

Charles's second parliament, which met on Feb. 6, 1626, impeached Buckingham before the House of Lords on a long string of harges. Many of these charges were exaggerated, and some were untrue. His real crime was his complete failure as the leader of he administration. Charles dissolved his second parliament as he had dissolved his first. Subsequently the Star Chamber declared he duke innocent of the charges. Recourse was had to a forced oan, and men were thrown into prison for refusing to pay it. Disasters had occurred to Charles's allies in Germany. The fleet sent out under Lord Willoughby (earl of Lindsey) against the Spaniards returned home shattered by a storm, and a French war was impending in addition to the Spanish one. The French were roused to reprisals by Charles's persistence in seizing French vessels. Unwilling to leave La Rochelle open to the entrance of an English fleet, Richelieu laid siege to it. On June 27, 1627, Buckingham sailed from Portsmouth at the head of a numerous fleet, nd a considerable land force, to relieve the besieged city.

His first enterprise was the siege of the fort of St. Martin's, on he Isle of Ré, which proved more difficult than had been expected. Before the reinforcements requested by Buckingham could arrive he French had thrown a superior force upon the island, and he was driven to retreat on Oct. 20 with heavy loss, only 2,989 troops ut of nearly 7,000 returning to England.

In the parliamentary battle, which ended in the concession of he Petition of Right, Buckingham resisted as long as it was ossible to resist the demand of the Commons, that the king should bandon his claim to imprison without showing cause. When the rst unsatisfactory answer to the petition was made by the king on une 2, the Commons suspected, probably with truth, that it had een dictated by Buckingham. They prepared a remonstrance on he state of the nation, and Coke said, "The duke of Bucks is the ause of all our miseries . . . that man is the grievance of grievances." Though on June 7 the king granted a satisfactory answer the petition, the Commons proceeded with their remonstrance, nd on the 11th demanded Buckingham's dismissal. Charles refused to surrender Buckingham, and a few days later he prorogued arliament in anger.

With the clouds gathering round him, Buckingham went down o Portsmouth to take the command of one final expedition for the relief of La Rochelle. For the first time even he was beginning to acknowledge that he had undertaken a task beyond his powers. He entered gladly into a scheme of pacification proposed by the Venetian ambassador. But before he could know whether there was to be peace or war, the knife of an assassin put an end to his career. John Felton, who had served at Ré, had been disappointed of promotion, and had not been paid that which was due to him for his services, read the declaration of the Commons that Buckingham was a public enemy, and eagerly caught at the excuse for revenging his private wrongs under cover of those of his country. Waiting, on the morning of Aug. 23, beside the door of the room in which Buckingham was breakfasting, he stabbed him to the heart as he came out.

Buckingham married Lady Katherine Manners, daughter of Francis, 6th earl of Rutland, by whom he left three sons and one daughter, of whom George, the second son (1628–87), succeeded to the dukedom.

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BUCKINGHAM, GEORGE VILLIERS, 2nd DUKE OF (in the Villiers line) (1628–1687), English statesman, son of the 1st duke, was born on Jan. 30, 1628. He was brought up, together with his younger brother Francis, by King Charles I. with his own children, and was educated at Trinity college, Cambridge, where he obtained the degree of M.A. in 1642. He fought for the king in the Civil War, and took part in the attack on Lichfield Close in April 1643. Subsequently, under the care of the earl of Northumberland, the two brothers travelled abroad and lived at Florence and Rome. When the second Civil War broke out they joined the earl of Holland in Surrey, in July 1648. Lord Francis was killed near Kingston, and Buckingham and Holland were surprised at St. Neots on the 10th, the duke succeeding in escaping to Holland. Charles II. admitted him to his privy council on April 6, 1650. In opposition to Hyde (*see* CLARENDON, 1st Earl of) he supported the alliance with the Scottish presbyterians, accompanied Charles to Scotland in June, and allied himself with Argyll, dissuading Charles from joining the royalist plot of October 1650, and being suspected of betraying the plan to the covenanting leaders. In the following year he was chosen to lead the projected movement in Lancashire and to command the Scottish royalists. He was present with Charles at the battle of Worcester on Sept. 3, 1651, and escaped safely alone to Rotterdam in October. In 1657 he returned to England, and on Sept. 15 married Mary, daughter of Lord Fairfax. Buckingham was soon suspected of organizing a Presbyterian plot against the Government, and in spite of Fairfax's interest with Cromwell an order was issued for his arrest on Oct. 9. He was confined at York House about April 1658, and having broken bounds was rearrested on Aug. 18 and imprisoned in the Tower, where he remained till Feb. 23, 1659.

On the king's return Buckingham, who met him at his landing at Dover, was at first received coldly; but he was soon again in favour. He accompanied the Princess Henrietta to Paris on her marriage with the duke of Orleans, but made love to her himself with such imprudence that he was recalled. On April 28, 1662, he was admitted to the privy council. The differences between Clarendon and Buckingham debarred the latter from high office. He therefore intrigued for Clarendon's fall, and in 1667 he was imprisoned for a short time in the Tower of London. But he was restored to favour and to his appointments on Sept. 15, and on the fall of Clarendon he became the chief minister, though holding no high office except that of master of the horse, bought from the duke of Albemarle in 1668. He favoured religious toleration, supported a scheme of comprehension in 1668, and advised the declaration of indulgence in 1672. He upheld the original jurisdiction of the Lords in Skinner's case. With these exceptions Buckingham's tenure of office was chiefly marked by an amazing series of scandals and intrigues. Arlington, next to Buckingham himself the most powerful member of the Cabal and a favourite of the king, was his serious rival. Buckingham had from the first been an adherent of the French alliance, while Arlington concluded through Sir William Temple in 1668 the Triple Alliance. But on the complete *volte-face* and surrender made by Charles to France in 1670, Arlington as a Roman Catholic was entrusted with the first Treaty of Dover of May 20, while Buckingham was sent to France to carry on the sham negotiations which led to the public treaties of Dec. 31, 1670, and Feb. 2, 1672. In June 1672 he accompanied Arlington to The Hague to impose terms on the prince of Orange, and with Arlington arranged the new treaty with Louis. He was disappointed at being passed over for the command of the English forces in favour of Schomberg. He now knew of the secret Treaty of Dover, and towards the end of 1673 his jealousy of Arlington became open hostility. He threatened to impeach him, but in January 1674 an attack was made upon Buckingham himself simultaneously in both houses. In the Lords the trustees of the young earl of Shrewsbury complained that Buckingham continued publicly his intimacy with the countess; in the Commons he was attacked as the promoter of the French alliance, of "popery" and arbitrary government. Buckingham was dismissed, retired, reformed his ways, attended church with his wife, began to pay his debts, became a "patriot," and was claimed by the country or opposition party as one of their leaders. In the spring of 1675 he was conspicuous for his opposition to the Test oath and for his abuse of the bishops, and on Nov. 16 he introduced a bill for the relief of the Nonconformists. Buckingham was sent to the Tower for a short time in 1677 with three other lords for refusing an apology for having raised a constitutional question. He was released in July, and immediately entered into intrigues with Barillon, the French ambassador, with the object of hindering the grant of supplies to the king; and in 1678 he visited Paris to get the assistance of Louis XIV. for the cause of the opposition. He took an active part in the prosecution of those implicated in the supposed popish plot, and accused the lord chief justice (Sir William Scroggs) in his own court while on circuit of favouring the Roman Catholics. A writ was issued for his apprehension, but it was never served. He promoted the return of Whig candidates to parliament, constituted himself the champion of the dissenters, and was admitted a freeman of the city of London. He, however, separated himself from the Whigs on the exclusion question, probably on account of his dislike of Monmouth and Shaftesbury, was absent from the great debate in the Lords on Nov. 15, 1680, and was restored to the king's favour in 1684.

He took no part in public life after James's accession, but returned to his manor of Helmsley in Yorkshire, the cause of his withdrawal being probably exhausted health and exhausted finances. He died on April 16, 1687, from a chill caught while hunting, in the house of a tenant at Kirkby Moorside in Yorkshire, expressing great repentance and feeling himself "despised by my country and I fear forsaken by my God."[1] As he left no legitimate children the title became extinct.

Even Buckingham's critics admit that he was good-natured, generous, an unsurpassed mimic and the leader of fashion; and with his good looks, in spite of his moral faults and even crimes, he was irresistible to his contemporaries. His portrait has been drawn by Burnet, Count Hamilton in the *Mémoires de Grammont*, Dryden, Pope in the *Epistle to Lord Bathurst*, and Sir Walter Scott in *Peveril of the Peak*. He is described by Reresby as "the first gentleman of person and wit I think I ever saw," and Burnet bears the same testimony. Racing and hunting were his favourite sports, and his name long survived in the hunting songs of Yorkshire. He was the patron of Cowley, Sprat, Matthew Clifford and Wycherley. He dabbled in chemistry, and for some years, according to Burnet, "he thought he was very near the finding of the philosopher's stone." He set up glass works at Lambeth, the productions of which were praised by Evelyn; and he spent much money, according to his biographer Brian Fairfax, in building *insanae substructiones*. Dryden described him under the character of Zimri in the celebrated lines in *Absalom and Achitophel* (to which Buckingham replied in *Poetical Reflections on a late Poem . . . by a Person of Honour*, 1682):

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[1] *Quarterly Review*, Jan. 1898, p. 110.

> A man so various, that he seemed to be
> Not one, but all mankind's epitome;
> Stiff in opinions, always in the wrong,
> Was everything by starts and nothing long;
> But in the course of one revolving moon,
> Was chymist, fiddler, statesman and buffoon . . .
> Beggar'd by fools, whom still he found too late,
> He had his jest, but they had his estate.

Buckingham wrote occasional verses and satires showing undoubted but undeveloped poetical gifts, a collection of which, containing however many pieces not from his pen, was first published by Tom Brown in 1704; while a few extracts from a commonplace book of Buckingham of some interest are given in an article in the *Quarterly Review* of Jan. 1898. He was the author of *The Rehearsal*, an amusing and clever satire on the heroic drama and especially on Dryden (first performed on Dec. 7, 1671, at the Theatre Royal, and first published in 1672), a deservedly popular play which was imitated by Fielding in *Tom Thumb the Great*, and by Sheridan in the *Critic*. Buckingham also published two adapted plays, *The Chances*, altered from Fletcher's play of the same name (1682) and *The Restoration or Right will take place*, from Beaumont and Fletcher's *Philaster* (pub. 1714); and also *The Battle of Sedgmoor* and *The Militant Couple* (pub. 1704). His works were edited by T. Evans (1775). Another work is named by Wood, *A Demonstration of the Deity*, of which there is now no trace.

BIBLIOGRAPHY.—The life of Buckingham has been well and accurately traced and the chief authorities collected in the article in the *Dict. of Nat. Biog.* (1899) by C. H. Firth, and in *George Villiers, 2nd Duke of Buckingham*, by Lady Burghclere (1903). *See* also Wood's *Athenae Oxon.* (Bliss), iv. 207; *Biographia Britannica*, by Brian Fairfax, printed in H. Walpole's *Catalogue of Pictures of George, Duke of Buckingham* (1758); Arber's edition of the *Rehearsal* (1868); R. Thyer, *The Genuine Remains of Mr. Samuel Butler* (1759), ii. 72; *Quarterly Review, Jan. 1898* (commonplace book); *A Conference on the Doctrine of Transubstantiation between . . . the Duke of Buckingham and Father FitzGerald* (1714); *A Narrative of the Cause and Manner of the Imprisonment of the Lords* (1677); *The Declaration of the . . . Duke of Buckingham and the Earls of Holland and Peterborough . . . associated for the King* (1648); S. R. Gardiner, *Hist. of the Commonwealth* (1894-1901); W. J. Courthope, *Hist. of Eng. Poetry* (1903), iii. 460; Horace Walpole, *Royal and Noble Authors*, iii 304; T. Brown, *Miscellania Aulica* (1702); and the *Fairfax Correspondence* (1848-49). For the correspondence see *Charles II. and Scotland in 1650* (Scottish History Soc. [1894], vol. xvii.); *Calendars of St. Pap. Dom.; Hist. mss. Comm. Series, mss. of Duke of Buccleuch at Montagu House, of Mrs. Frankland-Russell-Astley, of Marq. of Ormonde*, and *Various Collections;* and *English Hist. Rev.* (April 1905), xx. 373.

BUCKINGHAM, HENRY STAFFORD, 2nd DUKE OF (1454–1483), was the son of Humphrey Stafford, killed at the first battle of St. Albans in 1455, and grandson of Humphrey the 1st duke (cr. 1444) killed at Northampton in 1460, both fighting for Lancaster. The 1st duke, who bore the title of earl of Buckingham in right of his mother, was the son of Edmund, 5th earl of Stafford, and of Anne, daughter of Thomas, duke of Gloucester, youngest son of Edward III.; Henry's mother was Margaret, daughter of Edmund Beaufort, 2nd duke of Somerset, grandson of John of Gaunt. Thus he came on both sides of the blood royal, and this, coupled with the vastness of his inheritance, made the young duke's future of importance to Edward IV. He was recognized as duke in 1465, and next year was married to Catherine Woodville, the queen's sister. He was made a knight of the Garter in 1474, and in 1478 was high steward at the trial of George, duke of Clarence. He had not otherwise filled any position of importance, but his fidelity might seem to have been secured by his marriage. However, after Edward's death, Buckingham was one of the first persons worked upon by Richard, duke of Gloucester. It was through his help that Richard obtained possession of the young king, and he was at once rewarded with the offices of justiciar and chamberlain of North and South Wales, and constable of all the royal castles in the principality and Welsh Marches. In the proceedings which led to the deposition of Edward V. he took a prominent part, and on June 24, 1483, he urged the citizens at the Guildhall to take Richard as king, in a speech of much eloquence, "for he was neither unlearned and of nature marvellously well spoken" (More). At Richard's coronation he served as chamberlain, and immediately afterwards was made constable of England and confirmed in his powers in Wales. But early in August Buckingham withdrew to Brecon, where he fell under the influence of his prisoner, John Morton (*q.v.*), who induced him to give his support to his cousin Henry Tudor, earl of Richmond. A widespread plot was soon formed, but Richard had early warning, and on Oct. 15, issued a proclamation against Buckingham. Buckingham, as arranged, prepared to enter England with a large force of Welshmen. His advance was stopped by an extraordinary flood on the Severn, his army melted away without striking a blow, and he himself took refuge with a follower, Ralph Bannister, at Lacon Hall, near Wem. The man betrayed him for a large reward, and on Nov. 1, Buckingham was brought to the king at Salisbury. Richard refused to see him, and after a summary trial had him executed next day (Nov. 2, 1483).

Buckingham's eldest son, Edward (1478–1521), eventually succeeded him as 3rd duke, the attainder being removed in 1485; the second son, Henry, was afterwards earl of Wiltshire. The 3rd duke played an important part as lord high constable at the opening of the reign of Henry VIII. and is introduced into Shakespeare's play, but he fell through his opposition to Wolsey, and in 1521 was condemned for treason and executed (May 17); the title was then forfeited with his attainder, his only son Henry (1501–1563), who in his father's lifetime was styled earl of Stafford, being, however, given back his estates in 1522, and in 1547 restored in blood by parliament with the title of Baron Stafford, which became extinct in this line with Roger, 5th Baron in 1640. In that year the barony of Stafford was granted to William Howard (1614–1680), who after two months was created Viscount Stafford; he was beheaded in 1680, and his son was created earl of Stafford in 1688, a title which became extinct in 1762; but in 1825 the descent to the barony of 1640 was established, to the satisfaction of the House of Lords, in the person of Sir G. W. Jerningham.

The chief original authorities for the life of the 2nd duke of Buckingham are the *Continuation of the Croyland Chronicle*, Sir Thomas More's *Richard III.;* and Fabyan's *Chronicle*. Amongst modern authorities consult J. Gairdner's *Richard III.;* and Sir J. Ramsay's *Lancaster and York*. (C. L. K.)

BUCKINGHAM, JAMES SILK (1786–1855), English author and traveller, was born near Falmouth, the son of a farmer. His youth was spent at sea. After years of wandering he established in 1818 the *Calcutta Journal*. This venture at first proved highly successful, but in 1823 the paper's outspoken criticisms of the East India Company led to the expulsion of Buckingham from India and to the suppression of the paper by John Adam, the acting governor-general. His case was brought before parliament, and a pension of £200 a year was awarded him by the East India Company as compensation. On his return to England Buckingham published the *Oriental Herald* (1824) and the *Athenaeum* (1828) which was not a success in his hands. In parliament, where he sat as member for Sheffield from 1832–37, he was a strong advocate of temperance and of social reform. He was a most voluminous writer, and at the time of his death was at work on his autobiography, two volumes of the intended four being completed and published (1855).

His youngest son, LEICESTER SILK BUCKINGHAM (1825–1867), was a successful playwright, several of his free adaptations of French comedies being produced in London between 1860 and 1867.

BUCKINGHAM AND NORMANBY, JOHN SHEFFIELD, 1st DUKE OF (1648–1721), English statesman and poet, was born April 7, 1648. He was the son of Edmund, 2nd earl of Mulgrave, and succeeded to that title on his father's death in 1658. He served in the fleet and in the army under Charles II, was dismissed from court in 1682, was a firm supporter of James II, but acquiesced in the Revolution. Nevertheless in 1696 he was dismissed from the privy council. On the accession of Anne, with whom he was a personal favourite, he became lord privy seal and lord-lieutenant of the North Riding of Yorkshire, and in 1703 duke of Buckingham and Normanby. During the predominance of the Whigs between 1705 and 1710 Buckingham was deprived of his office as lord privy seal, but in 1710 he was made lord steward, and in 1711 lord president of the council. After the death of Anne he held no state appointment. He died Feb. 24, 1721, at his house in St. James's Park, which stood on the site of the present Buckingham palace. Buckingham was succeeded by his son Edmund (1716–35), on whose death the titles became extinct.

Buckingham, who is better known by his inherited title as Lord Mulgrave, was the author of "An Account of the Revolution" and some other essays, and of numerous poems, among them the *Essay on Poetry* and the *Essay on Satire*. It is probable that the *Essay on Satire*, which attacked many notable persons, "sauntering Charles" among others, was circulated in ms. It was often attributed at the time to Dryden, who accordingly suffered a thrashing at the hands of Rochester's bravoes for the reflections it contained upon the earl. Buckingham was a patron of Dryden, who may possibly have revised it but was certainly not responsible, although it is commonly printed with his works. Buckingham adapted Shakespeare's *Julius Caesar*, breaking it up into two plays, *Julius Caesar* and *Marcus Brutus*. He introduced choruses between the acts, two of these being written by Pope, and an incongruous love scene between Brutus and Portia. He was a constant friend and patron of Pope, who expressed a flattering opinion of his *Essay on Poetry*.

In 1721 Edmund Curll published a pirated edition of his works and was brought before the bar of the house of lords for breach of privilege accordingly. An authorized edition under the superintendence of Pope appeared in 1723, but the authorities cut out the "Account of the Revolution" and "The Feast of the Gods" on account of their alleged Jacobite tendencies. These were printed at The Hague in 1727. Pope disingenuously repudiated any knowledge of the contents. Other editions reappeared in 1723, 1726, 1729, 1740 and 1753. His *Poems* were included in Johnson's and other editions of the British poets.

BUCKINGHAM, municipal borough and market town of Buckinghamshire, England, situated in the northwest corner of the county in the open valley of the upper Ouse, which encircles the main portion of the town on three sides. Pop. (1938), 3,286. Buckingham (Bochingeham; Bukyngham) was an important stronghold in pre-Conquest times, and was the only borough to receive separate mention in the Domesday survey. In 918 Edward the Elder encamped there with his army for four weeks and threw up two forts, one on either side of the water. There are early mentions of markets and fairs, grants by various sovereigns being numerous. Edward III fixed here one of the staples for wool, but after the removal of all these to Calais the trade decayed so much that in an act of Henry VIII Buckingham is mentioned among 36 impoverished towns. The town received no charter until 1554, when Queen Mary created it a free borough, and this grant remained in force until the Municipal Corporations Act of 1835. The comparative decline of Buckingham since the middle ages may be attributed to the development of the routes from London in place of the old S.W.-N.E. routes, and the consequent growth of such towns as Aylesbury, High Wycombe and Wendover, and later of Wolverton and Bletchley. From 1545 until 1867 Buckingham returned two members to parliament, and from 1867 to 1885 one member.

The grammar school was founded by Edward VI, in part occupying buildings of earlier date (part of a charity) which retain a Norman door. Stowe school for boys, opened 1923, occupies Stowe house, former seat of the Grenvilles, dukes of Buckingham. The town is served by branches of the L. M. S. railway and of the Grand Junction canal. It is a market town with agricultural trade and manufactures of condensed milk and leather. The old industry of lacemaking survives to a modified extent. The borough is under a mayor, four aldermen and 12 councillors. Area 8.4 sq.mi. It is in the Buckingham parliamentary division.

BUCKINGHAMSHIRE, EARLS OF. The first earl of Buckinghamshire was John Hobart (*c.* 1694–1756), a descendant of Sir Henry Hobart (d. 1625), attorney-general and chief justice of the common pleas under James I, who was made a baronet in 1611, and who was the great-grandson of Sir James Hobart (d. 1507), attorney-general to Henry VII. In 1740 Hobart became lord-lieutenant of Norfolk and in 1746 earl of Buckinghamshire, his sister, Henrietta Howard, countess of Suffolk, being the mistress of George II. He was succeeded as 2nd earl by his eldest son John (1723–1793), who was member of parliament for Norwich and comptroller of the royal household before his accession to the title. From 1762 to 1766 he was ambassador to Russia, and from 1776 to 1780 lord-lieutenant of Ireland. He died without sons and his half-brother George (*c.* 1730–1804), became 3rd earl.

Robert Hobart, 4th earl of Buckinghamshire (1760–1816), the eldest son of the 3rd earl, was a soldier, and then a member of both the English and Irish houses of commons; from 1789 to 1793 he was chief secretary to the lord-lieutenant of Ireland, exerting his influence in that country to prevent any concessions to the Roman Catholics. In 1793, being known by the courtesy title of Lord Hobart, he was sent to Madras as governor, but in 1798, after serious differences between himself and the governor-general of India, he was recalled. Returning to British politics, Hobart was called up to the house of lords in 1798 (succeeding to the earldom of Buckinghamshire in 1804); from March 1801 to May 1804 he was secretary for war and the colonies (his family name being taken for Hobart town in Tasmania), and in 1805 he became chancellor of the duchy of Lancaster under Pitt. For a short time he was joint postmaster-general, and from 1812 until his death he was president of the board of control.

The 4th earl left no sons, and his titles passed to his nephew, George Robert Hobart (1789–1849), a son of George Vere Hobart (1761–1802), lieutenant-governor of Grenada. In 1824 the 5th earl inherited the Buckinghamshire estates of the Hampden family and took the name of Hampden, his ancestor, Sir John Hobart, 3rd baronet, having married Mary Hampden about 1655. On his death his brother, Augustus Edward Hobart (1793–1884), who took the name of Hobart-Hampden, became 6th earl. The 6th earl's two sons predeceased him, and he was succeeded by his grandson, Sidney Carr Hobart-Hampden (1860–1930), who added to his name that of Mercer-Henderson. His son, John Hampden Mercer-Henderson (1906–), became 8th earl in 1930.

See Lord Hobart's *Essays and Miscellaneous Writings*, edited with biography by Lady Hobart (1885).

BUCKINGHAMSHIRE (abbreviated Bucks), a south midland county of England, bounded on the north by Northamptonshire, east by Bedfordshire, Hertfordshire and Middlesex, south by Berkshire, and west by Oxfordshire. Its area is 749 sq.mi. The county has parts of the basins of Ouse and Thame, and reaches from the chalk Chilterns to the first outcrop of Jurassic rocks which rise in the west to form the Cotswolds, while the extreme south is drained by tributaries of the lower Thames flowing from the chalk.

Geologically it includes a succession of outcropping rocks dipping generally southeast from the Lias in the northwest to the Eocene of the London basin. The Great Oolite rises northwest of Buckingham in gentle undulations to a height of nearly 500 ft. The upper portions are limestones, quarried for building stones at Thornborough, Brock and elsewhere; the lower parts are more argillaceous. A large expanse of Oxford clay, rich grassland and famous hunting country, runs from Bicester to Bedford, including the low divide (Whaddon Chase) between the Vale of Aylesbury (mainly Kimmeridge clay) and the valleys of the Ouse and Ouzel. The clay is covered by numerous outliers of Portland, Purbeck and lower greensand beds. The upper greensand follows, and at the junction with the gault are numerous springs which have determined the sites of several villages. The chalk rises abruptly from the low-lying argillaceous plain to form the Chiltern hills. The crestline of these hills crosses the centre of the county from northeast to southwest at its narrowest point (11 mi.), though another portion, Steps hill, is included in a loop made by the county boundary on the northeast. To the south of this line almost the whole land is hilly the chalk outcropping and determining the form of the hills as far as Beaconsfield and Burnham. Eocene deposits, Reading beds and London clay, occupy the remaining southeast of the county. Between the Tertiary-capped chalk plateau and the Thames a gentle slope, covered with alluvial gravel and brick earth, reaches down to the river. Thick deposits of plateau gravel occur on most of the high ground in the south while much of the northern part is obscured by glacial clays and gravels which help to diversify the soil of this essentially agricultural county. To the west of Aylesbury, on the Oxford border, a few nearly isolated hills stand out, *e.g.*, Muswell hill and Brill hill (each over 600 ft.), marked on the geological map by outliers of gault. The Thames forms the entire southern boundary of Bucks. The River Ouse forms various portions of the northern boundary and receives the River Ouzel flowing along the northeastern side of the county. In the south the dip-slopes of the Chilterns are drained by the Wye, Misbourne and Chess, streams flowing to the southeast.

Traces of early man are not common in the county, though palaeolithic implements have at various times been found in the gravels of the Thames valley. Neolithic man probably inhabited the higher parts of the Chilterns, and though the numerous camps found there seem to be of the early iron age some may date farther back. The Icknield way is without doubt pre-Roman in origin. There is some indication that the Vale of Aylesbury was settled in pre-Roman times. The territory which was to become Bucks was reached by the West Saxons about 570, as by a series of victories they pushed north from the chalk of Hants and Wilts over the upper Thames. A large occupation of the chalk, such as one finds in Kent, Sussex, Berks and Wilts, is not indicated. The higher open ground was inhabited during the early part of the 7th century, as is shown by the mention of the Chiltern-Saetna, or "dwellers in Chiltern," in the tribal hidage, but it is suggested that there may have been a considerable element of native population among them. The Chronicle states that Aylesford, Bensington and Eynsham were captured by the Saxons in 571, and there is abundant archaeological evidence for their occupation of the Vale of Aylesbury. With the grouping of the settlements into kingdoms and the consolidation of Mercia under Offa, Buckinghamshire was included in Mercia until, with the submission of that kingdom to the Northmen, it became part of the Danelaw. In the 10th century Buckinghamshire suffered frequently from the ravages of the Danes, and numerous barrows and earthworks mark the scenes of struggles against the invaders. These relics are especially abundant in the Vale of Aylesbury, probably at this time one of the richest and best protected of the Saxon settlements. The Chiltern district, on the other hand, is said to have been an impassable forest infested by hordes of robbers and wild beasts. In the reign of Edward the Confessor, Leofstan, 12th abbot of St. Albans, cut down large tracts of wood in this district, and granted the manor of Hamstead (Herts) to a valiant knight and two fellow-soldiers on condition that they should check the depredations of the robbers.

The same reason led at an early period to the appointment of a steward of the "Chiltern Hundreds" (*q.v.*). The district was not finally disforested until the reign of James I.

The shire of Buckingham was formed by the aggregation of pre-existing hundreds as they were recaptured from the Danes. This explains the irregularities of the boundary line. As in the case of the midland counties generally, it took its name from the chief town, but it is a matter of some difficulty to understand why Buckingham should have been chosen. It was doubtless the chief town at the time; in the Domesday survey it is the only borough to receive separate mention. From the first, however, the church at Aylesbury tended to become the chief ecclesiastical centre of the county, while Buckingham never had more than one parish and one church. Of monastic foundations the Cistercian abbey of Medmenham was founded in 1201, while the Augustinian Notley abbey dates from 1162. The 18 hundreds of the Domesday survey have now been reduced to eight, of which the three Chiltern hundreds, Desborough, Burnham and Stoke, are unaltered in extent as well as in name.

The proximity of Buckinghamshire to London caused it to be involved in most of the great national events of the ensuing centuries. During the war between King John and his barons, William Mauduit held Hanslape castle against the king, until in 1216 it was captured and demolished by Falkes de Breauté.

The county was visited severely by the Black Death, and Winslow was one of many districts which were almost entirely depopulated. In the civil war Buckinghamshire was one of the first counties to join in an association for mutual defense on the side of the parliament, which had important garrisons at Aylesbury, Brill and elsewhere. Newport Pagnell was for a short time garrisoned by the royalist troops and in 1644 the king fixed his headquarters at Buckingham.

A consideration of communications is best based on the structural facts that have been outlined. Thus there are chains of villages along the water-bearing strips at the foot of the Chilterns, while it was along the Icknield way that the mediaeval traffic passed from the west of England to East Anglia. The raids of the West Saxons from beyond the Thames, and of the Angles from the Wash, were guided by similar influences, while the spread of the great diocese from Oxford and Dorchester to Lincoln is significant. The site and importance of Buckingham is probably indicative of the early use of the route on the oolite from northeast to southwest. In Roman times Watling street was built, crossing the Chilterns near Dunstable (Durocobrivae) in the transverse direction from southeast to northwest. Akeman street used the low route between Tring and Berkhampstead. The mediaeval, turnpike and modern roads chose the same gaps, using the Thames valley in the south and the High Wycombe, Wendover and Tring routes within the county. The main line of the L.M.S.R. uses the gap between Berkhampstead and Ivinghoe and crosses the northeast of the county. Bletchley is an important junction on this system, branches diverging northeast to Bedford and Cambridge, and west to Oxford and Banbury. In the south the chief railway is the G.W. passing through Slough and Taplow. The London Transport system, jointly with the L.N.E.R. and the G.W.R., serves Aylesbury, Chesham, High Wycombe and Princes Risborough.

There is no general manufacturing industry, though there are important factories at Slough. Boatbuilding, on the banks of the Thames, developed after the middle of the 19th century. High Wycombe is a centre of the manufacture of chairs and other furniture, and in the neighbourhood the centuries-old trade in turnery manages to subsist, chiefly owing to the presence of the beech woods of the Chilterns.

Lacemaking for a long period formed the most important industry of Buckinghamshire, but it is extremely small, while the making of straw-plait has almost died out. Paper mills were established in the Thames valley at the end of Elizabeth's reign, being centred at Aylesbury. Chesham has a trade in woodworking and brushmaking. Newer industries include those connected with communications. The Wolverton works, belonging to the L.M.S.R., give employment to the largest number of men in the north of the county.

The soils of the county vary greatly in different localities. On the lower lands, especially in the Vale of Aylesbury, about the headwaters of the Thame, they are extremely fertile. Beech is the predominant tree in the woods. In the south a remnant of ancient forest is preserved as public grounds under the name of Burnham Beeches (*q.v.*). There are numerous old-established private parks such as Biddlesden, Ditton, Thornton and Whaddon. The Cliveden and Hampden estates are perhaps the most famous in the county.

The former was presented by Viscount Astor to the National Trust, which owned, besides, 2.7 sq.mi. in the county in 1941 Of old country houses, Chequers Court dates from the late 16th century and in 1921 became an official residence of British prime ministers. Many towns and villages have become famous for their associations with statesmen or poets; *e.g.*, Stoke Poges with Gray, Beaconsfield with Burke, and Hughenden with Disraeli. Slough was the home of Herschel, who set up his great telescope there. The most notable institution within the county is Eton college.

Much of Buckinghamshire is pasture; of the total of 358,287 ac. under crops and grass in 1939, only about 19% was arable land. The raising of sheep and cattle (198,586 and 101,891 respectively) in 1939 was the main agricultural industry though pigs (45,265) were important. The principal crops are wheat (19,173 ac.) and oats (12,976 ac.). Beans occupy only a small acreage, but fruit is grown successfully. The Aylesbury district is famous for duck raising.

The area of the county is 749 sq mi., with an estimated population in 1938 of 309,600. However, wartime shifts in the population affected Buckinghamshire more than any other county, its population having increased 35% between Sept. 1939 and Feb. 1941, much of the increase being due to the exodus from London. It is in the midland circuit, and assizes are held at Aylesbury. It has one court of quarter sessions, and in 1943 was divided into 14 petty sessional divisions. The administrative county contained 223 civil parishes. It is entirely within the diocese of Oxford, but gives its name to a bishopric suffragan. There are three parliamentary divisions; those of Aylesbury, Buckingham and Wycombe, each returning one member. The municipal boroughs are Aylesbury, the county town; Buckingham; Chepping Wycombe, also Wycombe or High Wycombe; and Slough. Urban districts are Beaconsfield, Bletchley, Chesham, Eton, Linslade, Marlow, Newport Pagnell and Wolverton.

Other towns are Amersham, Olney, Princes Risborough and Wendover. Several of the villages on or near the banks of the Thames have become centres of residence, such as Taplow, Burnham and Woodburn.

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See also W. Bradbrooke and Prof. F. G. Parsons, "The Anthropology of the Chiltern Hills," *J.R.A.I.*, vol. lii. (1922).

BUCKLAND, FRANCIS TREVELYAN (1826–1880), English zoologist, son of Dean William Buckland, the geologist, was born at Oxford, and became house-surgeon at St. George's hospital, London, in 1852. The pursuit of anatomy led him to a good deal of out-of-the-way research in zoology, and in 1856 he became a regular writer on natural history for the newly-established *Field*, particularly on the subject of fish. In 1866 he started *Land and Water* on similar lines. In 1867 he was appointed government inspector of fisheries. Among his publications, besides articles and official reports, were *Fish Hatching* (1863), *Curiosities of Natural History* (1857–72), *Logbook of a Fisherman* (1875), *Natural History of British Fishes* (1881).

See *Life* by G. C. Bompas (1885).

BUCKLAND, WILLIAM (1784–1856), English divine and geologist, was born at Axminster. Educated at Tiverton grammar school and at Winchester, he was a scholar and then a fellow of Corpus Christi college, Oxford. He devoted himself systematically to an examination of the geological structure of Great Britain. In 1813, on the resignation of Dr. John Kidd, he was appointed reader in mineralogy in Oxford and was the first holder of the readership in geology. In 1818 Dr. Buckland was elected a fellow of the Royal Society, and in 1824 and again in 1840 was chosen president of the Geological Society. In 1825 he was presented by his college to the living of Stoke Charity, near Whitchurch, Hants, and in the same year he was appointed by Lord Liverpool to a canonry of the cathedral of Christ Church, Oxford. In 1825, also, he married Mary Morland, who assisted him in his literary work. In 1832 he presided over the second meeting of the British Association held at Oxford. In 1845 he was appointed by Sir Robert Peel to the vacant deanery of Westminster, and was soon after inducted to the living of Islip, near Oxford, a preferment attached to the deanery. In 1847 he was appointed a trustee of the British Museum. He died on Aug. 24, 1856. His first great work was *Reliquiae Diluvianae, or Observations on the Organic Remains contained in caves, fissures, and diluvial gravel attesting the Action of a Universal Deluge*, published in 1823 (2nd ed. 1824). His paper on "Geology and Mineralogy," published as one of the *Bridgewater Treatises* (*see* Bridgewater, Francis Henry Egerton) in 1836, went through three editions, the third of which, issued in 1858, was edited by his son, Francis T. Buckland, and is accompanied by a memoir of the author.

BUCKLE, GEORGE EARLE (1854-1935), British man of letters, was born at Twerton, near Bath, and educated at Winchester and New college, Oxford. From 1877 to 1885 he was a fellow of All Souls college. In 1880 he joined the editorial staff of *The Times*, London; four years later, while still under 30, he succeeded Thomas Chenery as its editor. This position he occupied for more than 28 years, retiring in Aug. 1912. When Mr. Monypenny, the biographer originally entrusted with the official *Life of Disraeli*, died in 1912, leaving his task unfinished, Mr. Buckle took over the work of completing it; under his authorship vols. 3, 4, 5 and 6 were published between 1914 and 1920. Buckle also edited *The Letters of Queen Victoria*, second and third series.

BUCKLE, HENRY THOMAS (1821–62), English historian, author of the *History of Civilization*, the son of Thomas Henry Buckle, a wealthy London merchant, was born at Lee, Kent, on Nov. 24, 1821. Owing to his delicate health he was only a very short time at school. He gained his first distinctions not in literature but in chess, being reputed, before he was 20, one of the first players in the world. After his father's death in Jan. 1840 he spent some time with his mother on the continent from 1840 to 1844. He now resolved to devote all his energies to the preparation of some great historical work. By 1851 he had decided in favour of a history of civilization. The first volume, which appeared in June 1857, made its author famous. The second volume was published in May 1861. From the end of Oct. 1861 to the beginning of March 1862 he was in Egypt, from which he went over the desert of Sinai and of Edom to Syria, reaching Jerusalem on April 19, 1862. After staying there 11 days, he set out for Europe by Beirut, but at Nazareth he was attacked by fever; and he died at Damascus May 29, 1862.

Buckle's fame, which must rest wholly on his *History of Civilization in England*, is no longer what it was in the decade following his death. His *History* is a gigantic unfinished introduction, of which the plan was, first to state the general principles of the author's method and the general laws which govern the course of human progress; and secondly, to exemplify these principles and laws through the histories of certain nations characterized by prominent and peculiar features—Spain and Scotland, the United States and Germany. In summing up Buckle's achievement Sir Leslie Stephen said: "What he did was not to achieve new results in the sciences of history, but to popularize the belief in the possibility of applying scientific treatment to historical problems."

Bibliography.—*See* A. W. Huth, *Life and Writings of Henry Thomas Buckle* (1880); and Sir L. Stephen in the *Dictionary of National Biography*.

BUCKLER, a shield with a boss in the centre (from old French *bocle* or *boucle*, a boss or a small round shield); now usually, but wrongly, refers to the entire shield.

BUCKMASTER, STANLEY OWEN, 1st Viscount (1861–1934), English lawyer, educated at Christ Church, Oxford He was called to the bar at the Inner Temple in 1884 and took silk in 1902. In 1906 he successfully contested Cambridge in the Liberal interest. Defeated at the general election of 1910, he re-entered the House in 1911 as member for Keighley, and, in 1913, was appointed solicitor-general, being knighted in the same year. In May 1915 Sir Stanley Buckmaster was appointed lord chancellor, and he was raised to the peerage in the following month. Here he was energetic, receptive of new ideas and powerful in debate. In 1916 he went out of office with Asquith; but continued to sit in a judicial capacity in the Lords. He was an advocate of divorce law reform. He was created viscount in 1933.

BUCKNER, SIMON BOLIVAR (1823–1914), American soldier and political leader, was born in Hart county, Kentucky, on April 1, 1823. Graduating at West Point in 1844, he was assistant professor of geography, history and ethics there in 1845–46. He fought in the Mexican War, received the brevet of first lieutenant for gallantry at Churubusco, and later, the brevet of captain. In 1848–50 he was assistant instructor of infantry tactics at West Point, later in the recruiting service, on frontier duty, and in the subsistence department. He resigned in March, 1855. During the attempt of Governor Magoffin at the outbreak of the Civil War to keep Kentucky neutral he commanded the State guard; but in Sept., 1861, after the entry of Union forces into the state, he espoused the Confederate cause, becoming eventually lieutenant-general. He was third in command of Fort Donelson when General Grant attacked (Feb. 1862), and it fell to him to surrender the post with its large garrison and valuable supplies. He was exchanged in August of the same year, and subsequently served under General Bragg in the campaign of Chickamauga. He was governor of Kentucky in 1887–91, a member of the Kentucky constitutional convention of 1890, and in 1896 candidate of "Gold" Democrats for vice-president of the United States. He died in Munfordville (Ky.), Jan. 8, 1914.

BUCKRAM, in modern days, a coarse fabric of linen or cotton stiffened with size or glue, and used for the stiffening of parts of clothes and in bookbinding. Falstaff's "men in buckram" (Shakespeare, Henry IV, pt. I., ii. 4) has become proverbial, and the word is often used as implying a false show of strength due to artificial stiffening. The derivation is from O.Fr. *boucaran*, a coarse cloth.

BUCKSTONE, JOHN BALDWIN (1802–1879), English actor and dramatic writer, was born at Hoxton, London, on Sept. 14, 1802. He made his first London appearance, on Jan. 30, 1823, at the Surrey theatre, as Ramsay in the *Fortunes of Nigel*. His success led to his engagement in 1827 at the Adelphi, where he remained as leading low comedian until 1833. At the Haymarket were produced a number of his plays and farces—*Ellen Wareham*, *Uncle Tom* and others. After his return from a visit to the United States in 1840 he played at several London theatres. As manager of the Haymarket he surrounded himself with an admirable company, including Sothern and the Kendals. He produced the plays of Gilbert, Planché, Tom Taylor, and Robertson, as well as his own, and in most of these he acted. He died on Oct. 31, 1879. He was the author of 150 plays. His daughter, Lucy Isabella Buckstone (1858–93), was an actress.

BUCKTHORN, known botanically as *Rhamnus catharticus* (family Rhamnaceae), a much-branched shrub reaching 10ft. in height, with a blackish bark, spinous branchlets, and ovate, sharply-serrated leaves, 1 to 2in. long, alternately arranged and somewhat fascicled at the ends of the shoots. The small green flowers are regular and have the parts in fours; male and female flowers are borne on different plants. The fruit is succulent, black and globose, and contains four stones. The plant is a native of England, occurring in woods and thickets chiefly on chalk; it is rare in Ireland and not wild in Scotland. It is native in Europe, north Africa and north Asia, and naturalized in parts of eastern North America. The fruit has purgative properties; the bark yields a yellow dye.

An allied species, *Rhamnus frangula*, is also common in England, and is known as berry-bearing or black alder. It is distinguished from buckthorn by the absence of spiny branchlets, its non-serrated leaves, and bisexual flowers with parts in fives.

Seabuckthorn is *Hippophae rhamnoides* (family Eleagnaceae), a willow-like shrub, 1 to 8ft. in height, with narrow leaves silvery on the underside, and globose orange-yellow fruits one-third of an inch in diameter. It occurs on sandy seashores from York to Kent and Sussex, but is not common. In the United States there are 12 or more native species of buckthorn, most numerous on the Pacific coast, 8 occurring in California, one of which, *R. purshiana* yields the medicinal *Cascara sagrada* (*q.v.*).

BUCKWHEAT, the fruit (so-called seeds) of *Fagopyrum esculentum* and of the allied species *F. tataricum*, an herbaceous plant, native of central Asia but cultivated also in Europe and North America. The fruit has a dark brown or gray tough rind enclosing the kernel or seed and is three-sided in form, with sharp angles, similar in shape to beech mast, whence the name from the Ger. *Buchweizen*, beechwheat. Tartary buckwheat fruits have rounded angles. The attractive white flowers depend upon bees and other insects for their pollination. Buckwheat grain is used for livestock feed. The hulled seeds, or groats, and the flour are used for human food. The chief food use in the United States and Canada is in the form of griddle cakes made from the flour, often mixed with wheat flour. "Buckwheat cakes" are brown, palatable and nutritious. Buckwheat often is grown for green manure or for smothering weeds. It is an important honey plant. On good soils buckwheat is less productive than other grain crops but it is particularly adapted to unproductive hilly lands. Its quick maturity makes buckwheat well adapted as a late-sown "catch" crop.

Two varieties, viz., Japanese and Silverhull are commonly grown in various parts of the world.

Russia (U.S.S.R.), France, Poland, Canada and the United States lead in buckwheat production. In Great Britain it is not of sufficient importance to be separately distinguished in the annual agricultural returns, but it is estimated that about 1,750 ac. are devoted to its cultivation in England and Wales. It is mainly used in England for feeding pheasants, for which it is considered specially suitable, and poultry, but it is also valuable for other kinds of farm stock. The crop is sometimes sown for feeding off green by sheep, or for ploughing under as green manure.

(J. H. Mn.)

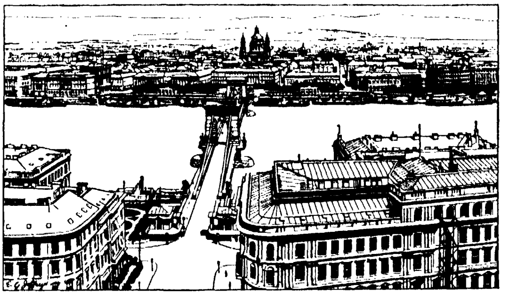
BUCOLICS, a term occasionally used for rural or pastoral poetry. The expression has been traced back in English to the beginning of the 14th century, being used to describe the "Eclogues" of Virgil. The most celebrated collecton of bucolics in antiquity is that of Theocritus, of which about 30 in the Doric dialect, and mainly written in hexameter verse, have been preserved. This was the name, as is believed, originally given by Virgil to his pastoral poems, with the direct object of challenging comparison with the writings of Theocritus. In modern times the term "bucolics" has not often been specifically given by the poets to their pastorals; the main exception being that of Ronsard, who collected his eclogues under the title of "Les Bucoliques." (*See* also Pastoral.)

BUCYRUS, a city of Ohio, U.S.A., 60 mi. N. of Columbus, on the watershed of the State, at an elevation of about 1,000 ft.; the county seat of Crawford county. It is on the Lincoln highway, and is served by the Pennsylvania and the New York Central railroads. The population in 1930 was 10,027; in 1940 it was 9,727. Division offices and shops of the Ohio central lines of the New York Central are situated here, and there are diversified industries. Among the distinctive products are copper kettles, locomotive cranes, automobile hoists, metal mail-boxes and cabinets, manganese steel, aluminum and brass castings, children's garments, grave vaults, cotton-picking machines, road-rollers, clay and cement machinery, fluorescent lights, rubber garden hose, small vehicle tires and hog and pig rings.

Bucyrus was settled in 1817; laid out in 1822; incorporated as a village and established as the county seat in 1830 and chartered as a city in 1885. It is at the intersection of the old turnpikes from Ft. Wayne to Pittsburgh and from the Ohio river to the Lakes. Its name is said to have been invented by Col. James Kilbourne, a surveyor who assisted the founder (Samuel Norton) by prefixing the syllable "bu," to suggest "beautiful," to the name of Cyrus, whom he admired.

BUD: *see* Flower; Leaf.

BUDAPEST, the capital and largest town of Hungary, is situated on both banks of the Danube and includes the former towns of Buda and O-Buda on the right bank and Pest, together with Köbánya, on the left bank. The site of the town is one of extraordinary geographical energy. The Danube has few good crossing places on its north-south course over the Hungarian plain, and the frowning hills (770ft.), over which straggle the old fortress and town of Buda, with their steep plunge beneath the sandy plain of Pest, are conveniently approached by an intermediate step in the river, the Margaret island. Around the hills curve easy valleys leading to the fertile plain of the Little Alföld and the wooded downs of Transdanubia. Northward the Danube valley is a threshold to the mines and pastures of the highlands, while the local heights are rich in building stone, lime and mineral springs. Less constricted than Esztergom and more central than either Esztergom or Székesfehérvár, the old capitals, the plain of Pest was a convenient rallying point for tribal conclaves which were protected by the marshes and by Buda. In time Buda became the outer guard of Vienna, since it commanded the gate between the Bakony mountains and the Carpathian ranges, by which that city is approached from the east.



LOOKING ACROSS THE CHAIN BRIDGE (LANCHID) FROM BUDA TO PEST. THE MOST IMPOSING OF THE BUILDINGS IS THE LEOPOLDSTADT BASILICA WITH ITS DOME 315 FT. HIGH

There is evidence of settlement on the right bank during pre-Roman time. The Romans founded a colony, which they called Aquincum, a little north of the site of a previous settlement, and where O-Buda now stands. This acted as an outpost of the empire until A.D. 376, when it fell before the assaults of the barbarians. History is silent about the centuries that elapsed before the Magyar invaders approached, but it is certain that when they arrived towards the close of the 9th century they found Slavonic settlements on the present sites of Buda and Pest. (Slav. Pestj = oven; *cf.* the Ger. term "Ofen" for Buda.) In 1241 Pest was destroyed by Mongols, after whose departure Bela IV., king of Hungary, founded the modern Buda (1247), and repeopled Pest with colonists of German and other nationalities. From this time onward both towns made rapid progress in the development of their separate functions. In 1361 Buda was selected as the capital of Hungary and henceforth gathered to itself the administrative duties while Pest looked more and more towards commerce. But neither was allowed to advance undisturbed. For centuries the rock of Buda overlooked scenes of strife between West and East, yet despite the periods of hardship, the attraction of its key position brought many compensations. Crusaders from the West brought with them the glories and advantages of 14th century French civilization. French masons and Italian artists combined to produce in Buda a city fit to rival those of the West, while Flemish and Venetian merchants raised Pest to the rank of one of the leading commercial centres of Europe. Then, in 1526, Pest was captured and sacked by the Turks, and later (1541) Buda was occupied and until 1686 controlled by Turkish pashas. Their architectural and other treasures stolen or destroyed, both towns were, at the close of this occupation, little more than ruins. But geographical site and situation, combined with historical tradition, were strong enough to overcome even this catastrophe. Stimulated by the patronage of Maria Theresa and Joseph II., revival was rapid, particularly in Pest, which in the 19th century completely outstripped Buda. In 1872 both towns were united into one municipality, Budapest, which became the political, commercial and intellectual centre of Hungary. World War I, followed by a brief period of Communist rule in 1918–19 and by Rumanian occupation and looting in 1919, brought its development to a standstill. The conclusion of peace caused an influx of thousands of refugees and unemployed officials from the lost Hungarian territories and resulted in much unemployment and a serious housing shortage. The milling industry, the greatest in Europe, upon which the city depended so heavily, was almost ruined by the high import duties upon grain entering Hungary and the difficulty of establishing relations with former customers. Further, since Budapest shared with Vienna the financial control of south-east Europe, the loss of this side of its commercial life brought ruin to many. The position began to improve after the financial reconstruction of 1924 and as a result of the action of the international committee of enquiry that met at Basle in Jan. 1925 to examine the financial position of the city in the interests of its bondholders.

The modern town covers an area of about 80sq.m., on both sides of the river, which varies in width from 300 to 650 yards. The two banks are connected by six bridges, which include one of the largest suspension bridges in Europe. In almost direct continuation of one end of this bridge a tunnel 383yd. long pierces the hill on which the castle of Buda is built.

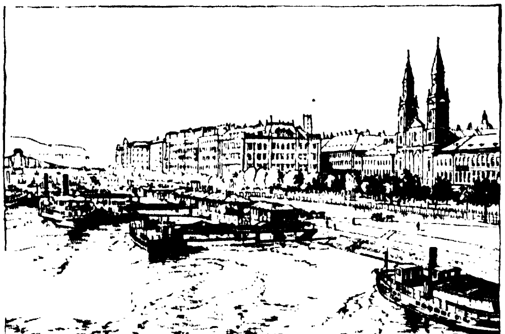
Buda, though of ancient origin, resembles Pest in its lack of buildings of historic and architectural interest. Both convey the impression of comparatively recent creation but the peace of Buda produces an appearance of old-world quietude that is a pleasing contrast to the bustle of its busy partner. Shabby, yellow-plastered houses, with here and there odd reminders of earlier glories in the shape of old arches and simple inscriptions commemorating the residence of by-gone notabilities, linger in the shadow of grandiose buildings in the ostentatious style that characterized the architecture of Budapest during the wave of construction that swept over it during the closing decade of last century. Reconstructions during the course of time to replace the ravages of war have failed to capture the spirit of continuity. Yet Buda has impressive buildings that are not without inspiration for its citizens. The plateau, which is approached by road, by terraced walks or by funicular railway, is crowned by the citadel and royal palace. Erected in 1748–71, it was partially destroyed by fire in 1849 but restored and enlarged in 1894–1905. The palace now contains 860 rooms, many of them furnished and decorated with great magnificence. A short distance away rises the coronation church, begun by King Bela IV. in the 13th century in Romanesque style and completed in Gothic by King Matthias Corvinus in the 15th century. After a period of service as a mosque during the Turkish occupation it lost some of its importance but regained it following the coronation there of Francis Joseph, and it was thoroughly restored in 1873–96. Behind the church is a fine bronze equestrian statue of King Stephen the Saint, which, situated near the edge of the plateau, overlooks the Fisher bastion and ramparts that terrace the slope. In Buda, too, are situated some of the larger curative baths for which the city is famed; these are at the base of the Blocksberg, where hot thermal springs (115°) gush from the limestone beds.

Standing on the heights of Buda, at the threshold of the huge Hungarian plain, the whole extent of Pest opens in a magnificent panorama. Below, hugging the hills, runs the Danube, broken by Margaret island with its baths, hotels and pleasure resorts, and bordered on the left bank by broad quays and on both banks by wide embankments; here human construction has been worthy of the greatness of the river. Lining the river on the left bank is a long range of imposing buildings, including the houses of parliament, a large late Gothic edifice erected in 1883–1902, the academy, in Renaissance style, the larger hotels and the Custom house. Beyond the left embankment, which stretches for a length of 2½m., the old "inner town" of Pest is the nucleus of the city. Built on a slight elevation, sufficient in earlier times to give protection from flood, it is the shopping centre and is encircled by wide boulevards, the Belsökörút or inner circle, on the site of the old walls. From it streets radiate like the spokes of a wheel, while built around this inner town is the new Pest, a vast number of large dwelling-houses and public buildings intersected by two other semicircular girdles commencing and ending at the Danube, the Nagykörút or large circle and the Külsökörút or outer circle, beyond which lie the manufacturing districts. Narrow cobbled streets, broad acacia-bordered boulevards, wide squares, lined with substantial buildings and dotted with gardens and monuments, all contribute to the grandeur of one of the most beautiful capitals of Europe.

Pest, too, has its fine buildings. Apart from those already mentioned the most striking in the town are the Basilica church, a Romanesque building with a dome 315 ft. in height, the opera house, in the Italian Renaissance style, the redoute buildings, in mixed Moorish and Romanesque styles, the university and the palace of justice, all of these dating from the latter half of the 19th century. Amongst the many other fine buildings may be mentioned the agricultural museum, the museum for fine arts and the national archives.

The finest thoroughfare in Budapest, the Andrassy avenue, runs in a straight line from the centre of the city to the city park, which is entered by way of the millennium monument, a semicircular pillar-colonnade, housing statues of the Hungarian kings and allegoric bronzes with, in the centre, a column, 117 ft. high, surmounted by a statue of the archangel Gabriel. The city park (Városliget), covers 240 ac. and is the centre of a vast system of amusements. In close proximity to it lie several museums, the zoological gardens and other smaller parks.

In many other directions Budapest has endeavoured to escape from the overshadowing influence of Vienna and to act as the real centre of inspiration for its country. Part of the scheme involved a strenuous effort to keep its students at home, and for this purpose numerous educational institutions of all types and grades were established. At the head is the University of Budapest with a staff of 500 and some 4,000 students. There is an institute of technology with a staff of 250 and about 2,500 students. The city also possesses an adequate number of elementary and secondary schools with a great number of special and technical schools. Scientific and literary societies are headed by the Academy of Sciences, founded in 1825, the Kisfaludy society (1836) and the Petöfi society (1875); the last two aim at the preservation of the Hungarian language and folklore. Other active associations of peculiar significance are the central statistical department, the communal bureau of statistics and the Hungarian sociographical institute. The natural love of music is furthered by the academy of music, of which Liszt was at one time director, and in addition the government maintains schools of drama and painting.



FRANZ JOSEF QUAI. THE MOST IMPORTANT OF THE LONG STRETCH OF QUAYS THAT FRONTS THE PEST SIDE OF THE DANUBE, AND IS LINED WITH MANY IMPOSING BUILDINGS

The growth of Budapest and the development of its cultural aspects was most rapid after the *Ausgleich* with Austria in 1867. After that time centralization was the watchword of the awakened national consciousness of Hungary. To that ideal transport, manufacture, trade and intellectual opportunities had been subordinated. The capital has little competition to meet from regional centres within the country. In fact it has grown at their expense and its composite population has become nine-tenths Magyar by absorption of non-Hungarian and by immigration from Hungarian regions. Thus, while in 1880 the population was 355,682, of whom 56.7% were Magyars, 34.4% Germans and 6.1% Slovaks, the corresponding figures for 1930 were as follows: —1,006,184, 94.3%, 3.8%, 0.8%. Pop. (1939) 1,115,877. The first step in the movement to rival Vienna was made in 1848 when Budapest became the seat of the legislature, and the promotion of its interests has been an integral feature of the policy of government. Consolidation of the political supremacy is the accomplishment of the Magyar aristocracy but the commercial and industrial leadership is the work of the Jews. The years after 1918 were marked by an extraordinary display of anti-Semitic feeling quite opposed to the original attitude of toleration customary in the city. This anti-Semitism grew under German influence, when Hungary decided to throw in her lot with the axis and participated in World War II. New industries, notably textiles and chemicals, rose to replace the older basic occupations of milling and steel-working. Other industries of importance are brewing, distilling and the manufacture of tobacco and leather goods. As a trading centre Budapest owes its importance to an energetic utilization of its natural advantages by the Hungarian government.

The trade of Hungary (*q.v.*), primarily an agricultural country, in stock, cereals, wines, hides and wool is handled on exchanges situated in the capital. To it much of the produce passes by road or river for redistribution and the government's assistance to industrial undertakings has always been controlled by an effort to locate the principal activities in Budapest. A zone system of railway development focussing on the capital has fostered this concentration.

Figures given above supply some indication of the phenomenal growth of the city, at least until the outbreak of World War II. Only Berlin surpassed Budapest in this direction, and the rate of increase during the first 90 years of the 19th century was nearly two and a half times that of London.

Budapest may be said to express faithfully the spirit of contemporary Hungary. It grew as a concrete expression of the national consciousness under the inspiration of such notable reformers and patriots as Count Stephen Szechenyi and derived great benefits from the diverse elements in its population. Like Vienna, but to a lesser degree, it suffered by its size in comparison with the reduced territory it served. Strenuous efforts to overcome the resultant difficulties were made, notably in the direction of attracting foreign visitors. Its virtues as a health resort and centre for tourists were well advertised. Such progress was, however, arrested during World War II, particularly after Hungary joined Germany in the invasion of the U.S.S.R. Under constant threat of bombing, the capital was blacked out, and experienced its first air-raid alarm in Sept. 1942.

See also F. B. Smith, *Budapest, the city of the Magyar* (1903); R. Millet, *Budapest et les Hongrois* (1913). (W. S. L.; X.)

BUDAUN, a town and district of British India, in the Rohilkhand division of the United Provinces. The town is near the left bank of the river Sot. Pop. (1941) 52,077. There are ruins of a powerful fort; and a handsome mosque of imposing size, crowned with a dome, and built in 1223, from the materials of an ancient Hindu temple, has recently been restored. According to tradition Budaun was founded about A.D. 905. After its capture by Kutb-ud-din in 1196 it became a very important post on the northern frontier of the Delhi empire. In the 13th century two of its governors, Shams-ud-din Altamsh, the builder of the great mosque, and his son Rukn-ud-din Firoz, attained the imperial throne. In 1571 the town was burned, and about a hundred years later, under Shah Jahan, the seat of the governorship was transferred to Bareilly. It ultimately came into the power of the Rohillas, and in 1838 was made the headquarters of a British district.

The District of Budaun has an area of 1,994 sq.mi. Pop. (1941) 1,162,322. The country is low, level, and generally fertile, and is watered by the Ganges, the Ramganga, the Sot or Yarwafadar, and the Mahawa. Budaun district was ceded to the British government in 1801 by the nawab of Oudh. There are several indigo factories.

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BY COURTESY OF (1, 3, 4, 5, 6) THE MUSEUM OF FINE ARTS, BOSTON, FROM (2) THE WARREN E COX COLLECTION

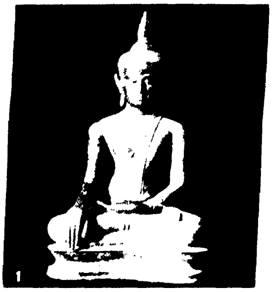
BUDDHA AND MINOR BUDDHIST DEITIES

1. Samantabhadra (Fugen), a Bodhisattva, one of Buddha's attendants, riding on an elephant. This Japanese painting on silk is of the Ashikaga period, late 15th century. 2. Figure of Daruma Buddha in Fukien porcelain, Ming Dynasty, China (1368–1644). 3. Padmapāni (Shō Kuanyin), the Holy Compassionate Lord. This Japanese painted wooden panel, from a

vara (a Bodhisattva), with eleven faces and eight arms, a Lamaist painting, Ming period, 16th century. 5. Maitreya (Miroku), here represented as a Bodhisattva in sculptured wood, overlaid with gold leaf. This Japanese work, by Kwaikei in 1189, is of the Kamakura period. 6. Avalokitesvara (Kuanyin), with a thousand arms and faces. The painting shows the

PLATE II

BUDDHA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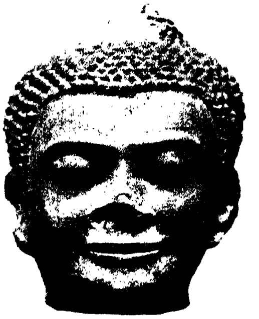
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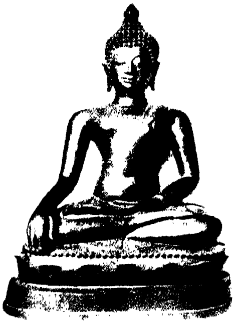
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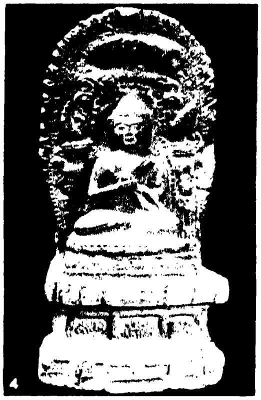
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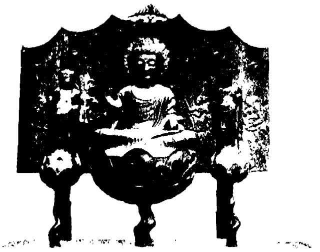
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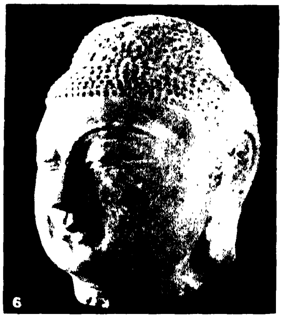
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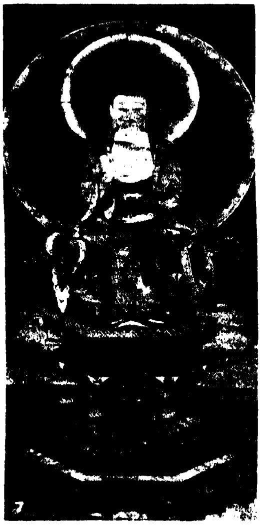
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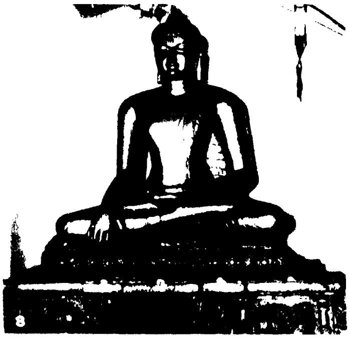
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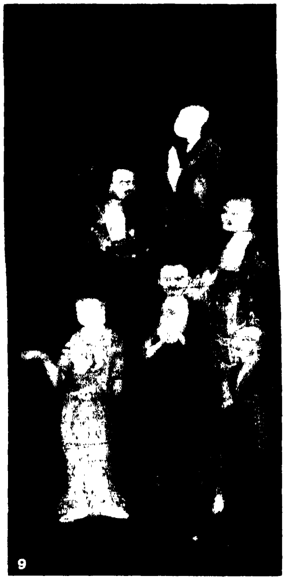
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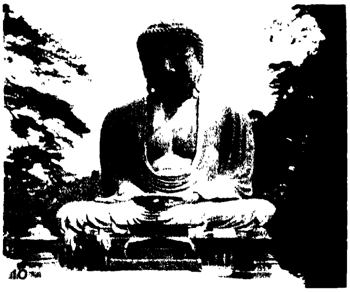
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BY COURTESY OF (1, 3) THE ROYAL INSTITUTE, BANGKOK, SIAM, (2) THE FOGG ART MUSEUM, HARVARD UNIVERSITY, (4, 6) THE CHICAGO NATURAL HISTORY MUSEUM, CHICAGO, (5) THE TRUSTEES OF THE BRITISH MUSEUM, (7, 9) THE MUSEUM OF FINE ARTS, BOSTON, (10) THE CANADIAN PACIFIC STEAMSHIPS, PHOTOGRAPH (8) BOURNE AND SHEPHARD

1. A 14th century bronze, found at Lopburi, Siam, a combination of Cambodian and Sakkodaya types. 2 Head of Buddha, Cambodian 10th–12th century. 3. Figure found at Chieng Mai, Siam, a northern Thai type, 13th–14th century. 4. Stone image of Buddha as Nageśvara, lord of the serpent-demons, Ming period, China, 1368–1644. 5. Statues of Buddha Amitabha and two head of Buddha, of gray stone. T'ang period, China, 618–907. 7. The Buddha Sakyamuni *preaching*, a Japanese *painting late* 15th century. 8. Statue of Buddha in the sanctuary of the temple at Gaya, India. 9. The Bodhisattva Samantabhadra and five of the Ten Great Disciples of Sakyamuni Buddha, a Japanese painting of the Kamakura period, 13th century. 10. Colossal bronze Amita

BUDDEUS, JOHANN FRANZ (1667–1729), German Lutheran divine, was born on June 25, 1667, at Anklam, Pomerania, where his father was pastor. He studied at Greifswald and at Wittenberg, was appointed professor of Greek and Latin at Coburg in 1692, professor of moral philosophy at Halle in 1693, and in 1705 professor of theology at Jena. In 1715 he became Primarius of his faculty and member of the Consistory. He died at Gotha on Nov. 19, 1729.

His principal works are: *Leipzig, allgemeines historisches Lexikon* (Leipzig, 1709 ff.); *Historia Ecclesiastica Veteris Testamenti* (4 vols., Halle, 1709); *Elementa Philosophiae Practicae, Instrumentalis, et Theoreticae* (3 vols., 1697); *Selecta Juris Naturae et Gentium* (Halle, 1704); *Miscellanea Sacra* (3 vols., Jena, 1727); and *Isagoge Historico-Theologica ad Theologiam Universam, singulasque ejus partes* (2 vols., 1727).

BUDDHA and **BUDDHISM.** Buddhism is the religion of the followers of Gautama Buddha, which formerly covered a large area in India, and is still widely spread in Ceylon, Burma, Siam, Cambodia, China and Japan. It arose in the 6th century B.C., as an offshoot of the prevailing Hindu religion of north India, in what is now approximately Bihar, west of Bengal. There are no historical records of this period, and our whole knowledge rests upon the religious documents of prebuddhistic Hinduism and on references in the Buddhist scriptures. Hinduism was then a polytheistic system possessing collections of sacred books, the Vedas and Brāhmaṇas. It had been developed in the hands of the priests into an elaborate sacrificial and ritual system, to which was adapted the social theory of caste (*q.v.*), with the priestly caste of brahmins claiming primacy over the rest. In the Upanishads, the latest development of the Vedic literature, there had already appeared the beginnings of a pantheistic philosophy, which sought a single reality behind all individual gods, and aimed at salvation not in the performance of ceremonies, but in the attainment of union with this reality.

Buddhism was only one of the protests which appeared at this time against the prevailing formalism. Ethically it sought reform in rejecting the authority of the Vedas and in teaching an independent morality, and philosophically in denying any permanent substratum in the world or in any of the gods of the Vedic pantheon. Independently of all such theories it offered a way for the attainment of salvation, which was set forth as being the discovery of the founder.

Authorities.—A large number of official documents exist as the Buddhist scriptures, purporting to record the exact teaching of the founder, but they all have been put into their present form after the split up of the community into sects. Only one of these collections now exists in completeness in any Indian language, the Canon of the Theravādins, "the school of the Elders," in Pāli, which still flourishes in Ceylon and further India. It owes its preservation to the fact that it was introduced into Ceylon by Buddhist missionaries in the 3rd century B.C. Thence it spread to Burma and Siam. It is held to have been reduced to writing in Ceylon, early in the 1st century A.D. Variant forms of the Canon, as it existed in other schools, are known from Chinese translations, and the chief divergences from the Pāli collection appear to be not doctrinal, but due to the fact that the records were preserved for centuries by memorizing, and that differences of arrangement and tradition arose inevitably between widely separated communities of monks. It is certain from the Pāli that there were various sects, which all appealed to the same authoritative records.

In all the older schools the Canon exists in a threefold division, the Tri-piṭaka, "the threefold basket." This consists of (1) the Vinaya-piṭaka, a collection of the 227 rules of discipline (*vinaya*) binding on the monks. The four most fundamental of these rules, violation of which involved expulsion from the Order, are those which forbid unchastity, theft, taking life or inciting to suicide, and making a false claim to supernormal powers. A second set of rules follows dealing with the organization of the several communities, and a commentary now reckoned as canonical accompanies the whole. (2) The most important section for doctrine (*dhamma*) is the *Sutta-piṭaka*, arranged in five collections of suttas or discourses called Nikāyas, or in some schools Āgamas. The first four Nikāyas are common to all the older schools. They consist chiefly of discourses attributed to the Buddha, but among them are included poems, legends, dialogues, and commentaries, and a number of them are ascribed to disciples. They are classified not according to any doctrinal principle, but chiefly with a view to convenience in their being learnt by heart. The first two, the *Dīgha-nikāya* "collection of long suttas," and the *Majjhima-nikāya*, "collection of middling long suttas," are arranged according to length, and subdivided with a slight reference to subject-matter. The third, the *Saṃyutta-nikāya*, "collection of connected suttas," is arranged in groups according as they are addressed to certain classes of people or individuals. In the fourth, the *Anguttara-nikāya*, the arrangement is numerical, as the Nikāya begins with a list of individual things, which is followed by lists of pairs, of threes, etc., up to groups of 11 things. The fifth, the *Khuddaka-nikāya*, "collection of minor works," is not recognized by all schools, but some of the contents are very old, and much of it exists in schools which do not possess the Nikāya as a whole. In the Pāli Canon it consists of 15 works, and among the most important items are the *Dhammapada*, "words of the Doctrine," a collection of 423 verses, the *Sutta-nipāta*, five books of suttas in verse, which also contains important legendary material, the *Jātaka* (*q.v.*), stories of the Buddha's previous births, and two collections of verses attributed to disciples, the *Theragāthā*, "verses of elders" and *Therēgithā*, "verses of women elders." (3) The third Piṭaka, the *Abhidhamma* (*q.v.*), "higher doctrine," deals chiefly with psychological ethics, and consists in the Pāli Canon of seven works. Similar, but so far as known, not identical works existed in other schools.

A BUDDHIST PRIEST ATTENDED BY HIS ACOLYTE

Chronology. Life of the Founder.—The Canon itself contains no chronological data. The basis of the usual computation is found in the *Dīpavaṃsa*, a Pāli chronicle of the 4th century A.D., which gives a list of Indian (Magadha) kings from the time of the Buddha down to Asoka, king of Magadha in the 3rd century B.C. It is from this list that the date 544 B.C. has been fixed by the Ceylon Buddhists as the date of the Buddha's death, but the chronicle contains another date—218 as the number of years elapsed after the Buddha's death, at the time when Asoka was consecrated king. This according to Geiger's calculation gives the more probable date 483 B.C., and the calculations of other scholars differ by only a few years. Internal evidence (references to Hindu mythology, to the rival system of Jainism, and to political conditions) also indicates a period not later than the 5th century B.C. The dates recorded by the Buddhists of Tibet and China differ widely from this and from one another, and seem to indicate that no real tradition has survived in those schools.

Except for isolated incidents the life of the Buddha is found only in post-canonical works and in works of Sanskrit schools.[1] They all agree that he was the son of a king of the Sakyas (Sākyas), a people of the warrior caste settled near the Himalayas and north of the Kosala kingdom, who claimed to belong to the Gautama clan (hence his clan name of Gautama); that as it had been prophesied at his conception that he would renounce the world on seeing a sick man, an old man, and a corpse, he was brought up in luxury, but left his home at the age of 29, and after six years of effort attained enlightenment under a tree (*see* BO-TREE) at Gayā in Magadha (hence his title Buddha, "the enlightened"); that he then formed an Order of monks, to which during his lifetime an Order of nuns was added, and spent the rest of his life as a wanderer preaching his newly discovered doctrin (*dhamma*) not only to the monks but to the laity generally, and died at the age of 80.

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[1] The most important are the Pāli introduction to the Jātaka (*see* JATAKA), Tibetan translations from the Sanskrit collected in Rockhill's *Life of the Buddha*, and in Sanskrit the *Lalita-vistara*.

The legend of Buddha's early life has been explained by Sena and Kern as mythology—the historicizing of ancient mythologica beliefs concerning astronomical and other natural phenomena. But even these scholars admitted the historical existence of th Buddha, and merely sought to explain the stories concerning him according to mythological theories. Their theories are not now generally accepted, but it is evidently impossible to determin what exact amount of fact there may be in an uncorroborated legend teeming with miracles, which refers entirely to a prehistori period. For the end of the Buddha's life we have an account in the Canon of several schools, the *Mahā-parinibbāna-sutta.* Although not a contemporary record, it was evidently compiled when the locality of the events was known, and when the sacred sites were places of pilgrimage. Przyluski, who has analysed the recensions of this sutta preserved in Chinese and Tibetan translations, discredits the view that the Pāli represent the most primitive account (see *Journ. Asiatique*, 1918, 1919).

Doctrines.—In the Canon occurs a sutta which is traditionally believed to be the first exposition of the doctrine, preached by the Buddha when he began his mission at Benares, the *Dhammacakkapavattana-sutta,* "the sutta of turning the wheel of the doctrine." It has remained even in the latest schools an exposition of the fundamental teaching regarding the goal of the disciple and the conditions for attaining it, even when in some cases it has been overlaid by additional dogmas.

The sutta is addressed to "him who has gone forth from the world" in the conviction that worldly life cannot give final happiness, and it repudiates two extremes which he ought not to follow —the profitless life of indulgence in sensual pleasure, and the equally profitless way of self-torture. The Middle Way, which "conduces to enlightenment and Nirvāṇa," has been won by the Tathāgata (the Buddha), and enlightenment consists in the knowledge of the four Truths. The first Truth is the noble truth of pain: "birth is pain, old age is pain, sickness is pain, death is pain . . . in short the five aggregates of grasping are pain." The second is the noble truth of the cause of pain, and this is the craving (*taṇhā*, thirst) that leads to rebirth, "the craving of the passions, the craving for (continued) existence, the craving for non-existence." The third is the noble truth of the cessation of pain, consisting in "the remainderless cessation of craving, its abandonment and rejection, emancipation, and freedom from support." These are the three truths knowledge of which constitutes the state of the arhat, the perfected disciple who has reached the goal of the cessation of pain. The fourth Truth consists in the actual means of arriving at these truths, the Noble Eightfold Path: "right views, right intention, right speech, right action, right livelihood, right effort, right mindfulness, right concentration." This description of the Path covers the whole training of the disciple, and its significance is best seen from the way in which it is developed in the suttas. It includes a theoretical part (right views), a system of ethical practice, and a method of mental training expressed in right effort, mindfulness and concentration.

Positively the only right views required are the four Truths, but from the first Buddhism stood in opposition to rival systems, and thus was compelled to take up a definite attitude on various points. Against both Hinduism and Jainism it denied a permanent self (*ātman*), and it analysed the individual into five groups of elements, which are referred to in the first sermon as the five aggregates of grasping (body, feelings, perception, mental elements, consciousness). This analysis, as well as the usual analysis into mind and body (*nāma-rūpa*), is merely a description of facts. But Buddhism is peculiar in going further and denying that there is anything beyond these elements as constituting the individual, and this attitude has always been one of the most vulnerable points of the system. It met with attacks from the defenders of the *ātman* theory, and it was troubled by the development of heretical views among its own members, who sometimes attempted to find a principle which would explain why an individual exists at all. The doctrine of non-self is from another point of view the doctrine of the impermanence of compound things, and in this form it was applied to all existent beings including the gods, who were held to be liable to the effects of karma and transmigration. On the other hand Buddhism sided with Hinduism in its opposition to the sceptical doctrine of the annihilation of the individual at death (*ucchedavāda*), and it accepted the doctrine of transmigration. The individual transmigrates until the aggregates that compose him are finally disintegrated with the cessation of craving.

Four questions are recorded which it was held that the Buddha had refused to answer. These are, whether the universe is eternal or not, whether it is finite or not, whether life is the same as the body, and whether one who is emancipated (a Tathāgata) exists after death. These are the undetermined questions, and the fact that they were left unanswered has led to the system being called agnostic. The last question is important with regard to the meaning of Nirvāṇa. Nirvāṇa, "blowing out," is the extinction of craving or passion, which is reached when the disciple attains the knowledge of the Truths and is emancipated. This state may be reached during lifetime, and it is affirmed quite explicitly in the fourth undetermined question, that the Buddha has not explained whether one who is thus emancipated exists after death. Neverheless modern scholars have attempted to guess. Oldenberg once nferred that the Buddha knew that final annihilation of the individual was the logical result of his teaching, but that he did not wish to discourage disciples by saying so. Later on Oldenberg held that there are traces which indicate a belief in an absolute ts highest aim, "a universal being stretching infinitely far beyond he limits of the individual." But Oldenberg's change of view shows how precarious the evidence is. Whatever may have been n the mind of Buddha, there is no doubt that the recognized eaching came to be that the answer had been left undetermined.

The doctrine of the origin of pain became formulated in he well-known Chain of Causation (*paṭicca-samuppāda*). This s a list of 12 causal states of the individual, each of which is supposed to determine the next: ignorance, mental elements, conciousness, mind and body, the six senses, contact, feeling, craving, becoming, birth, old age and death. There have been many xplanations of this formula. The usual Buddhist interpretation has been well set forth by S. Z. Aung and Mrs. Rhys Davids (*Compendium of Philosophy,* 1910) but as there are several variant formulas in the Canon, it is impossible to prove that the form with 12 links is primitive, and no one has ever shown that it has any philosophical value among theories of causation.

The ethical teaching has a significance far beyond the actual ules imposed on the monks. For the Order the rules formed a finitely ascetic system with all the liabilities to corruption that beset such attempts to reconstruct human nature. But the teaching concerning non-injury, forgiveness of enemies, and friendliess to all was a revelation of ethical ideals that went beyond any ystem. Ethics were further purified by the separation of moral ules from prescriptions of merely ritual significance. It was an normous stride forward in ethical theory to make motive the criterion of moral action, instead of judging goodness by the sum otal of good or bad actions performed.

This ethical reformation further resulted in moralizing the docrine of karma, which, along with the doctrine of rebirth, had been taken over from Hinduism. Karma (*q.v.*) no longer meant due number of sacrifices and gifts to brahmins. It is true that he thought of retribution implied in karma does not supply the ighest motive for moral action, but at least it was to moral ction that the theory was definitely applied, not to mere ritualm, and the theory that every action received its punishment or reward could be made plausible when several lives were allowed or retribution to take place.

The chief end of the disciple being not morality but knowledge, he practice of the Eightfold Path culminated in concentration or mystic meditation (*samādhi*). Concentration is essentially the ame as the Hindu practice of Yoga, and it holds such a prominent place in the early suttas that Senart has described Buddhism as a branch of the Yoga system. It consists in fixing the attention on one chosen point or subject, so that the mind passes through different stages of absorption or self-hypnotization (trance). In the older suttas only four stages of trance (*jhāna* or *dhyāna*) are described. Later on four or sometimes five stages called attainments are added, and in post-canonical works, especially Buddhaghosa's *Way of Purity,* the methods and subjects of meditation have been much elaborated. In modern Pāli Buddhism they have largely fallen into disuse, but in China and Japan the developments that took place in Sanskrit Buddhism have been preserved and even extended. The practice of concentration is probably prebuddhistic, and in Buddhism it appears to have been employed from the very first, but it is impossible to ascertain how much may have been borrowed from orthodox Yoga, as all the documents of this system belong to a later period.

The Eightfold Path is essentially a course of training, and in order to carry it out fully and extinguish craving the abandonment of a household life is essential. This career is expressed in the organization of the Sangha, the assembly or Order of monks. The rules of the Order, which are essentially the same in all the older sects, have been subject to additions, but two of the most important ceremonies are no doubt primitive, the assembly of *uposatha,* at which the *Pātimokkha,* the list of offences given in the Vinaya, was recited each fortnight and confession of any infringement required, and secondly the practice of Retreat (*vassa*), during the three months of the rainy season, when travelling was forbidden. The elaborate rules for admission of members, the internal regulations of the monasteries, and discipline, will be found in the second part of the Vinaya, and have been translated in *Vinaya Texts.*

Since the publication of the texts of the Pāli Canon there has been agreement on main points concerning the doctrine which they set forth. We know that already in the 3rd century B.C. there were other schools, and we know something of their tenets, but the differences so far were on minor points, and it is unlikely that the canonical texts diverged seriously. But in recent years it has become more clearly recognized that the Pāli Canon cannot be taken to be the doctrine in its primitive form. As it stands it is only the doctrine as it had become formulated in one school two centuries later. Hence there have been attempts to reconstruct the supposed primitive teaching of the founder. It is the view of Prof. de la Vallée Poussin that besides the official doctrine contained in the Scriptures there was a popular Buddhism, which soon made a god of the Buddha. Such a development among the laity is very probable, and it may be one of the factors that contributed to later Mahāyāna developments. According to Mrs. Rhys Davids the denial of the ātman, which is so much reiterated in the Canon, was not original, nor was the system primarily a monastic institution as we find it in the Vinaya. Dr. Paul Dahlke still finds that the pure Buddha-word is that which is laid down in the Pāli Canon. On these still disputed questions the works mentioned below must be consulted.

Later History.—The Chronicles record three councils, the first immediately after the Buddha's death (483 B.C.), at which the Scriptures, the Dhamma (Sutta) and Vinaya, were recited, the second a century later, when ten violations of monastic discipline were condemned and the first schism occurred, and the third in the reign of Asoka (247 B.C.). Although it is probable that the three councils were actually held, nothing properly historical is known about them. It is significant that while in Sanskrit works there are frequent references to Asoka, there is no mention of him in the Pāli Canon. This makes it probable that in the Pāli we possess the Canon as it was already settled in the time of Asoka. In the inscriptions of Asoka we have evidence of his support of the doctrine and of its spread over India. From the chronicles we learn that in Asoka's reign the doctrine was introduced by his son Mahinda into Ceylon.

The further history of the Theravādins is confined to Ceylon, and does not show any development in doctrine. For the later history of Buddhism in India the first authorities are the accounts of the Chinese pilgrims, chiefly Fa Hien in the 4th century and Hiuen Tsiang in the 7th. They found that Buddhism had extended into Central Asia, and they speak of the 18 schools as still existing in India, but they also refer to two great divisions, the Great and Little Vehicle. The Great Vehicle is the Mahāyāna, the new development of doctrine which showed itself from the 1st century, and which stigmatizes the older schools as Hinayāna, "low vehicle." (For this development *see* MAHĀYĀNA.) From Hiuen Tsiang we get a glimpse of the great importance of schools not recognized by the Theravāda. Kanishka, the Saka king of Gandhāra in the 1st century, being displeased at the contradictory teachings of various schools, caused a general council to be held. This council not only arranged the three Piṭakas, but is also held to have composed commentaries thereon. The Sanskrit schools reckon it as the third general council, and ignore the Council of Patna, which for the Theravāda is the third.

The cause of the decline of Buddhism in India has been supposed to be persecution. There is no real evidence for this, though there is one passage in which persecution is asserted. An examination of the latest Buddhist works makes it clear that the system gradually approximated to the surrounding Hinduism. The Buddhas were multiplied and divinized. Bodhisattvas were exalted and worshipped as the givers of merit, and female consorts were attributed to them, so that they became indistinguishable except in name from the manifestations of Siva and Krishna.

Modern Research.—The striking archeological discoveries of the last century have both confirmed and added to our knowledge, chiefly concerning the period of the great extension of the religion under Asoka. First among these come the inscriptions on rocks and pillars put up by Asoka after his conversion. The legend of his pilgrimage to the birthplace of Buddha in the Lumbini garden is borne out by the discovery in 1896 of a pillar within the borders of Nepal which he caused to be set up in record of his visit. Another pillar, found the year before in the same region, records his visit to the stupa of Konāgamana, a previous Buddha. But the most surprising find was made in 1898 by W. Peppé, who discovered near the Nepal border a stupa containing five vessels. One of these was a stone vase with a circular inscription in verse and in letters of the Asokan period, and containing fragments of bone, and other relics. The translation by Prof. Lüders (modified owing to the revised order in which it is to be read) is: "*Of the brothers Sukiti, jointly with their sisters, with their sons and their wives, this* (*is the*) *receptacle of the relics of Buddha, the holy one, of the Sakyas.*" Owing to a mistranslation it was once held to be the share of the relics given to the Sakyas after the cremation of Buddha's body. But this deposit was evidently made by a single family, and it is not likely to be earlier than the age of Asoka. Other relics of a still later date have since been found in north-west India. The discovery of Buddhist remains in Chinese Turkestan through the expeditions of Sir Aurel Stein and von Le Coq has shown the wide spread of Buddhism in Central Asia among peoples and in languages that have now disappeared. But they belong entirely to post-Christian times, and chiefly throw light on the latest stages of Buddhism.

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(E. J. T.)

BUDDHIST LAW: *see* INDIAN LAW.

BUDÉ (BUDAEUS), **GUILLAUME** (1467–1540), French scholar, was born at Paris. The work which gained him greatest reputation was his *De Asse et Partibus* (1514), a treatise on ancient coins and measures. He was held in high esteem by Francis I, who was persuaded by him, and by Jean du Bellay, bishop of Narbonne, to found the Collegium Trilingue, afterwards the *Collège de France* and the library at Fontainebleau, which was removed to Paris and was the origin of the Bibliothèque Nationale. He also induced Francis to refrain from prohibiting printing in France, which had been advised by the Sorbonne in 1533. He was sent by Louis XII to Rome as ambassador to Leo X, and in 1522 was appointed *maître des requêtes* and was several times *prévôt des marchands*.

Budé was also the author of *Annotationes in XXIV. libros Pandectarum* (1508), which had a great influence on the study of Roman law, and of *Commentarii linguae Graecae* (1529), an extensive collection of lexicographical notes, which contributed greatly to the study of Greek literature in France. He corresponded with the most learned men of his time, amongst them Erasmus and Thomas More. He was suspected of leanings towards Calvinism. Other works of his are: *De Philologia* (1530); *De Transitu Hellenismi ad Christianismum* (1534); and *De l'Institution du Prince* (pub. 1547).

See Le Roy, *Vita G. Budaei* (1540); Rebitté, *G. Budé restaurateur des études grecques en France* (1846); E. de Budé, *Vie de G. Budé* (1884), who refutes the idea of his ancestor's protestant views; D'Hozier, *La Maison de Budé;* L. Delaruelle, *Études sur l'humanisme français* (1907); *Répertoire analytique et chronologique de la correspondance de G. Budé* (1907); J. E. Sandys, *History of Classical Scholarship* (1908), vol. ii. pp. 170–173, with bibliography; J. Plattard, *Guillaume Budé* (1923).

BUDE, a small seaport and watering place of Cornwall, England, on the north coast at the mouth of the river Bude. With the market town of Stratton, 1½ mi. inland to the east, it forms the urban district of Bude-Stratton, with a population (1938) of 4,450. The coast scenery in the neighbourhood is fine, especially towards the south, where high cliffs, with banded strata, were broken into fantastic forms by the waves. Many ships were wrecked on the ragged reefs which fringe their base. The harbour, sheltered by a breakwater, will admit vessels of 300 tons at high water, and the river has been dammed to form a basin for the canal which runs to Launceston. The staple trade is the export of sand, which, being highly charged with carbonate of lime, is much used for manure. Bude is served by a branch of the Southern railway. Its only notable building is the Early English style parish church. Area of combined urban district 6.7 sq.mi.

BUDĚJOVICE (or BUDWEIS), Bohemia, Czechoslovakia, at the confluence of the Malše and the Vltava, which here becomes navigable. Founded in the 13th century by Budivoj Vitkovec, it later became a royal city and figured largely in Bohemian history during the 15th, 16th and 17th centuries, being granted many privileges in return for its allegiance to the royal cause. In 1783 it became the see of a bishop and was highly Germanized, but the Czech element increased rapidly and now forms 80% of the population (1930: 43,788). The town is noted for its fine square surrounded by imposing arcaded buildings, the principal one being the town hall built in 1730 in Renaissance style. Its prosperity results from the fact that it is the commercial centre of southern Bohemia, an important railway junction and a river port, with a varied development of manufactures, notably clay, timber and chemical products, beer, blacklead pencils and machinery, based in the main upon local resources of lignite, iron and other raw materials. Germany occupied the city in March 1939.

BUDENNY, SIMEON MIKHAILEVICH (1876–), Russian soldier, was born in southern Russia, the son of a farmer of the Cossack country. He entered the Russian army in 1903 and rose to be a noncommissioned officer. In 1917, after the revolution, he was elected president of the divisional soviet of the Caucasian troops. He did not join the Communist party until 1919, but soon after the beginning of the civil war found himself in conflict with the whites and, with only a few friends and relations, began to wage guerrilla warfare against the Cossacks in the district. His forces increased and early in 1918 he joined the red army. With the nucleus of his own men he organized the red cavalry, and after a rapid series of promotions became commander of the first cavalry army. In this capacity he took an active part in the operations against Wrangel and in the Polish War (1920). He became eventually chief of the red cavalry and was a member of the military revolutionary council of the soviet union.

BUDGE, SIR ERNEST ALFRED WALLIS (1857–1934), English archaeologist, was born in Cornwall on July 27, 1857 and educated at Christ's college, Cambridge, where he became Assyrian scholar and Tyrwhitt Hebrew scholar. In 1885 he became keeper of the Egyptian and Assyrian antiquities in the British museum, and he conducted excavations at Assuan, at Gebel Barkal on the island of Meroe (the site of the capital of ancient Ethiopia), at Nineveh and Der in Mesopotamia (1888–89) and in the Sudan, when the ancient monuments on the banks of the Nile were threatened with inundation by the raising of the Assuan dam. His long list of publications includes: *The Gods of Egypt* (1903); *The Egyptian Sudan* (1907); *The Nile* (1910, 12th ed. 1912); *Literature of the Ancient Egyptians* (1914); *By Nile and Tigris* (1920). He was knighted in 1920.

BUDGELL, EUSTACE (1686–1737), English man of letters, the son of Dr. Gilbert Budgell, was born on Aug. 19, 1686 at St. Thomas, near Exeter. He matriculated in 1705 at Trinity college, Oxford, and afterwards joined the Inner Temple, London. Addison, who was first cousin to his mother, befriended him, and, on being appointed secretary to Lord Wharton, lord lieutenant of Ireland, in 1710, took Budgell with him as one of the clerks of his office. Budgell took part with Steele and Addison in writing the *Tatler*. He was also a contributor to the *Spectator* and the *Guardian*—his papers being marked with an "X" in the *Spectator* and with an asterisk in the *Guardian*. He was subsequently made undersecretary to Addison, chief secretary to the lords justices of Ireland and deputy clerk of the council, and became a member of the Irish parliament. In 1717 he became accountant and controller general of the revenue in Ireland, but was removed from his post of accountant general on account of a libellous pamphlet. In the year 1720 he lost £20,000 by the South Sea scheme, and afterwards spent £5,000 more in unsuccessful attempts to get into parliament. He began to write pamphlets against the ministry and published many papers in the *Craftsman*. In 1733 he started a weekly periodical called the *Bee*, which he continued for more than 100 numbers. By the will of Matthew Tindal, the deist, who died in 1733, a legacy of 2,000 guineas was left to Budgell, but the bequest (which had, it was alleged, been inserted in the will by Budgell himself) was successfully disputed by Tindal's nephew and nearest heir, Nicholas Tindal. Hence Pope's lines in the *Epistle to Dr. Arbuthnot:*

> Let Budgell charge low Grub Street on his quill,
> And write whate'er he pleased—except his will.

The scandal ruined him. On May 4, 1737, after filling his pockets with stones, he took a boat at Somerset-stairs, and while the boat was passing under the bridge threw himself into the river.

On his desk was found a slip of paper with the words: "What Cato did, and Addison approved, cannot be wrong." Besides the works mentioned above, he wrote a translation (1714) of the *Characters* of Theophrastus. He never married, but left a natural daughter, Anne Eustace, who became an actress at Drury Lane.

See Gibber's *Lives of the Poets,* vol. V.

BUDGERIGAR, a small parakeet, *Melopsittacus undulatus*, inhabiting the greater part of Australia, living on saltbush flats and eating grass seeds, flocking and flying far in quest of food and water. It nests in hollows in gum trees, laying three or four eggs, which hatch in about 17 days, the young remaining in the nest about 31 days. It is also known as the grass parakeet, shell parakeet, zebra parakeet and Australian lovebird. It has upper parts mostly pale greenish-yellow, with transverse dark brown crescents; its under parts, rump and upper tail coverts are bright green; the cheek patches and two central tail feathers are bright blue. It is now one of the commonest cage birds throughout the world. Mutations have produced olive-green, azure-blue, cobalt-blue, violet-blue, mauve-gray, canary-yellow, white and blackish birds, as well as many other varieties, which have been preserved and crossbred, resulting in several dozen types. (*See* LOVEBIRD.)

See Marquess of Tavistock (H.W.S.R. Tavistock), *Parrots and Parrot-like Birds in Aviculture* (London, 1929); W. Watmouth, *The Cult of the Budgerigar* (London, 1935); Cessa Feyerabend, *The Budgerigar or Shell Parakeet as a Talker* (American Budgerigar society, Chicago, 1943); Denys Weston, *The Budgerigar in Captivity*, 9th ed. (London). (G. F. Ss.)

BUDGET. A budget is a balance sheet of estimated revenue and expenditure designed for financing the business of a future period.

In national finance the period is usually a year, called a financial year. A shorter period would not include a full round of seasons and harvests and would be unsuitable for purposes of comparison. A longer period would not only increase the difficulty of forecasting, but would lessen the financial control of a representative assembly. For this reason, when Bismarck submitted a two years' budget for 1883 and 1884 to the German reichstag on the plea of saving time and trouble, the budget for 1884 was ignored by the reichstag, which passed merely the 1883 budget. Bismarck immediately presented the 1884 budget afresh, and the reichstag solemnly threw it out vote by vote.

It will be seen that it is not sufficient to define a budget as an account, with Lord Buxton (*Dictionary of Political Economy* s. v. *Budget*) since accounts rest upon the basis of established fact, while a budget looks to the future; nor as "a plan for raising revenue," with Sir Hilton Young (*The System of National Finance*), since revenue is only one side of a balance sheet. The word is derived from the O.Fr. *bougette*, a little bag. The British chancellor of the exchequer is still said to "open" his budget, or receptacle of documents and accounts, when he makes his annual financial statement.

The commencement of the financial year is determined mainly by parliamentary convenience. In England the date was at first Michaelmas day. Jan. 5 (old Christmas day) was adopted as the end of the financial year 1799–1800.

In 1854, April 1 was made the beginning of the financial year by an act still in force. Since delay and uncertainty are prejudicial to business, the British chancellor of the exchequer lays before the house of commons as soon as may be after April 1 a statement giving the outturn of the previous financial year, as shown by the exchequer (*q.v.*) account at the Bank of England, the estimated expenditure for the new year, the estimated revenue on the basis of existing taxation and the changes, if any, which he proposes in order to balance the budget by reduction or increase of taxation.

The budget speech is anxiously awaited by the taxpayer and is one of the most interesting events of the parliamentary session. Not only do budget changes affect the pocket of the taxpayer, but the speech is often the occasion for announcing some new policy involving (as new policies are prone to do) additional expenditures for which provision must be made.

The budget system was first established in England, and has been followed with more or less variation in other countries.

It is desirable that the unity of the budget should be preserved by presenting the full estimates of revenue and expenditure in one mass and in one account. Some countries offend against this principle by dividing the budget into two parts—ordinary and extraordinary—and relegating to the latter exceptional or nonrecurrent revenue and expenditure. This tends to laxity and the manipulation of the ordinary budget by the transfer of doubtful items to the extraordinary side, and weakens the incentive to deal at once with emergency expense. Sometimes additional budgets are annexed to the main budget, providing apart for special services like posts, telegraphs, telephones, railways, etc. When such additions infringe the unity of the budget they are to be deprecated.

No objection can be taken to them if they are merely appended for further information, the gross figures appearing in the general budget.

A trading company, desirous of concealing from its competitors its rate of profit, will not disclose its gross trading profit in its balance sheet, but only the net profit after deduction of expenses. There is no such excuse for net budgets. The taxpayer is entitled to a full and frank disclosure of the purpose and amounts of public expenditure and of all sources and amounts of receipts. His constitutional right is to accept or reject taxation.

It is sometimes asserted that the British budget fails to show the full amount of national receipts and expenses owing to the device of appropriations in aid. Sums received by certain departments as fees, proceeds of sales of old stores, etc., are allowed to be used by the departments in reduction of the amounts which would otherwise require to be granted by parliament. They may thus appreciably reduce the grants and the apparent total expenditure.

As, however, both gross and net totals are printed in the estimates, the full information is available to the student of finance. If it should happen that the estimated receipts exceed the estimated expenditure, as in the case of the bankruptcy court, the mint, etc. the house of commons requires a token or nominal vote to be presented for £10 or some other small amount, which brings the whole operations of the department within the scrutiny of the house.

With this exception the British budget is a gross and not a net budget.

THE BRITISH BUDGET

Preparation.—It is a peculiar feature of British finance that no proposal which involves expenditure can be carried out without the approval of the treasury.

During the financial year departments approach the treasury with requests to sanction additional expenditure, either forthwith or from some future date. The treasury requires a reasoned statement to justify the proposals, and if it is not at first satisfied calls for further explanations. When doubtful points have been cleared up, the treasury authorizes or refuses to accept the proposals in whole or in part.

If additional expenditure is agreed upon the decision is referred to the estimate clerk to note.

On Oct. 1, the treasury sends a circular to the civil service and revenue departments requesting them to prepare and forward their estimates of expenditure for the next financial year. These estimates are checked by the estimate clerk against his record of the accumulated authorizations and he calls attention to any changes for which no treasury authority has been given or points out that some necessary provision has been omitted. He compares the estimates item by item, with those of previous years. An item may have been increased by some temporary emergency in the past and watchfulness is required to see that it is not continued on the same basis when the emergency is over. When for some time the actual expenditure has fallen considerably below the provision for specific items, pressure is applied for closer estimating.

A rise in the purchasing power of money will justify the estimate clerk in looking for lower estimates for stores and materials.

Intelligent scrutiny of this kind has often proved extremely effective. But while economy must be considered, sufficiency must also be borne in mind. To frame unduly high estimates would weaken parliamentary control, add to the difficulties of the chancellor of the exchequer, and result in an unnecessarily burdensome scheme of finance. On the other hand inadequate provision necessitates a further application to parliament and disturbs the settlement made by the year's budget. The estimates, approved by the treasury with or without modification, are presented in detail to parliament.

The fighting services (the army, navy and air force) are no exceptions to the general rule that all expenditures must be approved by the treasury, and the usual checks are applied throughout the year to such matters as pay and numbers of their civilian staff, etc. But the size of the forces, which governs the need for stores, uniforms, pay, rations, munitions and other chief heads of expense, is a matter of high policy settled in consultation with the chancellor and the cabinet. Technical requirements of the forces are obviously not susceptible to minute treasury criticism. The estimate clerk's supervision is, in their case, little more than formal. Each of the fighting arms is provided with a high financial officer whose duty it is to watch over financial interests within his department.

When all the estimates are sanctioned, a summary of these supply charges, as they are called, is laid before the financial secretary and the chancellor of the exchequer. An estimate is next made of the consolidated fund charges, which are not voted annually by the House of Commons, but rest upon statutory foundations, until parliament shall otherwise determine. Such charges are the interest and management of the national debt, payments to the road fund and to local authorities, the civil list (a life-annuity settled by parliament upon the sovereign at his succession in return for his surrender of the more valuable income from Crown lands), salaries and pensions of the speaker of the House of Commons, the judges, the comptroller and auditor-general, and others whose independence is shielded by depriving the House of an opportunity for criticism of their actions which would be given if their salaries were voted annually. Adding together the estimated supply charges and consolidated fund charges we have the total expenditure for which provision must be made.

It is now necessary to turn to the revenue side of the balance-sheet. The revenue departments—the customs and excise, the inland revenue and the post office—furnish to the chancellor their estimates of receipts on the existing basis and on the basis of any changes which are proposed. In framing these estimates they take account of the state of trade, the growth of population, and other disturbing factors. After allowing for capital transactions such as interest or principal receipts from loans, and miscellaneous revenue, the chancellor is able to strike a balance of estimated surplus or deficit. This will be modified by any changes approved by the cabinet in respect of policy, and a fresh balance-sheet is thus reached which may be adjusted on the revenue side by new taxes, increased rates of old taxes, repeal or reduction of existing taxes. The final result should show a balance on the right side, with due regard to contingencies not easily foreseen. The chancellor is now in a position to lay his draft budget before the cabinet and with their approval to unfold to the House of Commons the measures which are proposed to meet the financial needs of the nation in the course of the year. In times of peace he should pay his way and leave a small margin on the right side, but not too large a margin, or he will be pressed to reduce the burden of taxation forthwith. Lord Goschen's budgets were attacked by Lord Farrer on the ground that surpluses were "manufactured" by deliberate under-estimate of revenue and over-estimate of expenditure. Such a charge is more easily made than proved. If it were established it would show that the chancellor was unusually courageous, confident of continuance in office, and ready to sacrifice immediate popularity to an uncertain future.

Parliament and the Budget.—As the control of the British Treasury over the preparation of the estimates is peculiar to Great Britain, so is the presentation of the budget to the legislature. Instead of being embodied formally in a budget bill, as is the case in most countries of Europe, where the whole scheme of revenue and expenditure for the year is submitted for the sanction of parliament, the British budget is merely explained to the House of Commons by the budget speech. The House is called upon to authorize part of the estimated expenditure—the supply charges—and to assent to such changes in the law as may be needed to give effect to the revenue proposals of the budget.

At the beginning of each session the House sets up two great financial committees—the committee of supply and the committee of ways and means. Each is a committee of the whole House, sitting under a chairman instead of the Speaker. A former clerk of the House, Sir Reginald Palgrave, says "the exclusion of the King's emissary and spy—their speaker—was the sole motive why the Commons elected to convert themselves into a conclave called a committee, that they might meet together as usual, but without his presence." The speaker is no longer, if he ever was, an emissary and spy of the sovereign, but the practice continues. It has the advantage that in committee discussion is more informal and conversational, since a member may speak more than once. Broadly speaking, the business of the committee of supply is to agree to the votes required, as shown in the estimates, for the service of each department. The committee of ways and means approves the issue from the exchequer of the money which is needed to make supply effective.

The British "Budget Day."—As soon as the committee of supply has voted a grant for the ensuing year, the committee of ways and means (*i.e.*, the whole House) meets and the chancellor lays before it his budget proposals on what is called the "Budget Day." He takes the opportunity to examine the financial situation of the country as disclosed by the exchequer receipts and payments of the previous year, gives the reasons for any appreciable variation between estimates and results for that year, expounds the changes in the national debt, states the forecast for the current year, and discloses his plans for balancing the account. A white paper distributed just before his speech now enables him to abridge the statistical part of his exposition. The final balance-sheet, after alterations proposed by the chancellor of the exchequer, in 1927–28, was as follows:

ESTIMATED REVENUE, 1927–28 ESTIMATED EXPENDITURE, 1927–28
(In thousands of £)

	£			£
Customs	112,120	I. Consolidated fund services		
Excise	145,760	National debt services:		
		Interest, etc.	305,000	
Total customs and excise	257,880	Sinking funds.	65,000	
				370,000
Motor vehicle duties	24,100	Road fund		19,500
Estate, etc., duties	67,800	Payments to local taxation accounts, etc.		14,300
Stamps	25,500			
Land tax, house duty and mineral rights duty	800	Payments for Northern Ireland residuary share etc.		5,400
Income tax	247,000			
Super tax	62,000			
Excess profits duty	3,000	Other consolidated fund services		3,700
Corporation profits tax	2,700			
Total inland revenue	408,800	Total consolidated fund services		412,900
Total receipts from taxes	690,780	II. Supply services		
Postal service	37,300	Army votes		41,565
Telegraph service	5,700	Navy votes		58,000
Telephone service	19,000	Air votes		15,550
		Civil votes		235,725
Total post office	62,000	Customs and excise and inland revenue votes		12,007
Crown lands	1,050	Post office vote		57,643
Receipts from sundry loans, etc.	23,500			
Miscellaneous:		Total supply services		420,490
Ordinary receipts	30,500			
Special receipts	27,000	Total expenditure		833,390
Total non-tax revenue	144,050	Surplus		1,440
Total revenue	834,830	Total		834,830

Immediately after the budget speech the budget resolutions are moved to give effect to the scheme of revenue proposed. For the most part taxes rest upon continuing statutes, but one direct tax (the income tax with its surtax) and one indirect tax (the tea duty) are voted for one year only in order to ensure that direct and indirect taxation are brought within the purview of the House every year even though there be no budget changes in respect of them.

The committee of supply, to which the estimates of expenditure are referred, can vote the grant proposed to it, or reduce it, or reject it, but may neither increase it nor annex a condition to it nor alter its destination. The House will only vote money on a recommendation from the Crown, signified through a minister. If it desires to increase a vote this can only be done by a supplementary estimate, or by the withdrawal of the original estimate and its replacement by a new one. As rejection or even reduction of a vote would be a rebuff to the ministry and suggest want of confidence in the government, it would possibly lead to a general election. It is therefore very exceptional for discussions in supply to result in any change in the original estimates. When the committee has approved a grant, it reports its resolution to the House where the matter may be debated again with the speaker in the chair. If the House agrees with the committee's resolution the estimate goes to the committee of ways and means whose task it is to approve the provision of the necessary funds.

How the British Budget Becomes Law.—Upon the resolution of the ways and means committee is based a consolidated fund bill to authorize the issue out of the consolidated fund of sums to meet the grants in supply. The lump sums so authorized may not exceed the total of the grants previously voted in supply, and more than one consolidated fund Act is passed in each session. At the end of the session the final Consolidated Fund (Appropriation) Act completes the grants required, and earmarks or appropriates to each service the money assigned to it in supply.

From the committee of ways and means also springs the Finance Act which reimposes the annual taxes and makes any necessary changes in them or in taxation generally. After the passing of these two measures the budget is not only a plan but a legalized plan.

Twenty days before Aug. 5 are allotted to the committee of supply for the consideration of the estimates, including days spent on the vote on account and procedure in ways and means, but the government may allow three extra days if it thinks fit. At the end of the allotted days all outstanding votes are "guillotined" or put to the vote without discussion. Votes on account are in the nature of advances made to departments by special grant before there has been time to examine the estimates in detail in supply. As it is impossible for the committee of supply to consider all the estimates in the allotted time it is usual to allow the opposition to choose the order in which the votes shall be set down for discussion.

The estimates committee, consisting of 15 members drawn from all parts of the House, was first appointed in 1918. It may examine any estimate it chooses and send for persons, papers and records, but may not question the policy implied in the estimates. As policy to a large extent governs expenditure, and as the examination comes after the estimate has been presented, the discussions of this committee, like those in supply, and for the same reasons, have little effect upon the financial proposals of the year. The committee is purely advisory and the limitations under which it works deprive it of much practical influence.

When departments find their grants insufficient they put forward supplementary estimates for further grants. Such estimates should always be jealously scrutinized, and enquiry should be pressed why the contingencies were not foreseen and whether expenditure is so urgent that it cannot be postponed till the next budget. The estimates, if justified, must be passed through all their stages in time for the appropriation bill in order to avoid an excess of expenditure over the grant—a financial offence of the first magnitude. In cases where an excess has been incurred it is referred to a committee at the beginning of the next session in order that it may be fully justified and an excess vote passed to regularise the proceeding.

The finance bill and the consolidated fund bills are sent up to the House of Lords with a certificate by the speaker that they are money bills. By the Parliament Act, 1911, if a money bill, as defined in that act, be sent to the Lords at least one month before the end of the session, and is not passed by the House of Lords without amendment within one month, the bill shall, unless the House of Commons direct to the contrary, be presented to His Majesty and become an Act of Parliament on the royal assent being signified, notwithstanding that the House of Lords have not consented to the bill. The speaker consults two senior members of the House of Commons before giving his certificate, though the act makes his opinion sufficient. Complaint has been made that, as no one is infallible, the safeguard is not adequate, that a member of the House of Lords should be included in the panel, and that the statutory definition of a money bill needs amendment to ensure that far-reaching changes are not improperly withdrawn from the consideration of the Lords merely because they are inextricably interwoven with financial proposals and not easy to distinguish.

It will be seen that the budget, though theoretically the work of parliament, is dominated from start to finish by the executive government. The House of Commons accepts the estimates of expenditure as presented. It discusses the finance bill, and may succeed in making amendments designed to remove doubts or obviate hard cases. But the chancellor of the exchequer, though willing to smooth the passage of the measure by accepting small changes, will use his majority if there is any serious menace to the revenue which he requires. The dissent of the Lords is, like the veto of the Crown, no longer operative as a check upon the settlement of the budget.

Execution of the Budget.—A programme is one thing, its execution another. The House of Commons does not cease to concern itself with the budget proposals when they have received its assent, but is interested to see whether they work out according to plan, and if not, why not. The collection of revenue and the expenditure on public services are in the hands of officials whose operations are subject to control and audit on behalf of the House. The comptroller and auditor general, a high officer of parliament, appointed by the Crown and independent of any department, is required to make a test audit of the revenue receipts, to audit the accounts of expenditure of each department, and to report to parliament any irregularities or other matters of interest arising out of the accounts. He must see that any surplus of grant over expenditure is surrendered to the national debt commissioners for the old sinking fund. It is also his duty to authorize all issues of moneys out of the exchequer and to take care that no such issues are made without parliamentary authority. His annual report is laid before the House and referred to the public accounts committee, which summons before it the accounting officers and officials of the Treasury and other departments for such explanations as it may desire, and reports its proceedings to the House. Any recommendations made by the public accounts committee are communicated to the Treasury for consideration.

The public accounts committee, like the estimates committee, is precluded from entering upon questions of policy, and it has often been urged that its control would be more effective in the interests of economy if it were aided by an inspector-general, whose function it would be to investigate wasteful expenditure wherever it can be found. The estimates are framed upon a non-functional basis, under such headings as salaries, travelling expenses, stores, etc. If they were set out on a cost-accounting basis, comparison would be more revealing of lack of economy. An experiment was made in this direction with the army estimates, but was abandoned after a short trial for reasons which, so far as they have been made public, are far from convincing.

There is in England no formal act of parliament to close the accounts of the year. The exchequer account, being merely a cash or pass-book account, is made up when the Bank of England closes at 4 P.M. on March 31. The account audited by the comptroller and auditor general is the appropriation account. It includes all orders for payment drawn on or before March 31 whether or not they were cashed before April 1. Three months in the case of civil departments and six months in the case of the fighting services are allowed for the purpose of including all such transactions. The totals of the appropriation account therefore differ slightly from those of the exchequer account. It is the appropriation account which is dealt with by the public accounts committee, and when this account is closed any further receipts or payments, whether proper to the past or present year, are included in the accounts of the year in which they are encashed.

In some countries the accounts are kept open until all the receipts and payments proper to the year can be included. This sometimes requires the accounts to be kept open for several years. The British system has the advantage of closing the accounts promptly, and with approximately close results, outweighing the advantages of the theoretically more exact method.

The serious political, constitutional and financial changes brought about by the World War severely jolted the framework of the budgets of governments all the world over. But it must be emphasized that the essentials of a budget are few in number—(i.) an estimate of the expenditure required for discharging the functions of the authority concerned, brought into relation with (ii.) an estimate of the revenues out of which the expenditure is to be defrayed during the budgetary period. It follows that assets and liabilities find no place in the budget except in so far as they involve receipts and payments within that period. A budget does not afford a picture of the financial condition of a government. It does not show the total cost of governing a country, since there may be subordinate local governments, or a superior federal government as in Germany, the United States, Australia, Canada, India, South Africa, etc. The demarcation between such varied authorities is determined by the law and custom of the constitution or by historical circumstances.

The most fertile source of fallacies in statistics is the comparison of dissimilar things as if they were alike. It would for example be grossly misleading to compare the cost of government in a highly centralized kingdom, like Italy (where under the Fascist regime only sanitary and social services are left to local government), with the federal budget of the United States, where 48 states, largely autonomous, with their own tax laws, include large cities, boroughs, urban and rural districts each with its own budget and financial system. Payments between these authorities are inextricably interwoven, and an addition of all their expenditures would include several items two or three times over. A budget may be accompanied by a mass of documents, accounts, financial memoranda and explanations designed to show the financial situation in its entirety. From the budget itself no more can be extracted than the limited information which it contains for its limited purpose.

BUDGETS OF OTHER COUNTRIES

France.—The financial year begins on Jan. 1. The budget consists of several documents:

(i.) The general budget. To this are appended "annexed" budgets for the national printing office, the gunpowder service, the posts, telegraphs and telephones, the mint, the railways and state factories in Alsace-Lorraine, the state railways, the national savings banks, the naval invalidity fund and other special establishments.

The general budget is, in principle, a gross budget. But only the net surplus or net deficit is carried to the general budget in the case of the printing office, the gunpowder service, the posts, telegraphs and telephones, the mint and the railways and state factories in Alsace-Lorraine. Any surplus or deficit of the national savings banks account is carried to its own reserve fund account.

(ii.) Cost of armies of occupation (expenses recoverable).

(iii.) Debt redemption fund.

(iv.) Accounts of autonomous offices attached to various departments.

(v.) Special Treasury accounts, of which the chief are expenditure on state railways, interest on advances by the Bank of France, reduction of amounts advanced by the Bank of France, payment of debt service to Great Britain and the United States, and advances to foreign governments.

Besides all these there is a special Treasury account of payments by various powers in execution of the Peace treaties, to which all reparation recoveries are credited. The receipts are destined to cover the cost of armies of occupation, sums due to war victims, service of the inter-Allied debt, and redemption of internal debt.

Each department is responsible for the preparation of its own estimates, which are centralized (but not controlled) by the ministry of finance. All revenue and all expenditure is voted for one year only. No taxes are permanent. No charges are laid upon a consolidated fund. Ministers are forbidden to incur liabilities or make payments for purposes not specified in the budget, to overspend the credits granted to them, or to enter into commitments extending beyond the financial year. The hands of the chamber are thus entirely free every year. Each minister is personally and pecuniarily responsible for any breach of financial regularity in these respects.

The budget bill is presented to the Chamber of Deputies without a speech, and is referred to the finance committee of about 40 members, which is a microcosm of the chamber, based on proportional representation of the party groups. This committee overhauls both sides of the budget, sends for persons and papers, and reports to the full chamber a budget which often differs considerably from the original. It follows that the chamber discusses, in practice, not the government proposals but the proposals of the finance committee. Such discussions may result in further changes. But no additions may be made to the estimates of expenditure unless they are simultaneously coupled with proposals for raising an equivalent amount of additional revenue. No limit is imposed upon the number of sittings or upon the speeches.

The budget settled by the chamber is sent to the Senate, which claims equal powers of revision, sets up its finance committee and follows the same procedure as the chamber. Amendments made in the Senate, either by way of increase or reduction, are sent down to the chamber, which may accept, modify or reject them. The budget is then returned to the Senate, and in the last resort differences are settled by conference or compromise, or submission on one part or the other.

The minister of finance is charged with the duty of keeping the departments in funds, within the limits of the credits granted to each of them, but he is not concerned with their use of such funds. The accounts of each department are, at the end of the year, rendered to the ministry of finance, which adds its own account and the accounts of receipts, and prepares a general account which is sent to the *cour des comptes*—a quasi-judicial and extra-parliamentary tribunal. This court examines all the documents embraced by the accounts, but does not examine the accountants or officials concerned in administration. It draws up an annual report to the president of the Republic, enumerating the principal irregularities it has found, and stating the accounting reforms it thinks desirable. Ministers are required to reply to the criticisms of the court, whose observations and the replies are printed and the whole is then presented to parliament.

In each chamber an accounts committee is set up to examine the audited accounts. When the bill based upon their reports (*loi de règlement*) is passed the accounts are closed. No closed account has been published for any year later than 1916.

The year 1926 is the first year since the World War in which the closed account shows a balance of surplus on the general budget.

Germany.—The financial year begins on April 1.

The general budget is in principle a gross budget, including all receipts except those of certain public undertakings, the posts, telegraphs and telephones, the railways, printing office, etc., and such items as cost of sales by auction, surveys and agency fees. It is divided into two parts, general administration and war charges. These are again subdivided as follows:—

General administration—(i.) ordinary revenue; (ii.) ordinary expenditure (*a*) recurrent, (*b*) non-recurrent; (iii.) extraordinary revenue and expenditure.

War charges—(i.) ordinary revenue; (ii.) ordinary expenditure (*a*) recurrent, (*b*) non-recurrent; (iii.) extraordinary revenue and expenditure.

Extraordinary expenses in the first part include investments and are so widely construed as to include the cost of building cruisers, while the extraordinary revenue comprises loans and receipts from capital sources, etc. The reparations payments (in fulfilment of the Dawes plan) are regarded as extraordinary expenses in the budget of war charges. The corresponding revenue is derived by transfers from ordinary revenue.

Only net figures are shown in the general budget as regards public undertakings mentioned above. Transfers are made from one budget to another and from one vote to another if the votes are independent. In certain special cases unspent credits for non-recurrent and extraordinary expenditure may be carried over to another year.

After the revolution of 1918 a new law of the constitution was enacted on Aug. 11, 1919. This law is incomplete so far as budgetary procedure is concerned. To some extent former practice is still in use, and new standing orders have made some modification, but custom has not yet crystallized into a final shape.

The budget takes the form of a law, which, like all other laws, is voted by the Reichstag alone. The budget must be signed and published by the president of the Reich. It is prepared by the government, and after approval by the cabinet is presented by the minister of finance to the Reichsrat, in which the governments of the states are represented. The Reichsrat may adopt or amend the budget proposals, which are then communicated to the Reichstag with the comments of the cabinet. The Reichstag decides by a majority upon any difference between the cabinet and the Reichsrat.

The Reichstag refers the budget to a standing budget committee and may reduce the estimates of expenditure or increase them. But over any increase not proposed by the government the Reichsrat has a veto. Failing agreement the president of the Reich may order a referendum.

So far as revenue is concerned further precautions against hasty legislation are taken All laws proposed must first be presented to the vote of the Reichsrat, but before new taxes are proposed to the Reichstag the Reichswirtschaftsrat or imperial economic council must also be consulted in advance. This advisory body of experts is non-political. Its duty is to sound a note of warning if financial proposals threaten to react unfavourably upon the economic life of the nation. The Reichsrat has a suspensive veto on new taxes proposed by the Reichstag. If it ultimately rejects such proposals, and if the president does not order a referendum the Reichstag may carry the law by a two-thirds majority over the head of the Reichsrat. No government may remain in office if it has lost the confidence of the Reichstag.

The accounts are kept open till May 10, and are then closed upon a cash basis of receipts and expenditure for the financial year. The audit court exercises its control after expenditure has taken place and reports to the minister of finance, who lays the reports and closed accounts before the legislature. The closed accounts for 1925–26 were published on Feb. 3, 1927.

The reparation payments under the Dawes plan (London Agreement of Aug. 1924) amount to 1,750 million gold marks in 1927–28, and thenceforward 2,500 million yearly, subject to increase on a "prosperity index" based on various factors of national capacity to pay.

Italy.—The financial year begins on July 1. Before the end of January, the minister presents to the chamber the estimates prepared by the various ministers embodied in a budget bill for the ensuing year and providing for any modifications, such as supplementary credits, proposed for the current financial year. The principles of the unity of the budget and of gross budgeting are observed, with the exception of an autonomous amortization fund which has been created for the reduction of the war debts to Great Britain and the United States. This fund is credited with the whole of the Italian share of reparation payments. Certain special funds and autonomous undertakings including railways are the subject of separate accounts, appended for information, the gross figures being included in the general budget. A certain elasticity is allowed for excess of expenditure over the authorized grants in specified cases.

There are two categories of budget accounts (*a*) the authoritative account, including all the revenue and expenditure legally due in the year, whether or not received within the year; (*b*) the arrears account, comprising all outstanding claims and liabilities. A patrimonial account is also submitted, showing assets and liabilities of the State. Any surplus on the budget accrues to the Treasury and is not carried forward to the next budget.

A *giro* account, published for information, is designed to disclose "veiled" charges upon the public which would not otherwise be disclosed in the accounts. Examples are the rent of State buildings occupied by the State for official purposes, interest on State securities held by the State, taxes due on State property. In all these cases the State is both debtor and creditor for equal amounts and no cash passes.

The budget bill is laid before the Chamber of Deputies, which elects a budget committee of 36 members. Every deputy may nominate 27 members. Those who receive less than one-eighth of the votes are struck out of the list. The committee usually consists of ex-ministers or other prominent deputies. It appoints subcommittees and reports in writing to the chamber. The result, as in France, is to recast the budget. The powers of the Senate are so restricted that it is claimed that the Senate may only correct material errors due to some oversight in the chamber.

The audit court is peculiar to Italy in so far as it exercises anterior or preventive control, over (i.) acts and decrees entailing expenditure. All these must be registered by the court, which has the right to refuse registration if they are judged to be contrary to law, or, if not, to refer to parliament the question of maintaining them; (ii.) pay vouchers, which must be not only registered but also endorsed by the court; and (iii.) the issue of Treasury bills. The audit court also exercises posterior control over (i.) receipts, (ii.) cash transactions and (iii.) the closed accounts.

Australia.—The financial year begins on July 1. The budget estimates are presented to the House of Representatives by a speech of the treasurer, and to the Senate on the same day by a speech of another minister; the procedure throughout, as in most of the self governing parts of the empire, follows very closely that of the British House of Commons.

The government receipts and expenditure are shown in three distinct funds (*a*) consolidated revenue, (*b*) loan, (*c*) trust funds.

The first is credited with all cash receipts of real revenue, but not receipts from loans, and debited with all expenditure to be paid out of such revenue. The loan fund is credited with proceeds of loans and debited with expenditure to be met by loans All proceeds of the sale of property purchased (or of work produced or paid for) out of the loan fund are credited to that fund. The trust funds are those administered by the State outside the annual budget. Such are the invalid and old age pension fund, the interest (Imperial Government) and war pensions funds. The assets of these trust funds are mainly miscellaneous receipts and budgetary grants.

The accounts of these three divisions of government receipts and expenditure are so closely interwoven that it is hardly possible to obtain a proper conspectus of the finances of the Commonwealth without considering them all. Any surplus or deficit on the accounts is carried forward to the next year.

As a provisional arrangement, subsidies are at present paid by the central government to the states at the rate of 25/- per head per annum.

India.—The financial year begins on April 1. As this is before the monsoon falls accurate forecast is made more difficult, and the Chamberlain committee proposed that the date should be altered to Oct. 1. The proposal has not been adopted.

The Government of India Act, 1919, introduced various constitutional changes, one of which makes each provincial government responsible for its own finances. The Indian States are similarly responsible. So far as finance is concerned the Indian budget must be regarded as a federal budget. Section 25 of the Act requires that "the estimated annual expenditure and revenue of the governor general in Council shall be laid in the form of a statement before both chambers of the Indian legislature in each year"; that "no proposal for the appropriation of any revenue or moneys for any purpose shall be made except on the recommendation of the governor general"; and that the Government's proposal for the appropriation of revenue or moneys relating to: (I.) interest and sinking fund charges on loans, (II.) expenditure of which the amount is prescribed by or under any law, (III.) salaries and pensions of persons appointed by or with the approval of His Majesty or by the secretary of state in Council, (IV.) salaries of chief commissioners and judicial commissioners, and (V.) expenditure classified by the order of the governor general in Council as (*a*) ecclesiastical, (*b*) political, (*c*) defence, shall not be submitted to the vote of the Legislative Assembly unless the governor general otherwise directs. All proposals relating to headings of expenditure not specified above shall be submitted to the vote of the Legislative Assembly in the form of demands for grants. In cases, however, where the assembly refuses or reduces the demands of the Government relative to any matter which the governor general in Council deems essential to the discharge of his responsibilities, it is open to him to override the decision of the assembly and act as if the grant asked for had been assented to.

The general budget is divided into two parts: *(a)* revenue, and expenditure charged to revenue (mainly representing current revenue and expenditure); *(b)* "receipts and disbursements" (representing capital transactions). This part of the budget is often called the "Ways and Means Budget."

In addition there is a special railway budget from which the net surplus is transferred to the revenue side of the general budget. Only the net receipts from irrigation works are included. With these exceptions the budget is a gross budget.

The budget is presented to both chambers at the some time—to the Legislative Assembly by the financial member, and to the Council of State by the financial secretary. After an interval of a week for reflection a day or two is allotted for a general discussion in which details are not to be brought forward. Next comes the voting of supplies for which a maximum of 15 days is allowed. The Council of State does not amend the appropriation bill, dealing with grants, but discusses in detail the finance bill, dealing with revenue. About one half of the expenditure is non-votable or permanent. The executive government of India is responsible, not to the central legislative in India but to the British parliament. And finally the Constitution of 1919 is professedly experimental and transitional. For all these reasons the relations of financial authorities are by no means settled, and the governor general has been obliged in recent years to certify the budget or legalize it by an act of authority without the consent of the legislature.

The accounts, kept on a cash basis, are closed on Oct. 10. Any surplus on the revenue account is applied to the reduction of debt unless the Government and the legislature otherwise determine.

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UNITED STATES OF AMERICA

The financial or fiscal year in the United States begins on July 1. Until 1921, the United States had no centralized budget. Congress was called upon to vote annually the appropriations necessary to cover the estimates of expenditures of the various departments and independent establishments. Several committees in the two houses of Congress framed the bills, without any co-ordination of effort.

Federal Bureau Established.—The first bill to establish a bureau of the budget was passed in 1920 and vetoed by President Wilson because of the provision that a certain official would be immune from removal by the president. The bill was re-passed by Congress and signed by President Harding on June 10, 1921. The bureau of the budget is in the Treasury department, but independent of that department, being directly under the president. The head of the bureau is the director, who is appointed by the president. Under rules and regulations prescribed by the president, the bureau prepares for him estimates for an annual budget and also such deficiency estimates as the president may recommend from time to time to Congress. To this end, under the Budget and Accounting act, the bureau has the authority "to assemble, correlate, revise, reduce or increase the estimates of the several departments and establishments" (sec. 207). The head of each department and establishment appoints a budget officer whose duty is to prepare, under his direction, the departmental or establishmental estimates of appropriations and such supplemental or deficiency estimates as later may be required (sec. 214). These officials are liaison officers between the department or establishment and the bureau. The bureau deals directly with them in its routine of preparing the budget. The estimates are prepared and submitted to the bureau in prescribed forms (sec. 216). On or before Sept. 15 of each year the head of each department and establishment revises and submits his estimates to the bureau (sec. 215). The bureau also may be directed by the president to make detailed studies of the departments and establishments in order to determine what changes should be made in the interest of economy and efficiency, in "(1) the existing organization of activities, and methods of business of such departments or establishments; (2) the appropriations therefor; (3) the assignment of particular activities to particular services; or (4) the regrouping of services" (sec. 209). Each department and establishment is required, under presidential regulations, to furnish to the bureau such information as it may from time to time require. Officials of the bureau are given the authority to have access, for the purposes of examination, to the books, papers and records of any department or establishment that they wish to inspect (sec. 213).

Preparation of the Budget.—The steps taken in the preparation of the budget may be considered as: (1) president's financial policy; (2) preliminary estimates; (3) final estimates; (4) hearings before the board of estimates of the bureau; (5) estimates returned to departments for revisions; and (6) preparation of the budget document. (*See* Henry P. Seidemann, "The Preparation of the National Budget" in *The Annals*, May, 1924.) The budget, with whatever recommendations the president desires to make is transmitted to Congress at the convening of each regular session on the third day of January. Deficiency estimates are submitted from time to time in the same way. The documents which are submitted in this message are: *(a)* estimates of the expenditures and appropriations he judges necessary for the support of the Government for the ensuing fiscal year; *(b)* his estimates of the receipts of the Government during the ensuing fiscal year under (1) laws existing at the time the budget is transmitted and (2) the revenue proposals, if any, contained in the budget; *(c)* the expenditures and receipts of the Government during the last completed fiscal year; *(d)* estimates of the expenditures and receipts of the Government during the fiscal year in progress; *(e)* the amount of annual, permanent or other appropriations, including balances of appropriations for prior fiscal years, available for expenditure during the fiscal year in progress, as at November 1 of such year; *(f)* balanced statements of: (1) the condition of the Treasury at the end of the last completed fiscal year, (2) the estimated condition of the Treasury at the end of the fiscal year in progress and (3) the estimated condition of the Treasury at the end of the ensuing fiscal year, if the financial proposals contained in the budget are adopted; *(g)* all essential facts regarding the bonded and other indebtedness of the Government; and *(h)* such other financial statements and data as in his opinion are necessary or desirable in order to make known in all practicable detail the financial standing of the Government.

Appropriation Bills.—With the establishment of the bureau of the budget, the House of Representatives centred all of the authority in framing the major appropriation bills in the committee on appropriations. This committee is composed of 35 members. The committee is divided into 13 sub-committees of five members each. Each sub-committee frames one of the major appropriation bills, but each bill must be acted upon by the full committee on appropriations before it is reported to the House. Through practice, all of the major appropriation bills originate in the House. The committee on appropriations has a rule that no appropriation may be considered by it which has not been recommended by the bureau of the budget, and, if considered, may not be increased. Further no official is allowed to oppose a reduction of his estimate before the committee Hearings are held by the sub-committees and sometimes by the full committee, at which the director of the budget and other witnesses, with documents and explanations, may be required to assist the committee. The annual appropriation bills which are framed as the result of the division of the budget into 13 items are for: (1) the agricultural department; (2) labour department; (3) District of Columbia; (4) executive office and independent offices, commissions, etc.; (5) interior department; (6) legislative branch; (7) navy department; (8) post office department; (9) state department; (10) treasury department; (11) war department; (12) commerce department and (13) justice department. Deficiency appropriation bills may cover one or more of these divisions.

When the bill has been reported to the House amendments may be made. Upon passage by the House it goes to the Senate, where it is referred to the committee on appropriations and in turn to a sub-committee of that body. Two members of the committee of the Senate having particular interest in the department or establishment included in the appropriation sought may sit with the committee in considering the bill there. Any differences between the two houses of Congress are settled by one or the other accepting the bill as passed by the other body, or through conference committees of both houses by which compromises are effected. The appropriation bills generally are larger after passage by the Senate.

Accounting of Funds.—Receipts and expenditures are accounted for in: (1) a general fund; (2) a loan fund; (3) special accounts, as the post office account; and (4) revolving funds. The general fund embraces all ordinary receipts, including, *e.g.*, proceeds of Government sales and loans (repayment of interest or principal by foreign Governments), and all ordinary expenditures, including capital expenditures, interest on the debt, redemption of the debt, etc. It is in principle a gross budget and a unified budget. The loan fund accounts for credit operations in connection with the principal of the public debt. Revolving funds are allotted to some departments as working capital. In these cases net expenditure is shown in the budget. At the end of the fiscal year, cash receipts and expenses of the general fund and the loan fund are published, as also accounts of warrants issued but not cashed. If there is a deficit in the receipts, the president is obliged to recommend to Congress new taxation, new loans, etc. A surplus or deficit balance is not carried from one budget to another, but is accounted for in the Treasury cash statement.

State Budgets.—All of the States have made provisions for a budget. In six, California, Louisiana, Maryland, Massachusetts, Nebraska and West Virginia, the procedure is provided for in the State constitution. In Maryland, the plan directs the governor to require estimates from the different divisions of the government and he may revise the same, except those relating to the legislature, judiciary and school system. He submits his estimates in the form of two budgets and two accompanying bills for one year each, for the use of the legislature at its biennial session. The legislature may not increase those relating to the branches of government other than the legislature and judiciary, but may reduce the others with the exception of certain constitutional limitations as to the public school system and also salaries for officers for the terms for which appointed. The Massachusetts budget plan is similar except that the legislature may make increases, subject to the authority of the governor to veto individual items in appropriation bills. The Nebraska budget is also similar, except that by a three-fifths vote of both houses the legislature may, without subjecting the item to veto, increase particular provisions. In Louisiana the tax commission is the budget-making authority. The legislature there may not pass an appropriation bill within five days of the end of the session. The governor in California is required to submit a budget plan with a bill. Before the budget bill is enacted, no appropriation bill, unless for legislative expenses, may be passed without the approval of the governor. The governor may reduce or eliminate items, but the legislature by a two-thirds vote may override his action.

Under legislative enactment, a department of finance has been created in Illinois, whose head is appointed by the governor. The legislature may increase the appropriations over his recommendations, but under the centralized control which the governor exerts over the non-constitutional officers, a partial executive budget is in effect. Utah has a legislative act similar to the Maryland plan, whereby the legislature will not make increases over the gubernatorial recommendations and will not consider any appropriations not so recommended to it. A similar plan in effect in New Mexico also permits the governor and executive and administrative heads to appear and be heard by the legislature. The secretary of State, appointed by the governor, is the budget officer in Pennsylvania. The legislature is not limited in its action on the budget but the governor may veto particular items of appropriation bills. The governors of Vermont and Tennessee also submit budgets to the legislatures. In Wisconsin a board of affairs controls the budget-making. It is composed of the governor as chairman, three of his appointees, the secretary of State, the president pro tempore of the senate, the speaker of the house and the chairmen of the two legislative finance committees. In the remaining States, such budgets as exist are largely the result of legislative rather than executive supervision. They comprise hearings by legislative committees on appropriations desired by State departments, agencies and institutions and submitted by them in individual estimates. New York State also has a budget plan.

Municipal Budgets.—Budget plans also have been adopted by many cities. In New York the responsible municipal heads submit estimates to the city council. This is followed by the adoption by the board of estimate and apportionment, composed of the mayor, controller, president of the city council and the presidents of the five boroughs, of a tentative and then a proposed budget for submission to the city council, after hearings have been held. The council may not increase items but may reduce them, subject to the veto of the mayor, which veto may be over-ridden only by a three-fourths vote.

In Detroit and Philadelphia the head of each department is given a specified sum to spend, along with a uniform classification of accounts.

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BUDGET, BUSINESS. A budget, defined in its simplest terms, is merely an estimate of future needs. These needs may be for money, for labour, for materials, for advertising, for sales, for production, for capital expenditures, for personnel, or for any item of either income or expense. Nevertheless the business budget remains merely an advance estimate of the needs of the company for a definite future period.

Budgetary control, however, involves not only estimates of income and expense but implies a plan whereby these are logically related one to the other and actual income and expense definitely controlled in relation to the plans. Any plan of budgetary control must of necessity be closely co-ordinated with the organization structure of the company and with the policy making and managerial elements. Rightly conceived and administered, a budget plan is of inestimable value to the business manager. By means of the budget, responsibility is definitely fixed, a better co-ordination of all activities is assured, a barrier to unwise expansion is established, a proper relationship between income and expense is maintained and a guide set up by which estimated and actual results may be checked one against the other periodically. Budgeting is not a substitute for good management. It is, however, one of the most practical and useful tools of management and accountability available, insuring as it does, considered planning before doing and replacing "hindsight" with "foresight."

The basic principles of successful budgetary control are simple and few in number. In the first place, executive support of both the principle and plan of budgetary control is absolutely essential. Indeed, unless all the executives of the company, from the chairman of the board of directors and the president down to the *least important department supervisor*, are in full accord and sympathy with the principle of planning, the success of the budget is in danger. Nothing so retards the success of any plan or method than to have it known that it has only the lukewarm sympathy and support of the principal executives. A budget should not be regarded, either by those working under it or by those administering it, as restrictive in character. Budgets must be elastic and flexible to meet changing conditions. Another important principle of budgetary control is that those who are to execute plans should have a definite and active part in making them. A salesman, for example, who is asked to assist in setting his own *quota*, is *much* less likely to complain about *its* size or to present alibis, than is one who has been assigned a quota by his sales manager or other superior without previous consultation.

Regardless of the size of the organization, the number of people affected and the nature of the business, it is essential that the procedure for budgetary control be kept as simple as possible. An example of what can be done in this connection is found in the case of one of the largest meat-packing companies in the United States, having sales in excess of $900,000,000 a year, which operates under a plan of budgetary control covering all phases of its business. This company, however, finds it necessary to have only six people in its budget department, including the director of budgets. In order to give practical effect to the principle of operating the business in accordance with plans made, it is necessary that provision be made for frequent comparisons between estimated and actual performance. Such comparisons should be provided for at least once a month, with summaries every three months. One real danger, especially in a company's early experience with budgeting, is that estimates made will be merely optimistic hopes rather than real expectations of accomplishment. Expenses are budgeted in relation to anticipated income. If actual income falls far short of the budget, net profits will be reduced unless the situation is noticed in sufficient time to reduce expenses in the same proportion. Finally, it is essential that plans once made be adhered to except in cases where sound business judgment indicates that changes are desirable. As someone has expressed it, "Manage through your budget; don't let it manage you."

Actual responsibility for the direction of the budget plan rests with different executives in different companies. The plan under which the controller or the treasurer assumes the duties of budget supervision is by far the most widely used. Under this plan of organization, it is usual to find someone with the title of budget director, head of the budget department, supervisor of budgets, or controller of the budget, reporting directly to the treasurer or controller. In a relatively few cases, a person with title of assistant to the president is the administrator of the budget plan. Whatever the title of the executive in charge of budgeting may be, it should be clearly understood that he is representing the president in the discharge of his duties.

One of the most important budgets and yet, undoubtedly, the one which it is most difficult to prepare, is the sales budget, which shows both anticipated income from sales as well as quantities which it is expected will be sold. Best practice favours the separation of sales income from sales expense. In preparing the sales budget, the three fundamental factors of probable market conditions, past sales, and plans and policies of the company for the coming year are used. Of these three, the first is the most difficult to deal with. During recent years a great deal of attention has been given to market analysis, both by companies themselves as well as by research organizations. While space does not permit of a detailed discussion of this important phase of budgeting, it should be clearly understood that a thorough market analysis must necessarily precede the preparation of a sales budget. After the sales budget has been prepared, the next step is the co-ordination of the estimated sales volume and income with other factors. In the case of a manufacturing business it is obvious that the sales estimate must be co-ordinated with the production capacity of the plant and that inventories must also be considered. Likewise, it may be necessary to make the original sales estimate conform to such factors as the ability of the company to finance the contemplated sales programme, the percentage of selling expense, anticipated net profits, advertising plans, personnel available to carry out the sales estimate, etc.

While the modification of the sales budget is being carried on, but after the original sales estimate has been prepared, other executives are preparing various expense budgets. A detailed budget of selling expenses must be drawn up. The advertising appropriation or budget must be prepared. If a manufacturing business, a production budget is necessary. Similarly, a budget of materials and supplies needed to fabricate the finished product, or in the case of a department store, the amount of goods to be purchased to supply the anticipated sales demand, must be drawn up. In the preparation of this latter budget, inventory requirements, minimum and maximum quantities and turn-over are given special consideration. In every business a budget of general overhead expenses, including such items as interest, taxes, general operating expenses, administrative expenses, is necessary. Similarly, a budget covering capital expenditures for additions and replacements to plant and equipment, including proper allowances for depreciation and obsolescence, is essential. Upon completion of all of the budgets mentioned, the executive in charge of the budget plan prepares the master or financial budget. This budget is very largely a consolidation, by totals only, of the individual departmental and functional budgets previously prepared. In a growing number of cases, estimated balance sheets and profit and loss statements are being prepared from the financial budget. Since the balance sheet and the profit and loss statement are the two accepted financial statements which summarize the past activities of the business from a financial point, it is only logical that the plans be finally put into estimated statements of the same kind. Banks throughout the United States are more and more asking companies to whom they extend accommodations, to submit estimated financial statements of this kind.

One test of the success of any budget plan is the way in which [illegible] ryc [illegible] pr [illegible] ide [illegible] opc [illegible] To make the budget function properly, executive support, as has been said, is absolutely essential. In addition, frequent comparisons between estimated and actual results are necessary. A few companies have taken further steps in this direction by offering to executives, department heads, foremen and others, bonuses for the operation of the units for which they are responsible, below the estimated figures. A smaller number of companies have prepared manuals descriptive of their budget procedure. Such manuals not only serve to inform the entire organization, in a specific way, of the general plan of budgetary control, but contain specific directions for the detailed procedure involved in preparing each budget, which are most helpful to all who are concerned with budget making.

In summary it may be said that the principle of budgetary control is not new. For many years it has been applied successfully by governments, municipalities, charitable institutions and individuals. Informally, too, it has been applied by business organizations. With the growing necessity, however, for better management and the increasing realization that planning in advance is an integral part of good management, the budget has found its way into use in an increasing number of companies.

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BUDGET, FAMILY. For the control of family expenditure (and for individual expenditure as well) the budget is coming more and more into use. A budget is a plan for the use of a given amount of money, a plan made under specific headings. Accounts are kept under the same headings, so that the budget plan can be constantly checked, and unless they are so kept, the budget becomes useless. On the other hand, household accounts have little value unless they are so kept as to make them the basis for planning future expenditure.

Attention was first called to the subject in the United States by Ellen H. Richards in *The Cost of Living* (1899). Statistics of family expenditure have been collected by Government departments, by economists and by welfare societies. These have been chiefly for low income levels and have been used in consideration of the minimum wage, the "decency level" and the "comfort level" for wage earning and dependent families. Some data have been collected regarding the use of larger incomes, but not to the same extent as for the low incomes. "Model" or "ideal" budgets for given incomes have been issued from many sources, to be used as a basis only, since the budget must be an individual matter with each family. Dr. Ernst Engel in 1857 enunciated his "laws" for the budget, stating that in the wage earner's family as the income increases the percentage spent on food decreases, while the percentages spent on clothing, housing and general operating expense change very little. F. H. Streightoff in *The Standard of Living* (1911) has re-stated these laws for American conditions. There seems to be a general agreement that rent should not exceed 25% of the income, that clothing should not exceed 15% or 20%, and that savings must be at least 10% for safety. The savings possibilities must vary with family conditions, 10% being impossible to many with low incomes and large families, while 50% is quite possible to others; 10% provides for emergencies, but would rarely be enough to produce an old age income.

The United States Treasury department, during and after the World War of 1914–18, did much to promote the use of the family budget. The bureau of home economics of the United States department of agriculture is still carrying on this work. Many of the mutual savings banks have established a "home bureau," the head of which acts as budget consultant. A few department stores have done the same, and some newspapers and women's magazines are running special budget departments. The national thrift committee has a sub-committee on the subject, and presents the budget all the year round as one of its seven points of thrift.

The purpose of the budget is to enable the family, by taking a long look ahead, to decide how it wishes to use the income available. It is seldom advisable to make it for a shorter period than a year. A plan, properly checked by accounts, ensures wiser expenditure than is possible in day-to-day spending without a plan. The family budget is made by husband and wife together, as senior partners, or by other heads of a family. Older children are often called into counsel as junior partners. The large items of rent, food and clothing are first considered, then other headings in detail. Good budget-making allows no miscellaneous or sundries heading, as the object is to control expenditure, and such headings are not easily controlled. Allowances for personal expense are usually made to some members of the family, including children old enough to keep accounts. In good budget-making it is always stated definitely what such an allowance must cover. In the family accounts only the amount of the allowance as paid is recorded, but certainly for children a simple budget and accounts should be required. For the expenditure under each of the headings some member of the family is responsible. In the average family, the wife controls the spending under most of the headings, and it is her part not only to keep the accounts carefully, but also to use the money as wisely as possible.

Different budget headings are recommended by different advisers, and many printed forms of accounts are distributed by banks, insurance companies and others. The family should choose with care the form best suited to its needs. Since unexpected expenses may occur at any time, readjustment of the budget plan must often be made. If one heading calls for more money, another or others must have less, and which shall lose must be considered. The budget should never be looked on as an iron-bound restriction of expenditure, but rather as a plan that can at any moment be changed to fit changing needs.

One important purpose of the budget is to secure regular savings (of the amount possible to the family), which are difficult to make if the income is not carefully apportioned. The savings bank may be used for an emergency fund or for funds for special purposes of the near future. The budget makers study savings and investments, with the purpose to be served by each; whether the home shall be owned or rented; whether the family should make investments on which they can realize quickly in case of need, or may choose long-time investments to produce an old age income. Life insurance in its many forms must be studied, so that any policy taken fits the need which it will be or may be called on to meet. The careful consideration brought about by the use of the budget tends to ensure safe investments. When the husband and wife consider these together, the latter learns to judge of safety and advisability for herself, so that if she should be left with the responsibility, she is not at the mercy of her advisers. The family assets and liabilities are reckoned at the end of each budget year, and the gradual growth of the net assets is both a reward and a stimulus.

The advocates of the budget believe it to be of the greatest value, not only because by the control of expenditure the family is in safer condition financially, but also because the family ideals are better maintained when a long-time plan is made.

See C. W. Taber, *The Business of the Household* (1918); I. E. Lord, *Getting Your Money's Worth* (1922), *The Family Budget* (1924); S. A. Donham, *Spending the Family Income* (1933). (I. E. L.)

BUDINI, an ancient nation in the north-east of the Scythia (q.v.) of Herodotus (iv. 21, 108, 109), probably on the middle course of the Volga about Samara. They are described as grey eyed and red haired, and lived by hunting in their thick forests. They were probably Finns of the branch now represented by the Votiaks and Permiaks, forced northwards by later immigrants. In their country was a wooden city inhabited by a distinct race, the Geloni, who seem to have spoken an Indo-European tongue. Later writers add nothing to our knowledge, and are chiefly interested in the tarandus, an animal which dwelt in the woods of the Budini and seems to have been the reindeer.

BUDWEIS: *see* Budejovice.

BUECHELER, FRANZ (1837–1908), German classical scholar, was born in Rheinberg on June 3, 1837. He held professorships successively at Freiburg (1858), Greifswald (1866), and Bonn (1870), and in 1878 became joint-editor of the *Rheinisches Museum für Philologie*. Among his editions are: *Frontini de aquis urbis Romae* (Leipzig, 1858); *Pervigilium Veneris* (Leipzig, 1859); *Petronii satirarum reliquiae* (Berlin, 1862; 3rd ed., 1882); *Hymnus Cereris Homericus* (Leipzig, 1869); *Q. Ciceronis reliquiae* (1869); *Herondae mimiambi* (Bonn, 1892). He wrote also *Grundriss der lateinischen Deklination* (1866); *Das Recht von Gortyn* (Frankfurt, 1885, with Zitelmann); and supervised the third edition (1893) of O. Jahn's *Persii, Juvenalis, Sulpiciae saturae*.

BUELL, DON CARLOS (1818–1898), American soldier, was born near Marietta (Ohio), on March 23, 1818. He graduated at West Point in 1841, and was company officer of Infantry in the Seminole War of 1841–42 and the Mexican War, winning the brevet of captain at Monterey, and that of major at Contreras-Churubusco. From 1848 to 1861 he acted chiefly as assistant-adjutant-general. On the outbreak of the Civil War he was appointed lieutenant-colonel, then brigadier-general of volunteers, and major-general of volunteers in March, 1862. He aided in organizing the Army of the Potomac, and was sent, in Nov. 1861, to Kentucky to succeed Gen. William T. Sherman in command. Here he organized and trained the Army of the Ohio, which to the end of its career retained a standard only surpassed by that of the Army of the Potomac. In the spring of 1862 Buell followed the retiring Confederates under Sidney Johnston, served under Halleck in the advance on Corinth, and in the autumn commanded in the campaign in Kentucky against Bragg. A period of manoeuvring virtually ended in the indecisive battle of Perryville. The alleged tardiness of his pursuit, and his objection to a plan of campaign ordered by the Washington authorities, brought about his removal from command. The complaints made against him were investigated in 1862–63, but the result was not published. Subsequently he was offered military employment, which he declined. He resigned his volunteer commission in May, and his regular commission in June 1864. He died near Rockport (Ky.), on Nov. 19, 1808.

BUENAVENTURA, a Pacific port of Colombia, in the department of Valle, about 210 mi. W.S.W. of Bogotá. Population in 1938, 14,515. The town is situated on Cascajal, a small island, at the head of a broad estuary or bay projecting inland from the bay of Chocó and 10m. from its mouth. The estuary is deep enough for vessels of 20ft. draught and affords an excellent harbour. Buenaventura is 360m from Panama and is the first port of call south of the canal for several lines of steamers. It is the Colombian landing-place of the West Coast cable. The town has a very unhealthful climate, oppressively hot and humid. It is the port for the upper basin of the Cauca, an elevated and fertile region, with two large commercial centres, Popayán and Cali (with which it is connected by rail), and also for the gold and platinum districts along the upper San Juan river.

BUENA VISTA, a battleground of very rugged terrain, situated about 8 m. south of Saltillo, Mexico. There on Feb. 23, 1847, was fought the final engagement of the northern campaign of the war between Mexico and the United States (1846–48). Gen. Santa Anna, with some 20,000 Mexicans, moved north in order to overpower Maj.-Gen. Zachary Taylor's forces which, owing to dispersions and changes, numbered not more than 5,000 men. The coup was planned with cunning and the U.S. troops would have been at a disadvantage, had the Mexicans displayed more aggressiveness. As it was, the main American camp was surprised and withdrawn to Buena Vista. Col. Wool was left in command by Taylor, who went back to Saltillo to prepare that place for defence. Although Wool had selected the site and disposed his troops well, before nightfall (Feb. 22) the defenders of the mountain pass in front had been repulsed. Next morning the Mexican army in force came through the pass, and nearly outflanked the troops who had re-ascended the mountain, when Washington's battery began to have a telling effect. In the centre, a regiment and a half of State troops fled before the Mexican onslaught. Other dragoons of militia, being cut off, withdrew in panic. Although Bragg, Sherman and O'Brien trained their guns on the Mexicans against great odds, the way to the Americans' rear lay open. Though Taylor's appearance on the scene lent confidence, he uttered so few directions that the initiative fell upon his trained subordinates. Col. Jefferson Davis with his Mississippians and Col. Bowles with the remaining Indianians charged and repulsed Ampudia's cavalry. Col. Davis, painfully wounded and bleeding, refused to leave his saddle until the field was secure.

Gen. Taylor ordered Hardin to charge a large force of Mexicans in front. Although Bissell, McKee and Thomas joined in the attack, the Mexicans overwhelmed them. Hardin, McKee and Henry Clay perished, standing to the last. But Bragg and Sherman galloped from another part of the field with their tired batteries, and some of the Indiana and Mississippi regiments charged the enemy's flank and rear. Col. Davis was carried to his tent as the Mexicans began their retirement. Taylor had lost over 2,000 men, dead, wounded or missing in the engagement. The Mexican losses are variously estimated but were doubtless heavy. Even though Santa Anna was still stronger in numbers, he withdrew to the south, fearing to risk another engagement.

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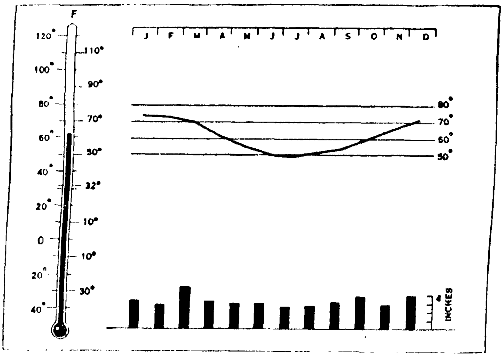
(W. A. G.)

BUENOS AIRES, the province of Buenos Aires is one of the 14 provinces which together with 9 territories (*gobernaciones*) and the federal capital form the nation Argentina. It is bounded north by the provinces of Córdoba, Santa Fé and Entre Ríos, the last named separated by the river Paraná; east by the Plata estuary which separates it from the Republic of Uruguay, and by the Atlantic ocean; south by the Atlantic and the territory Río Negro from which it is separated by the river of the same name; west by the territories of Río Negro and La Pampa and the Province of Córdoba. The province is situated between 33° 8′ and 41° 4′ S. lat. and 56° 36′ and 63° 30′ long. W. from Greenwich. Its area is approximately 118,750 sq.mi.



WEATHER GRAPH OF BUENOS AIRES. THE THERMOMETER REGISTERS THE ANNUAL MEAN TEMPERATURE. THE CURVE SHOWS THE MONTHLY MEAN TEMPERATURE AND THE COLUMNS INDICATE THE NORMAL PRECIPITATION FOR EACH MONTH

Physical Features.—Although the province has a frontage of about 1,000 mi. on the Río de la Plata and the Atlantic and nearly 310 mi. bounded by the Paraná in the north and the Río Negro in the south, it has but few good natural ports, the best being Bahía Blanca, where the Argentine government has constructed a naval port, and Ensenada de Barragán (La Plata), where extensive artificial basins have been constructed for the reception of ocean-going steamers. San Nicolás and General Uriburu (formerly Zárate), on the Paraná, have fairly good ports, while at Buenos Aires and Mar del Plata (a fashionable seaside resort) extensive artificial ports have been constructed. In its general aspect the province forms a part of the great treeless plain extending from the Atlantic and La Plata estuary westward to the Andes. A fringe of small tangled wood covers the low river banks and delta region of the Paraná between San Nicolás and Buenos Aires; thence southward to Bahia Blanca the seashore is low and sandy, with a zone of lagoons and partially submerged lands immediately behind. The southeastern and central parts of the province are low and marshy, with numerous lakes. Two ranges of low mountains extend partly across the southern part of the province—the first from Mar del Plata, on the coast, in a northeast direction, known at different points as the Sierra del Volcán, de los Padres, Azul, Tandil and Olavarría. The second and shorter range starts near Bahía Blanca, has the same general direction as the above, and is known at different points as the Sierra Pillahuinco and Sierra de la Ventana (3,543 ft.). The country is well-watered with numerous lakes and small rivers, the largest river being the Rio Salado, which rises near the northwest boundary and flows entirely across the province in a southeasterly direction with a course of about 360 miles. The Río Colorado crosses the extreme southern extension of the province, a distance of about 80 mi., but its mouth is obstructed, and its lower course is subject to occasional disastrous inundations. The climate, healthful and mild, is generally temperate; although sudden changes are frequent. The rainfall is very irregular, varying from an annual precipitation of about 32 in. in the north to about 10 in. in the extreme south.

Population.—The province is not only the largest but also the most populous in the republic.

The official census of 1914 gave it a population of 2,066,165, of whom 703,931, or 31% were foreigners. The most numerous of the foreign element are Spanish, Italian and French, however, there are also Germans, English and other nationalities. An official provisional estimate of Dec. 31, 1943, gave it a population of 3,633,256, or a density of 30.6 persons per sq.mi. The principal cities with their estimated populations are: Avellaneda (399.000), an important industrial centre adjacent to the city of Buenos Aires; La Plata (256.680), capital of the province and its chief overseas shipping point; Bahía Blanca (121,055), an important Atlantic port; Mar del Plata (94.500), a famous seaside resort; Lomas de Zamora (100,000); Vicente López (95.770); San Isidro (61.581); Quilmes (50,000); San Fernando (46,950); Pergamino (37.956); Chivilcoy (37.000); and Tandil, Seis de Septiembre and Azul, each with a population of approximately 30,000.

Government.—Considerable legislative and administrative power is vested in the provincial government. The executive is a governor, who, with a vice-governor, is elected by popular vote for four years. The legislature consists of a senate and a chamber of deputies. The judiciary comprises the supreme court, and courts of appeal in La Plata, and civil, commercial and criminal courts in La Plata, San Nicolás, Mercedes, Dolores, Bahía Blanca and Azul.

The province is divided into 110 *partidos*, or districts, and eight electoral sections.

Education.—According to the census of 1914, 30.8% of the population was illiterate; the percentage, however, is rapidly being lowered. In 1941 there were 2,873 schools in the province, attended by 430,308 pupils. There are national secondary schools in all the principal cities and a national university at La Plata.

Livestock and Agriculture.—A mild climate, an abundant rainfall (except in the extreme south) and a humid soil have all contributed to endow the province with an abundant vegetation, not only in its rich, natural pastures, but also of cultivable plants suited to the temperate zone. Cattle-raising quite naturally became the principal industry of this region soon after its settlement by the Spaniards, and sheep-raising on a profitable basis was developed about the middle of the 19th century. Toward the end of that century the export of wool, livestock and dressed meats reached enormous proportions. There is still a limited export of jerked beef (*tasajo*), but the chief exports are refrigerated meats and livestock, which go to the neighbouring South American republics, Europe, South Africa and the United States. Much attention has been given to the raising of horses, and, to a more limited extent, to mules and swine. There were in the province on June 1, 1941, according to a census of livestock of that date, 11,068,249 cattle, 17,216,925 sheep, 1,807,740 horses and 1,203,289 swine. Buenos Aires ranks first in the republic, alike for the number and the high quality of its livestock. Dairying has gained considerable prominence during recent years.

Little attention was given to agriculture until the last quarter of the 19th century, but its subsequent development has tended more and more to displace the pastoral industry. Maize (Indian corn) and linseed are the chief crops of the north; in the centre and southwest wheat predominates; and in the southeast potatoes. Oats, barley, alfalfa, fruit and vegetables are less localized. About 40% of the area sown to cereals and linseed in the whole of the republic is in the province of Buenos Aires. The land in actual cultivation increased from 3,400,000 ac. in 1895 to approximately 20,270,000 ac. in 1941. The areas and productions of the principal crops for the agricultural year 1940–41 are given in the table.

Fruit-growing—peaches, grapes, pears, strawberries and figs—has made good progress, especially on the fertile delta of the Paraná river.

Crops of Buenos Aires Province, 1940–41

Crop	Area in acres	Production in tons
Wheat	7,306,107	3,160,000
Maize	4,850,645	4,314,400
Oats	2,834,657	474,900
Linseed	1,891,798	447,000
Barley	1,427,126	592,000
Rye	914,218	82,000
Sunflower	753,079	318,807
Birdseed	145,789	29,400

Industry and Transportation.—Buenos Aires also ranks first as regards industrial and commercial development and means of transportation. Chief among the manufacturing establishments are meat refrigeration plants, flour-mills, creameries and cheese factories, breweries, distilleries, foundries, tanneries, boot and shoe factories and numerous industries with a smaller output. Meat refrigeration is by far the chief industry. In 1941 the refrigerating plants slaughtered 2,911,958 cattle, 5,283,506 sheep and 755,535 swine. The products of the factories with those of agriculture give rise to an extensive commerce, both domestic and foreign.

Because of the difficulties of navigating the Paraná, the greater part of the trade of the northern and western provinces must pass through the ports of Buenos Aires and La Plata, at which an immense volume of business is concentrated. All the great trunk railways of the republic pass through the province and converge at these ports, and from them a number of transatlantic steamship lines carry away the products of its soil and factories. The province is also liberally supplied with branch railways, bringing the total mileage to approximately 8,850.

In 1941 there were some 23,000 mi. of improved roads and highways in the province.

History.—The early history of the province of Buenos Aires was a struggle for supremacy over the other provinces for a period of two generations. Its large extent of territory was secured through successive additions by conquest of adjoining Indian territories south and west, the last additions being as late as 1870. Buenos Aires became a province of the confederation in 1820, and adopted a constitution in 1854, which provides for its administration by a governor and legislature of two chambers. An unsuccessful revolt in 1880 against the national government led to the federalization of the city of Buenos Aires (74 sq.mi.), and the founding (1882) of La Plata as the provincial capital, the republic assuming the public indebtedness of the province at that time, as an indemnification. Liberal laws as regards immigration and foreign capital have caused the province to grow rapidly in both population and material wealth.

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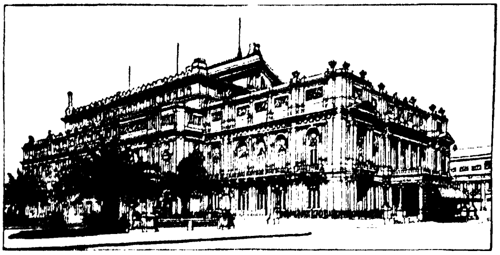
BUENOS AIRES, the capital of the republic of Argentina, situated in a federal district of 74 sq.mi. on the western shore of the Rio de la Plata estuary, elevation 65 ft., lat. 34° 36′ 30″ S and long. 58° 22′ 20″ W. The estimated population on Dec. 31, 1944, was 2,595,861, the largest city in the southern hemisphere and the 11th largest city of the world. The mean annual temperature is 61° F. and the average rainfall is 38 in. July is the coldest month, with a mean temperature of 49° F., and January is the warmest (73.6° F.). There is no well defined seasonal periodicity in rainfall, although June, July and August are normally the driest months, each averaging about 2 in. April is the wettest month, with an average of 4.8 in. of rain, and March, November and December each average about 4 in.

With few exceptions, the streets of the city intersect at right angles, and Porteños, *i.e.*, the people of Buenos Aires, may be genuinely proud of such beautiful thoroughfares as Avenida de Mayo, extending from Plaza de Mayo to Plaza del Congreso, Roque Sáenz Peña (Diagonal Norte), Avenida 9 de Julio, a 425-ft. avenue, which, when completed, will extend from C. Santa Fé to Plaza Constitución, a distance of about 3 mi., Avenida Rivadavia, the longest street in the city, Paseo Colón, Leandro N. Alem, Avenida La Plata, and many others. Avenida General Paz extends 18 mi. from a point on the river at the N. extremity of the city, following the W. and S. margin of the federal district, to the Riachuelo. This is a part of the projected Avenida de Circunvalación, which will eventually encompass the city.

According to the census of 1936 there were 234,000 buildings in Buenos Aires, while in 1940 alone some 16,700 applications for building permits (new construction) were filed. Among the noteworthy public buildings facing Plaza de Mayo are the Casa

Rosado (Government palace), the Treasury building, the Ministry of War building, the Intendencia Municipal (building of the executive branch of the municipal government) and the old Cabildo.

Along the north side of the Plaza are the cathedral and the Banco de la Nación. Other imposing public buildings include the Palacio del Congreso, Argentina's capitol, on the plaza of the same name, the Palacio del Concejo Deliberante on Diagonal Julio A. Roca, the Palacio de Justicia and the Colón theatre. The Cavanagh building facing Parque del Retiro is the tallest building in the city (29 stories).


BY COURTESY OF THE CANADIAN PACIFIC S. S. CO.

THE COLON THEATRE IN BUENOS AIRES, CONDUCTED UNDER MUNICIPAL MANAGEMENT AND DEVOTED CHIEFLY TO GRAND OPERA. IT IS SAID TO HAVE BEEN ERECTED AT A COST OF $1,700,000

There are nearly 2,000 ac. of open space in the city, a relatively large part of which was created after 1930. Of the scores of parks, plazas and small squares, Parque 3 de Febrero is the largest (about 1,000 ac.), situated between the Río de la Plata and the suburbs of Belgrano and Palermo. Other notable parks include Parque del Retiro, the Carlos Thais botanical garden and the Clemente Onelli zoological garden. In 1941 there were 191 public libraries, with a combined total of 2,361,138 volumes. The largest of these libraries are the National, on C. Méjico, Congress, Concejo Deliberante and that of *La Prensa*, Argentina's leading newspaper. Of the 21 museums in the city the principal are the Histórico Nacional, the Nacional de Bellas Artes, the Municipal de Arte Colonial and the Postal y Telegráfico. The city has more than 30 hospitals, 7 of which are maintained by the city's major foreign colonies, 35 theatres, 175 motion picture houses, several large markets, and hundreds of hotels, restaurants and cafes, many of which are world famous.

The urban and interurban transportation system of Buenos Aires is excellent. In 1941 the network consisted of 456 mi. of street railways, 32 mi. of subways, with more under construction and more than 2,000 route miles covered by buses and "jitneys." Average daily passenger traffic in 1940 was nearly 3,400,000. The city is also the terminus of every major railway in the republic.

In 1940 the total passenger movements through the five principal railway stations (Retiro, Once, Constitución, Lacroze and that of the Compañía General de FF.CC) amounted to 25,137,043.

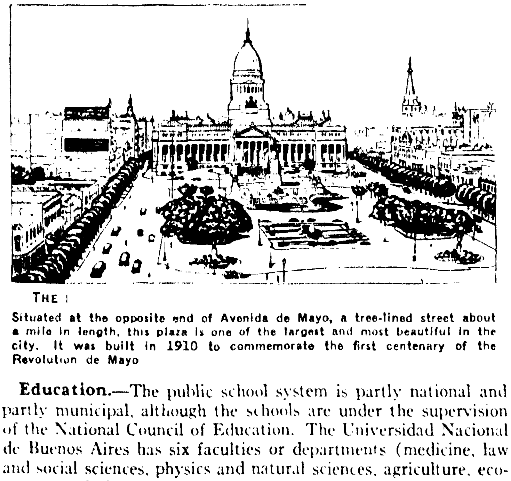
Port Facilities.—In addition to being one of the largest ports in the world and the leading port of Argentina, the harbour of Buenos Aires is entirely man-made. Actually there are five ports or units, comprised of interlocking basins and docks, which extend along the river front for a distance of about five miles. From S. to N. these are: Port of Inflamables (under construction in 1941), Dársena Sud (South Basin), Riachuelo, Puerto Madero and Puerto Nuevo (completed in 1935), which includes Dársena Norte. Access to the port from the outer roads is by way of a channel that leads to within 5 or 6 mi. of the port, at which point it branches into two channels, one leading to Puerto Nuevo and Dársena Norte, the other to the Riachuelo and Dársena Sud. The depth of water in the main channel and northern branch is 31 ft. while in the southern branch it is about 27 ft. As a result of World War II the foreign trade of Buenos Aires decreased steadily.

In 1937, 2,824 vessels (10,413,445 net register tons) entered the port as compared with 1,439 vessels (4,311,912 net register tons) in 1941. During the same period, imports decreased from 8,628,744 to 5,768,628 short tons, and exports from 5,384,735 to 3,482,611 short tons.

Government.—The government of Buenos Aires is composed of two branches, executive and legislative, the latter being known as the *Concejo Deliberante*, or city council. The legislative branch consists of councillors, whose number (30 in 1940) is determined by a somewhat complicated system of representation proportionate to the voting population of the city. The head of the executive branch is the *Intendente Municipal*, or mayor, who is appointed by the president of the republic, subject to the approval of the senate. By a decree of Oct. 9, 1941, the *Concejo Deliberante* was replaced by a commission of 21 interventors (*Comisión Interventors de Vecinos*), appointed by the executive head of the nation.

Buenos Aires, in addition to being a municipality, is also the capital of the republic, and as such has intimate connection with the federal government. Through the *intendente* matters pertaining to the welfare of the municipality are presented to the national congress whenever necessary, and he, as the representative of the national government, is empowered to present to the municipality matters affecting it that have originated in congress. Other manifestations of this dual character of the city are to be found in the police and fire departments, under the control of the federal government, which meets the expenses of these departments. Certain branches of the educational system, and also the sanitary regulations of the city, carried out by means of a national department of public service, are partly national in character.

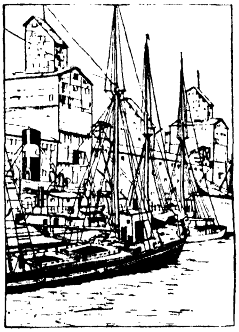
Public sanitation is directed by two organizations, one national, the other municipal. The first body controls conditions that directly affect the country by virtue of the city's being the gateway to the republic. The second body has charge of municipal laboratories, conducts bacteriological examinations and disinfecting activities, and controls the relief services that respond to emergencies. The city's water supply and sewer system are departments of the national government. Water is obtained from the Plata far enough up stream to avoid pollution, the supply being taken from wells bored beneath the surface of the river. At central stations this water is purified further by sedimentation and filtration. The sewerage system discharges into the Plata below the city; whence it is carried out to sea. Gravity not being sufficient, a series of pumps and relief sewers were installed


THE

Situated at the opposite end of Avenida de Mayo, a tree-lined street about a mile in length, this plaza is one of the largest and most beautiful in the city. It was built in 1910 to commemorate the first centenary of the Revolution de Mayo

Education.—The public school system is partly national and partly municipal, although the schools are under the supervision of the National Council of Education. The Universidad Nacional de Buenos Aires has six faculties or departments (medicine, law and social sciences, physics and natural sciences, agriculture, economics and philosophy and letters) occupying separate buildings in various parts of the city. In 1940 there were 762 faculty members and 16,610 students. Secondary education is provided in a total of 276 institutions, staffed by approximately 7,000 instructors and attended by more than 60,000 students. In 1940 there were 961 primary schools with an enrolment of 353,734. Primary education is free and compulsory for children from six to 14 years of age.

History.—In 1515 Juan de Solís sailed his vessels into the water known today as the Río de la Plata, believing that he had found the route to the Indies. Solís and his party were the first Europeans to reach this waterway, but the leader never lived to tell the story. On the north shore of the river he and most of his followers met their death in an encounter with the Charrúa Indians. Five years later another European expedition arrived, headed by a Portuguese, Ferdinand Magellan, in the service of the Emperor Charles V. Magellan followed the coast of the country and finally discovered a watercourse leading to the east. In 1527, Sebastián Cabot, the Venetian, who had resigned from the service of England for that of Spain, was sent by Charles V to determine the line of demarcation between the colonizing spheres of Spain and Portugal. Learning of inland regions abounding in silver, he decided to move up the river. In 1536 another expedition, commanded by Pedro de Mendoza, landed on the present site of Buenos Aires. This event marks the first serious attempt of Europeans to establish themselves within the bounds of what is now Argentina. The Indians proved hostile, after a time conditions became desperate, and Mendoza himself decided to return to Spain, but died on board ship before reaching there. Those he left behind, also discouraged, migrated farther up the Plata and the settlement started by Mendoza soon disappeared. In 1580 Juan de Garay arrived with other adventurers and reoccupied the site that Mendoza had abandoned. The origin of the name of the city, Nuestra Señora del Buen Aire or de los Buenos Aires, has never been definitely established.


GRAIN ELEVATORS ALONG THE WATER FRONT OF BUENOS AIRES

The settlement had grown to a village of several hundred people by 1650. Most of the houses were constructed of stone and mud and had thatched roofs, although a few were roofed with tile. Dwellings were low, many not more than 12 ft. high. A census appears to have been taken in 1664, when the town had 211 families, or a population of more than 1,000 people. With the exception of a few brief intervals during the 19th century, Buenos Aires has been the capital of Argentina from the earliest days of the republic. (W. A. R ; R. W. Rd.)

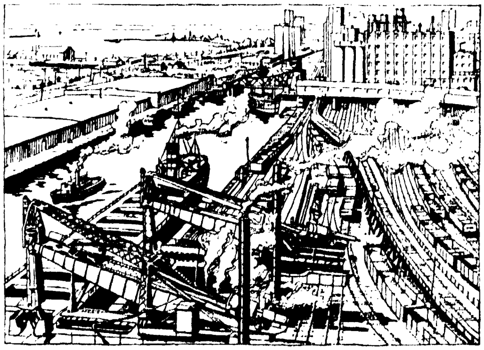
BUER, former mining and engineering town in the southwest of the district of Münster in the Prussian province of Westphalia, Germany. Pop. was 99,307. It grew very rapidly. Its position on the watershed between the Emscher and the Lippe and its fine woodlands gave it special advantages. On April 1, 1928, it was incorporated with Gelsenkirchen.

BUFF, a dull yellow leather originally made from the skin of the buffalo (Fr. *buffle,* a buffalo), now also from the skins of other animals; used for making the military buff-coat or jerkin. The East Kent Regiment and the 2nd battalion Seaforth Highlanders are called the "Buffs" and the "Ross-shire Buffs" respectively, from the yellow or buff-colour of their facings. The term is commonly used now of the colour alone.

BUFFALO, a city and port of entry, and the county seat of Erie county, New York, U.S.A., the second city in population in the State, at the eastern extremity of Lake Erie and at the upper end of the Niagara river, distant by rail from New York city 423 mi., from Boston 499 mi. and from Chicago 540 mi. It has an area of 39.4 sq.mi. The site of the city is on a broad, undulating tract of ground, rising gradually from the lake to an elevation of 50 to 80ft. its altitude averaging somewhat less than 600ft. above sea-level. The high land and temperate climate and the excellent drainage and water-supply make Buffalo one of the most healthful cities in the United States. As originally laid out by Joseph Ellicott, the plan of Buffalo resembled that of Washington. It has broad and spacious streets, most of which are lined by trees. The municipal park system consists of a chain of parks with a total area of 2,296 ac., encircling the city and connected by boulevards and driveways. The largest is Delaware park, about 365ac., including a lake of 46¼ac., in the north part of the city; the west part of the park was enclosed in the grounds of the Pan-American Exposition of 1901.

Buildings and Monuments.—Buffalo is widely known for the beauty of its residential sections, the houses being for the most part detached, set well back from the street and surrounded by attractive lawns. The Federal building, county hall, city hall and State office building provide quarters for various branches of governmental work. The chamber of commerce is the centre of business activity. There are three State armouries. An auditorium and a music-hall are owned by the city. The Albright art gallery and the building of the Buffalo Historical Society, which houses a library and a museum, stand in Delaware park. The museum of the Buffalo Society of Natural Sciences is in Humboldt park. A monument in memory of President McKinley distinguishes Niagara square, around which is the civic centre. A soldiers and sailors' monument, commemorating Civil War veterans, is in Lafayette square; a statue "The Hiker" appropriately recalls the Spanish War, and the figure of Commodore Oliver Hazard Perry at The Front preserves the memory of the commander of the American squadron in the battle of Lake Erie on Sept. 10, 1813. In Forest Lawn cemetery are the monuments to President Millard Fillmore and the famous Seneca chief Red Jacket (1751–1830), a friend of the whites, who was faithful when approached by Tecumseh and "the Prophet," and warned the Americans of their danger. Churches include St. Joseph's (Roman Catholic) and St. Paul's (Protestant Episcopal) cathedrals, and Trinity (Protestant Episcopal), Westminster Presbyterian, Delaware Avenue Baptist, Delaware Avenue Methodist, First Presbyterian and others.

Education.—In addition to the usual high and grammar schools, the city supports a training school for teachers and a system of night schools, kindergartens and vocational schools, including 7 vocational high schools. The State teachers' college at Buffalo, developed from a State normal school, has expanded on a new site with enlarged and appropriate buildings. The University of Buffalo (organized in 1846) comprises schools of medicine (1846), pharmacy (1886), law (1891), dentistry (1892), arts and sciences (1913), school of business administration, school of social work, Millard Fillmore college, school of education, and school of nursing. The university in 1909 under Chancellor Charles P. Norton acquired a new site of 106 ac. in the northern part of the city, to which 44 ac. were added in 1919. In 1920 an endowment fund of $5,177,000 was raised by popular subscription, since


A VIEW OF INDUSTRIAL BUFFALO, SHOWING THE LARGE ORE UNLOADING CRANES AND FLOUR MILLS AT THE END OF THE STATE BARGE CANAL

increased by other gifts and bequests. A unique gift by the will of Chancellor Norton provides for the conferring by the university annually of a civic medal to the citizen of Buffalo who is adjudged to have given the most distinguished service to the community and the world. The first medal was given in 1924 to Bishop Charles H. Brent, delegate of the United States to the international opium conference. Canisius college (Jesuit) was established in 1870 and chartered in 1883. In 1920 it raised by popular subscription an endowment fund of $1,000,000 and with the erection of a new building began a notable expansion. D'Youville college for women (Roman Catholic) was opened in 1908. Other important schools are the Academy of the Sacred Heart, Buffalo seminary, Franklin school, Elmwood school, Holy Angels academy, St. Mary's seminary, St. Joseph's Collegiate Institute, Nardin academy, Mt. St. Joseph academy and Nichols school for boys. Important libraries are the Buffalo public (founded in 1837), the Grosvenor, a reference library founded in 1859, the Buffalo Historical society library, which includes special collections, the law library (8th judicial district) and the Catholic institute.

Public Institutions.—The new city hospital in Buffalo and the J. N. Adam Memorial hospital for tuberculous patients at Perrysburg (N.Y.) are maintained by the city. The Erie county home and infirmary occupies a farm site at Wende (N.Y.). The U.S marine hospital is maintained by the federal government. Other important hospitals are the General, the Millard Fillmore, the Hospital of the Sisters of Charity, the Children's, the Deaconess, the Columbus, the Lafayette, the Emergency, the Mercy, the Moses Taylor and the Providence Retreat. Among the charitable institutions are the Home for the Friendless, Buffalo and St. Vincent's orphan asylums, Children's Aid society, Erie county lodging-house, Ingleside home and Le Couteulx St. Mary's deaf-mute institution The Charity Organization society, now the Family Service society, was founded in 1877, the first of its kind in the United States, and has been the model followed in many cities

The first newspaper, the *Gazette* (a weekly), was established in 1811 and became the *Commercial* (a daily) in 1835. The first daily was the *Western Star* (1834), which later became the *Courier*. There were in 1940 two English daily papers, the *News* and the *Courier-Express*.

Government and Population.—From 1916 to 1928 Buffalo had a commission form of government with legislative and executive powers united in five commissioners, chosen at non-partisan primaries and elections. A new charter went into effect on Jan 1, 1928, which restored government by mayor and council with some original features. Nominations, though under direct affiliated primaries, are by party tickets. The elective officers are mayor, comptroller, president of the council, five councilmen at large and nine district councilmen. The mayor prepares the budget, and executive powers are strongly concentrated in his hands, with the council holding a check through the powers of taxation, appropriation and confirmation. The council sits as a unicameral body. The mayor, president of the council and councilmen at large may not be re-elected to succeed themselves after completing their four-year terms. The district councilmen, who are elected for two-year terms, may be re-elected once, but may not serve for more than four continuous years.

Buffalo's first census, taken in 1820, showed a population of about 2,000. A century of growth brought it in 1920 to 506,775, with a total of 602,847 in the metropolitan district (Buffalo and suburbs) The federal census figures of April 1, 1930 were 573,076; those of 1940 were 575,901. The population includes numerous elements of German, Canadian, Polish, Irish and Italian birth or descent.

Commercial Importance.—Situated almost equidistant from New York, Boston, Philadelphia, Baltimore and Chicago, at a natural junction point for lake and railroad transportation, Buffalo has become one of the leading commercial and industrial centres of the United States. Its annual record in tonnage handled usually ranks the city eighth or ninth among all American ports. It is first in value of commerce. The outer harbour is protected by a breakwater 4½ mi. long enclosing an area of about 680 acres. There are 37.4 mi. of water frontage, obtained in part by the development of the Buffalo river and canals. Municipal piers supplement private dockage. Grain elevators have a capacity of almost 42,000,000 bu. and handle from 200,000,000 to 300,000,000 bu. a year. The New York state barge canal gives water transport to the seaboard for barges up to 2,000 tons capacity. Eleven main railway lines make the city an exceptional centre for land transportation. Electric power is obtained in great part from Niagara Falls. Natural gas, piped from Pennsylvania and western New York fields and supplemented by manufactured gas, is an important source of fuel supply. An abundant water supply is pumped from Lake Erie and a filtration plant protects its purity. A municipal airport provides adequate landing facilities for airborne mails and commerce. Flour and grain products, iron and steel, rubber, aeroplanes, chemicals and meat products stand among the city's most important manufactures. There is diversity in lesser lines of manufacture.

History.—The first white men to visit the site of Buffalo were undoubtedly the adventurous French trappers and various Jesuit missionaries. On the east bank of the Niagara river at the mouth of Cayuga creek, La Salle in 1679 built his ship the "Griffon," and at the mouth of the river built Ft Conti, which, however, was burned in the same year. In 1687 Marquis Denonville built at the mouth of the river a fort which was named in his honour and was the predecessor of the fortifications on or near the same site later called Ft. Niagara. The neighbourhood was the scene of military operations up to the close of the Revolutionary War. As early as 1763 the present site of the city of Buffalo came to be known as the "Buffalo Creek region," either from the herds of buffalo or bison which, according to Indian tradition, had frequented the salt *licks* in the neighbourhood, or more probably from an Indian chief. In 1784 Capt. William Johnston, Ezekiel Lane and Michael Middaugh became the first permanent white residents. The land was a part of the original Phelps-Gorham purchase. In 1797 it came into the possession of the Holland Land company, being part of the tract known as the Holland purchase.

Joseph Ellicott, the agent of the company, who has been called the "Father of Buffalo," laid out a town in 1803, calling it New Amsterdam, and by this name it was known on the company's books until about 1810. The name of Buffalo Creek, or Buffalo, however, proved more popular. The village became the county seat of Niagara county in 1808, and two years later the town of Buffalo was erected. Upon the outbreak of the second war with Great Britain Buffalo became headquarters for most of the military operations on the Niagara frontier. Lieut. Jesse D. Elliott, U.S.N., established a navy yard on Scajaquada creek where several vessels were built that figured in later naval operations. On Oct. 9, 1812, he led an expedition which captured two merchant vessels moored under the guns of Ft. Erie on the Canadian side. On Nov. 30, 1812, Gen. Alexander Smyth made an unsuccessful attempt to cross the river and attack Ft. Erie. On July 11, 1813, a British force crossed the river and a sharp skirmish occurred within the present limits of Buffalo. On Dec. 30–31, 1813, and Jan. 1, 1814, British, Canadians and Indians under Gen. Sir Phineas Riall (1769–1851) burned the greater part of Buffalo and Black Rock, with little resistance from the defending troops. The destruction, in which most of the other villages along the frontier were included, was an act of retaliation for similar devastation done by American troops in Canada. Gen. Jacob Brown from headquarters in Buffalo directed the troops which crossed the river and received the surrender of Ft. Erie on July 3, 1814. The army thence marched down the river to the vicinity of Niagara Falls, where the battles of Chippewa (July 5) and Lundy's Lane (July 25) were fought. The American troops retired to Ft. Erie. A strong attack by the British was repulsed on Aug. 15, a portion of the fort being blown up. On Sept. 17 a sortie of the Americans against the British camp resulted in the abandonment of the siege for the time being. Another advance by the Americans as far as Chippewa was turned back in October and on Nov. 5, 1814, Maj.-Gen. Izard abandoned Ft. Erie and withdrew across the river to Buffalo.

After the war Buffalo was rapidly rebuilt. It was incorporated as a village in 1816. With the westward movement of immigration its prosperity increased. The first steamboat on the Great Lakes, "Walk-in-the-Water," was built in Buffalo in 1818. It was named in honour of a famous Wyandot Indian chief. The completion of the Erie canal in 1825 greatly increased the importance of the place. In 1832 Buffalo was incorporated as a city and Dr. Ebenezer Johnson was chosen as the first mayor. In that year and again in 1834 cholera epidemics caused considerable loss of life.

In the Civil War, Erie county, of which Buffalo is the chief city, furnished 15,249 men to the Federal army. Their casualties numbered 4,704. In 1882 Mayor Grover Cleveland of Buffalo was elected governor of the State of New York, and in 1884 was nominated and elected president of the United States. In 1901 Buffalo citizens organized the Pan-American Exposition with the purpose of promoting trade between the United States and other countries in this hemisphere. While attending this exposition, President William McKinley was assassinated by an anarchist, who had come to Buffalo for the purpose (Sept. 6, 1901). Vice-President Theodore Roosevelt took the oath of office as president in Buffalo.

THE CAPE BUFFALO OF AFRICA, WHICH RESEMBLES THE ASIATIC SPECIES IN SIZE AND HABITS

Buffalo furnished over 10,000 volunteers and selected service men to the U.S. army in the World War. The greater number of these served in the 77th and 78th Divisions and had an active part in several battles. On Aug. 7, 1927, an international vehicular bridge was opened to Fort Erie as a memorial to a century of Canadian-United States peace. In July 1932, the city celebrated its centennial with an exposition Recent construction includes a new city hall and a federal building.

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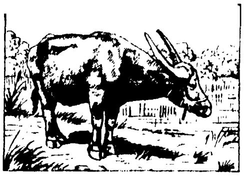
BUFFALO (*Bubalus bubalus*), a member of the ox family (Bovidae, *q.v.*), which, from time immemorial, has been a domestic animal in India and Malaya, and has been introduced into Egypt, Italy, Gascony and Hungary. The name has since been applied to related cattle, and, in America, to the bison. (*q.v.*).

The Indian buffalo is larger than the ox, but is less docile. It is employed both for farm-work and as a draught animal. The cow gives much milk, very nourishing but of a peculiar flavour. The horns are long, widely separated and backwardly directed. In a wild state the animal haunts swampy marshes and, like the domestic specimens, loves to wallow in the mud. A larger Indian form is called the arnee. The adult buffalo is quite a match for a tiger. Buffaloes form herds of 50 or more, which, however, break up into small parties, comprising a bull and three or four cows, at the rutting season.

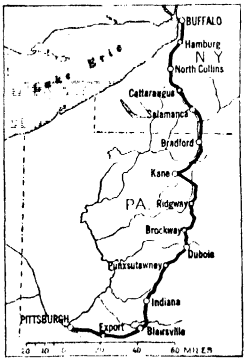

THE INDIAN BUFFALO (BUBALUS BUBALUS) DISTINGUISHED BY THE SPREAD OF THE HORNS, IS DOMESTICATED FOR FARM WORK

The Cape buffalo (*Syncerus caffer*) is distinguished by its shorter horns, the bases of which are immensely thickened and cover the whole forehead. Several well-marked varieties are known. In habits and size it resembles the Asiatic species, and ranges over south and central Africa. This animal is credited with great intelligence, and a wounded buffalo is almost a synonym for cunning and ferocity They are among the most dangerous of big game and are treated with respect even by experienced hunters.

Several other species inhabit Asia and Africa, including the dwarf *S. nanus* from the west of the latter continent.

BUFFALO-BERRY, called also rabbit-berry and Nebraska currant (*Lepargyrea argentea* or *Shepherdia argentea*), a hardy North American shrub of the oleaster family (Elaeagnaceae), allied to the seabuckthorn (*Hippophae rhamnoides*) of English coasts. The buffalo-berry is native to stream banks in the Great Plains region from Manitoba, Saskatchewan and Alberta southward to Kansas, New Mexico and Nevada. It grows from 6 ft. to 20 ft. high, with whitish, somewhat thorny branches and small, oblong, silvery leaves, and in August or September bears a profusion of oval, scarlet-red, or golden-yellow berries, about the size of currants. The fruit has a tart flavour and makes a good meat relish. The plant is not only an attractive shrub, but, because of its spiny branches, is suitable also for hedges Attempts have been made to cultivate it for its fruit, and some nurserymen catalogue it, but the sale of plants is limited. The bushes are productive, and great quantities of the berries could be gathered from the wild. Propagation is effected by seeds and cuttings Seeds should be stratified over winter and planted in nursery rows in spring. Two or three years are required to grow plants large enough for sale. Cuttings are made and handled like currant cuttings. Plants may be dug from native thickets, but they do not readily bear transplanting. Since buffalo-berry is dioecious, it is necessary to set out one male plant with each four to six female plants. Male plants may be distinguished by their dense clusters of plump buds, while the female plants have looser clusters of pointed buds. The smaller thornless Canadian buffalo-berry (*L. canadensis* or *S. canadensis*), 4 ft. to 8 ft. high, with ovate leaves, silvery only on the under surface, grows on wooded banks from Newfoundland to Alaska, and southward to New York and Oregon, extending in the Rocky mountains to New Mexico. Its rounded red or yellowish currant-like fruit is insipid

BUFFALO-BUR (*Solanum rostratum*), called also beaked nightshade and prickly potato, a North American annual of the nightshade family (*Solanaceae*), native to high plains east of the Rocky mountains from North Dakota to Mexico. The plant grows from 1 ft. to 2½ ft. high and in aspect strongly resembles the potato (*q.v.*), to which it is closely related, but is more slender, has bright yellow flowers and is armed throughout with needle-like prickles, especially on the burrlike covering inclosing the berry. The buffalo-bur is the original host or food plant of the destructive Colorado potato beetle (*q.v.*) and has become sparingly naturalized eastward to Ontario and New Hampshire and also in southern California.

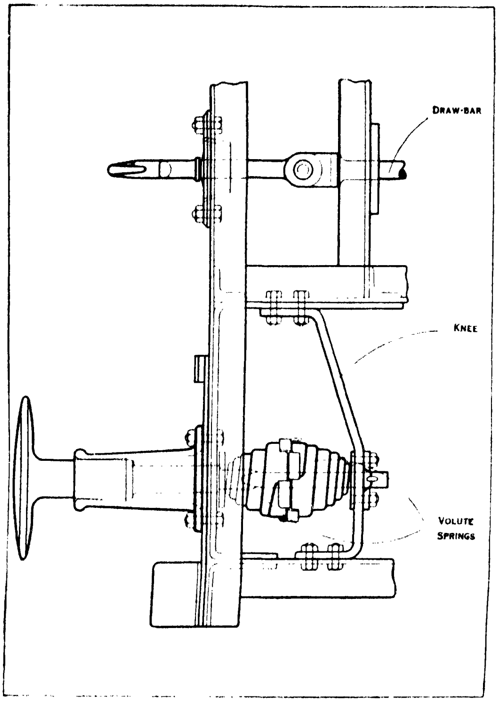


BUFFALO-PITTSBURGH HIGHWAY, a thoroughfare extending from Buffalo, New York, to Pittsburgh, Pennsylvania, about 265m. in length and paved throughout. It passes through the rich farming country of New York and the mountainous regions of Pennsylvania and takes in Collins, Salamanca, Bradford, Kane, Du Bois and Blairsville on the way.

BUFFER, a member which receives and absorbs the shock of an impact gently, and thus protects other parts from damage. A buffer must contain some flexible material, such as a steel spring, a rubber block, air-cushioning or a hydraulic cylinder. Buffers are employed in railway trains to protect the individual trucks and carriages, as well as the engine and tender.

British Practice.—Buffers are placed at the corners of the car body, and consist of circular or oval heads having long stems extending into the body, as shown by the details of a Great Western Railway steel carriage underframe designed by C. B. Collett. The volute springs surrounding the stems are 9in. diameter over the largest coil, and thrust against steel knees. A stroke of 5in.

is allowed for. An elliptical shape, 12in. by 19in., is chosen for the buffer faces in order to avoid any possibility of the buffers locking at sharp curves. Buffers for shunting engines have an extra large head. Close-coupled vehicles for suburban traffic are sometimes constructed without the two side buffers, there being a central elliptical block, and the draw-bar pulling against rubber springs. In the automatic buffer couplers the coupling end passes through a large-faced buffer, which is sometimes widened to carry two stems fitted with a compensating beam.



DETAILED DIAGRAM OF THE TYPE OF BUFFER USED ON THE GREAT WESTERN RAILWAY IN A CARRIAGE STEEL UNDERFRAME

The volute springs are thrust against steel knees, and the buffer faces, 12 by 19 inches. The elliptical shaped heads prohibit the buffers from locking at sharp curves. Engines employed to switch cars from one track to another have buffers with an extra large head

The fixed buffer-stop at a terminus, or at the end of a siding, may be a plain wooden beam, though it is often provided with springs. As a safeguard against the partial failure of brakes, the Ransomes and Rapier hydraulic buffer-stops are installed at many important termini. The buffer head carries a long rod that terminates in a piston working in a cylinder filled with water or oil. Passages lead out of the cylinder, permitting the fluid to escape gradually; these are larger at the front end than the back. As the speed is checked, less and less passage is provided, offering a resistance which retards the train without shock or recoil. The lengths of stroke range from 5–11ft.; the buffers in the latter case are capable of stopping a train of about 900 tons moving at 10m. an hour. (F. H.)

American Practice.—The buffer is used in passenger-train cars in combination with the draft gear, and consists of a steel plate carried by three horizontal stems extending into the car body just below the floor level and above the "draw-bar." The plate comes in contact with a similar plate on the adjoining car. The stems which carry the buffer plate carry long coiled springs, the central stem in some designs also acting upon sliding friction members in combination with steel springs. A passenger car buffer serves not only to absorb the impact caused by the collision of two cars, but to take up the slack in the couplers when cars are in a train, and to close up the gap between cars, making it safe for passengers to walk from car to car. Standard practice allows for a total stroke of 5½ inches. When cars are in a normal coupled condition, the buffers are compressed 3in., leaving 2½in. for the absorption of compressive shocks. In freight yards and sidings, a stopping device that slides along the rail is frequently employed. This depends on the friction generated between the rail and a cast-steel shoe upon which the car wheel mounts. As the shoe slides along the rail, the energy of the car is dissipated. Blocks bolted to the end of the rails finally bring the car to rest. (*See* also RAILWAYS.)

Spring buffers also called "bumpers" are fitted to motor-cars to protect the ends from the effects of collision. (X.)

BUFFER ACTION. A buffer in chemistry is any material which lessens the activity of acid or alkali, added to a solution containing that material. Buffer action may be described as the resistance offered by a solution to change of acidity or alkalinity through the addition or loss of acid or alkali. Common buffer substances include alkali salts (sodium acetate or phosphate), proteins (gelatin), the phosphates in raw sugars, carbonates in raw water, carbonates and silicates in clay, alum and rosin in paper sizing. Buffers play a very important rôle in the blood, permitting large amounts of acid to be transported and eliminated without appreciably changing the slight alkaline reaction of the blood.

The acidity or alkalinity of a solution is measured in terms of the concentration of hydrogen ions (H^+) or hydroxyl ions (OH^-) present. Since there is a definite relation between (H^+) and (OH^-) concentrations, due to their relationship in the water molecule, the acidity or alkalinity of a solution can be conveniently expressed, when the quantities are small, in terms of grams of hydrogen ion per litre, and, for the sake of convenience, as the reciprocal logarithmic exponent of this concentration, called the "pH." For example, 0·001 gram of hydrogen ion per litre of solution may be expressed as 1×10^{-3} gram per litre, or simply as pH3. At pH7, hydrogen ions and hydroxyl ions are present in equal quantities and the solution is neutral. The buffer action of certain substances is made possible by the circumstance that they maintain an equilibrium between their ionized and non-ionized forms, according to the older theory of ionization; and that the ionized form has a definite pH value. As acid or alkali is added, the equilibrium shifts so that the pH is held as nearly constant as possible. Thus, although acid or alkali is added (within reasonable limits), the pH of a buffer solution will change only very slightly. Dilution changes the pH of buffer solutions only slightly; for example, sodium acetate of pH 4·615 on fivefold dilution shows a pH of 4·665. (*See* HYDROGEN ION CONCENTRATION; SOLUTIONS.)

See *Trans. Am. Electrochem. Soc.* (1927); W. Clark, *The Determination of Hydrogen Ions.* (A. NE.)

BUFFET, a piece of furniture, of French origin, closely akin to the sideboard, cupboard and dresser. It came into its greatest prominence during the Stuart period, but has varied so widely in form that it is difficult to trace its natural development. It has been more commonly used as a place to keep the necessary equipment of the dining table—dishes, china, glass and silver. The buffet, originally a small room, or recess, in which was a counter where food was served, was always provided with one or more flat spaces, or broad shelves, for the reception of dishes, etc. One type of buffet, a table with a super-structure that fits against the wall, is meant more for the display of plate than anything else. Another type, the forerunner of the sideboard of the 18th century, consisted of a heavy, low table with deep drawers beneath. The early buffets, after they became pieces of furniture, were sometimes carved with the utmost elaboration, but the Renaissance did much to refine their ornament and vary their form. The early Georgian period, however, made the buffet a subject for cabriole legs, club feet and other variations characteristic of the period. About this same time tiers of shelves, with or without a glass front, were quite often called buffets—perhaps because they were used as a place for dishes. In fact, almost any dining-room receptacle for articles that were not immediately wanted came at last to bear the name, regardless of its form

BUFFIER, CLAUDE (1661–1737), French philosopher, historian, and educationalist, was born in Poland of French parents, who returned to France and settled at Rouen. He taught in the college of the Jesuits in Paris, where he spent the rest of his life. He seems to have been an admirable teacher, with a great power of lucid exposition. His principal work is the *Traité des Vérités Premières* (1717). He anticipated the spirit and methods as well as many of the results of Reid and the Scottish school. Voltaire described him as "the only Jesuit who has given a reasonable system of philosophy."

He wrote also *Éléments de Métaphysique* (1724), a "French Grammar on a new plan," and a number of historical essays. Most of his works appeared in a collected form in 1732, and an English translation of the *Traité* was published in 1780.

BUFFLEHEAD, the common name for a North American duck (*Bucephala albeola*), or butterball, allied to the golden-eyes (*q.v.*). In colour the bufflehead is black or blackish above, white below, with a white band extending around the back of the head from eye to eye, and with the remainder of the head and the neck glossed with purple, green and blue. This small duck, about 15 in. long, is noted for its powers of quick diving. It feeds in part on small fish, which it pursues and captures beneath the surface. It breeds from central Alaska and western Ontario south to British Columbia, northern Montana, and Manitoba, wintering southward. Four have been recorded in England. (G. F. Ss.)

BUFFON, GEORGE LOUIS LECLERC, COMTE DE (1707–1788), French naturalist, was born at Montbard (Côte d'Or), his father, Benjamin François Leclerc de Buffon (1683–1775), being councillor of the Burgundian parlement. He studied law at the college of Jesuits at Dijon, where he made the acquaintance of a young Englishman, Lord Kingston, and with him travelled through Italy and then went to England. He published a French translation of Stephen Hales's *Vegetable Statics* in 1735, and of Sir I. Newton's *Fluxions* in 1740. At 25 years of age he succeeded to a considerable property, inherited from his mother, and from this time onward his life was devoted to regular scientific labour. In 1739 he became keeper of the Jardin du Roi and of the royal museum. He there began to collect materials for his *Natural History*. He entrusted the descriptive and anatomical portions of the treatise to L. J. M. Daubenton, and the first three volumes made their appearance in 1749. In 1752 (not in 1743 or 1760, as sometimes stated) he married Marie Françoise de Saint-Belin, and felt deeply her death in 1769. He himself died in Paris at the age of 81 of vesical calculus, having refused to allow any operation for his relief. He left one son, George Louis Marie Leclerc Buffon, who was an officer in the French army, and who died by the guillotine, at the age of 30, on July 10, 1793 (22 Messidor, An II). Buffon was a member of the French Academy (his inaugural address being the celebrated *Discours sur le style*, 1753), perpetual treasurer of the Academy of Science, fellow of the Royal Society of London, and member of most of the learned societies in Europe. Without being a profound original investigator, he possessed the art of expressing his ideas in a clear and attractive form. His chief defects as a scientific writer are that he was given to excessive and hasty generalization.

His *Histoire naturelle, générale et particulière* was the first work to present the previously isolated and apparently disconnected facts of natural history in a popular and generally intelligible form. The sensation made by its appearance in successive parts was very great, and it did good service by diffusing a taste for the study of nature. The *Histoire naturelle* passed through several editions, and was translated into various languages. The first edition is highly prized by collectors, on account of the beauty of its plates; it was published in Paris (1749–1804) in 44 quarto volumes, the publication extending over more than 50 years. In the preparation of the first 15 volumes of this edition (1749–67) Buffon was assisted by Daubenton and subsequently by P. Guéneau de Montbéliard, the abbé G. L. C. A. Bexon, and C. N. S. Sonnini de Manoncourt. The following seven volumes form a supplement to the preceding, and appeared in 1774–89, the famous *Époques de la nature* (1779) being the fifth of them. They were succeeded by nine volumes on the birds (1770–83), and these again by five volumes on minerals (1783–88). The remaining eight volumes, which complete this edition, appeared after Buffon's death, and comprise reptiles, fishes and cetaceans. They were executed by B. G. E. de Lacépède, and were published in successive volumes between 1788 and 1804. A second edition, begun in 1774 and completed in 1804, in 30 volumes quarto, is in most respects similar to the first, except that the anatomical descriptions are suppressed and the supplement recast.

BUG, the name of two rivers of Europe. (1) A stream of European Russia, which rises in the Avratynsk hills near the Polish frontier and flows generally southeast through Podolia and Kherson, to enter, at Nikolayev, the *liman* or lagoon into which the Dnieper also discharges. Its upper part is beset with rapids and its lower has numerous sandbanks and rocky stretches which prevent navigation. (2) A tributary of the Vistula, rising in eastern Galicia east of Lwow (Lemberg) and flowing north-northwest to Brest-Litovsk, where it becomes navigable as it turns west between the provinces of Siedlce, Grodno and Lomza, to join the Vistula, 23 mi. below the city of Warsaw.

BUG, the common name for insects of the suborder Heteroptera of the order Hemiptera (*q.v.*), also used in North America for almost any kind of insect; *e.g.*, ladybug (ladybird), June bug (cockchafer). In a more restricted sense it is applied to members of the hemipterous family Cimicidae of which the best known examples are the bedbugs. These are oval, flattened, mahogany-coloured insects with vestigial wings and piercing, suctorial mouth parts. The commonest species are the cosmopolitan *Cimex lectularius*, the bedbug of Europe and North America; and *C. rotundatus*, the bedbug of the orient. These insects breed in careless households, and are nocturnal, hiding by day in crevices. They are blood-sucking in habit, chiefly attacking man; pathologists have suspected them of transmitting several diseases, but further evidence is needed. Other members of the family include parasites of birds and bats.

BUGEAUD DE LA PICONNERIE, THOMAS ROBERT, DUKE OF ISLY (1784–1849), marshal of France, was born at Limoges on Oct. 15, 1784. He came of a noble family of Périgord, and was the youngest of his parents' 13 children. Harsh treatment led to his flight from home, and for some years about 1800 he lived in the country, engaged in agriculture, to which he was ever afterward devoted. At the age of 20 he became a private soldier in the *Vélites* of the Imperial Guard (1804), with which he took part in the Austerlitz campaign of the following year. Early in 1806 he was given a commission and served in the Jena and Eylau campaigns. He served in Spain through the Peninsular War. At the first restoration he was made a colonel, but he rejoined Napoleon during the Hundred Days, and under his old chief Suchet distinguished himself greatly in the war in the Alps. For 15 years after the fall of Napoleon he was not re-employed. In the chamber of deputies, to which he was elected in 1831, he remained an opponent of democracy. His conduct as gaoler of the duchesse de Berry led to a duel between Bugeaud and the deputy Dulong, in which the latter was killed (1834); this affair and the incidents of another *émeute* exposed Bugeaud to ceaseless attacks in the chamber and in the press. He was re-elected in 1834, 1837 and 1839.

About this time Bugeaud became much interested in the question of Algeria. At first he appeared to have disapproved of the conquest, but his undeviating adherence to Louis Philippe brought him into agreement with the government. Sent to Africa in a subordinate capacity, he proceeded to initiate his war of flying columns. He won his first victory on July 7, 1836, made a brilliant campaign of six weeks' duration, and returned home with the rank of lieutenant-general. In the following year he signed the treaty of Tafna (June 1, 1837), with Abd-el-Kader, an act which, though justified by the military and political situation, led to a renewal of the attacks upon him in the chamber, to the refutation of which Bugeaud devoted himself in 1839. Finally, in 1840, he was nominated governor-general of Algeria, and early in 1841 he put into force his system of flying columns. His swiftness and energy drove back the forces of Abd-el-Kader. In 1842 he secured the French positions by undertaking the construction of roads. In 1843 Bugeaud was made marshal of France, and in this and the following year he continued his operations with unvarying success. His great victory of Isly on Aug 14, 1844 won for him the title of duke. In 1845, however, he had to take the field again in consequence of the disaster of Sidi Brahim (Sept. 22, 1845), and up to his final retirement from Algeria (July 1846) he was almost constantly employed in the field. His resignation was due to differences with the home government on the question of the future government of the province. In 1848 the marshal was in Paris during the revolution, but his orders prevented him from acting effectually to suppress it. He was asked, but eventually refused, to be a candidate for the presidency in opposition to Louis Napoleon. His last public service was the command of the army of the Alps, formed in 1848–49 to observe events in Italy. He died in Paris on June 10, 1849.

Bugeaud's writings were numerous, including his **Oeuvres militaires**, *collected by Weil (1883), many official reports on Algeria and the war there, and some works on economics and political science. See* Comte d'Ideville *Le Maréchal Bugeaud* (3 vols., 1881–82, another ed. 1885).

BUGENHAGEN, JOHANN (1485–1558), known as the Doctor Pomeranus, German Protestant reformer, was born at Wollin near Stettin June 24, 1485. In 1509 he was ordained priest, and became a vicar in the collegiate *Marienkirche* at Treptow; in 1517 he was appointed lecturer on the Bible and Church Fathers at the abbey school at Belbuck. In 1521 he went to Wittenberg, where he formed a close friendship with Luther and Melanchthon, and in 1522 he married. In 1528 he arranged the church affairs of Brunswick and Hamburg; in 1530 those of Lübeck and Pomerania. In 1537 he was invited to Denmark by Christian III., and remained five years there, organizing the church and schools. He passed the remainder of his life at Wittenberg. He died on April 20, 1558. Among his numerous works is a history of Pomerania, which remained unpublished till 1728. Perhaps his best book is the *Interpretatio in Librum Psalmorum* (1523). He helped Luther in his translation of the Bible and himself translated the Bible into Low German.

See Life by H. Hering (1888); Emil Görigk, *Bugenhagen und die Protestantisierung Pommerns* (1895). O. Vogt published a collection of Bugenhagen's correspondence in 1888, and a supplement in 1890.

BUGGE, SOPHUS (1833–1907), Norwegian philologist, the author of the first critical edition of the *Edda*, was born at Laurvik, Norway, educated at Christiania, Copenhagen and Berlin, and in 1866 became professor of comparative philology and Old Norse at Christiania University. He was a pioneer in the collection and study of Norwegian folk-songs, traditions, and Runic inscriptions. Bugge's critical edition of the elder Edda (*Norroen Fornkvoedi*) was published at Christiania in 1867. He maintained that the songs of the Edda and the earlier sagas were largely founded on Christian and Latin tradition imported into Scandinavian literature by way of England. His next most important work was the monumental edition (1891 *et seq.*) of ancient Norwegian inscriptions. His writings also include *Gamle Norske Folkeviser* (1858), a collection of Old Norse folk-songs; *Bidrag til den aeldste skaldedigtnings historie* (1894); *Helgedigtene i den Aeldre Edda* (1896, Eng trans., *The Home of the Eddic Poems*, 1899); *Norsk Sagafortaelling og Sagaskrivning i Island* (1901).

For a further list of his works *see* J. B. Halvorsen, *Norsk Forfatter-Lexikon*, vol i. (1885).

BUGGY, a vehicle with either two (in England and India) or four wheels (in America). English buggies are generally hooded and for one horse. American buggies are for one horse or two, and either covered with a hood or open; among the varieties are the "Goddard" (the name of the inventor), the "box," so called from the shape of the body, the "cut under" *i.e.*, cut out for the front wheels to cramp beneath and so turn in a narrow space, the "end-spring" and "side-bar," names referring to the style of hanging. A skeleton buggy, lightly constructed, is used on the American "speedways," built and maintained for fast driving. The word may be connected with "bogie," a truck.

BUGIS, a semi-civilized Muslim tribe, inhabiting the south of Celebes, of Malayan stock, noted for their enterprise as pirates, traders and voyagers. They are particularly liable to the homicidal mania known as "running amok." They have formed settlements in Borneo, in the Philippines and elsewhere and do a large trade in cloth, and are famous for filigree work, for shipbuilding and for the manufacture of arms, as well as for weaving. They use a bow of Asiatic form, and hunt deer on horseback. In spite of their religion, a good deal of animistic belief survives and a shrine is reserved for the sacred objects of the tribe. Their written character resembles that of the Batta (*q.v.*) and besides translations of the Koran they possess written laws. They were converted to Islam at the beginning of the 17th century by their neighbours and kinsmen, the Mangkassaras, of similar culture, who were themselves apparently converted at some time after the arrival of the Portuguese in 1512. The princes of the Mangkassaras used each to be given a new name after death. (J. H. H.)

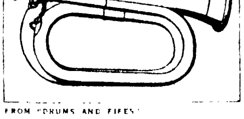
BUGLE, a treble brass wind instrument with cup-shaped mouthpiece and conical bore.

Those members of the brass wind such as the horn, bugle, trumpet and tuba, which, in their simplest form, consist of tubes without lateral openings, depend for their scale on the harmonic series obtained by overblowing, *i.e.*, by greater pressure of breath and by the increased tension of the lips, acting as reeds, across the mouthpiece. The harmonic series thus produced, which depends on the acoustic principles of the tube itself, and is absolutely uninfluenced by the manner in which the tube is bent, forms a natural subdivision in classifying these instruments:—(1) Those in which the lower harmonics from the second to the sixth or eighth are employed, such as the bugle, post-horn, the cornet-à-pistons, the trombone. (2) Those in which the higher harmonics from the third or fourth to the twelfth or sixteenth are mostly used, such as the French horn and trumpet. (3) Those which give out the fundamental tone and harmonics up to the eighth, such as the tuba and ophicleide.

Only five notes are required for the various bugle-calls, although the actual compass of the instrument consists of eight, of which the first or fundamental, however, being of poor quality, is never used.

In order to increase the compass and musical possibilities of the bugle, two methods have been adopted, the use of (1) keys and (2) valves. The application of keys to the bugle produced the Kent bugle (named after the duke of Kent, who was commander-in-chief at the time of its invention in 1810) and later the ophicleide. The application of valves produced the family of saxhorns.

The bugle, like the hunting horn, is an instrument of great antiquity. The shofar of the ancient Hebrews, used at the siege of Jericho, was a cow's horn (Josh. vi. 4, 5, 8, 13, etc.), translated in the Vulgate *buccina*, in the paraphrase of the Chaldee *buccina ex cornu;* while Gideon's use of a massed band of three hundred shofars to terrify and defeat the Midianites (Judges vii. 16) and Saul's call to arms (I Sam. xiii., 3) may also be recalled. During the middle ages the use of the bugle-horn by knights and huntsmen, and perhaps also in naval warfare, was general in Europe.



FROM "DRUMS AND FIFES"

THE BRITISH ARMY BUGLE, WHICH, IN THE 17TH CENTURY, REPLACED THE DRUM FOR SIGNALLING

Meyerbeer introduced the bugle in B flat in his opera *Robert le Diable* in the scene of the resurrection of the nuns, and a bugle in A in the fifth act.

BUGTI, a Baloch tribe of Rind (Arab) origin, numbering about 20,000, who occupy the hills to the east of the Sind-Peshin railway, between Jacobabad and Sibi, with the Marris (a cognate tribe) to the north of them.

See *Census of India;* vol. iv. (1911).

BUHL WORK, the process of inlaying different kinds of metal into tortoise-shell, or a composition which passes for tortoise-shell, or sometimes wood. The metal used is generally brass or silver, both of which lend themselves to engraving. The inventor of this process was André Boulle (*q.v.*), but "Buhl," named after him, came to be the English spelling of this particular kind of work. Although England and America never became greatly interested in the inlaying of metal, Sheraton and a few others of the 18th century designers made occasional use of it. In the inlaying of the metal, Salisbury glue mixed with plaster of Paris is often found necessary, while the finishing calls for emery cloth, files, oil and pumice powder. *See* MARQUETRY.

BUHTURĪ [al-Walīd ibn 'Ubaid Allāh] (820–807), Arabian poet, was born at Manbij (Hierapolis) in Syria, between Aleppo and the Euphrates. Like Abū Tammām, he was of the tribe of Tāi. Although long resident in Baghdad he devoted much of his poetry to the praise of Aleppo, and much of his love-poetry is dedicated to Alwa, a maiden of that city. He died at Manbij (Hierapolis) in 897. His poetry was collected and edited twice in the 10th century. It was published in Constantinople (in 1883). Like Abū Tammām he made a collection of early poems, known as the Hamāsa (index of the poems contained in it, in the *Journal of the German Oriental Society*, vol. xlvii., pp. 418 ff., *cf.* vol. xlv., pp. 470 ff.).

Biography in M'G. de Slane's translation of Ibn Khallikān's *Biographical Dictionary* (Paris and London, 1842), vol. iii. pp. 657 ff.; and in the *Book of Songs* (*see* BAR-HEBRAEUS), vol. xviii. pp. 167–175.

BUILDERS' RITES. The view that the custom of placing within a cavity beneath a foundation stone a few coins of the realm, newspapers, etc., ensured that particulars might be found of the event on the removal of the stone hereafter, may suffice as respects latter-day motives. But such memorials are deposited in the hope that they will never be disturbed, and originally it appears that living victims were selected as "a sacrifice to the gods," and especially to ensure the stability of the building. There is no lack of evidence as to this gruesome practice, both in savage and civilized communities. In the 15th century, the wall of Holsworthy church was built over a living human being, and when this became unlawful, images of living beings were substituted (*Folk-Lore Journal*, i. 23–24).

See G. W. Speth, *Builders' Rites and Ceremonies* (1893). *See* also *Religion of the Semites* (3rd ed., 1927).

BUILDING. A building is that which is built; and the term is also used to cover the practical activities necessary for the erection and maintenance of structures, built where they are to stand, for the shelter or use of human beings.

Developments in Building up to Recent Times.—The genesis of constructional forms adopted in modern building must be sought in the solution of building problems in the past. Forms of early construction have been modified as technical knowledge and trade skill have increased. To understand the origin and significance of these changes requires a brief survey of the development of building from mediaeval times.

To judge by the existing buildings of that period, both the technical skill of the trades and their co-ordinated efforts in the production of great buildings reached a very high level.

Among the chief factors favourable to the development of a high measure of craft skill at that period were the extremely slow development of constructional methods and the rare introduction of revolutionary changes. The resulting stability of conditions allowed a simple system of apprenticeship to develop into an instrument of education and craft training, which was of a high order in relation to the needs of the period, and helped to raise the status of the craftsman. Again, the craft gilds had monopolist powers, an essential factor in their constitution, and one that counted for efficiency in the training of apprentices and the suppression of bad workmanship.

In spite of the controlling power of the gilds the traditional systems of training and construction did not long survive the introduction of new methods which accompanied the "foreign" styles of the Renaissance. The reactions due to these changes varied in the several European countries, but they resulted generally in the introduction of the professional designer; gradually the native craftsman was displaced and his skill declined.

Profound changes in building processes followed the invention of Portland cement by Aspdin in 1825, and the subsequent inventions of Bessemer and Siemens which helped to reduce the cost and increase the production of mild steel. The 19th century was one of great industrial expansion and constructional activity, and witnessed a steady extension of the uses of cement and steel. This extension was greatly assisted by an increased knowledge of scientific principles as applied to construction. Steel-framed buildings, reinforced concrete structures, and the increasing use of machinery both in the work-shops and during the erection of buildings are striking results of these changes. It is certain that improved methods of design, with more accurate assessment and computation of the strength and permanence of building materials, will have far-reaching results upon all branches of building in the future.

The Initiation of Building Work.—The production of buildings in civilized countries to-day is generally the result of co-operation between four parties, viz., the building owner or client, the architect or professional adviser to the client (including all concerned with planning and designing), the builder (including all concerned with the actual erection of the building and the preparation of its parts), and the community, which is concerned with the public safety, the hygienic conditions and the effect of building on the amenities of a neighbourhood, always an important consideration.

Owners may range from the private individual requiring a dwelling to the large industrial, civic or national body initiating some great undertaking.

The architect may be assisted in his approach to the problem of his client by the intimate general knowledge of the requirements which his client may be expected to possess and which may, in the case of large corporate bodies, be based upon long experience of the use of buildings for a similar purpose. The architect will, however, be expected to possess special knowledge of a more particular and technical character, which may be the result of long experience in particular classes of work; *e.g.*, works and offices for special trades and industries, banks, hotels, churches, schools, hospitals, theatres and cinemas. In the case of the larger firms of architects, the special knowledge required may be confined to one partner or responsible assistant. In America, where commercial schemes are often of abnormal size, architects and allied professional men, having varying specialized knowledge, work together in groups. The special advice they are able to offer frequently includes an estimate of the financial prospects of a scheme and determines the nature of the plan and the type of construction to be utilized. Programmes formulated under such circumstances may make unusual demands upon the building industry, but impracticable schemes are guarded against by the fact that the architect is responsible for the supply of detailed information to the builder and for the general direction of procedure.

Assuming that the architect has reached the position where the actual design of the building may proceed, general plans, elevations and sections are prepared for the consideration of the owner, alternative schemes being sometimes considered. When approved by the client these drawings are elaborated to explain the proposals to the local authority and to the contractors who will later be invited to compete for the execution of the work. During the preparation of a scheme the architect must give due consideration to local building by-laws, which call for the recognition of a building line, the provision of adequate light, open spaces of a minimum area, proper foundations, thicknesses of walls appropriate to their height and purpose, damp-resisting provisions, and sizes of timbers in floors and roofs. For massive buildings and those of great height, difficulties may arise in regard to foundations, involving preliminary investigations on the site to determine the nature and resistance of the natural foundation. Occasions arise in extensive and exceptional schemes where the architect requires expert assistance of a particular kind. He may then recommend the owner to employ a professional consultant to prepare or advise upon a detailed scheme for a particular branch of work. Alternatively, if a patent method of construction is proposed or a special production of a particular firm is to be employed, such firms are usually willing to submit a scheme in the hope of being employed to execute the work or to supply the material. Specialists of this type undertake such work as structural steelwork, reinforced-concrete work, patent floors, heating, ventilating, lighting, lifts, rolling shutters, patent glazing and equipment for specific purposes. In this respect architectural practice in Great Britain differs somewhat from that followed in America, where the larger offices often have sufficient specialists to prepare preliminary designs for a large and complete building. These arrangements are intended to secure co-ordination and economy of effort.

When a scheme is completely arranged, steps are taken to ensure its realization. In important work a *specification* is provided; *i.e.*, a document prepared by the architect, describing in detail the material and its preparation and the methods of construction to be employed in the building. At least two copies are provided, one being retained by the architect and the other used by the builder. It is appropriate at this or an earlier stage to obtain an approximate estimate of cost for the consideration of the client, the usual method being to *cube* the building and to apply a unit cost obtained from an analysis of actual costs of comparable buildings. For example, in the case of churches, schools and entertainment buildings a unit price per seat is applied, and in the case of hospitals a unit price per bed.

In much modern practice a separate specification is not employed, but an abbreviated description of the work allotted to each trade is provided in the *bill of quantities*. This is prepared by a *quantity surveyor*, the architect himself occasionally acting in this capacity. Quantities are obtained by measurement from the plans already prepared and with the assistance of the full or abbreviated specification. The bill is so arranged that by pricing the items the builder may readily arrive at a total estimate for the proposed work. The provision of a detailed bill of quantities is usual in Great Britain, and has the advantage of defining with some exactness the amount of work intended to be done and the price for which each item will be executed. These details facilitate the settlement of accounts at a later stage, especially where variations from the original intentions have been made either by the architect or his client, or at the instance of the builder with the approval of the architect. The preparation of the bill occupies considerable time, and where work is being hurried forward or the competition is limited to a few building contractors, formal quantities are often omitted and the estimates prepared by reference to well detailed general drawings. This is largely done in America, where plans are specially elaborated for the purpose at an early stage.

The position has now been reached where the architect is ready for inviting "tenders," or offers to execute the work at a stated price. This may be done either by advertising in the local press and in reputable trade journals, or by inviting tenders from a limited number of selected contractors of whose work and reputation the architect has some previous knowledge. Unless there is some special reason to the contrary, a contract is usually entered into with the firm submitting the lowest tender, after which construction may be begun.

BUILDING ADMINISTRATION

The Builder.—The builder is the person chiefly concerned in the submission of a tender for the erection of a building. The term *builder*, though in common use, has not a very exact connotation, and in this it differs from the term *architect*, which may be strictly defined in the professional sense. Industrially the term is considered applicable to a person (or firm) employing labour from more than one of the building trades. The size of such a business may range from the very small firm occupied mainly in the repair of small buildings, to the large firm undertaking substantial contracts at widely separated centres.

A builder who initiates building projects on his own behalf is known as a "speculative builder," but the term cannot logically be applied exclusively to the erector of small and cheap property. The speculative builder with knowledge and vision may do and has done good service, as is proved by the well-known work of the Adam brothers at the Adelphi, of Grainger and Dobson at Newcastle-on-Tyne, and of Allen and Wood at Bath. These works were "speculative" in the sense defined above.

A builder whose establishment and command of capital enable him to accept ordinary building contracts is usually called a *building contractor.* If, in addition, he undertakes comprehensive work such as road-making, drainage schemes, waterworks and storage reservoirs, he is called a *public-works contractor.* All the above descriptive terms apply to businesses having similar working organizations, and differing in scale or degree rather than in kind.

The Preparation of the Estimate.—Before the actual execution of building contracts, the preparation of a tender or estimate of the builder's price for the proposed work is a vital operation. The problems involved cannot be detailed here; they require much knowledge and experience, and their solution imposes a severe test upon the organization of the business. An experienced builder readily determines ordinary item prices in simple ways, but in large organizations estimating is done by delegation to several persons. The former method of estimating would be impossible and fundamentally wrong for large contracts. Delegation requires system, and the system must permit the two fundamental operations of costing and estimating or pricing to be properly done. Costing is the operation of ascertaining the actual cost to the builder of an individual piece of work. The process may consist of totalling the expenses incurred in the execution of a whole contract in order to compute the total profit or loss on the work; or it may be a detailed analysis of cost, under known conditions, of many smaller operations. In modern practice the latter form of costing is sometimes called production costing, in which by careful and immediate analysis of actual cost, waste may possibly be prevented and the cost made to fit the price. It is only on the second system of costing that reliable item prices may be determined for use in pricing bills of quantities. Special factors which affect costs and require careful consideration when preparing tenders are the nature and accessibility of the site, the freedom for delivery and storage of materials, the supply of labour and of water and power, the time allowed for completion of the contract, and the disposal of surplus material from the site. The time limit is a vital matter (especially where a builder has undertaken several contracts) and serious difficulties often arise in organizing an adequate supply of materials and specialities in the order required and in time to avoid delay.

The time element is, to the estimator, an important factor in many cases. Business premises and places of entertainment in big cities may be projected on very expensive sites; there are high capital charges which, with the absence of revenue during erection, may justify exceptional methods of procedure to hasten completion of the structure. Such methods may involve greater but justifiable expense to the builder and would result in a higher tender for the work. In America the question of rapid construction has been investigated for economic reasons, and special methods have been adopted to shorten the period of erection. These include the use of time schedules or charts which schedule the time allotted for the completion of each important subdivision of the work. The dates for the ordering and delivery of building material and of fabricated work are thus clearly indicated. It is usual, in American practice, for the contracting firms, when tendering, to submit a time schedule to indicate their proposals for the progress of the scheme within the time limit. In British practice at present, a schedule, if used, is prepared after consultation between the interested parties subsequent to the signing of the contract.

The Contract.—After the decision of the owner, with the advice of the architect, to accept a particular tender, the acceptance should be made legal by the execution of a formal contract between the owner and the contractor. Many legal issues may arise even in the smallest contracts, and it is of importance that the form of contract should be drawn up with care and its provisions based upon the best legal advice. To combine economy with safety and to take advantage of common experience in the building industry, it is now usual to adopt an agreed form of contract which has been approved by the associations and federations representing architects, contractors and sub-contractors. Such forms of contract were adopted in Great Britain, and in America, after joint discussions between architects and contractors.

The contract documents usually state the price which the owner undertakes to pay, and the contractor to accept, upon satisfactory completion of the work being certified by the architect. The architect undertakes to supply certain drawings and details, a specification and copies of the bill of quantities; he further undertakes to supervise the work. Other important contract conditions provide for the periodic payment of the contractor as the work proceeds on the issue of certificates by the architect, the amount of the payment being usually limited to an agreed percentage of the value of work so certified. The date of completion is embodied in the contract, which also provides for proportionate penalties and bonuses payable or receivable for overrunning or keeping within the time limit. A clause is also inserted defining the arrangements for arbitration upon disputes which may arise between the architect and the contractor.

The previous paragraphs have dealt with the procedure of letting a contract by a fixed sum tender. For some kinds of work, particularly in the repair of large and old buildings, where the nature of the proposed work is known, but not the quantity, two other forms of tender are recognized. In the first, known as the priced schedule, the contractor tenders an estimate containing prices for each item of work of a specified kind. On completion the items of work are measured and the total liability ascertained. An accurate forecast of the cost cannot be expected on this basis. The second method of tender is termed actual cost plus profit, by which the contractor undertakes to charge only the actual cost of executing the work, together with a fixed profit, the rate of which is embodied in the contract.

Relation of the Architect to the Contractor.—Prior to the signing of a contract, the architect acts as the professional adviser to the owner, but when the contract has been signed, the relations necessarily change. The architect is, by custom, the person responsible for interpreting the conditions of the contract and of deciding the manner in which these conditions shall be complied with. It is generally held that, in spite of the fact that he is paid by the owner, the architect should act impartially towards both parties, thus ensuring a faithful observance of the contract.

Sub-letting.—The range of constructional trades is now so extensive that most building contractors confine their direct activities to a few trades. Sub-letting of portions of contracts is thus a common practice. The employment of certain specialist sub-contractors may be dependent upon the architect's selection of certain methods of construction. The contract figures, or approximate values, for these sub-contractors' work are usually included in the bill of quantities under the heading of provisional sums. The employment of other sub-contractors by the builder is usually subject to the approval of the architect. The general contractor not only assumes legal responsibilities under a contract, but may be held responsible for the general progress of the work, which requires co-ordination of the functions of sub-contractors; he should therefore provide by separate agreements for the observance of the general conditions of the main contract.

The Building Contractor in the United States.—In the United States of America much more emphasis is laid upon organization for production than in Great Britain, and consequently there has developed a professional type of building contractor, who may or may not possess works, but will undertake the responsibility for a complete contract and possibly sublet the whole of the work to sub-contractors. The reputation of such a contractor will depend upon successful completion of contracts within predetermined limits of time and cost; the system tends to focus attention on methods, processes and business organization for expediting the erection of the building. Remarkable results have already been achieved by reducing the period of time required for the completion of large buildings. Whatever the means adopted, the duties of the general contractor are so important that special attention should be given in the future to his selection and training.

On important contracts the architect is represented by a clerk of works, whose duties are to ensure that the material used and the methods of construction employed are in accordance with the terms of the contract. The clerk of works is paid directly by the owner.

Local Building Regulations.—The plans of a building must be approved by the local authority in whose area the building is to be erected. The same authority will exercise control during erection, and to some extent will be responsible for certifying satisfactory completion. It is important that the contractor should be reasonably acquainted with the local regulations controlling building work. These are incorporated in building by-laws, which range from the relatively simple by-laws of small towns to the complex regulations made under the various Building and Health acts of London. Supervision for a local authority is conducted by building inspectors, and for London by district surveyors acting under the superintending architect. The duties of the latter officers are specified and regulated by clauses of the Building acts.

There are regulations affecting the prosecution of building work on a town site such as those concerning the provision and use of hoardings and scaffolding, the demolition of old buildings, the necessity for shoring and gantries, and the use of cranes and machinery. The builder must comply with these.

Various details of materials and construction are dealt with under separate headings. (*See* Architecture; Brick; Brickwork; Cement; Concrete; Fire Prevention and Extinction; Foundations; Masonry; Plasterwork; Roofs; Scaffold; Shoring; Stone; Structural Engineering; Timber; etc.)

THE BUILDING INDUSTRY

In spite of the fact that, until comparatively recent times, the various building trades were only very loosely bound together, the relations between them being relatively casual and more a matter of tradition than of definite organization, it has never been a very difficult matter to assess the dimensions of these occupations, since they were by tradition largely compacted in several well-defined and readily understood trade groups. In modern times there has been a steady extension of the number of occupations having some connection with building work, many of them being engaged in the manufacture of fittings, equipment and materials of a kind not previously used, or only used to a slight extent in such work. It has thus become extremely difficult for statistical purposes to set exact occupational and industrial limits to this industry.

The term building industry, however, may be correctly used to include all those occupations, industrial and professional, which are entirely or mainly occupied in building work, excluding those which are concerned only in part in supplying some product used in building, *e.g.*, the production of cast-iron goods and ironmongery. The main trades usually included in it as well as the number of persons occupied may be judged from the following list of insured persons engaged in the building trades in England and Wales in July 1927. Carpenters, 134,450; bricklayers, 75,760; masons, 24,560; slaters, 6,130; plasterers, 22,130; painters, 114,610; plumbers, 34,220; labourers to the above 265,020; all other occupations, 170,980; total, 847,860.

Owing to the widespread demand for the services of the building industry, the occupations comprised therein are distributed with remarkable uniformity over the whole country; hence the industry is not subject to those striking concentrations which may be observed in other industries.

Training of Personnel.—The problem of most obvious import both to this industry as a whole and to each of the separate trades involved in it is the training and selection of personnel. Pronouncements on these problems were made in Great Britain by the National Industrial Council and also by the National House Building Committee at a later date (1924), dealing, however, chiefly with the question of the selection and training of apprentices. These and similar discussions have resulted in a clearer understanding of the nature of these problems and of the relative merits of various solutions which have been propounded. The most stable scheme so far established is probably that initiated in connection with the painting and decorating trade. This is *organized by a national joint education committee and aims at* the encouragement of a *better standard* of craftsmanship by means of competitions, the improvement of craft education, and the establishment of properly considered apprenticeship conditions. Other national schemes of apprenticeship have been set in motion in the plumbing trade, in the plastering trade, and in the heating and ventilating trade. Local apprenticeship schemes have been established in a number of centres, all involving co-operation with the education authorities in the provision of suitable technical education

The steady growth in the size of individual building firms, which has accompanied the initiation of large-scale building projects and has been the result of a desire to benefit by the economy of large-scale business methods, has created a demand for a higher type of employee who shall be capable of dealing with the larger problems of organization and control in large contracting businesses. Increasing attention is being given to this problem by technical institutions The Institute of Builders, which has been reorganized so as to be able to deal with all matters affecting the general improvement of the building industry as a whole, has considered, among other proposals, the establishment of degree courses in building at one or more of the universities. Such courses would deal with those larger problems arising in connection with the work of the industry, and would help to raise the general level of technical knowledge and ability in the industry. Similar efforts are being made in other countries.

In New York joint boards have recently been established which include in their constitution all parties likely to be interested in the methods of improving building practice, such as architects, owners, employers and employees in the building trades, and the local authority These bodies deal with apprenticeship, craftsmanship safety co operation between the trades, and the regulation of seasonal demands for building work. The work of the Federal Board for Vocational Education may also be referred to in this connection (F. E. D ; J. L. M)

BIBLIOGRAPHY. Reference may be made to the following *Reports:* On the Provision of Dwellings for the working classes, Cd. 9,191 (1918), on the Building Industry after the War, Cd. 9,197 (1918); on Building By-Laws, Cd. 9,213 (1918); on Reconstruction and Production (United States Senate Committee, 1920); on National House Building, Cd. 2,104 (1924); on the Construction and Control of Buildings and the Development of Urban Areas in the United States (London County Council, 1926). *See* also the *Specifications* of the British Engineering Standards Committee; the *Standard Contract for the Construction of Buildings* of the American Institute of Architects; the *Contract Form* of the Royal Institute of British Architects; and various papers of the Building Research Board, and of the Bureau of Standards (U S.A).

BUILDING SOCIETIES. The name "Building Society," once entirely descriptive, has become almost a misnomer as the functions undertaken by these societies have developed and become modified. A few unincorporated societies may still build houses, finance building operations, or acquire property, but the great incorporated societies do not any longer undertake these tasks The title fails to describe their actual purpose, and the most authoritative textbook describes the building society as "a combination of investors and borrowers operating under a measure of government control to promote the ideals of thrift and home-ownership The investors—who are either member-shareholders or merely depositors—supply the funds from which house-purchase loans are made The difference between the rate of interest received from the borrower and that paid to the investor represents the margin which enables a society to meet its management expenses—a very modest figure in most cases—as well as to build up and maintain adequate reserves "

The society derives its funds from depositors and shareholders. It has financial relations with three classes of people, viz., savers of small weekly and monthly sums, depositors and shareholders with more substantial interest, and its borrowers To a limited degree it is like a bank, but its lending powers are much more circumscribed Loans are made for (1) the purchase of existing premises, (2) assistance in having houses built or extended, and (3) paying off existing mortgages.

In the large societies there is a difference of approximately *1% between the rate of interest paid and that received*, and this forms a sufficient margin for administrative expenses. Development in the movement during the early part of the 20th century was so rapid as almost completely to change its character, and this fact has, in many cases, outdistanced the popular conception, which still tends to regard the movement in the light of the characteristics it exhibited late in the 19th century. For example, the earliest societies were all terminating societies, consisting of a limited number of members and ceasing to exist when all had participated according to their agreements. Some of these still exist, but by the building society movement is understood now the permanent societies which are overwhelmingly important. In these there is no legal limit to the number of shares or to the general expansion. Speaking generally, terminating societies are of historical interest only.

History of Development.—It was long supposed, and indeed indicated in earlier editions of this Encyclopædia, that 1705 in Birmingham was the starting point, but the researches of Mr. Harold Bellman have revealed the fact that a society was established in Birmingham in 1781 on a large scale.

> "Dec. 3, 1781—Proposals for establishing a Society for Building on Lands belonging to William Jennings, Esq., to continue certain streets in the Hamlet of Deritend, called Bradford Street, Alcester Street, Lombard Street, Moseley Street, Birchall Street, and Cheapside; and open certain new Streets, to be called River Street and Long Bridge Street."

(The full conditions are set out by Langford in his *Century of Birmingham Life*, vol. i. p 201.)

Other authorities have suggested the origin at Kirkcudbright in 1809. The movement originated about the same time as friendly and co-operative societies, and building societies were first certified under the Friendly Societies act of 1834 Their rapid rise led in 1836 to a special act which extended the friendly society regulation to them, binding all members of a society by the rules which were certified by especially appointed officers who gave security. Provision was made for control by a committee of management. The society's property was vested in trustees empowered to bring and defend actions and to settle disputes by arbitration. Exemptions were given from stamp duty and usury laws. By 1850 over 2,000 societies were registered in the United Kingdom, many of them marked by glaring defects in their financial arrangements.

About 1846 the idea of permanence was first developed in practice, because it was recognized that there were many non-borrowing members who were really investors and it was of no significance at what point they began to invest In 1871 a Royal Commission enquired into and reported on their working, and in 1874 a consequential act was passed that was the foundation of present practice. Under this act the liability of members was limited to the arrears due from them for the amount owing under mortgage. New societies could no longer be formed unincorporated, and in 1925 only 30 of the unincorporated societies survived, while there were 1,088 incorporated societies.

One effect of incorporation was that members and all who derive title through them were relieved from having to trace that title through the successive trustees of a society. Power to borrow money was also expressly given to the societies by the act, but upon two conditions: that the limitation of liability must be made known to the lender, by being printed on the acknowledgment for the loan, and that the borrowed money must not exceed two-thirds of the amount secured by mortgage from the members, or, in a terminating society, one year's income from subscriptions. Previous to the passing of the act (or rather to the judicial decision in *Laing* v. *Read*, which the clause of the Act made statutory) there had been, on the one hand, grave doubts on high legal authority whether a society could borrow money at all; while, on the other hand, many societies in order to raise funds carried on the business of deposit banks to an extent far exceeding the amounts used by them for their legitimate purpose of investment on mortgage. The act stipulated that if a society borrowed more than the statute authorized, the directors accepting the loan should be personally responsible for the excess.

The Starr-Bowkett societies which at one time were regarded as typical of the movement (over 1,000 being established) are no longer considered typical. They existed to provide advances to members, free of interest, and in practice advances were made to borrowers without specified interest. Upon the accumulation of a special sum it was balloted to one of the members, who repaid it by instalments over an agreed period. The successful member often had the right to sell at a profit, but this gave rise to many difficulties and was later modified.

Various undesirable practices, and the failure of the famous "Liberator" in Oct. 1892, led to further legislation which was designed to secure the position of the large majority of societies, that were soundly administered, and to prevent their reputations being tarnished by the few which were less carefully conducted. The act of 1894 required all incorporated societies to make a return on a prescribed form of:

(1) Individual mortgages in excess of £5,000.
(2) Properties which had been in the possession of a society for more than 12 months through default on the part of the mortgagors.
(3) Mortgages more than 12 months in arrear.

Since this act public confidence has been steadily restored, disturbed only by the failure of the Birkbeck Bank in 1911. In the case of the "Liberator" failure in 1892, it ought to be clearly recognized that it had long ceased to perform normal building society functions. In the hands of Jabez Spencer Balfour its funds were applied without scruple to all kinds of speculative enterprises. The frauds excited public indignation and disgust, and the widespread distress was met by a public relief fund to which £114,000 was subscribed.

The Birkbeck failure was a clear illustration of the necessity for adhering strictly to the rules of the movement and for non-indulgence in banking business. In this case the total mortgaged assets were only three-quarters of a million, whereas the other assets accounted for 11½ millions. It was not an incorporated society; it was not worked under the building societies acts, or subject to their regulations. Its difficulties arose not from its building society business, but from its bank business. The official receiver reported that the failure was due to shrinkage of securities and lack of banking experience.

The capital of incorporated societies fell from 54 millions in 1887 to 43¾ millions in 1895. The recovery began in 1898, and since the setback in 1911 there has been a steady forward march to the end of the World War, with a subsequent development of remarkable proportions.

Control and Administration.—The chief registrar of friendly societies prescribes the form of annual accounts for each society from which he compiles his abstract and report for parliament. The rules of a society, as approved by him, can be amended only subject to his approval, and he exercises a general supervision to see that the societies are acting within their powers.

A society's annual statement has to show particularly the number of mortgages and the amounts outstanding thereon, classified up to £500, then £500 to £1,000, from £1,000 to £3,000, and from £3,000 to £5,000. Details have to be given of repayments 12 months in arrear, or property in possession, and mortgages in excess of £5,000. The form of account is by no means ideal, but it is the result of compromise and historical evolution.

Very exacting rules are laid down for the auditors. On the investment side building societies are practically confined to trustee securities.

The ultimate authority of a society rests in its general meeting, which elects directors and auditors, and one of the latter must be a public accountant. It is a common practice for the directors to have an audit of their own.

Arrangements for Investment.—It is usually claimed that investment in a well-run society is free from risk of depreciation, with a good yield of interest and easy realization. The securities, apart from gilt-edged securities, are carefully selected in individually investigated mortgages. First of all, there is an *ad hoc* specific valuation, with a definite margin between this and the advance, and then the advance is steadily and rapidly reduced so that, by the monthly or quarterly repayments, the margin of safety on each mortgage is rapidly increased. Moreover, the personal covenant of a borrower of repute stands behind. Deposit or loans to a society are limited to two-thirds of the mortgaged assets and are not based upon securities. Shares are held either as fully paid or partly paid, the latter being specially suitable for small saving by instalments. The rate generally paid in the south of England on share capital is 4½ or 5% free of tax, but 4 to 4½% is common in the north.

There are no expenses to the investors for brokerage, commission, or stamp duty, and fines for non-payments of subscriptions on partly paid shares are leniently administered. Special arrangements have been entered into with the Inland Revenue department, whereby the society pays income tax direct on a conventional fraction of the share deposit interest, the basis of which is an assumption that half the recipients are exempt and half have incomes liable on the lower ranges of tax. A part of the arrangement generally adopted is that the payer of mortgage interest to the society is not under the ordinary obligation of a borrower to deduct tax from the interest and account for it by direct payment to the Revenue. It will be noted, of course, that investment by way of deposit or share capital is in no way limited to people interested as borrowers. The borrower is usually required to find the minimum amount of 20% of the society's valuation of the property. Short lease property, with its depreciation of value and risk of dilapidation claims, is rarely made the subject of mortgage. A borrower can obtain a higher advance if he deposits further collateral security, concerning which, however, practice and rules are rather complicated. At other times guarantees are given through insurance offices, but this practice is not of rapid growth. The borrower sends his survey fee and a small entrance fee in advance, and then upon final acceptance, on examination of the title, legal fees become payable. Advances are usually repayable by fixed monthly instalments of principal and interest spread over varying periods, and the borrowing member may choose any term from five to years, or even more, in discharging his liability. This system, which frees the borrower from the trouble of making monthly calculations of the amount due, also permits of a larger proportion being lent than by any other method, as the amount of the advance is being gradually reduced throughout the whole period for which it is granted.

Every encouragement is given to the borrower to pay off sums in addition to his monthly liability. On such extra repayments of principal interest ceases to be charged, and the sums may be employed to reduce either the total of the monthly payment or the term of repayment. Favourable circumstances sometimes enable the mortgagor to repay the whole of the balance, and this is usually permitted, with the provision either that a specified (and usually short) notice is given, or that interest for the same period is paid in lieu of notice (H. Bellman, *Building Society Movement*, p. 45).

No borrower is actually tied to the mortgaged property during the whole term of repayment, for he can arrange a sale and clear up the outstanding balance. On the other hand, he is under no risk of a mortgage being called in, and there are, therefore, important differences between his position and that of an ordinary mortgagor. In practice great care is taken in the admission of borrowers.

Of late years a special insurance arrangement has been entered into with many societies whereby, for a single premium, the whole of the outstanding balance in the event of the payer's death is remitted, thus avoiding any difficulty to the dependents in keeping up payments. Some 150 societies have now adopted this scheme.

Economic and Social Position of the Movement.—Since the World War the movement has entered upon an altogether new stage. The special conditions attaching to the building industry for several years prior to the war, the abnormal circumstances of the five years' war period, the natural incidence of the increase of population arriving at the adult stage—all combined to make a house shortage of extraordinary stringency. Even outside the actual wage-earning classes those who needed houses were great in number and insistent in demand. Those who had professionally supplied them on hire would no longer do so. Each would-be occupier had to supply his own demand and become also an owner. In the vast majority of cases he was not himself possessed of the necessary circulating capital. The demands for the available supplies of capital in other directions were enormous. In the absence of the building society movement it is probable that in response to such pressure a large number of institutions would have sprung up to supply the need. They would have varied enormously in their resources and their regulations, in their probity and their wisdom and foresight. New and hastily improvised structures would have been suddenly subjected to a vast and rushing flood of insistent requirements. It is fairly clear that out of such a situation must have come many failures, disappointments, and losses. But, as it was, the onrush was actually made upon a system of accredited institutions with traditional practice laid down on sound lines and with all the prestige of solid and steady progress, *standing ready for their task*. They had won the *right to be trusted with this larger task*, and they took the whole of the weight of it from the community without abating anything of their practised caution; but revelling, rather, in the new opportunity of adapting their elastic organization to every reasonable fluctuation of human and communal need.

Movement in the Dominions.—On the whole the British model prevails and the act of 1874 is in many places adopted almost in its entirety. In New South Wales the movement began about 1846 and the terminating has been much more popular than the permanent system. Many former defects in the administration and constitution were put right in 1923 and it is thought that these long overdue improvements will re-establish public confidence. In Western Australia the first society was established in 1862. Queensland, South Australia, and Victoria have movements on British lines calling for little comment. In Canada the loan companies are wholly the offspring of the co-operative building societies of pre-confederation days, the first one recorded being in Montreal in 1845. In contrast to building societies in England these loan and trust companies have shewn a tendency to amalgamation. In 1900 legislation was passed, providing for shares to be fixed, permanent and non-withdrawable, and this was effective in eliminating weakness, for, by the end of 1924 there were large increases in total resources. These companies have contributed enormously to the development of every province in the dominion. In India the conditions are so different that these institutions hardly come within our definition. In New Zealand there are 41 permanent and 45 terminating societies, with £3,000,000 and £1,500,000 advances respectively. In 1920 power was given to the governor-general to approve a society for the investment of trust funds, but in 1924 this privilege ceased, not because of dissatisfaction where it had applied, but because of the invidious distinction which it seemed to make in cases of approval or non-approval. In South Africa the Natal Building Society was the first permanent society, established in 1882. Societies are not yet under government supervision or control, but in spite of this grave defect it is estimated that their combined assets are not less than £16,000,000.

European Conditions.—On the Continent, there are many institutions connected with house-purchase, but they are almost entirely State-aided or run by municipalities, Spain being practically the only exception.

See H. Bellman, *The Building Society Movement*, with an introduction by Sir Josiah Stamp (1927); *The Silent Revolution* (1928).

(J. S.)

BUILDING AND LOAN ASSOCIATIONS, U. S. A.

The Oxford Provident Building Association was organized in Philadelphia in 1831 for the purpose of enabling its members to become home owners. Membership was limited to those interested in home ownership. Trustees served without compensation. Through a system of fees, fines, and forfeitures, forced saving was adopted as an early characteristic of the program. It was intended that the pooling of resources by continuous regular contributions would enable the members, one by one, to buy or build homes. When this result was accomplished, the association would disband. Thus was started the first *terminating* building and loan association in the United States. This type is no longer used. With the spread of the movement, it soon became evident that the same association could serve a series of incoming member groups, each constituting, in effect, a terminating association. From this recognition developed the idea of *serial* associations. Although this type is less common than formerly, there were, in 1930, many serial associations in existence. Experience also taught that some contributors would never exercise their borrowing privilege for home purchase purposes. Instead of asking such members to withdraw, both borrowing and non-borrowing members were welcomed. The former secured debt-free homes when their series matured. The latter were paid in cash the matured value of their shares.

The admission of non-borrowing, savings members resulted in the further change in the plan of operation of many associations into *permanent* financial institutions. Savings members were admitted at any time and individual accounts were opened in their names. Earnings were credited to these accounts. Gradually the idea of permanent investment rather than withdrawal at the time of maturity of a series resulted in the offering of types of shares not used by the serial and terminating associations.

Incorporation.—In the earliest associations the form of organization was very simple. Members elected trustees to manage the business, without much thought about legal liabilities. Later, enabling acts were obtained in most of the States to provide for incorporation of building and loan associations. All but those classed as Federal savings and loan associations—to be discussed later—operate under State charters.

Investment Plans.—The types of shares most commonly used by State-chartered building and loan associations are as follows. Both serial and permanent associations use all types of shares discussed here except the optional savings shares which are used by permanent associations only. *Instalment thrift shares* have a par or maturity value. Purchasers subscribe for a predetermined number of shares and make a first instalment payment thereon. Thereafter, regular weekly or monthly payments are made on such contracts until all payments, plus credited dividends, equal the par or maturity value. Several modifications of this general plan have been used. Fines have been assessed for neglect of regular payments. Occasionally premiums have been offered for completion of the original contract without any deviation. All instalment thrift share programs carry the implication of forced savings. The Dayton plan, originating in Dayton, Ohio, modified the permanent plan by waiving requirements for systematic investment of regular amounts. Investors were invited to put in large or small amounts at their convenience. Shares issued to such investors are called *optional savings shares*. Withdrawal was permitted on reasonable notice without loss of either principal or credited dividends. This modification further minimized the need for fees, fines, and forfeitures. Lump sum investments are indicated by one of two kinds of shares. Some investors prefer to build an account solely from credited dividends. By investing, let us say $75, in a lump sum, it is intended that dividends will be credited rather than paid in cash. Without further investment by the owner of such an account, it will eventually grow to the par or maturity value of say $100. At such time it may be the intention of the investor to withdraw his entire amount credited to his name. Shares of this kind have been given the name *prepaid shares*.

Lump sum investments are made also in the form of *full-paid income shares*. At the time of the original investment in such shares the full par or maturity value is paid to the association. Thereafter dividends are paid in cash instead of being retained by the association and credited to the investor's account. At the maturity of instalment thrift, optional savings, or prepaid shares, they are sometimes converted into full-paid income shares. Thereafter they are continued as a more or less permanent investment.

Other forms of securities have been used in limited areas. In California *investment certificates* came into use about 1890. They are evidences of creditorship and bear a fixed rate of interest. A variety of certificates have been used, including full-paid, instalment, accumulative or optional payment, prepaid, definite-term, and minimum term. The first four of these parallel the kinds of shares discussed above. Definite-term certificates run for the time specified in the contract. At their maturity it is expected that the funds will be withdrawn or reinvested. Minimum term certificates may not be presented for retirement until a date agreed upon in the contract. Thereafter they become regular full-paid certificates. In Ohio the deposit system created a creditor obligation that carried a definite rate of interest and supposedly was repayable on demand at the option of the holder of the certificate of deposit or passbook. In effect this system operated in such fashion that, if few depositors wished to withdraw their funds at any time, they could probably obtain them without difficulty. In times of crises, however, deposit institutions froze up just as did those issuing only shares. The acceptance of deposits did not change the character of the assets in which the associations invested their funds.

Lending Plans.—Building and loan associations have used several lending plans. The original one was known as the *share-accumulation* or *share-account-sinking-fund* plan. Keeping in mind that the first associations were organized to facilitate the purchase or construction of homes by their members, it is evident that such members necessarily occupied a dual relationship to their associations. As a borrower, each member gave a mortgage on his home to the association. As a compulsory saver, he became a share-holder. Since the association was operated on a semi-philanthropic basis, it was not known how much the mortgage money would ultimately cost. Hence the borrower subscribed for shares whose maturity value was equal to his mortgage. When his payments on his shares plus dividends credited thereon equalled his obligation to the association, his mortgage would be cancelled. Meantime, of course, he has paid interest on the loan. The original amount of the loan is never decreased until it is cancelled completely.

Under this plan, the contract to repay the original amount of the loan and the regular interest payments were obligations of the borrower. The regular payments on the shares subscribed for were also of a fixed character. The earnings to be added to these payments in order to mature the shares and thereby effect a cancellation of the mortgage were always indefinite. Any losses suffered by the association before the maturity of the borrower's shares created additional hazards for him. Earnings credited one year might be recaptured in a subsequent year to absorb losses. The general uncertainty about the actual cost of a loan under the share-account-sinking-fund plan has diminished its popularity.

With the acceptance of investing members who were not borrowers, the building and loan associations began to consider loans to borrowers who were not investors. This led to the introduction of the *direct reduction loan* plan. Under this plan, from each payment is deducted the interest for one month. The balance is credited to the principal, reducing it month by month until the debt is completely amortized. While the monthly payments usually remain constant throughout the life of the loan, the interest charges decrease constantly and the principal instalments increase correspondingly. The definiteness of the direct-reduction plan and the absence of complicating hazards have caused it to grow in popularity. In order to maintain the legal appearance of mutuality, State-chartered associations that use this plan usually require the purchase by the borrower of a small amount of stock. Sometimes $1 is the amount invested for this purpose.

Between the share-account-sinking-fund loan and the direct-reduction plans are many modifications. One in common use is called the *cancel-and-endorse* plan. The borrower starts with a subscription to shares equivalent to the amount of his loan. Whenever his share payments amount to the maturity value of a share, one share is cancelled and its maturity value is endorsed on his note, reducing the unpaid principal by that amount. Those who favour the direct-reduction plan are not satisfied with the cancel-and-endorse program as a substitute.

Management.—The older serial and terminating associations were operated by a non-salaried board of trustees or directors who met once a week or less frequently to receive payments and to disburse funds on hand. Even in the early days "window dressing" was practiced in the selection of well-known citizens to serve as directors. A system of fees for specific services was developed.

Associations operating under the permanent plan began to depart from the semi-philanthropic character of the serial and terminating associations. Many of them opened offices, keeping regular business hours like any other financial institution. Salaried managers and paid staffs were hired to conduct their business. Frequently the secretary was given the job of management. In some sections of the country the chief executive is still called secretary. The modern tendency is to give him the title of president.

Nationals.—The growing popularity of the building and loan plan of savings and home financing invited the organization, in the decade beginning in 1880, of a large number of national associations. For the most part they conducted a mail order and selling business. Savings were attracted by mail and by salesmen working on a fee basis. Even loans were made by mail on a national scale.

The promoters who managed such associations overlooked little opportunity to take full advantage of fees, fines, and forfeitures. Whatever benefit accrued to the investors and borrowers was frequently incidental to the demands for profits to the management. The depression of the 1880s put a damper upon the operation of the nationals. A flood of restrictive State legislation, induced by an aroused community of action by managers of local associations, helped to prevent the recovery of the nationals.

After the turn of the century only remnants of the once flourishing national movement remained. A few were still in existence in 1939, chastened considerably and made more respectable than their predecessors. The collapse of the nationals left an unsavoury flavour which retarded the development of local associations in some parts of the country for a great many years.

Growth.—The first reliable estimate of the importance of locally managed building and loan associations in the United States was made by the United States Commissioner of Labor in 1893. He reported 5,598 associations with 1,348,345 members, of whom 402,212 were borrowers. It was estimated that 3,600 of these associations had been organized in the decade between 1880 and 1890.

Recovering from the depression of the '90s, building and loan associations in most sections of the U.S. enjoyed a steady growth in both numbers and assets for two decades. In 1920 there were 8,633 associations with total assets in excess of $2,500,000,000. The membership had increased to 4,962,919. During the decade beginning in 1920 the number of associations increased to a high point of 12,804 in 1927 and declined to 11,777 in 1930; total assets increased each year to reach a peak of $8,828,611,925 in 1930; and membership grew steadily to 12,343,254 in 1930.

Wide Variety of Plans.—Up to 1930 there was little coherence in the building and loan movement in the United States. A wide variety of policies and practices characterized the industry. Several types of associations with their concomitants of fees, fines, and forfeitures, were still common in many States. It has been estimated that in the city of Philadelphia alone there were more than 3,000 associations, meeting one night per week or even less frequently. Many of these specialized in second mortgages. The three States of New Jersey, Pennsylvania, and Ohio constituted the "building and loan belt" of the United States. In their associations were three-sevenths of all the building and loan assets of the country. While Pennsylvania and New Jersey still followed the serial plan, many of the associations in Ohio had made further modifications in the Dayton plan by accepting deposits, payable on demand, and promising definite interest rates instead of dividends. Even the names given to these associations were confusing except in the areas in which they were used. For example, in Massachusetts they are still known as "co-operative banks;" in Louisiana they are "homestead associations;" while various combinations of "building," "loan," "savings," are used in various parts of the country, sometimes in connection with other descriptive terms in addition to proper names.

U. S. GOVERNMENTAL AGENCIES

Nationalization of the Building and Loan Industry.—The United States Building and Loan League was organized in 1893, largely as a defensive move against the encroachment of the nationals. From that date to 1930 the league held annual conventions for the discussion of common problems. Other than at the time of these conventions there was little contact among its members. Even before the crash of 1929, however, leaders of the industry were planning a more effective type of organization. Accordingly, in 1930, the constitution of the league was revised to produce a more active management. A salaried manager was employed. With him was associated a paid staff equipped to render a variety of services to the members of the league and to the industry which it represents. This marked the beginning of the nationalization of the building and loan industry

Depression Following Crash of 1929.—The reorganization of the United States Building and Loan League occurred none too soon.

The collapse of the thrift and home financing structure, following the crash of 1929, brought to light fundamental weaknesses in its foundation. Both necessity and fear caused unusual demands for withdrawal of funds invested in building and loan associations. Meantime, general unemployment reduced drastically payments to the associations from both borrowers and investors. As a consequence, most of the building and loan associations froze up. They ceased to serve either investors or borrowers in the time of their greatest need.

As fast as funds came into the associations they were used to meet insistent withdrawal demands. The number of associations that were taken over by supervising authorities for liquidation was not large. Being mutual associations they could carry on, after a fashion, without facing insolvency. Nevertheless, most of them were liquidating under their own power since their disbursements exceeded their receipts. Each year from 1931 to 1937 inclusive (the latest year for which complete information is available) the total assets of the industry decreased. From 1930 to 1937 the number of associations declined from 11,777 to 9,762; total assets decreased from $8,828,611,925 to $5,711,658,410.

Remedial Legislation.- Soon after the reorganization of the United States Building and Loan League, its new management was called upon to find new remedies for the ills of the industry. The effectiveness of this new management was soon demonstrated in its participation in the drafting of a series of bills for submission to Congress. While the league is not to be given sole credit for the resulting legislation, its officers and directors had considerable part in shaping it. A part of the legislation passed by Congress in the years 1932 to 1935 inclusive was of an emergency character, while other laws have made more permanent changes in the financial machinery of the United States. The most important of these laws will be discussed separately.

Federal Home Loan Bank Act. Until 1932 the building and loan associations were dependent upon their local commercial banks for assistance whenever they needed additional funds to meet the needs of their investors and borrowers. These were all short time loans. They could be called for payment either at the will of the lender or on very short notice. Frequently payment was insisted upon at times when the borrower was least able to meet this kind of an obligation. As early as 1918 efforts were made to obtain legislation to provide national assistance in such emergencies. It was not until 1932 that legislation could be secured and the Federal Home Loan Bank Act was passed. It provided for the establishment of a reserve credit system to serve the needs of thrift and home financing institutions.

This law provides for the appointment by the President of the United States of a bi-partisan board of five members to be known as the Federal Home Loan Bank Board. This board was empowered to establish and supervise a system of regional banks whose stock may be owned by building and loan associations, savings banks, and life insurance companies, which wish to become members, and the United States. As of June 30, 1939, the 12 banks in the system had 3,946 member institutions, nearly all of which are of the building and loan type. In order to get the system established, the Government of the United States agreed to invest not to exceed $125,000,000 in the capital of the 12 banks. As of June 30, 1939, the amount actually invested was $124,741,000. The law provides the conditions under which this investment is to be retired. In addition, as of the same date, member institutions held stock in these banks amounting to $39,600,100. Modest dividends are paid on the stock of these banks.

In addition to the capital of the Federal Home Loan banks, which may be loaned to their members for either short periods of time or for terms up to ten years, the banks had outstanding on June 30, 1939, $90,000,000 in consolidated debentures. They also had deposits from their members aggregating $32,291,600. Advances to members on the same date amounted to $108,062,000 and consolidated assets of the 12 banks amounted to $206,630,000.

Each bank is organized as a separate corporation, with a board of directors of 12 members. Eight are elected by the members and four are appointed by the Federal Home Loan Bank Board. While the management of each bank directs its own internal affairs, the limits of broad policies are set by law and by the regulations of the Federal Home Loan Bank Board. On many questions the system is operated on a basis of co-operation among all 12 banks.

Home Owners Loan Corporation.—The Federal Home Loan Bank system was organized too late to be of much assistance to its members in stemming the tide of depression in the early 1930s. By the time the system was established and ready to make advances, the thrift and home financing industry was badly frozen. Distressed borrowers in great numbers were facing the spectre of foreclosure. The number of actual foreclosures was increasing at an alarming rate. In the absence of home financing facilities of sufficient magnitude to stop this flood, it appeared that real estate values would spiral downward indefinitely, resulting in the creation of a major catastrophe. To avert such a consequence, Congress came to the rescue of distressed home owners in June 1933. By almost unanimous vote, the Home Owners Loan Corporation was created.

This corporation has for its directors the five members of the Federal Home Loan Bank Board. Its original capital of $200,000,000 was subscribed by the Reconstruction Finance Corporation, a Government-owned lending agency. The HOLC was authorized to issue bonds to an amount not to exceed $4,750,000,000. The principal and interest are guaranteed by the United States. The corporation was authorized to exchange its bonds for the mortgages of distressed home owners. Bonds to a total in excess of $3,000,000,000 were used to acquire mortgages on more than 1,000,000 homes. The corporation ceased making new loans in June 1936.

The direct effects of the operations of this corporation are as follows. It gave distressed home owners an opportunity to work out their home financing problems under favourable conditions. It increased the liquidity and helped to maintain the solvency of untold numbers of home financing institutions by giving them readily marketable bonds in exchange for delinquent mortgages. And it helped to check the downward spiral of real estate values.

The indirect effects of this corporation's entrance into the home financing field are important. It substituted the monthly direct reduction loan for a wide variety of lending policies. Because of the broad scope of its operations, it has done more than any other agency to popularize the advantages of the direct reduction loan plan. It introduced a common interest rate of 5% into a field of finance where rates were generally higher—in some sections of the country very much higher. The effects of this lower rate have already borne fruit in encouraging lower rates on loans by private institutions. Effective Sept. 16, 1939, the HOLC reduced its interest rate on mortgages to four and one-half percent. It introduced improved techniques in making loans, some of which have since been adopted by private agencies.

Federal Savings and Loan Associations.— The Home Owners Loan Corporation gave temporary relief to distressed home owners whose mortgages it acquired. In the same law there was included a clause which had for its major purpose the repair of the foundations upon which the home financing structure was erected. As pointed out above, the depression of the 1930s brought to light serious weaknesses in home financing plans.

Those who drafted the bill which became the Home Owners Loan Act of 1933 provided for the chartering and supervision of Federal savings and loan associations by the Federal Home Loan Bank Board. The plan of organization and operation of the Federal associations is essentially a composite of the most effective practices followed by building and loan associations in various parts of the United States. In the main, it follows the outline of a model plan promulgated by a special committee of the United States Building and Loan League a few years before the Federal association was authorized. Some have called this type of institution the stream-lined building and loan association because it represents the most modern type of thrift and home financing institution.

Federal charters are granted under either of two sets of conditions. Some associations have started with only a modest amount of cash subscribed by interested parties in any community. Others have been converted from State-chartered building and loan associations. In either event they are locally owned and locally managed thrift and home financing institutions operating under rules and regulations formulated by the Federal Home Loan Bank Board.

On the thrift side of their operations they resemble mutual savings banks. They offer savings and investment accounts to the investing public. Unlike the older types of building and loan associations, the tendency of the Federal associations is to say less and less about stock or shares. On the lending side, the Federals use the monthly direct reduction loan plan. Both investors and borrowers are members of Federal savings and loan associations, with the right to vote at all meetings of members.

In order to encourage private investment in Federal savings and loan associations, Congress placed at the disposal of the Federal Home Loan Bank Board in 1933 $50,000,000 to be invested by the United States Treasury in Federal associations. In 1935 Congress authorized the Home Owners Loan Corporation to invest an additional $300,000,000 in Federal associations and in eligible State-chartered associations. All of the original $50,000,000 was invested in Federal associations. Up to June 30, 1939, $219,150,000 had been invested by the Home Owners Loan Corporation; about one-fourth in State-chartered associations and three-fourths in Federal associations. As of the same date, 636 new Federal savings and loan associations had been organized with total assets on that date of $397,239,000. Seven hundred and fifty State-chartered associations had been converted into Federal associations. Their total assets amounted to $1,044,830,000. As a class, the Federal associations represented the most active type of thrift and home financing institution in the United States in 1938 and 1939. The Federal associations have had a broader influence upon the industry than their numbers and financial resources would indicate. The progressive managers of many State-chartered associations have adapted to their own uses the basic features of the Federal plan of organization and operation. In some cases, State building and loan codes have been drastically revised to provide for the operation of associations under their jurisdiction in a manner to conform essentially to the Federal plan. The leadership of the Federal associations is bearing fruit throughout the entire industry.

Federal Savings and Loan Insurance Corporation.—At the time of the bank holiday in 1933, the people of the U.S. had lost confidence in the commercial banking structure of the country. The demand for the withdrawal of more money than there was available brought on the closing of the banks. When they were reopened, their accounts were insured by the Federal Deposit Insurance Corporation. This insurance of bank deposits worked wonders in restoring the confidence of the public. Over night, money flowed back into these same commercial banks from which it had been withdrawn by panic-stricken depositors only a few days before. In 1934 the magic of insurance of accounts was extended to building and loan associations. In that year Congress authorized the organization of the Federal Savings and Loan Insurance Corporation. Its stock of $100,000,000 is owned by the Home Owners Loan Corporation. The five members of the Federal Home Loan Bank Board constitute its board of trustees. All Federal savings and loan associations are required to have their accounts insured. State-chartered associations are invited to apply for insurance of their accounts. All insured associations pay premiums to this corporation to meet operating expenses and build up reserves against future losses. The accounts of commercial banks are insured as to both safety and liquidity by the FDIC. The Federal Savings and Loan Insurance Corporation insures only the safety of its members' accounts up to $5,000 each. Since no one has ever discovered a sure means of making long-term mortgages liquid, it would be folly to undertake to insure the liquidity of an account in an institution which invests most of its resources in long term loans. Up to June 30, 1939, the Federal Savings and Loan Insurance Corporation had insured 2,170 associations with total assets of $2,339,411,000. The total number of individual investors represented in these insured associations was 2,376,100

Progress Toward Recovery.—As of June 30, 1939, the building and loan industry of the United States showed definite evidence of recovery from the prolonged depression of the previous decade. Particularly is this true of those associations which are taking advantage of the assistance provided for their use by the various agencies of the United States Government discussed above.

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(H. E. Ho.)

BUILTH WELLS, market town and urban district of Brecknockshire, Wales. Pop. (1938), 1,508. Area, 1.1 sq.mi. The town is at the focus of the Irfon, Ithon and Wye valleys in a small plain beneath high hills, and as such the region has a marked individuality, already noticed by Nennius. Under the Normans the district became a lordship marcher annexed to that of Brecon, but it fell away on the marriage of William de Braose's daughter. At the east end of the town is a fine moat and bailey castle probably erected by Bernard de Newmarch, with traces of a later stone castle of Edwardian date. As an advanced outpost of the invaders in the upper Wye valley the castle suffered severely, notably at the hands of Llewellyn ap Gruffydd, prince of Wales, in 1260. In this neighbourhood Llewellyn himself fell in ambush in 1282 and with him collapsed much of the Welsh resistance. The lordship remained in the Marches until the Act of Union, 1536, when it was grouped with a number of others to form the shire of Brecknock. With the development of better roads in post-mediaeval times Builth became an important gathering centre for west Wales cattle for transport by road to England; and its fairs and marts, for sheep and ponies, are still well attended. It is a summer resort, visitors being attracted chiefly by the beautiful surroundings, mineral springs and salmon fishing. The town has a station on the old Cambrian (now G.W.R.) line from Moat Lane to Brecon and has been an urban district since 1894. In 1898 the urban district was made conterminous with the civil parish and renamed Builth Wells. It is included for parliamentary purposes in the joint counties of Brecon and Radnor. (*See* BRECONSHIRE.)

BUISSON, FERDINAND (1841–1932), French educationist, was born at Paris on Dec. 20 1841. He became an inspector of primary education (1870), inspector-general in 1878, and in 1890 director. He left the Education Department in 1896 to take the chair of education at the Sorbonne, which he held until 1902. His most important written work is his *Dictionnaire de Pédagogie* (1882–93). At the general election of 1902 he was returned to the chamber of deputies as a radical socialist by the XIII^{me} arrondissement of Paris. He supported the policy of M. Combes, and presided over the commission for the separation of church and state. He sat in the Chamber until 1914, and re-entered it in 1919. M. Buisson was for 13 years president of the Ligue des Droits de l'Homme and, after retiring from active work in the Ligue, remained its honorary president. He was one of the earliest advocates of a League of Nations. His life-work for peace was recognized in 1927 by the award to him of the Nobel peace prize.

BUITENZORG, a foothill city in west Java, residence of the governor-general of the Netherlands Indies, site of the famous tropical botanical gardens and capital of a regency as well as of a residency of the same name. Buitenzorg (meaning "without care," *sans souci*) is south of Batavia, 875 ft. above sea level, with a fairly cool and healthful climate, the average mean temperature for the year being 77.2°. Governor-General van Imhoff chose this spot on his estate in 1745 as a residence instead of malaria-ridden Batavia. The botanical gardens were laid out for the government in 1817 by C. G. E. Reinwardt, formerly professor of botany at Amsterdam, and have become one of the world's outstanding centres of research. Electric trains provide fast and frequent service with Batavia. The population of 65,431 (1930) includes 5,233 Europeans. The residency of Buitenzorg, much enlarged by the territorial redivision of 1925, consists of the regencies of Buitenzorg (1,436 sq.mi., 1,022,324 inhabitants in 1930), Soekaboemi and Tjiandjoer. It is bounded on the north by Batavia, east by Batavia and Priangan, south by the Indian ocean and west by Bantam. The area is 4,483 sq.mi., population (1930) 2,212,997. Most of the residency is mountainous, with many volcanoes and fertile plateaus. The chief crops are rice, tea, cinchona (quinine), rubber and coffee. Other cities in the residency are Soekaboemi (34,191 in 1930) and Tjiandjoer (20,812 in 1930).

BUKHARA (BOKHARA). (1) Town and province in the Uzbek Soviet Socialist Republic. The town, old Bukhara, Lat 39° 52′ N., Long. 64° 30′ E. Alt. 1,200 ft. Pop. (1939) 50,382. It is the centre of the fertile oasis depending on irrigation from the Zerafshan river; the canal supplying Bukhara is the Shahri-Rud. Water-borne diseases, especially the "rishta" or cotton thread worm, are common, since the water stagnates in the canals. The Labihauz, or tank, in front of the chief mosque, with its shady trees, is picturesque but dirty, as the Zerafshan river is here nearing exhaustion and economy is necessary. Bukhara has a dry, sunny climate with extremes of cold and heat and cloudless skies most of the year. The approach to the city is lined with gardens of apricots, apples, cherries, vines, melons, roses, irises, sunflowers, poppies and tobacco plants. The unburnt brick, one-storeyed, flat-roofed houses are in striking contrast to the innumerable mosques, amongst which are the beautiful 16th century Mir-Arab, the Mejid-kalyan or Kok-humbez mosque of the emir, near which is the brick minaret 203ft. high, from whose summit state criminals were thrown until 1871. Bukhara is a commercial centre for Central Asia and its bazaar (a noted slave market until the Russian occupation) extends for 7m. with roofs of beaten clay upon undressed timber: its booths display carpets, dress fabrics, karakul (lamb's wool), copper ware, cutlery, trinkets and every variety of Asiatic ware. One section, roofed by a dome of ancient brick work, is set apart for literature. There is a separate market for raw cotton, the production of which increased with the opening of the railway. The population includes Uzbegs, Turkomans, Tadzhiks, Afghans, Arabs, Hindus and a Jewish colony said to have migrated from Baghdad.

Bukhara has always been a centre of Mohammedan learning. When the Mongol invasions of the 13th century laid waste Samarkand and other Muslim cities, it retained its independence and became the chief seat of Islamic culture. It has numerous madrasas (theological colleges) and, though many of their libraries have been scattered or destroyed, there are still literary treasures preserved in private collections, and Afghan, Persian, Armenian and Turkish bibliophiles look to Bukhara for rare texts, so that it is the principal Central Asiatic book market. The present city was begun A.D. 830 on the site of an older city, was destroyed by Jenghiz Khan 1220 and later rebuilt. The Raghistan is the chief square and has a citadel on an artificial eminence 45ft. high, surrounded by a mile of wall and containing the former Emir's palace, the larger houses, the prisons and the water cisterns. The city wall is 28ft. high, 8m. long, and has semicircular towers and 11 gates, but is of little value for defence. In any case Bukhara's fate depends on Samarkand, which can cut off its water supply.

(2) New Bukhara or Kagan, a Russian town near the railway station, 8m. from Old Bukhara, is the centre for the Bogoyetidin district of the Bukhara province, a district which has a population of 78,691. (X.)

HISTORY

The most important part of Bukhara belonged to the country of Sogdiana, which, after the conquest of Alexander the Great formed part of the Seleucide empire. For many centuries this country had been inhabited by the Sakas who, towards the end of the 2nd century A.D., were driven out of the Oxus country by the Yue-chi, who, in their turn, were ejected by the Ephthalites, or White Huns, in A.D. 450. One hundred years later the Turks of Central Asia defeated the king of the Ephthalites near Bukhara and became possessed of the rich lands between the Oxus and the Jaxartes. The Ephthalites had been engaged in a continual warfare with the Sassanian rulers of Persia, and when the Turkish Khan had driven them out of Bukhara he wrote to the Persian king that "the blood of their common enemy had reddened the waters of the Oxus." Down to the time of the invasion of Transoxiana by the Muslims at the end of the 7th century Bukhara had remained under the overlordship of the Western Turks. The town of Bukhara actually fell in the year A.D. 676. It was not, however, till 30 years later that Transoxiana was finally subdued. The Arab historians gave to the country the name of Mavera-un-nahr or "what lies beyond the river" (*i.e.*, the Oxus). Down to the beginning of the 9th century Transoxiana was under the jurisdiction of the governor of the Eastern Provinces of the Caliphate. Hitherto Arabs had been appointed to this governorship, but in 820 it was given to a Persian named Tahir in whose family the post became hereditary. These governors in their turn appointed sub-governors to various provinces and several members of a Persian family known as the Samanids were employed in this capacity in Transoxiana. One of the Samanids named Ismail managed in A.D. 904 to make himself a semi-independent ruler with Bukhara as his capital and founded a dynasty which lasted down to the end of the 10th century. It was under the Samanids—the first Persian dynasty to rule in Islam—that Bukhara became a centre of learning. On the fall of the Samanids Transoxiana again fell into the hands of the Turks, and it continued to be governed by various branches of this race until the Russian occupation. In 1220 Bukhara was sacked by Jenghiz Khan. It attained its greatest importance during the rule of the Shaybanids (1500–99).

Towards the middle of the 19th century Bukhara became an object of rivalry to Russia and England and envoys were sent by both nations to cultivate the favour of its Emir. Two of the English emissaries, Colonel C. Stoddart and Captain A. Conolly, were thrown into prison by the Emir Nasrullah and there put to death in 1842. In 1866 the Russians invaded the territory of Bukhara proper, and crushingly defeated the Emir's forces. In 1868 the Russians entered Samarkand, and a treaty was concluded whereby the Emir of Bukhara became, to all intents and purposes, a vassal to the conquerors and undertook to protect Russian trade. In 1882 a Russian political agent was appointed to reside in Bukhara and a Russian bank was established; thus gradually Bukhara became a part of Russian Turkistan. In 1892 the Emir made a journey to the Russian court and left his two sons to be educated in Russia. In 1920 a Soviet revolution broke out in Bukhara and the Emir took refuge in Afghanistan. In the following year an anti-Soviet Pan-Turanian movement, known as the Basmachi revolt, started in Eastern Bukhara and found a leader in the person of Enver Pasha who arrived in the country at the end of Nov. 1921, got into touch with the fugitive Emir of Bukhara and became his commander-in-chief. The main object of the Basmachi revolt was the creation of a large Pan-Turanian empire comprising Persia, Bukhara, Afghanistan and eventually Turkey. In Jan. 1922 Enver sent an ultimatum to Moscow demanding total abandonment of Turkistan by the Soviet. The Red Army was then despatched to Bukhara and in August the movement was definitely broken by the death of Enver Pasha in a rear-guard action. After the suppression of this rising the two former Russian protectorates of Khiva and Bukhara became "People's Independent Soviet Republics," linked to the U.S.S.R. as independent contracting parties. In 1924 a new grouping of Turkistan took place according to the national principle and it now consists of three republics, namely: (1) Turkmanistan (capital, Ashkhabad, formerly Poltoratsk), comprising Khiva and western parts of the frontier Bukhara Khanate; (2) Uzbegistan (capital, Samarkand), comprising the lands inhabited by the Uzbegs and the rest of Bukhara; and (3) Kirghizistan (since re-named Kazakstan). Within Uzbegistan is an autonomous state called Tajikistan (capital, Stalinabad), created for that section where Iranian languages are spoken. (*See* PERSIA.)

See Khanikov's *Bokhara*, translated by De Bode (1845); Vambéry, *Travels in Central Asia* (1864), *Sketches of Central Asia* (1868), and *History of Bokhara* (1873); Fedchenko, "Sketch of the Zarafshan Valley," in *Journ. R. Geogr. Soc.* (1870); Hellwald, *Die Russen in Central Asien* (1873); Skrine and Ross, *The Heart of Asia* (1899); Lipsky, *Upper Bukhara*, in Russian (1902); Lord Ronaldshay, *Outskirts of Empire in Asia* (1904); Le Strange, *The Lands of the Eastern Caliphate* (1905); J. Castagné, *Les Basmatchis* (Paris, 1925); and V. Barthold, *Turkestan down to the time of the Mongol Invasion* (1927). (E. D. R.)

BUKHĀRĪ (Mohammed ibn Ismā ʿīl al-Bukhārī) (810–872), Arabic author of the most generally accepted collection of traditions (*ḥadīth*) from Mohammed, was born at Bokhara (*Bukhārā*), of an Iranian family, in A.H. 194 (A.D. 810). Already, in his eighteenth year, he had devoted himself to the collecting, sifting, testing and arranging of traditions. He travelled over the Muslim world, from Egypt to Samarkand, and learned (as the story goes) from over a thousand men three hundred thousand traditions, true and false. His theological position was conservative and anti-rationalistic; he enjoyed the friendship and respect of Ahmad Ibn Ḥanbal. In law, he appears to have been a Shāfiʿite. After sixteen years' absence he returned to Bokhara, and there drew up his *Ṣaḥīḥ*, a collection of 7,275 tested traditions, arranged in chapters so as to afford bases for a complete system of jurisprudence without the use of speculative law, the first book of its kind (*see* ISLAMIC LAW). He died in A.H. 256, in banishment at Kartank, a suburb of Samarkand. His book has attained a quasi-canonicity in Islam, being treated almost like the Koran. Pilgrimages are made to his grave.

See F. Wüstenfeld, *Schāfiʿiten*, 78 ff.; McG. de Slane's trans. of Ibn Khallikan, i. 594 ff.; I. Goldziher, *Mohammedanische Studien*, ii. 157 ff.; Nawawi, *Biogr. Dict.* 86 ff.

BUKOVINA, a small province of northern Rumania. Until 1918 it was a crown land of Austria, which it had become in 1849. Originally it had been a principality of Moldavia under Turkish control. It was occupied by Russia in 1769 and by Austria in 1774, to whom it was finally ceded by Turkey in 1775.

It is inhabited mainly by Rumanians and Ruthenians, and by minorities of Germans and Poles. The capital is Czernowitz (Cernăuti) which lies upon the main railway-line that joins Bucharest with Lemberg (Lwów). Bukovina contains some very remarkable examples of Rumanian art and architecture in the shape of the monasteries of Sucevita and Voronetz, which, with many of the churches of the province, have the unique peculiarity of being almost wholly covered with paintings on the outside. Heavy eaves protect much of the painting from the weather. The population of Bukovina numbered 845,903 by the census of 1930, with a density greater than in any other part of Rumania. Czernowitz is the third largest city of Rumania, with a population of 111,122 by the census of 1930 and an estimated population of 100,698 in 1939; it has a university with three faculties, founded in 1875.

History.—The Bukovina was most probably inhabited by Ruthenian tribes from an early date. Later, it formed part of the Principality of Moldavia, whose ancient capital, Suceava, was in this province. From 1775 to 1849 it formed part of Galicia (*q.v.*), being then created a separate crown land. Under Austrian rule many Germans were settled in the province, which made great progress, and was considered a model for the rest of Austria for the harmony which reigned among the different nationalities. On the collapse of the Austro-Hungarian Monarchy, the last governor, Count Etzdorf, handed over the province to the Ruthenes (Oct. 23, 1918). Four days later, representatives of the Rumanians met at Czernowitz and proclaimed a Constituent Assembly which voted the union of the province within its historic boundaries with Rumania. The Assembly then appealed to the Rumanian government at Jassy for Rumanian troops, which entered Czernowitz on Nov. 11, 1918. In June 1940 northern Bukovina was ceded to the soviet union, but it was reoccupied by Rumania in the summer of 1941 after Germany's attack on the U.S.S.R.

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BULACAN, a municipality (there is an administrative centre and 14 *barrios* or districts) of the province of Bulacan, Luzon, Philippine Islands, on an arm of the Pampanga delta, 22 mi. N.N.W. of Manila, with which it has railway connection. Pop. (1939) 11,931, of whom 5,777 were males, and one was white. The place is well known for its fishponds and fisheries. The surrounding region is fertile and produces palay (rice), sugar and various tropical fruits. Native cloth (jusi and piña), perfume made of ilang and sugar products are manufactured. The town was founded by the Spaniards in 1578 and has a long history. In 1898 it was nearly destroyed by fire. The vernacular is Tagalog. The population gain, 1918–39, was 1,508. (C. S. L.)

BULANDSHAHR, a town and district of British India in the Meerut division of the United Provinces. The town is on a height on the right bank of the Kali-Nadi, whence its name Bulandshahr (high town). The population in 1941 was 29,701.

The district of Bulandshahr has an area of 1,889 sq.mi. on a level plain, with a gradual but very slight elevation about midway between the Ganges and Jumna. The Ganges canal intersects the district, and serves for both irrigation and navigation. The Lower Ganges canal has its headworks at Narora. In 1941 the population was 1,317,223. The district is very highly cultivated and thickly populated. The chief centre of trade is Khurja, an important centre of the cotton-ginning trade.

Mahmud of Ghazni in A.D. 1018 received the submission of the Hindu rajah and his followers to Islam. In 1193 the city was captured by Kutb-ud-din. In the 14th century the district was subject to invasions of Rajput and Mongol clans who made permanent settlements. Under the Mogul empire peace was restored, the most permanent effect of this period being the large proportion of Moslems among the population, due to the zeal of Aurangzeb. The decline of the Mogul empire gave free play to the turbulent spirit of the Jats and Gujars, under the nominal domination of the Mahrattas. After Koil and the fort of Aligarh had been captured by the British in 1803, Bulandshahr and the surrounding country were at first incorporated in the newly created district of Aligarh (1805).

BULAWAYO, chief town of Matabeleland, the western district of Southern Rhodesia, Africa; 20° 11′ S., 28° 41′ E.; 4,460 ft. above sea level. Distance by rail from Capetown, Cape of Good Hope, U. of S.Af., 1,355 mi.; from Durban, Natal, U. of S.Af., 1,162 mi.; from Beira, Mozambique, 670 mi.

The climate is fairly healthful, though high temperatures are common, especially in October and November, when over 100° F. may be recorded. The average rainfall is about 26 in., concentrated largely in the five months November to March. The population of Bulawayo (including suburbs) in 1941 was 39,817, of which 16,603 were Europeans, 21,340 were natives, and 1,874 were Asiatics and coloured.

Bulawayo was inaugurated in 1893 on the site formerly occupied by Lobengula's kraal. It then consisted of a collection of tents. In 1894 the settlement was moved to its present site, 3 mi. away, though the government house, built by Cecil Rhodes and now the seat of the governor, still occupies the original position. The town is situated amidst undulating pastoral country. It is laid out on a rectangular plan, centred about the market square.

Bulawayo is well provided with parks, and with grounds for sports. There are several primary and secondary schools, government and private. Among the principal buildings and memorials are the stone-built edifice occupied by posts, customs and the municipal offices, the museum, the Matabeleland war memorial, consisting of cloisters, in the garth of which is a large granite monolith, and the large bronze statue of Cecil Rhodes at the junction of two of the principal streets. Bulawayo is the headquarters of the Beira, Mashonaland and Rhodesia railways. The gold fields of the Matabeleland region centre about Bulawayo and Gwelo. Bulawayo area produced 227,388 oz. of gold in 1937.

BULB, *the name applied to the structure formed by many* plants from a bud, the outer leaves of which are thick and fleshy by reason of the reserve food products with which they are crowded. This enables the plant to tide over an unfavourable period, such as a cold or dry spell, safely buried in the earth, and to be ready to come into flower as soon as good conditions return. Bulbs are very characteristic of arid regions such as the South African Karroo. Many of the best-known spring flowers are bulbous, *e.g.*, the daffodil, narcissus, hyacinth, etc. The crocus is not technically a bulb, the structure often referred to as such in this plant being a corm, which is the thickened base of a stem.

BULBUL, the Persian nightingale (*q.v.*); the name is also used to denote birds of the passerine family Pycnonotidae occurring in Africa and southern Asia. The common bulbul of India (*Pycnonotus plumosus*) is a familiar bird in that country, feeding on fruits and seeds and often nesting on verandas. The pugnacious males, which are crested, are kept by the natives for fighting. The bird has a fine song. The common African *Pycnonotus barbatus* frequently feeds on fermenting fruit to such an extent as to become intoxicated. The bulbul of Persian poets is probably *Luscinia golzii*, a nightingale (*q.v.*) belonging to the thrush family Turdidae. (G. F. Ss.)

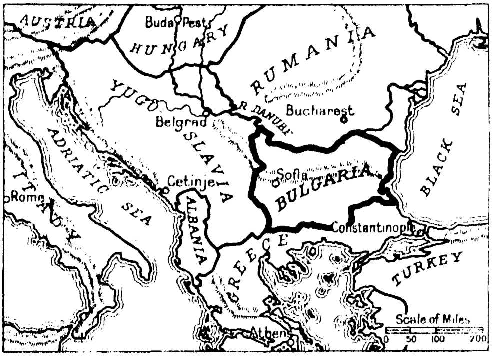
BULDANA, a town and district of India, in the Central Provinces and Berar. Pop. of town (1941) 8,788. It was selected because of its elevation and cooler climate to be the headquarters of the district, but is otherwise unimportant. The northern plain in the valley of the Purna is a rich cotton tract. The southern part, consisting of small plateaus with rich valleys between them, is also fertile. It is bounded on the south by the Nizam's dominions. Area 3,763 sq.mi.; pop. (1941) 820,862. Its trading centres are on the railway (Nagpur branch of the Great Indian Peninsular line), and it has several considerable towns, Khamgaon 26,402, Malkapur 17,565, and two other towns of 10,000 each. Cotton is the commercial crop of the district. *Juar* is the staple food but a considerable area of wheat is also grown and the district is better provided with wells than most of Berar.

BULDUR or **BURDUR,** chief town of a vilayet in Turkey. Pop. (1940) 14,603. It is called by the Christians *Polydorion*. Its altitude is 3,150 ft. and it is situated in the midst of gardens, about 2 mi. from the brackish lake Buldur Geul (anc. *Ascania Limne*). Linen-weaving and leather-tanning are the principal industries. There is a good carriage road to Dineir, by which much grain is sent from the Buldur plain, and a railway connects it with Dineir and Egerdir. Pop. of vilayet (1940) 119,498; area 3,025 sq.mi.

BULFINCH, CHARLES (1763–1844), American architect, was born in Boston (Mass.), on Aug. 8, 1763, the son of Thomas Bulfinch, a prominent and wealthy physician. He was educated at the Boston Latin school and at Harvard, where he graduated in 1781, and after several years of travel and study in Europe settled in 1787 in Boston, where he was the first to practise as a professional architect. Among his early works were the old Federal Street theatre (1793), the first playhouse in New England, and the "new" state house (1798). He was chairman of the board of selectmen of Boston from 1797 to 1818. He provided for new systems of drainage and street-lighting, reorganizing the police and fire departments, and straightening and widening the streets. He was one of the promoters in 1787 of the voyage of the ship "Columbia," which under command of Captain Robert Gray (1755–1806) was the first to carry the U.S. flag round the world. In 1818 Bulfinch succeeded B. H. Latrobe (1764–1820) as architect of the national capitol at Washington. He completed the unfinished wings and central portion, constructing the rotunda from plans of his own after suggestions of his predecessor, and designed the new western approach and portico. In 1830 he returned to Boston, where he died on April 15, 1844. Bulfinch's work, marked by sincerity, simplicity and refinement of taste, greatly influenced American architecture in the early formative period. His son, STEPHEN GREENLEAF BULFINCH (1809–70), was a Unitarian clergyman and author.

See "The Architects of the American Capitol," by James Q Howard, in *The International Review*, vol. i. (1874), and *The Life and Letters of Charles Bulfinch* (1896), ed. by his granddaughter.

BULGARIA, a Balkan kingdom of roughly rectangular shape, lying to the east of the peninsula, had in 1934 a total area of about 40,000 sq.mi. (pop., 6,370,000). The south and west frontiers run through hilly country, separating it from European Turkey and Greece on the one hand and Yugoslavia on the other. With Rumania, the frontier is mainly the line of the Danube, while there is an eastern frontage on the Black sea. The transverse Balkan mountains divide the main agricultural area of Bulgaria into two parts, the northern tableland sloping gently down to the Danube and the basins and valleys of the Upper Maritsa system to the south. The latter are cut off physically from the open waters of the Aegean by the Rhodope upland, along or near the crest of which the frontier runs.



MAP SHOWING THE FRONTIERS OF BULGARIA, AS ADJUSTED BY THE TREATY OF NEUILLY, 1919

The Maritsa plains have, however, an outlet to the Black sea through the port of Burgas. The Danubian tableland has in Ruschuk a port on the river Danube, and in Varna a more important outlet to the Black sea.

The existing frontiers date in part from the treaty of Berlin in 1878, and in part from later ones, including that of Neuilly (1919). Bulgaria is thus essentially a modern state, having little relation, whether territorially or socially, to the Bulgar empire of the 9th and 10th centuries. The population density of 153 per square mile, considerably above the average for the peninsula, may be associated with the relatively high percentage of arable land, 43% of the total surface being under cultivation, while forests cover about 31·6% Within the peninsula Bulgar, or *Bougar*, means cultivator, or ploughing peasant, with an implication of servitude as compared with the free peasants of Serbia. With this is connected the fact that both in the loess-covered Danubian tableland to the north and in the alluvial basins of the Maritsa to the south of the Balkan mountains there are fairly extensive level and fertile areas, well fitted for cereal cultivation, wheat being particularly important in the northern area.

The second fundamental fact is that the Balkan chain, owing both to the presence of passes and to the slope of the northern tableland, is not, as might be supposed, a barrier between the two agricultural areas. Two great highways may, indeed, be said to converge in the land which has become Bulgaria. One is the route which comes from Central Asia by way of the steppes and grasslands of southern Russia, and can be continued to the south over the Balkan passes. The other is that which links Asia Minor to Europe by the straits, and can be continued along the Maritsa valley, and so to the Morava and the Danube at Belgrade The two unite in the plains of southern Bulgaria.

In consequence of these two facts—fertile lands able to form a granary for a great power and converging routes—two strands may be said to be interwoven in the history of Bulgaria. So far as the mass of the people is concerned, 80% of whom are peasant cultivators, the ruling passion has been to obtain and then to keep their plots as freeholds. But at successive periods, whenever the power enthroned at Constantinople seemed to be weakening, their leaders have dreamed of making themselves heirs of Byzantium. In the 9th century Simeon, the Bulgar chief, after an unsuccessful attempt to take Constantinople, proclaimed himself Tsar (= Caesar). In 1908, at the time of the Young Turk revolution, Prince Ferdinand of Bulgaria adopted the same title, still held by the reigning king. The participation of Bulgaria in the World War on the same side as Turkey and against her former protector, Russia, may seem at first sign an anomaly. But it has to be remembered that Greece had also Byzantine ambitions, and that Serbia desired to expand along the other great highway which leads to Salonika. Further, with the development of Bulgaria's export trade in cereals, particularly wheat, the question of easy access to the Aegean has become of great importance. The actual result of Bulgaria's participation in the War was the loss of territory, particularly of the small strip on the Aegean coast, obtained at the peace of Bucharest, with the port of Dedeagatch.

Essentially, then, postwar Bulgaria was a land of peasant cultivators, producing a surplus of cereals and other agricultural commodities, but deprived of direct access to its western markets by the need of exporting these by the Black sea, with a subsequent passage of the straits.

NATURAL REGIONS

From what has been already said it is clear that the country falls into four regions:—the northern or Danubian tableland; the mountain belt of the Balkans; the valleys and basins of the Maritsa system; the part of the Rhodope upland falling within the country, with its north-western continuation, which converges towards the Balkan chain, and a western hill belt separated by the Struma valley.

Danubian Tableland.—This, often called the Balkan Foreland, is the area between the low northern scarp of the folded Balkans and the Danube. The Balkans consist largely of schists and granite, with some limestones, while the tableland is floored by undisturbed, horizontally-bedded rocks, mainly cretaceous limestones, often concealed by a deep mantle of loess. The Danube, which forms the northern frontier to a point downstream from Ruschuk, varies in width from 1/5 of a mile to well over a mile and, despite its navigable waterway, forms an excellent boundary. Its Bulgarian bank is high, loess cliffs 5–600ft. in height rising above the valley floor, while the opposite or Rumanian bank is low. The river is liable to flooding in spring and early summer, as the snows of the plains and higher grounds melt successively, and its valley is swampy, with lagoons rich in fish, especially carp and sturgeon, reed beds and willow brakes. It is malarious in summer and bitterly cold in winter, when navigation is impeded by ice, and the river may freeze over. No bridge crosses the river in Bulgarian territory.

Downstream from Ruschuk the frontier leaves the river to pass in a south-easterly direction to the Black sea, which is reached north of the port of Varna. Before 1940 the southern Dobruja as well as the northern was within Rumania, which had acquired it from Bulgaria in 1913. In that year, in the treaty of Bucharest, the frontier was drawn definitely on strategic grounds. It ran through a gentle swelling of the surface, formerly heavily wooded, to which it owes its Turkish name of Deli Orman, or wild forest. The trees have been largely cut down but patches of stunted oaks remain on the higher levels, where also the limestones appear on the surface, giving rise to a karstic type of country. This wooded belt formed the frontier and dominated alike the steppe areas of the Rumanian Dobruja to the north and the not very dissimilar steppe-like country of eastern Bulgaria to the south.

The tableland, as thus defined, forms a well-marked unit. The underlying tabular rocks display south-to-north faultlines, and the rivers which run north to the Danube follow these. To the west the Isker, the second largest river in Bulgaria, the Maritsa taking first place, breaks through the whole Balkan chain, thus bringing the high basin of Sofia (1,800ft.) into communication with the Danubian tableland. The valley is traversed by a railway, and the choice of Sofia as a capital is thus justified by the fact that it is linked to both the great productive areas, to the Maritsa plains by the main Belgrade-Constantinople route and its Bulgarian branches, and to the tableland by the Isker valley. Both west and east of the Isker smaller streams rising in the Balkans flow direct to the Danube, the Yantra, to the east, being the largest and most important of these. All carry a comparatively small amount of water, and some even dry up in summer; but owing to the soft loess deposits all have cut out remarkably deep valleys. It is a general rule that the right bank of each stream is higher than the left, where plains of deposition occur.

These deeply-sunk rivers, with their fairly extensive valley plains, are of very great importance from the human standpoint. The plateau levels above, dry because of the limestones which underlie the porous loess, exposed to cruelly cold winds in winter and to desiccating blasts in summer, practically devoid of wood, so that dried dung has to be used as fuel, are remarkably productive, especially in favourable seasons, but do not attract settlement. The valleys have a better climate, owing to shelter from strong winds; spring water is available as compared with the dry plateau above; a greater variety of crops can be produced. They serve, therefore, as natural sites for towns and villages, and Trnovo, in the Yantra valley, should be noted as typical. Once a Bulgarian capital, it owes its greater size and importance as compared with its analogues to its river. This affords a line of access to the Shipka pass (4,303ft.), while one of its tributaries allows the passage of a railway to the Maritsa plains. A certain amount of market-gardening is carried on around the town, and it is characteristic generally of the valleys that, as compared with the almost uniform sweep of the wheat fields above, maize, the bread-plant, is grown, and with it plants like tomatoes and peppers, so important where tasteless maize forms a large part of the diet, as well as such crops as lucerne and sugar-beet. In the more sheltered and lower parts of the valleys the vine can also be grown. These valley settlements, where a measure of protection is obtained both from the rigours of nature and the risk of invasion by man, are a striking feature, and they involve long daily journeys from the home to the fields above.

To the east the Provadi and Kamchik rivers find their way direct to the Black sea instead of to the Danube, Varna being situated near the mouth of the former. In this eastern area the steppe-like character becomes accentuated, and the upper levels may be more suited for summer pastures than for wheat cultivation.

This whole tableland region has undergone great changes since the time of the treaty of Berlin. Before that date it was the seat of great feudal domains, the Turkish *tchiflik,* its physical features fitting it for this form of exploitation. Since that time it has been divided up into small holdings, worked by the peasants, the typical Bulgarians. Their industry, their frugality, their remarkably high level of agricultural skill, their passion for education, have been remarked by all observers. It is inevitable that in view of the conditions and of their history they should show also the defects of their qualities—a thriftiness verging on greed of gain, a "dourness" which is in marked contrast to the light-heartedness of the Serbs. Much of the wheat grown is exported from Varna, and thus forms a money crop, the peasants living chiefly on the cheaper maize. There are no minerals, and the towns, placed mainly either on the Danube or within the tributary valleys, are primarily market centres, with minor industries, usually dependent on the working up of local raw material, such as milling, wine-making, the making of caviare in the Danubian fishing towns, woollen and leather goods. The gold and silver filigree work of Vidin and Ruschuk is interesting, because artisans practising traditional crafts linger in various parts of the peninsula and recall the fact that its early Byzantine civilization did not disappear completely during the long Turkish night when the Ottoman ruled the Balkan peninsula.

Mountain Belt of the Balkans.—The Balkan belt is very different from the tableland, both as regards physical features and the human response. From the valley of the Timok, the lower course of which forms the frontier with Yugoslavia, the folded chains extend over a distance of some 375 miles, first in a south-easterly and then in an easterly direction to the Black sea, where they break off abruptly. The gorge of the Isker to the west and the Demir Kapu pass to the east divide them into three sections, of which the central is at once highest, rising to a maximum of nearly 7,800ft., and narrowest, being only some 18m. wide. The western section has a maximum height of a little over 5,000ft., while the eastern is lower and divided into two or three separate ridges.

A striking feature of the chain is the appearance on the south of the "shadow" range of the Anti-Balkans, divided into the Sredna Gora to the west and a narrowed eastern portion called the Karaja Dagh. This range is separated from the Balkans proper by the sub-Balkan depression, a very fertile valley area. Its western part is drained by the Striema tributary of the Maritsa, which has cut back between the Sredna Gora and the Karaja Dagh and separates the two, and the eastern and larger part by the Tunja, a powerful left-bank tributary of the Maritsa with numerous feeders.

Despite the presence of schists and granites, of which they are largely composed, and the heights to which they rise, the Balkans present generally the appearance of an upland rather than of a mountain chain. Their summits are rounded, forming undulating summer pastures, rocky peaks being absent, and the slopes are heavily wooded, chiefly with oak and beech. To the south, especially in the Central Balkans where there is much faulting, the hill country is separated by high and steep scarps from the fertile sub-Balkan depression; the northern scarp is much lower and less conspicuous. Though as a whole scantily peopled the Balkan region contains a certain number of basins suitable for settlement, of which those of Kotel and Gabrovo may be specially mentioned. Coal, not of very good quality, and not in large amount, occurs on the northern side near Gabrovo and on the southern near Slivno, and there are also oil-springs and some small deposits of copper, lead, and zinc.

It is clear from this description that the Balkan region, despite its elevation and the absence of the wide tracts of fertile soil found in the tableland, has certain advantages of its own. There is a greater variety of products and of possible occupations, for in addition to agriculture, based mainly on the hardier cereals, rye and barley, with buckwheat, the forests give occupation to wood-cutters and charcoal-burners, and the pastures permit of a considerable development of the pastoral industry. Since in addition to the coal beds there is a certain amount of water-power, minor manufactures can be carried on, and the mineral deposits, if insignificant in themselves, are sufficient to support small local industries. Further, in the days before railways, the traffic across the passes afforded an accessory source of wealth and increased the market for local products, particularly saddlery, blacksmith's work, and so forth. Other industries carried on are the making of woollen goods, pottery, cutlery, wooden articles, copper goods, and so on. Apart from these resources the region has gained in the past from the fact that the physical features give some opportunity of evading the control of feudal lords, while at the same time the scarcity of arable land makes such control less profitable and thus not likely to be exerted to the same extent as in more productive areas. In point of fact it is found that some trace of national feeling seems to have persisted even through the days when the Turkish yoke bore heaviest, and certain of the mountain towns and villages served as foci for the Bulgarian nationalist movement. The first Bulgarian schools and libraries were founded in Kotel and Gabrovo, and some of the leaders came from the Sredna Gora region.

Valleys and Basins of the Maritsa System.—The Maritsa region, taken in the larger sense to include the sub-Balkan depression, differs profoundly from the two regions already described. Forming the heart of the Eastern Rumelia of the treaty of Berlin, it displays in its climate Mediterranean influences, while in its crops, including roses for attar, rice, cotton, tobacco, vines, peaches, walnuts, mulberry for silkworm-rearing, with wheat, the effects of the position and of the shelter given by the hills to the north are clearly seen. Towns of ancient origin, such as Philippopolis (Plovdiv), indicate its historical importance as a highway, and the traces of the earlier Turkish occupation its value to the owners of Constantinople. Till the treaty of Berlin and later the population was of a very mixed nature, with Turks, Greeks, and Slavs, in addition to Bulgarians. Since that time the Bulgarian element has increased greatly, but the gardener-cultivators here differ in some respects from the peasants of the tableland.

Of its two sections the sub-Balkan depression is of great interest from the standpoint of physical geography. There is reason to believe that it was once occupied by a continuous river, flowing from west to east and entering the Black sea near the present port of Burgas. It is believed that sections of this hypothetical river were tapped, or captured, successively by feeders of the Maritsa, cutting back into the sub-Balkan range. The result has been to give rise to a series of basins, arranged in a line from west to east, and separated from each other by comparatively low sills. The more westerly of the basins are drained by streams, the Topolnitsa and the Striema, which flow directly to the Maritsa, but the eastern members of the series are strung along the Tunja, a powerful river with a number of tributaries. Where the slopes of the Karaja Dagh sink down eastwards to the plain, the Tunja swings round at a sharp angle, running southward to join the Maritsa, beyond the confines of Bulgaria, at the town of Adrianople. The result of this arrangement and of the fact that the Anti-Balkan range is highest in the west, in the Sredna Gora, is that the western basins are smaller, higher, and more definitely cut off by gorges from the main Maritsa valley than the eastern ones. The most easterly, that of Slivno, practically merges into the Maritsa basin, for to the south of it the Karaja Dagh is represented only by hilly country.

Among the other basins mention may be made of that of Zlatitsa, the most westerly, containing the town of that name. It is small and noted especially for its fruit-trees, including walnuts. The next basin, that of Karlovo, is watered by the feeders of the Striema, and vines and roses grow freely. But the most important and largest of the basins is that of Kazanlik, in the Tunja section, which has always been celebrated for its beauty and fertility. Here are the most extensive rose gardens in the world, essences being distilled particularly at Stara Zagora; under modern conditions more prosaic crops, such as sugar beet and potatoes, are, however, largely displacing the rose bushes, even though attar is still an important export.

The Maritsa river rises in the Rhodope and after leaving the hills enters a great basin, the largest of the areas of depression which are characteristic of the peninsula. It lies between the Anti-Balkan range to the north and the Rhodope upland to the south and west and thus the river has two sets of tributaries. Those coming from the wooded Rhodope have a fairly even flow, and some of them are used for transporting the timber to the lower grounds. The left-bank tributaries are steep and, flowing as they do mainly over bare slopes, show great fluctuations in volume, and when in flood carry large amounts of silt. The main stream, which has low banks, is constantly changing its course and its valley is marshy. Rice is cultivated on irrigated land, particularly round the junctions of the northerly streams. Maize, wheat, and tobacco are grown somewhat farther from the river, while the slopes are planted with vines, mulberries, and various fruit-trees. Some cotton is grown, the fact being interesting even if the amount is not large. In addition to Philippopolis, Tatar Bazarjik is an important town, and there are many others.

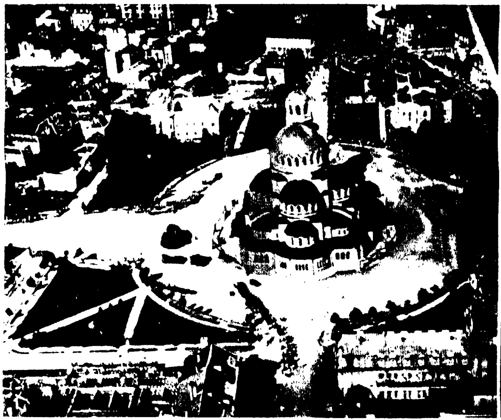
Farther east, towards the north-to-south section of the Tunja and beyond the river, the climate becomes drier and the country more steppe-like. In this district wheat is the main crop, accompanied by stock-rearing, and the wheat-producing area extends to the hinterland of the port of Burgas. Farther south are the slopes of the Istranja hills, which extend to the shores of the Black sea. These are mostly wooded; but the scrub-like character of the woods, made up of low, twisted and gnarled oaks, indicates the effects of the climatic conditions. This region forms a general exception to the rule that the sub-Balkan depression and the Maritsa basin are areas of great fertility. They owe this fertility to the alluvial deposits by which they are floored, the loess of the tableland not reappearing south of the Balkans.

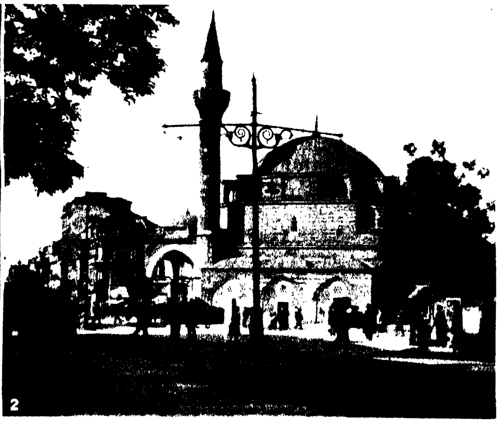
The Rhodope Upland.—If the Maritsa region repeats, with differences, the characteristics of the tableland, so too the Rhodope upland and its continuations repeat, again with marked contrasts, some of the features of the Balkan chain. Sofia—tucked away in its little upland basin but with arm-like highways stretching out to the eastern productive areas as well as to the west—of ancient origin but modern aspect, is peculiarly representative of Bulgaria. That much of its trade is in the hands of Jews is but one illustration of the difficulty of modernizing rapidly a state mainly peopled by peasants. Another is the intense pre-occupation of the townsfolk with politics of the "realistic" type. A somewhat careful study of the exact relations of the Sofia basin to the mountain massifs and basins of the upland in which it lies is essential in order to grasp the reason why the political history of Bulgaria has been so troubled, and particularly why the Macedonian question has played and is playing so important a part.

Western Hill Belt.—So far the name Rhodope has been used in a broad and general sense for the hill country in the south-west of Bulgaria, of which strictly speaking it forms but a part. From the western Balkans, or Stara Planina, there extends south a region of broken country along which the frontier between Bulgaria and Yugoslavia runs. The southern part of this receives the name of Osogovska Planina, and has a certain individuality of its own, due both to its height and to the fact that the Struma river makes a definite line of separation between it and the still higher mountains to the east. The Struma, which has a general north-to-south direction, rises in the Vitosha Planina, south-west of Sofia, a mountain mass rising to heights of over 6,500 feet. After leaving Bulgarian territory it flows through Greek Macedonia to the Aegean. To the east of the valley line is a long belt of mountain country extending from the Vitosha Planina to the Rila mountains, a beautifully wooded group with a maximum height of nearly 9,000ft., and continued into the Pirin Dagh to the south and into the Rhodope Planina to the south-east. The Isker river, which passes through the basin of Sofia, rises in the Rila mountains and thus to the south of the source of the Struma, their headwaters overlapping, as it were. The Vitosha mountains form a certain obstacle to routes from Sofia into the Struma valley, but can be turned both to the north-west and to the south-east.

The Struma, running as it does between the complex hill country which bounds the Morava-Vardar furrow on the east and the high and alpine mountains of south-western Bulgaria, is of great importance, and that for two reasons. In the first place the main stream and some of its tributaries pass through basins of considerable fertility, which gain in importance from the surrounding mountain land. Secondly, their valleys open out routes to the heart of the peninsula as well as to the Aegean, these routes acquiring special significance from the fact that they can be reached from Sofia.

Some of the basins may be noted. The highest is that of Pernik (about 2,500ft.) where good brown coal (lignite) occurs. At a much lower level is that of Kustendil (about 1,600 feet). This is very fertile, producing vines, tobacco, and plum trees and having a bathing establishment, due to the presence of hot sulphur springs. From the plain, over the slopes of the Osogovska mountains, there passes an important route to Uskub in Yugoslavia. Of the basins watered by tributaries that of Dupnitsa, traversed by a left-bank tributary and lying in nearly the same latitude as Kustendil, is important. This also is fertile and has direct access to Sofia. Farther down the Strumitsa, a right-bank tributary, flowing west to east, has a very fertile valley of which only a part, according to the 1919 treaty, falls in Bulgaria. This valley was the scene of severe fighting during the World War, and affords a good line of access into the region of the lower Vardar valley. Before 1919 the Bulgarian frontier lay farther to the west, and





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PHOTOGRAPHS, (1) ORIENT AND OCCIDENT, (2) EWING GALLOWAY, (3) PIX FROM PUBLIX, (4-6) PAUL'S PHOTOS

SCENES IN SOFIA AND PHILIPPOPOLIS

1. Airview of Alexander Nevsky place, in the centre of Sofia, capital of Bulgaria, showing St. Alexander Nevsky cathedral
2. Maria Luisa boulevard in Sofia, and the Banya-Bashi mosque
3. A residential street of Sofia
4. General view of Philippopolis (Plovdiv), second city of Bulgaria and centre of the tobacco industry
5. The royal palace in Sofia
6. A quiet moment on Parliament square, Sofia. At the left is the monument of the Emperor Alexander II

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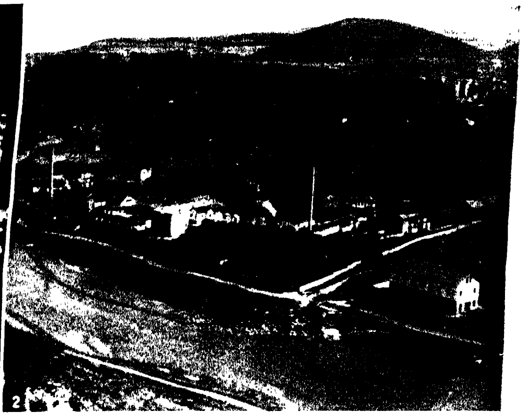
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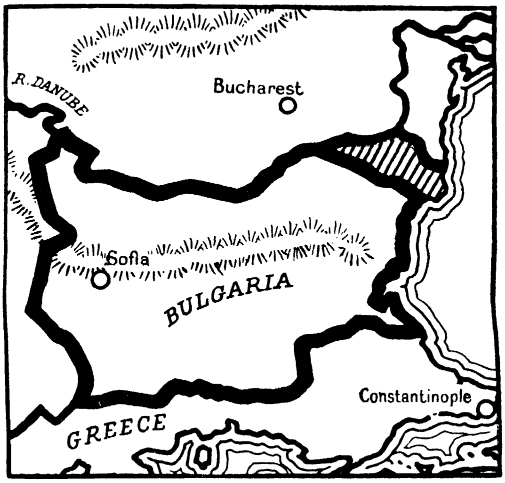
PHOTOGRAPHS (1, 2, 4, 5) EWING GALLOWAY, (3) E.N.A.

SCENES IN BULGARIA

1. The royal summer palace at Varna, on the Black Sea
2. Spinning mills and leather-dyeing factory at Trnovo, in northern Bulgaria
3. The Shipka pass through the Balkan mountains, between the towns of Kazanlik, on the south side, and Gabrova, on the north side. The pass is 4,363 ft. high and, although very steep and winding, is a route for wheeled traffic
4. Bulgarian poppy field in bloom. Opium is exported in medicinal forms
5. Mountaineers threshing grain with flails



MAP OF BULGARIA SHOWING TERRITORY OF SOUTHERN DOBRUJA (CROSS-HATCHED) CEDED BY RUMANIA, 1940

the chopping of the fertile valley into two parts, if it has a strategic justification, does necessarily increase Bulgarian interest in Macedonia.

The Rhodope and Rila massifs, built as they are of hard rocks, are much more formidable mountains than the Balkan chain. The peaks are bare and rocky with old glacial cirques and moraines dating from the glacial period, and the valleys are deeply cut and steep. Woods are abundant, with beech and oak below and pine and fir above and there are extensive summer pastures at the higher levels. Though the more elevated areas are unfit for permanent habitation, the margins and the included valleys offer opportunities and are sufficiently diverse to permit of the development of separate human strains. Thus the Rhodope region is the home of the Pomaks or Muslim Bulgarians, who adopted the religion of the Turkish conquerors and became instruments in the oppression of the Christians. They are, or were, mainly woodcutters and charcoal burners, while the Vlachs found in the region in summer are, as usual, herdsmen. Another point of interest is that while the monastic life does not as a rule make much appeal to the Bulgarians, the dense woods of the higher mountains there, as in so many parts of Europe, lodge monastic establishments to which great forest tracts were formerly attached. The most interesting of these is the famous Rila monastery, placed at a height of nearly 3,900 ft. in the massif of the same name, and a favourite place of pilgrimage. It is of ancient origin, though the existing buildings are modern.

Neglecting the deep gap of the Struma valley and looking at this upland country as a whole, it is obvious that, even more than the easily crossed Balkans, it is fitted to serve as a refuge for fugitives, and thus as a centre for the growth of a spirit of revolt. Bulgaria, as has been seen, arose as a unified state in the period 1878–1908 by the combination of the two productive areas linked by the Balkan passes. But to the west of the great upland lie the basins and hills of Macedonia, where the cultivating peasants were also oppressed by the Turkish conquerors. The Struma and its feeders link Sofia to Macedonia by various routes, not difficult as difficulty is counted in the peninsula. Apart altogether from the much disputed question of the "racial" affinities of the Macedonians, the position of Sofia made it inevitable that Bulgarian politicians should interest themselves in the Macedonian problem, both with a view to the enlarging of the state boundaries and in the hope of connecting the state capital directly with the Aegean. The great complexity of the structure of the peninsula, and particularly the fact that the rivers tend to flow through sunken basins, capable of settlement, but separated rather than linked by gorges difficult of passage, has made the drawing of frontiers satisfactory both from the strategic and economic standpoint an almost insoluble problem. It is this geographical fact rather than the real or supposed racial differences between Serbs and Bulgarians that is the basis of many of the troubles of the peninsula.

Population and Government.—According to the census of 1934, three-quarters of the population is Bulgarian, and about half of the remainder Turkish. Elementary education is free and obligatory, and in 1934, 79·6% of the male population and 57·2% of the female population were literate. Of the population 84·4% belonged to the Orthodox Church; 13·5% were Moslems; and Jews and Roman Catholics numbered 0·8% each. The legislative authority is the Sobranye, which is composed of 160 members, but since 1937 party candidature has been prohibited, and government tends to be authoritarian in character.

BIBLIOGRAPHY.—A large number of books on Bulgaria has recently been published in Germany. *See* also Logio, *Bulgaria* (Manchester, 1937); Prost, *La Bulgarie de 1912 à 1930* (Paris, 1932); *The Balkan States* (information dept. of the Royal Inst. of International Affairs, 1936). (M. I. N.)

HISTORY

The ancient Thraco-Illyrian race which inhabited the district between the Danube and the Aegean, were expelled or absorbed by the great Slavonic immigration which lasted from the 3rd to the 7th century A.D. The many tumuli found in all parts (*see* Herodotus v. 8) and some stone tablets with bas-reliefs remain as monuments of the aboriginal population, and certain structural peculiarities, common to the Bulgarian and Rumanian languages, are perhaps due to the influence of the primitive Illyrian speech. The Slavs, an agricultural people, were governed, even in those remote times, by the democratic local institutions to which they are still attached; they possessed no national leaders or central organization and their only political unit was the "*pleme*," or tribe.

They were considerably influenced by contact with Roman civilization. It was reserved for a foreign race, altogether distinct in origin, religion and customs, to give some unity and coherence to the scattered Slavonic tribes.

BY COURTESY OF THE NATIONAL BOARD OF THE Y.M.C.A.
COSTUME OF BULGARIAN WOMAN

The Bulgars.—The Bulgars, a Turanian race, akin to the Huns and Avars, belonged to the wave of migrants which came westward behind the Huns. They were a horde of wild horsemen, fierce and barbarous, and governed despotically by their *khans* (chiefs) and *boyars* or *bolyars* (nobles). Their religion, about which little is known, was probably polytheistic, although some of them had certainly embraced Islam. Men and women wore baggy trousers, and the women veiled their faces, while the men wore large turbans over heads shaven clean. Their principal food was meat, and they lived by and from war. In the 4th century the Bulgars had reached the steppes between the Urals and the Volga; but in A.D. 433, their federation split into two groups—the Utiguri and the Kutriguri. The latter were at first the more powerful. For 100 years they formed a strong state on the north coast of the Black sea, whence they formed a continual menace to the eastern Roman empire. About A.D. 560 this state was annihilated by the Avars, who absorbed the survivors into their ranks, and herewith the Kutriguri disappear from history. The Utiguri, living farther eastward, were subject only a few years to the Avars, and after these had passed on, to the Turks. In A.D. 582 they recovered their independence and founded a state on the Volga, remains of which survived into the 13th century under the name of Great (or Black) Bulgary. A tribe of Utiguri, under their khan Asparuch, or Isperich, moved westward, before the pressure of the expanding Khasar state, crossed the Danube in 679 and, after subjugating the Slavonic population of Moesia, advanced to the gates of Constantinople and Salonika. The east Roman emperors were compelled to cede to them the province of Moesia and pay them an annual tribute. The invading horde was not numerous, and during the following centuries it became gradually merged in the Slavonic population Like the Franks in Gaul, the Bulgars gave their name and a political organization to the more civilized race which they conquered and whose language, custom and local institutions they adopted. No trace of the original Bulgarian tongue remains in the language now spoken in Bulgaria.

Early Dynasties.—*The early Bulgarian state lay along both banks of the Danube, although the suzerainty of their khans over the northern bank, which at the time was practically a no-man's land, was probably always shadowy. Khan Krum (802–804) and his son Omortag (814–831) succeeded to the heritage of the Avars* in much of eastern Hungary and Transylvania, but with the arrival of the Magyars and Petchenegs (*q.v.*) at the end of the 9th century, all territory north of the Danube was abandoned and *even the southern half of the Danube valley was depopulated by* raids and filled with alien races who settled there in considerable number. The expansion of the Bulgar empire southward was more lasting. In numerous campaigns against Byzantium, the Bulgar khans gradually extended their frontiers, and Kardam (777–802) and Krum again exacted the tribute paid to Asparukh. Khan Krum waged a desperate campaign against the emperor Nicephorus, who invaded Bulgaria and burned Preslav; but Krum annihilated the army as it returned through the Balkan passes (811), slew the emperor and converted his skull into a drinking goblet. In following years he devastated Thrace "like a new Sennacherib" and besieged Constantinople itself, and the city was only saved by his sudden death. Khans Pressian (836–853) and Boris (857–888) extended the frontier of Bulgaria far to the south-west, to include Debar, Okhrida and all the upper Struma valley, as well as the Morava valley on the west. The great majority of the enlarged Bulgarian state was now almost purely Slavonic; and for 300 years, while the whole of north-eastern Bulgaria was repeatedly ravaged by Russians, Magyars, Petchenegs and Cumans, the Slavonic centre and the south-west was to become even more the centre of gravity of the Bulgarian state. This process was accelerated by the official introduction into Bulgaria of Christianity by the disciples of the "Apostles of the Slavs," S. S. Cyril and Methodius. The adoption of the Slavonic or "Old Bulgarian" language as that of the official liturgy was the final stage in the assimilation of the original Bulgar race. Boris probably adopted Christianity from political motives, although according to legend he was frightened into it by the ghastly pictures of Hell painted on his palace walls by a Byzantine monk, and he ended his own days in a monastery. The great controversy between Rome and Byzantium regarding the Patriarch Phocas had broken out in 800. Boris long wavered between the rival churches, but when the Pope failed to fulfil the hope that he had held out of granting Bulgaria an independent and national Patriarch, Boris, in 870, decided for the Eastern Church. The decision was fraught with momentous consequences for the future of his country. The nation altered its religion in obedience to its sovereign, and some of the boyars who resisted the change paid with their lives for their fidelity to the ancient belief. The independence of the Bulgarian Church was recognized by the Patriarch, a fact much dwelt upon in recent controversies. The Bulgarian primates subsequently received the title of Patriarch; their see was transferred from Preslav to Sofia, Voden, and Prespa successively and finally to Okhrida

The First Empire.—The national power was at its zenith under Simeon (893–927), a monarch distinguished in the arts of war and peace. In his reign, says Gibbon, "Bulgaria assumed a rank among the civilized powers of the earth." It was under Simeon that the trans-Danubian possessions were finally lost, but he extended his frontiers to the Adriatic in the south-west and also brought the Serbs under his sway, which now reached as far as the Sava and the Drina. Having become the most powerful monarch in eastern Europe, Simeon assumed the title of "Emperor and Autocrat of all the Bulgars and Greeks," a style which was recognized by Pope Formosus. He aspired, however, to a higher title still. His numerous campaigns against Byzantium were prompted by the ambition to place on his head the Imperial crown; and his pursuit of this dream left his country nearly exhausted. While he reigned his people made great progress in civilization, literature flourished, and his capital Preslav is reputed as rivalling Constantinople in magnificence, and full of "high palaces and churches."

The West Bulgarian Empire.—After Simeon's death, the Bulgar power declined owing to internal dissension. The upper classes were demoralised by the Greek manners introduced by *Simeon's wife, and the peasants, whose lot was not happy, embraced in large numbers the doctrines of pacifism and equality preached by the Bogomils (q.v.) who acquired great prominence* t this time. Serbia recovered its independence in 931 and Macedonia, under a certain Nicola, the "Comes" or prince of the Slavonic Bersites in northern Macedonia, revolted successfully in 963, Nicola soon after assuming the title of tsar. New waves of astern invaders harassed northern Bulgaria; and in 972 the Emperor John Zimisces took advantage of the inroad of Russia o dethrone Tsar Boris II. and recover eastern Bulgaria for the Roman empire. Macedonia, however, under Nicola, retained its ndependence, and Nicola's son Samuel (980–1014), actually re-overed Serbia and northern Bulgaria for this new "Bulgarian" mpire, and extended his power southward to Thessaly; but in 014 he was defeated at Belasitsa by the emperor Basil II., surnamed Bulgaroktonos, who put out the eyes of 15,000 prisoners aken in the fight. Samuel died of grief and a few days later his lynasty was extinguished; for more than a century and a half 1018–1180) all the former Bulgarian territories remained subject o the Byzantine emperors.

The Second Empire.—After a general insurrection of Vlachs nd Bulgars under the brothers Ivan and Peter Asen of Trnovo, orthern Bulgaria recovered its independence (1185) and Ivan sen assumed the title of "Tsar of the Bulgars and Greeks." The sens asserted their descent from the old rulers of Bulgaria; ut they are said, actually, to have been of Vlach origin, and are nerally referred to in contemporary documents as "Tsars of he Vlachs and Bulgars." They received great assistance from he Cumans, now settled on the north banks of the Danube, to hom they were allied by *treaty and marriage.* Kaloyan, or oanitsa, the third of the Asen monarchs, extended his dominions o Belgrade, Nish, and Skoplje; he acknowledged the supremacy the Pope who, in his own words, "extolled him above all other hristian monarchs," received the royal crown from a papal legate nd was certainly the strongest party in the three-cornered warare which was waged for many years between the Byzantine mpire, the Crusaders (at that time established in Constantiople), and the Bulgars. The greatest of all Bulgarian rulers was van Asen II. (1218–41) a man of humane and enlightened haracter. After a series of victorious campaigns he established sway over Albania, Epirus, Macedonia and Thrace, and overned his wide dominions with justice, wisdom and moderation. his time the nation attained a prosperity hitherto unknown; ommerce, arts and literature flourished. Trnovo, the capital, was nlarged and embellished, and great numbers of churches and onasteries were founded or endowed. At this period, to judge om the chronicles of the Crusaders, Bulgarian civilization was n a level with that of Europe. The dynasty of the Asens became xtinct in 1280. None of their successors were able to establish strong central authority, and feudal anarchy prevailed. Further, orthern Bulgaria was repeatedly ravaged by the invasions of ongols, to whom it was vassal in 1292–95. Two other dynasties, th of Cuman origin, followed—the Terterovtsi, who ruled at rnovo, and the Sišmanovtsi, who founded an independent state Vidin, but afterwards reigned in the national capital. Eventully, on July 28, 1330, Tsar Michael Sišman was defeated and ain by the Serbians, under Stephen Uroš III., at the battle of elbuzhd (Kustendil). Bulgaria, though still retaining its native lers, now became subject to Serbia, and formed part of the short-lived empire of Stephen Dušan (1331–56). The Serbian hegemony vanished after the death of Dušan, and the Christian races of the Peninsula, distracted by the quarrels of their petty princes, fell an easy prey to the Muslim invader.

In 1340 the invading Turkish forces had begun to ravage the entire valley of the Maritsa; in 1362 they captured Philippopolis, and in 1382 seized Sofia. In 1366 Ivan Šišman III., the last Bulgarian tsar, was compelled to declare himself the vassal of the Sultan Murad I. In 1389 the rout of the Serbians, Bosnians and Croats at Kosovo Polje decided the fate of the Peninsula. Shortly afterward Ivan Šišman was attacked by the Turks; and Trnovo, after a siege of three months, was captured, sacked and burnt in 1393. The fate of the last Bulgarian sovereign is unknown; the national legend represents him as perishing in a battle near Samokov. Vidin, where Ivan's brother, Srazhimir, had established himself, was taken in 1396, and with its fall the last remnant of Bulgarian independence disappeared.

The five centuries of Turkish rule (1396–1878) form a dark epoch in Bulgarian history. The invaders carried fire and sword through the land; towns, villages and monasteries were sacked and destroyed, and whole districts were converted into desolate wastes. The inhabitants of the plains fled to the mountains, where they founded new settlements. Many of the nobles embraced Islam; others, together with numbers of the priests and people, took refuge across the Danube. Among the people only the Bogumils adopted Islam in large numbers; the Pomaks of the Rhodopes were converted only in the 17th century. Large colonies of true Turks were, however, settled in the plains both north and south of the Balkans, the true Bulgarian element being driven back into the less fruitful districts. All the regions formerly ruled by the Bulgarian tsars, including Macedonia and Thrace, were placed under the administration of a governor general, styled the beylerbey of Rumili, residing at Sofia; Bulgaria proper was divided into the sanjaks of Sofia, Nikopolis, Vidin, Silistria and Kiustendil. A new feudal system replaced that of the *boyars*; fiefs or *spahiliks* were conferred on the Ottoman chiefs and renegade Bulgarian nobles. The Christian population was subjected to heavy imposts, the principal being the *haratch*, or capitation-tax, paid to the imperial treasury, and the tithe on agricultural produce, which was collected by the feudal lord. Among the most cruel forms of oppression was the requisitioning of young boys between the ages of ten and twelve, who were sent to Constantinople as recruits for the corps of janissaries. Yet the conquest once completed, the condition of the peasantry during the first three centuries of Turkish government was better than it had been under the tyrannical rule of the boyars. Military service was not exacted from the Christians, no systematic effort was made to extinguish either their religion or their language, and within certain limits they were allowed to retain their ancient local administration and the jurisdiction of their clergy in regard to inheritance and family affairs. Many districts and classes enjoyed special privileges; chief of these were the merchants, miners, and the inhabitants of the "warrior villages" (*voinitchki sela*), who received self-government and exemption from taxation in return for military service. Some of these towns, such as Koprivstitsa in the Sredna Gora, attained a great prosperity, which declined after the establishment of the principality. So long as the Ottoman power was at its height, the lot of the subject-races was tolerable. Their rights and privileges were respected, the law was enforced, commerce prospered, good roads were constructed, and the great caravans of the Ragusan merchants traversed the country. Down to the end of the 17th century there was only one serious attempt at revolt, as distinguished from the guerilla warfare maintained in the mountains by the *haiduti*, or outlaws: that occasioned by the advance of Prince Sigismund Bathory into Walachia in 1595. Both this revolt, and an equally unsuccessful rising in 1688, were arranged in conjunction with Austrian forces; but after the peace of Belgrade (1739) Austria abandoned her active Balkan policy. Her heritage was taken over by Russia, who as early as 1687 had for political reasons assumed the role of protector of the Orthodox Christians of the Balkans; a claim officially put forward in the Treaty of Kuchuk Kainarji (1774). As the power of the sultans declined after the unsuccessful siege of Vienna (1683), anarchy spread through the Balkans; although Bulgaria, being nearer the capital, still suffered less from the oppressions of the feudal lords than the remoter districts. Early in the 18th century, however, the inhabitants suffered terribly from the ravages of the Turkish armies passing through the land during the wars with Austria. Towards its close their condition became even worse owing to the horrors perpetrated by the Krdzalis, or troops of disbanded soldiers and desperadoes, who, in defiance of the Turkish authorities, roamed through the country, supporting themselves by plunder and committing every conceivable atrocity. In 1794 Pasvanoglu, one of the chiefs of the Krdzalis, established himself as an independent sovereign at Vidin, putting to flight three large Turkish armies which were despatched against him. This adventurer (1758–1807) possessed many remarkable qualities. He adorned Vidin with handsome buildings, maintained order, levied taxes and issued a separate coinage.

The National Revival.—At the beginning of the 19th century the existence of the Bulgarian race was almost unknown in Europe. Disheartened by ages of oppression, isolated from Christendom by their geographical position, and cowed by the proximity of Constantinople, the Bulgarians took no collective part in the insurrectionary movement which resulted in the liberation of Serbia and Greece. The Russian invasions of 1810 and 1828 only added to their sufferings, and great numbers of fugitives took refuge in Bessarabia, annexed by Russia under the Treaty of Bucharest. But the long-dormant national spirit now began to awake under the influence of a literary revival. The precursors of the movement were Paisii, a monk of Mount Athos, who wrote a history of the Bulgarian tsars and saints (1762), and Bishop Sofronii of Vratsa. After 1824 several works written in modern Bulgarian began to appear, and in 1835, the first Bulgarian school was founded at Gabrovo. Within ten years some 50 Bulgarian schools came into existence, and five Bulgarian printing-presses were at work. The literary movement led to a reaction against the influence and authority of the Greek clergy. The spiritual domination of the Greek patriarchate had tended more effectually than the temporal power of the Turks to the effacement of Bulgarian nationality. After the conquest of the Peninsula the Greek patriarch became the representative at the Sublime Porte of the *Rum-millet*, the Roman nation, in which all the Christian nationalities were comprised. The independent patriarchate of Trnovo was suppressed; that of Okhrida was subsequently Hellenized. The Phanariot clergy—unscrupulous, rapacious and corrupt—monopolized the higher ecclesiastical appointments and filled the parishes with Greek priests, whose schools, in which Greek was exclusively taught, were the only means of instruction open to the population. Greek became the language of the upper classes in all Bulgarian towns, the Bulgarian language was written in Greek characters, and the illiterate peasants, though speaking the vernacular, called themselves Greeks. The Slavonic liturgy was suppressed and in many places the old Bulgarian manuscripts, images, testaments and missals were burned. Thus although from 1828 onward sporadic military revolts had been led by Mamarčev, Rakovski, Panayot Khitov, Haji Dimitr and Stefan Karaja, these isolated Bulgarian patriots could not hope for success until the Greek ascendancy had been removed. For forty years the pioneers of Bulgarian nationality fought for the establishment of an autonomous church. At one time they even secured from the pope the appointment of an archbishop of the Uniate Bulgarian Church, causing Russia to urge the pope to grant Bulgaria's wishes; and on Feb. 28, 1870 a firman was issued establishing a Bulgarian Exarchate with jurisdiction over 15 dioceses, including Nish, Pirot and Veles. The first Exarch was elected in Feb. 1872. He and his followers were at once excommunicated by the patriarch; but Bulgaria was now free to develop her national feeling.

The Revolt of 1876.—Following on the rising of 1875 in Bosnia and the Hercegovina, a general revolt was organized in Bulgaria in 1876. It broke out prematurely in May in Koprivštitsa and Panagurište, and hardly spread beyond the sanjak of Philippopolis. It was repressed with fearful barbarity by Pomaks, bashi-bazouks and recently settled Circassians and Tatars. Some 5,000 Bulgarians were massacred near Philippopolis, including 5,000 men, women and children in Batak alone, and 58 villages and five monasteries were destroyed. Isolated risings which took place on the northern side of the Balkans were crushed with similar barbarity. These atrocities were denounced by Gladstone in a celebrated pamphlet which aroused the indignation of Europe. The Great Powers remained inactive, but Serbia declared war in the following month, and her army was joined by 2,000 Bulgarian volunteers. Reforms proposed by a conference of the Powers held at Constantinople at the end of the year, were disregarded by the Porte, and in April 1877 Russia declared war (*see* RUSSO-TURKISH WARS, and PLEVNA). In the campaign which followed the Bulgarian volunteer contingent in the Russian Army accompanied Gourko's advance over the Balkans, behaved with great bravery at Stara Zagora, where it lost heavily, and rendered valuable services in the defence of Shipka.

Independent Bulgaria. Treaties of San Stefano and Berlin.—After advancing to Chatalja, Russia dictated the Treaty of San Stefano (Mar. 3, 1878) which realized almost all Bulgarian ambitions. An autonomous principality was created, the western frontier of which ran down from the Timok river to embrace Pirot, Vranje, Skoplie, Debar, Okhrida and Kastoria. Leaving Salonika and Chalcidice to Turkey, the frontier left the Aegean south-east of Xanthe and ran along the Rhodopes, passed north of Adrianople, curved down to include Lule-Burgas, and reached the Black sea north of Midia. The Dobruja was reserved as compensation to Rumania for Russia's annexation of Bessarabia. The area included in the new Bulgaria constituted three-fifths of the Balkan peninsula, with a population of 4,000,000 inhabitants. The Powers, however, fearing that this State would become practically a Russian dependency, intervened. The Treaty of Berlin, (*q.v.*), of July 13, 1878, reduced the principality of Bulgaria, (which was to be independent, but under the sovereignty of the Porte), to the territory between the Danube (excluding the Dobruja) and the rest of the Balkans, with Samokov and Kiustendil. Vranje, Pirot and Nish were given to Serbia, Turkey retaining nearly all Macedonia. An autonomous province of Eastern Rumelia, subject to the sultan but with a Christian governor general, a diet and a militia, was created between the Balkans and the Rhodopes. A European commission was to draft a constitution for Rumelia; for Bulgaria, an assembly of notables was to meet at Trnovo within nine months, draw up an organic law and elect a prince; their choice was to be confirmed by the Porte with the assent of the Powers.

The country was meanwhile occupied by Russian troops and administered by Russian officials.

The Constitution of Trnovo and the Election of Prince Alexander.—The Constituent Assembly, which met at Trnovo on Feb. 22, 1878, was overwhelmingly democratic in character. The majority of its members were peasants, and the Liberal party, under Tsankov, Karavelov and Slaveikov, easily predominated over the Conservatives. The constitution elaborated at this assembly was among the most democratic in Europe.

On Aug. 20, 1879 the first regular Bulgarian Assembly elected to the Bulgarian throne Prince Alexander of Battenberg, a member of the grand-ducal house of Hesse and nephew of the tsar Alexander II. of Russia. Prince Alexander arrived in Bulgaria and took the oath to the Constitution on June 26 amid general rejoicings; but from the first his position was difficult. Elected as Russia's candidate, and autocratic by nature and training, the young prince considered himself less a Bulgarian ruler than an agent for the foreign and domestic policy of his protector. Little else was, indeed, expected of him by the courts of Europe, but on both these scores he came into early conflict with the Bulgarian Liberals, now led by Stambulov, who commanded the bulk of Bulgarian public opinion and were strongly averse from any unnational policy, or any infringement of the democratic constitution.. The prince first formed a Conservative ministry to take the place of the outgoing Russian officials, but was forced by the popular agitation to form a Liberal Government under Tsankov. As the Liberals, once in power, initiated a violent anti-foreign and anti-Russian agitation, the prince dismissed them, formed a new Conservative Government under the Russian general Ernroth, and charged him with arranging new elections to the Grand Sobranje. The general obtained a subservient sobranje which agreed (July 13, 1881) to suspend the constitution and invest the prince with absolute powers for seven years. A period of dictatorship followed, under the Conservatives and the Russian generals Sobolev and Kaulbars, who were despatched from Russia to enhance the authority of the prince. His own adherents, however, disagreed among themselves over the question of railway concessions. The prince, whose relations with Russia had been less cordial since the death of Alexander II. in 1881, quarrelled with Sobolev, and began to favour Bulgarian aspirations. On Sept. 19, 1883 he restored the constitution by proclamation, and formed a coalition Government of Conservatives and moderate Liberals, which was succeeded on July 9, 1884 by a government of the Left-wing Liberals under Karavelov.

Union with Eastern Rumelia and War with Serbia.—In East Rumelia, as in Bulgaria, political life had brought forth a Conservative, or "Unionist," and a Liberal party. The differences between them were rather personal than of principle for each was equally eager to promote the union with Bulgaria, but the Unionists, who were Russophil, had declared, in compliance with Russia's wishes, that the time was not yet ripe for the union. The Liberals, who were in opposition, seized the opportunity and on Sept. 18, 1885, having assured themselves beforehand of *Prince* Alexander's consent, they seized the governor-general, Krastović Pasha, and proclaimed the union. The prince arrived in Philippopolis a few days later, took over the government, and mobilized all available troops on the Turkish frontier to resist a possible attack. Turkey, however, beyond massing her troops on the frontier, made no move, but awaited developments in the international situation. The Western Powers showed Bulgaria sympathy, and Germany preserved a neutral attitude, but Russia, incensed by such independence of action, recalled her officers from the Bulgarian Army, and summoned conferences in Constantinople in September and October, where she urged that the union be cancelled and the sultan's authority restored in East Rumelia. This was opposed by Great Britain; and meanwhile King Milan of Serbia, declaring that the balance of power in the Balkans was endangered, suddenly declared war (Nov. 14, 1885) The Serbs advanced as far as Slivnitsa; but here they were met and brilliantly defeated by the untrained Bulgarian Army (Nov. 10) which pursued them over the frontier, took Pirot (Nov. 27), and was only stopped by the intervention of Austria (*see* SERBO-BULGARIAN WAR). Peace and the *status quo* were restored by the Treaty of Bucharest (March 3, 1886), and by the Convention of Top-Khané (April 5). Prince Alexander was appointed governor-general of East Rumelia, and the Rumelian administrative and military forces united with those of Bulgaria

The Abdication of Prince Alexander and the Regency.—Discontent with these events impelled Russia to set afoot a conspiracy among the Russophils in Bulgaria and certain discontented officers, who on Aug. 21, 1886 seized the prince in his palace, forced him to sign his abdication, and transported him out of the country. The country in general disapproved the plot; Stambulov, the president of the assembly, and Colonel Nutkurov, commandant of the troops at Philippopolis, initiated a counter-revolution, overthrew the conspirators and recalled the prince. The tsar, however, whom he had informed of his return, answered: 'I cannot approve your return to Bulgaria " As no European Power would support him in face of Russia's ill-will, Alexander abdicated on Sept. 7, appointing as regents Stambulov, Karavelov and Mutkurov. The regency was successful, in difficult circumstances, in preserving order and securing the goodwill of Turkey. The election of a new prince was a more difficult task. Russia sent Gen. Kaulbars to Bulgaria to arrange for the election of the prince of Mingrelia; but finding fresh causes of discontent, broke off relations on Nov. 17. The Bulgarian delegates who toured the courts of Europe found the difficulty of selecting a prince who should be agreeable to Russia and to the rest of Europe alike, almost insurmountable. At last their offer was accepted by Prince Ferdinand of Saxe-Coburg-Gotha (*q.v.*).

Prince Ferdinand.—The new prince was elected by the Grand Sobranje on July 7, 1887, and took over the Government on July

14. His position was difficult, as Russia denounced him as a usurper and brought pressure on the Porte to declare his presence in Bulgaria illegal. Stambulov, who became minister president on Aug. 3, had to rule almost as a dictator in face of a raid led by the Russian captain Nabokov, a refusal by the bishops of the Holy Synod to pay homage to the prince, and a military conspiracy under Major Panitsa (1890). Fortunately Stambulov's foreign policy was very successful. The Powers withheld recognition; but Ferdinand was received personally in Vienna, London and Rome; and relations with Turkey became really cordial, the Porte granting the Bulgarian schools and Church valuable concessions in 1890, 1892 and 1894. While, however, Stambulov sought the friendship of the Porte, Ferdinand was anxious to recover the favour of Russia, and thus secure his own recognition. Relations between the two grew ever more strained, until Stambulov resigned in 1894. Under his successor, Dr. Stoilov, Ferdinand inaugurated a Russophil policy, which was facilitated by the death of the Tsar Alexander III. in Nov. 1894. The banished Russophils and other victims of Stambulov's autocratic regime were amnestied; some of these murdered the great minister in the streets of Sofia on July 14, 1895. In the spring of 1893 Ferdinand had married Princess Marie Louise of Bourbon-Parma, Stambulov had persuaded the Grand Sobranje to alter the constitution and to allow the issue of the marriage to be brought up in the Roman Catholic faith. Now, however, he had his eldest son, Prince Boris, baptized into the Orthodox faith (Feb. 14, 1896), a step which, although it incurred the grave displeasure of Austria-Hungary, sealed the reconciliation with Russia. On March 14, the Powers having signified their assent, Ferdinand was nominated by the sultan prince of Bulgaria and governor-general of Eastern Rumelia. Russian influence again became predominant in Bulgaria. It was no longer conspicuous in her internal affairs, but a secret military convention was concluded in Dec. 1902.

The Macedonian Question and the Declaration of Independence.—The question which was now to dwarf all others in importance, and to sway all Bulgarian policy, was that of Macedonia. The narrow limits drawn by the Treaty of Berlin had left Bulgarians under foreign rule in Rumania, Serbia and Turkey. If the hope of recovering portions of the Dobruja and Western Serbia had prevented Bulgaria from initiating cordial relations with those two countries, she had recognized the impossibility of an aggressive war. With Turkey, however, matters were different. Macedonia constituted the largest Bulgaria irridenta; here the sense of Bulgarian nationality was especially strong and genuine; here, too, there was a fair possibility that the present masters would soon leave the field, and territorial acquisition prove possible. The Macedonian revolt of 1903 (*see* MACEDONIA) brought Bulgaria to the verge of war with Turkey; and despite a convention of April 8, 1904, she was obliged to keep up an army with a view to possible war, which, together with the maintenance of many destitute refugees from Macedonia, proved a heavy drain on her finances. Nor did the question end here. Other countries laid claim to Macedonia. Serbs, Greeks, Albanians, Vlachs, as well as Bulgars, carried on their rival propagandas by force of arms. Outrages committed by Greek bands in 1906 led to reprisals on the Greek population in Bulgaria, while with Serbia the situation was even more strained, especially since the return of the Karageorgević dynasty in 1903, the consequent increase in Serb propaganda in Macedonia and the increasing favour enjoyed by Serbia in Russia. It was partly, no doubt, the desire to set his country on an equality with Serbia, as well as the growing impatience of prince and people alike at the nominal vassalage to Turkey (even though the tribute imposed in 1878 was never paid) that decided Prince Ferdinand to proclaim Bulgarian independence. On visiting Vienna in Feb. 1908, Prince Ferdinand was well received; Bulgaria's aspirations towards the Dobruja and Nish made the conclusion of an alliance between her and Austria-Hungary impossible; but they were now in sympathy. After the Young Turk revolution of July 1908 an understanding was reached between Ferdinand and the Emperor Francis Joseph. Further pretexts were supplied by a diplomatic incident in Constantinople, and a strike in those sections of the Eastern Rumelian railways which were owned by Turkey but leased to the Oriental Railways. On Oct. 5, 1908, the day after the Austrian annexation of Bosnia and the Hercegovina, Ferdinand proclaimed Bulgaria (including Eastern Rumelia) an independent kingdom. (J. D. B.; C. A. M.)

The Balkan Alliance and the First Balkan War.—The protests of Serbia against this action were stilled by Russia, who feared that Bulgaria might be driven definitively into the arms of Austria-Hungary. Bulgarian policy swung back into its old groove. Turkey had claimed an indemnity of £4,800,000 for the Declaration of Independence. Bulgaria had agreed to pay £1,520,000. In Feb. 1909 Russia undertook to advance the difference. A preliminary Russo-Turkish protocol was signed on March 16, and in April, after the final agreement had been signed, the independence of Bulgaria was recognized by the Powers.

In March 1911 the Malinov cabinet fell, and Guešov, head of the Nationalist party, became minister president. Negotiations for a Balkan alliance against Turkey commenced. The first, between Bulgaria and Greece, were conducted through J. D. Bourchier, Balkan correspondent of the London *Times*. A secret treaty of defensive alliance was signed between Bulgaria and Greece on May 29, 1912. The Serbo-Bulgar treaty was signed in Sofia on March 13, and supplemented by the secret military conventions of Varna, May 12 and July 12. Bulgaria had desired autonomy for Macedonia; Serbia, its division into uncontested Bulgar and Serb zones, and a third zone on which the tsar of Russia was to arbitrate. Ultimately Serbia recognized "the right of Bulgaria to the territory east of the Rhodope mountains and the river Struma"; while Bulgaria recognized "a similar right of Serbia to the territory north and west of the Sar mountains"; if autonomy for the rest of Macedonia proved impossible, an agreed line from Golem Mountain to Okhrida was to be accepted, subject to the tsar's approval. Hartwig, the Russian minister at Belgrade, had kept his government informed throughout. Early action was necessary in view of the approaching end of the Italo-Turkish War and the unrest in Macedonia. The Great Powers endeavoured to prevent war by the tardy offer of a guarantee for the autonomy of Macedonia. The Balkan Allies mobilized on Sept. 30. On Oct. 8, Montenegro, with which country no formal agreement had been made, declared war on Turkey. On Oct. 13 the Balkan Allies sent an ultimatum to the Porte; on Oct. 18 Greece declared war on Turkey.

The successes of the Balkan Allies were swift, although the casualties of Bulgaria, especially, were heavy. On Dec. 3 an armistice was signed between Turkey, Bulgaria and Serbia. A conference met in London to decide terms of peace, but negotiations broke down over the possession of Adrianople. On Feb. 3, 1913, hostilities reopened. Again the allies were everywhere successful, and after the surrender of Adrianople to the Bulgars and Serbs (March 26) the Turks sought the mediation of the Powers, and a second armistice was concluded between Bulgaria and Turkey on April 16. On May 30 1913 the delegates to the second London Conference were induced to sign a treaty, the terms of which had been drafted by the Powers. Turkey surrendered to the allies all her possessions in Europe up to a line drawn from Enos on the Aegean to Midia on the Black sea. Albania was granted independence. (*See* BALKAN WARS.)

The Second Balkan War.—Difficulties immediately arose as to the interpretation of the treaty. The Serbs claimed that, after the unforeseen success of the campaigns and the modification by the Powers of the arrangements on the Adriatic coast, a revision of the treaty was necessary, while the Bulgars held out for the letter of the territorial agreement. The secret annexes (March 13, 1912) stated that "all territorial gains acquired by combined action . . . shall constitute the common property (*condominium*) of the two allies" until final settlement. The Serbs and Greeks, as a result of their victories, held much territory in Macedonia that had originally been assigned to Bulgaria, and they seemed to be preparing for a permanent occupation. Early in 1913 Bulgaria began to suspect that her allies were combining against her, and the military party, with King Ferdinand at their head, prepared for action.

On June 1 Guešov and Pašić met in the hope of averting war; on the same day a treaty between Serbia and Greece was signed at Salonika. Guešov, finding no support from King Ferdinand in his efforts for peace, resigned; he was succeeded by Danev. On June 29 the Bulgarian 4th Army, acting on orders signed by Gen. Savov, made a treacherous attack on their Serbian and Greek allies. It must, however, be remembered that the attack was not unexpected, and that it probably only just forestalled a declaration of war by Serbia and Greece. Guešov states in his memoirs that the reports of the Ministerial council contain no minute ordering the attack. A judicial inquiry into the case was opened in Sofia, but never concluded. Savov asserted that Ferdinand as commander-in-chief gave the order to attack

The Second Balkan War brought calamity on both Bulgaria and Macedonia By the Treaty of Bucharest (Aug 10, 1913) Rumania acquired the rich lands of the Southern Dobruja, which had belonged to Bulgaria since 1878; Serbia and Greece divided Macedonia between them; Bulgaria was accorded the mountainous region of the Pirin and Dospat down to the Aegean, with the two indifferent ports of Dedeagatch and Port Lagos.

BULGARIAN PEASANT BRINGING MILK TO THE MARKET

Rapprochement with the Central Powers.—The Radoslavov Government which took office in July 1913, abandoned the Russophil policy which had given Macedonia to Serbia. When France, Britain and Russia refused to grant a loan to meet obligations and for constructive work, they turned to the Central Powers, and in July 1914 concluded a loan of 500,000,000 leva with the Disconto-Gesellschaft of Berlin, the group obtaining control of the Bulgarian State coal mines, the port of Lagos, and the projected railway to it. Negotiations for a treaty had been going on simultaneously, and in August were approaching completion (*see* EUROPE); and thus, when the World War broke out, although most Bulgars wished to preserve neutrality, the pro-German sympathies of the king, who also believed Germany invincible, were reinforced by a widespread feeling that the Central Powers, and they alone, might yet gain Macedonia for Bulgaria. The efforts made by the Entente through the summer of 1915 to win over Bulgaria were frustrated by the refusals of Serbia and Greece to cede territory. On Sept 6 Bulgaria signed a military convention and treaty with the Central Powers at Pless (Pszczyna), and Turkey made the concessions demanded by Bulgaria. On Sept. 15 the Entente promised Bulgaria part of Macedonia unconditionally, if she would declare war on Turkey. The Opposition protested vehemently against the king's policy, Stambolisky being, in consequence, condemned to imprisonment for life for lèse-majesté, but mobilization was decreed on Sept. 22, and Bulgaria declared war on Serbia on Oct. 12 Great Britain, France and Italy declared war on Bulgaria on Oct. 15, 16 and 17 respectively

The World War, 1915–18, and the Treaty of Neuilly.—The initial successes of the Bulgarian troops in Serbia, and later in the Dobruja, gave some popularity to the war; but the Opposition continued to urge retirement from the War, especially when her national objectives, Macedonia and the Dobruja were attained. Southern Dobruja passed to her, with immediate occupation, under the Treaty of Bucharest, May 7, 1918; but shortage of food and munitions, exhaustion, and the hopes raised by President Wilson's pronouncement of the Fourteen Points, intensified the desire for a separate peace. Malinov replaced Radoslavov in office on June 18, and when the Bulgarian line was broken and the country invaded (Sept 15–27), he asked for an armistice, which was signed unconditionally on Sept 29 Stambolisky, who had been released on Sept. 25 and sent to the front to calm the troops, proclaimed a republic and advanced on Sofia; order was restored by loyal troops with German assistance, after some fighting. On Oct. 3 King Ferdinand abdicated in favour of his son Boris and left the country. Under the Treaty of Neuilly (*q.v.*) Bulgaria was disarmed, condemned to a heavy indemnity, and lost the Southern Dobruja to Rumania, Caribrod and Strumica to Yugoslavia, her recent gains in Macedonia to Greece, and her Aegean coastline to the Allies and Associated Powers, who assigned it to Greece at the Conference of San Remo (April 1920, *q.v.*).

The Agrarian Government, 1920–23.—Post war revolutionary feeling in Bulgaria took the form of a reaction against her war policy. Stambolisky, its most courageous opponent, was the hero of the hour. The elections of March 28, 1920 gave the Agrarians an absolute majority, and Stambolisky, as premier of an Agrarian cabinet, opened a campaign against the bourgeoisie which in its methods closely resembled that of the Russian Bolsheviks, with whom he later opened up direct communications; he was also the author of a plan for a "Green international" of peasants. He used the Communists of Bulgaria as allies against the bourgeoisie, but denounced and persecuted them as enemies of property. His valuable measures, which were not repealed after his fall, were an agrarian law whereby Crown and Church lands and property over a certain size (30 hectares for peasant proprietors, ten for married, four for single urban proprietors who did not themselves cultivate the soil) were expropriated in favour of landless peasants; and the institution of a year's obligatory State service.

Stambolisky's foreign policy was sensible and conciliatory. He attempted to live on peaceful terms with his neighbours and to fulfil treaty obligations. Despite grave economic difficulties, Bulgaria commenced payment of the reparations, the total of which was finally reduced from £90,000,000 to £22,000,000, payable over 60 years. Despite this, Bulgaria failed at the two conferences of Lausanne to secure an adequate fulfilment of clause 48 of the Treaty of Neuilly, which guaranteed her an issue to the Aegean (*see* THRACE), and her relations with her neighbours were left in a state of tension by the question of the Bulgarian minorities in Thrace, Dobruja and Macedonia.

The Refugee Question.—The Treaties of Bucharest (1913) and Neuilly had left large numbers of Bulgars under foreign rule, which was in most cases extremely harsh and unjust. While those who remained in their homes complained of oppression, large numbers took refuge in Bulgaria, while others were brought in under the exchange of population scheme with Greece. Since 1918 alone 260,000 refugees had entered Bulgaria, mostly from Macedonia and Thrace; and most of these were landless, destitute, and resentful, while the Bulgarian State, with its shattered finances, could do little to relieve their miseries. A large proportion of the population of Bulgaria, refugee or otherwise, was of Macedonian origin, and the powerful and ruthless Internal Organization of the Macedonians, under their capable and terrible leader, Todor Alexandrov (*q.v.*), gained general sympathy in its fight for Macedonian autonomy, and thus formed an underground factor of the first importance in Bulgarian politics. While the Bulgarian delegates to the League of Nations (which Bulgaria joined on Dec. 16, 1920) voiced at every opportunity the grievances of the Bulgarian minorities in Macedonia, Thrace and the Dobruja, the refugee organizations, particularly the Macedonians, raided the territory of Bulgaria's neighbours from their fastnesses in the Bulgarian mountains, and thus helped to perpetuate a state of discord between Bulgaria and her neighbours. The Bulgarian Government was not the least of the sufferers from the situation; and an agreement concluded by Stambolisky with the Yugoslav Government at Nish (March 1923) was believed to contain a clause directed against the Macedonian Committee. Upon this the Macedonians combined with the Bulgarian Nationalists and those of the officers and bourgeoisie who had suffered most from Stambolisky's arbitrary rule. A *coup-d'etat* in the night of June 8/9, 1923, overthrew the Agrarian Government. Stambolisky was killed, most of his ministers imprisoned, and his Orange Guards dispersed.

The Tsankoff Government, 1923-25.—Professor Tsankoff now took office at the head of a government subsequently strengthened by the fusion of all political parties, except the Liberals, Communists and Agrarians, into the single "Democratic Entente." For some time Bulgaria was on the verge of civil war. The Agrarian refugees migrated in large numbers to Yugoslavia, where the government gave them shelter, and allied themselves with the Communists, who with support from Moscow, attempted to bring about a revolution. Tsankoff repressed these movements with great severity. In September several thousand persons were killed, and others imprisoned for long periods without trial. Meanwhile the *Comitadji* warfare on the frontier continued. Relations with Greece, especially, became particularly difficult on account of the severe reprisals taken by that country for an attempted rising in the Maritsa valley in 1923, and an incident at Tarlis on July 26/27, 1924, where a Greek post arrested 70 Bulgars and murdered several of their prisoners. A protocol signed at Geneva between Greece and Bulgaria, on Sept. 29, 1924, which had promised a settlement, was repudiated by Greece at the instance of Yugoslavia. Meanwhile acute dissensions broke out within the Macedonian organization itself, one group of which wanted autonomy for Macedonia, the other a federative scheme. There was a further disagreement as to how far the help of Moscow ought to be accepted. On Aug. 31, 1924 Alexandrov was murdered, and the subsequent reprisals deprived the organization of most of its coherence and moral justification. The Agraro-Communist agitation, too, continued unabated. There were some 200 assassinations in 1924; on April 14, 1925 an attempt was made on the life of King Boris, and General Gheorghiev was killed the next day. At his funeral, which was held on April 16 in the cathedral of Sveta Nedelia, Sofia, a bomb was exploded killing 123 persons and wounding 323. The government proclaimed martial law. Five persons were later hanged publicly for the crime, but a large number were either shot summarily or imprisoned. To maintain order, the government obtained the permission of the Conference of Ambassadors for a temporary increase in its armed forces of 10,000 men; and in fact, its extreme energy prevented any general rising. The Tsankoff Government also successfully survived a fresh frontier incident with Greece, which occurred on Oct. 19, when Greek troops occupied 70 square miles of Bulgarian territory near Petritch. The matter was settled by the League of Nations (*q.v.*) on appeal from Bulgaria. The repressive measures which Tsankoff had felt obliged to take had, however, been more fitted for emergencies than for ordinary times, and as the Agraro-Communist agitation seemed much sobered by the dreadful events of the spring of 1925, Tsankoff resigned on Jan. 2, 1926 in favour of a more conciliatory government under Liaptcheff, a leader of the Democratic party. On Feb. 4 the Liaptcheff government promulgated an amnesty for political offenders, which affected 6,325 persons.

BULGARIAN PEASANT GIRL WEARING HER HAIR BRAIDED AND ORNAMENTED WITH COINS

The Liaptcheff Government and the Refugee Loan.—The effects of this change were most beneficial. The Agrarians were allowed to reconstitute their party in Bulgaria, and the 2,000 or so emigrés who remained in Yugoslavia soon lost credit. The Social Democrats were less fortunate, but even here hostility gradually grew less as Moscow ceased to finance the extreme Communists so liberally.

On June 11, 1926, the council of the League of Nations decided that the state of Bulgaria warranted the grant of a loan, for which application had first been made 18 months previously, for the settlement of the destitute Bulgarian refugees. The question was of supreme importance for Bulgaria, both financially and politically, for it was from among these refugees, with whom the whole population sympathized, that the *comitadjis* were recruited, whose incessant frontier raids so troubled Bulgaria's relations with her neighbours. Following the decision of the League, the Bank of England on Aug. 26 advanced £400,000 for immediate work, which was at once set on foot. An arrangement with the bondholders of Bulgaria's prewar debt was signed on Dec. 11 and the loan, for £2,400,000 nominal in England and $4,500,000 in the United States of America, was floated very successfully on Dec. 26. Bulgaria's neighbours had shown an unjustifiable apprehension regarding the application of the loan funds, and had made fresh outbursts of *comitadji* activity in the summer of 1926 the occasion of a joint note to the Bulgarian government demanding the dissolution of the revolutionary organizations (Aug. 27). This was, indeed, more easy to demand than to fulfil; but there seemed little doubt that Liaptcheff's government was sincerely anxious to restrain the Macedonian and other committees. Bulgaria had been politically almost isolated for more than a decade; a treaty of friendship signed with Turkey on Oct. 18, 1925 was no compensation for continual tension with Yugoslavia, Greece and Rumania. Factors began, however, to tend in favour of a rapprochement. The apprehensions of Yugoslavia were aroused by the conclusion in 1926 of the treaty of Tirana between Italy and Albania; although attempts to improve relations with Bulgaria were frustrated by new Macedonian outrages.

Bulgaria in the '30s.—The last years of the '20s were on the whole outwardly quiet, though tension with Yugoslavia over Macedonia continued. Briand as president of the council of the league gave voice to a suspicion that Bulgaria was not living up to the disarmament clauses of the Treaty of Neuilly. On May 15, 1930, the cabinet of Premier Andrea Liaptcheff was reorganized as a result of a dispute within the Democratic Entente between the premier and his rival Professor A. Tsankoff. The government also undertook measures to suppress the agitation of the secret Macedonian revolutionary organization, the famous I.M.R.O., whose leader Mihaileff was arrested on July 18. In the same year King Boris III married Princess Giovanna, a daughter of King Victor Emmanuel III of Italy. A princess, Marie Louise, was born to the royal couple in 1933, and an heir to the throne, Prince Simeon of Trnovo, was born on June 16, 1937.

In the year 1931 the Liaptcheff cabinet fell on June 21, and after a brief ministry under Alexander Malinoff a new cabinet under the former minister of the interior Nicholas Moushanoff was appointed on Oct. 12, 1931, and reorganized on Dec. 31, 1932. It comprised representatives of the Democratic, Liberal, Agrarian and Radical parties, all four represented in the government coalition, the so-called National Bloc. Outside this bloc which formed the majority, the Parliament contained members of the so-called Liaptcheff Coalition parties, 31 communists, 8 Macedonians and 5 Social Democrats. The year 1932 brought to Bulgaria the full weight of the financial and economic crisis which was then sweeping all over Europe and hitting also the agrarian countries of southeastern Europe. An agrarian conference which was held at Sofia and which was attended by delegates from Bulgaria, Yugoslavia, Rumania, Hungary, Poland and Czechoslovakia, did not bring any relief.

Under these conditions the authoritarian trend noticeable in other Balkan countries made itself felt also in Bulgaria. On May 19, 1934, under military leadership, the ministry was overthrown and King Boris accepted a semidictatorial government under Prime Minister Gueorguiev. The government disbanded all political parties and suppressed their newspapers. A strict censorship was introduced and measures were taken to reduce the indebtedness of the population. The government which represented the so-called Zveno group closed a large number of high schools, as it was afraid of an overproduction of intelligentsia, and organized a national youth organization after totalitarian pattern. The Zveno group under Col. Veltchev lost its influence the following year, when King Boris asserted his authority, and from then on he himself ruled in an authoritarian way with the help of a cabinet headed by Georgi Kiosseivanoff. A new electoral law in Oct. 1937 prohibited all party candidates and fixed the number of seats in the Parliament at 160. A return to democracy was impeded by the disunity of the opposition groups. The dictatorial government succeeded in establishing better relations with Yugoslavia and in easing the tension with Turkey. On Jan. 24, 1937, a treaty of "inviolable peace and sincere and perpetual friendship" was signed with Yugoslavia.

On July 31, 1938, Bulgaria signed a nonaggression pact with the Balkan entente; in exchange it was permitted, officially, to rearm. Bulgaria's revisionists then clamoured for restitution of the country's former frontiers, and the outbreak of World War II in 1939 seemed to offer them some hope. On Feb. 15, 1940, Bogdan Philoff became premier; his pronouncedly pro-German government and King Boris leaned heavily toward the German cause. To tilt Bulgaria completely over to their side, the Germans awarded southern Dobruja to Bulgaria (Sept. 7, 1940) and the government signed (March 1, 1941) the axis tripartite pact; then German troops were permitted to occupy the country and establish bases therein for subsequent operations against Greece and Yugoslavia. In return, Bulgarian troops were later permitted to occupy certain Greek and Yugoslav territories.

The Bulgar government, however, refused to declare war on the U.S.S.R. at the time Hitler attacked the soviet union in 1941. Philoff feared a revolt of the predominantly pro-Russian masses. He did, however, declare war on Great Britain and the United States.

King Boris died mysteriously on Aug. 28, 1943, and a council of regents was appointed to rule until six-year-old Prince Simeon came of age. In 1944, when the victorious soviet armies were entering the Balkans, the Bulgar government broke off relations with Germany and denounced the Axis pact. The soviets suspected the sincerity of this sudden turnabout and declared war on Bulgaria, Sept. 5. Three days later (Sept. 8), Bulgaria, to prove its good faith declared war on Germany. The next day (Sept. 9) it was granted an armistice by the soviet union, following which soviet forces occupied the country. Thereupon, Kimon Georgieff formed a cabinet acceptable to the soviets. (*See* WORLD WAR II.)

In the summer of 1945, a United States protest that Bulgaria's scheduled procedure for popular elections was neither democratic nor free led the Sofia government (Aug. 25) to postpone voting until a more democratic electoral plan could be evolved. The new elections were scheduled for Nov. 18. Another United States demand for postponement to further democratize the electoral procedure was rejected by the Georgieff government and the Fatherland Front, the only slate presented, was voted into power. The opposition charged that Communists dominated the Fatherland Front and that the populace was "terrorized" into voting. The Fatherland Front leaders denied these charges and asserted that the opposition had voluntarily withdrawn long before the election had begun.

The issue of democratic elections in Bulgaria led to sharp controversy within the Big Three, the United States and Britain contending the elections were not democratic and the soviet union insisting that they were. At the Moscow conference in Dec. 1945, the Big Three's foreign ministers agreed that the soviet union was to give "friendly advice" to the Bulgarian government regarding the inclusion of two "truly representative" ministers of the democratic parties not then in the government, provided these representatives were "really suitable" and would work "loyally" with the government. The United States, however, was not satisfied that these conditions were being complied with and reminded the Bulgarian government (Feb. 22, 1946) to broaden its base so as to include opposition members. The soviet union rejoined, March 8, that this memorandum was a "violation" of the Moscow agreement.

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(E. F. B. G.; H. Ko.; X.)

DEFENSE

From the earliest times (A.D. 678) when the Bulgarians, a Slavonian tribe, first established a kingdom, the country has at intervals been the scene of turbulence and bloodshed. After suppression by the Emperor Basil in 1014, the kingdom was reestablished in 1186, but only to be again suppressed and annexed to Turkey in 1396. In modern times a revolution against Turkish rule in 1876 was ruthlessly suppressed. From the date of the war against Serbia in 1885–86, Bulgaria was the scene of constant revolutions and of participation in wars against Balkan neighbours until, in 1915, the Bulgarians seized the opportunity to strike a deadly blow from the rear against the army of their old enemy, Serbia, then engaged against an army of the Central Powers. The Bulgarian army held its own against an Allied army operating from Salonika until the tide had turned definitely in favour of the Allies, when Bulgaria was the first to sue for an armistice (Sept. 29, 1918) which was followed by a peace treaty in which the Allied triumph was embodied.

After the conclusion of the treaty of Neuilly-sur-Seine (Nov. 27, 1919) Bulgaria possessed land frontiers of 1,077 mi. and 163 mi. of coast on the Black sea. Universal compulsory military service was abolished by that treaty, and only voluntary enlistment was allowed The total number of military forces was limited to 20,000, including officers and depot troops. By an agreement signed at Salonika on July 31, 1938, between Bulgaria and the four governments of the Balkan Entente, the military restrictions imposed upon Bulgaria by the treaty of Neuilly were removed.

See also *Treaty of Peace between the Allied and Associated Powers and Bulgaria*, and Protocol. Treaty Series 1920, No. 5; League of Nations *Armaments Yearbook, 1928.*

ECONOMICS AND TRADE

Bulgaria consists of two mountain ranges, the Balkans and the Rhodopes, and two valleys. The Balkans run just north of her central line, almost due east and west, and the Rhodopes, breaking off from them on Bulgaria's western frontier, curve round in a southeasterly sweep until they straighten out again so as to run almost parallel with the Balkans above them. Between these two ranges is enclosed the valley of the Maritsa, which gradually widens out toward the Black sea as the Maritsa leaves it and twists southward to its outlet at Dedeagatch. As a result largely of the mountainous character of the country the proportion of the total area (39,825 sq.mi.) used for agricultural purposes is only about 43%. About a third of the area is covered by forest and about 26% is wholly unproductive. But of this forest land a large part is unproductive scrub, and many of the real forests are inaccessible. Indeed, the wood imports into Bulgaria exceed her exports. The area immediately available for the production of wealth in Bulgaria is, therefore, small, and although the soil in certain districts is extremely rich the agricultural production and the wealth of the country are both low. Over 80% of the population are engaged in agricultural pursuits, and such industries as exist (flour milling, spinning and weaving, cigarette manufacture, etc.) are relatively unimportant.

Agriculture.—Until 1879 Bulgaria was under Turkish domination. Between 1911 and 1918, with but brief intervals, she was at war. The land, except the communal pastures and the forests, is owned by the peasants, and there are no large holdings. As a result of these facts the system of agriculture in Bulgaria remains extremely primitive. A large proportion of the ploughs used are made of wood; corn is usually sown by hand; artificial fertilizers are not used, and farm manure only to a very restricted extent.

Before the War of 1914–18, wheat was at once the most important agricultural product and article of export. In 1910 over a million hectares were devoted to its cultivation; the crop amounted to 1,148,000 metric tons, and exports, including wheaten flour, to about 300,000 metric tons. Great changes followed the war. Between 1910 and 1923 the area under cereals dropped by 13%, while that devoted to tobacco rose from 7,800 to 60,000 hectares. Before the treaty of Bucharest the tobacco industry in Bulgaria was of quite minor importance. The rapid increase in prices during the war, however, stimulated its cultivation, and after the armistice, Bulgaria seized the opportunity which the continuation of hostilities between Greece and Turkey afforded her, and rapidly expanded the acreage devoted to tobacco. Her postwar economic recovery must largely be attributed to this fact. But after the final settlement at Lausanne of the war between Turkey and Greece, and the revival of these two countries as producing areas, the supply of oriental tobacco became excessive, and the acreage under this crop in Bulgaria had sunk by 1927 to 26,000 hectares. As the tobacco area shrank more land was devoted to cereals, cotton, sugar beet and other industrial crops, more especially oleaginous plants. But the area under cereals in 1927 was still 6% lower than in 1910. Meanwhile the population grew, partly on account of the immigration of refugees, from 4,338,000 in 1910 to 6,370,000 in 1940.

The yield of wheat amounted in 1938 to 2,149,674 metric tons, of which the export amounted to 360,657,000 leva. This shows a constant rise as against a yield of 985,848 metric tons in 1923, 1,337,740 metric tons in 1928 and 1,309,758 in 1932. A similar rise was noticeable in the value of the exports. The total yield of cereals (of which the most important were, besides wheat: rye, barley, oats and maize) in 1938 was 3,312,490 metric tons, as compared with 2,544,968 in 1923, 2,623,012 in 1928 and 2,821,699 in 1932.

While the yield from wheat increased considerably, the yield from tobacco decreased. It amounted in 1937 to 35,379 metric tons from an area of 100,675 ac. The exported value amounted to 2,363,933,000 leva. In 1923 the area amounted to 141,197 ac., with a yield of 51,269 metric tons. Cotton yielded, in 1937, 101,913 quintals from 124,520 ac. Sugar production amounted in the same year to 27,910 metric tons from an area of 25,908 ac. The production of silkworm cocoons was 1,640,128 kilos valued at 74,558,000 leva.

Of still greater importance, however, are the attempts which are being made to increase the production per hectare by the introduction of modern machinery, the improvement of methods of agriculture, the establishment of model farms and the improvement of stock by crossbreeding.

Owing to the configuration of the land, Bulgaria is well adapted for a mixed system of agriculture, the mountain slopes affording adequate pasturage for a considerable head of beasts. Her herds and flocks are in fact large, and she has more sheep in proportion to her population than any other country in Europe. The census of 1934 gave 531,500 horses, 1,497,600 cattle, 8,839,500 sheep, 913,000 goats, 902,000 pigs. The export of live animals in 1938 amounted to 199,758,000 leva.

Industry and Mining.—As already stated, the industries in Bulgaria are of minor importance, and with three exceptions—the preparation of tobacco leaf, the distillation of attar of roses and flour milling—they are confined to the domestic market. On Jan. 1, 1938 there were in Bulgaria 3,089 industrial undertakings, large and small, in operation. But the peasant himself supplies most of his own requirements, spinning and weaving his own textiles and making his own shoes.

Although the country is reported to be rich in minerals, the only mines of importance are those of soft coal, which are almost all owned by the state. Of the total output in 1937, viz., 1,852,544 metric tons, only 340,024 metric tons were extracted from private mines. The total production is adequate to meet the needs of the country and even to allow a small surplus for export when prices are favourable. In addition, small quantities of aluminium and salt are mined.

Trade.—The international trade of Bulgaria necessarily consists of the exchange of agricultural products for cheap manufactures. Just under one-third of her imports consists of textiles, mainly for the town population, and about one-third of machinery—largely agricultural—and other manufactures of metals. The composition of her exports has undergone considerable changes owing to the increase in the importance of tobacco and the falling-off in the available supply of cereals. In 1910 cereals accounted for nearly 60% of the total exports by value, and in 1924–26 for only about 33%. The most important drop was in wheat, from about 30% to 5% or less. On the other hand tobacco leaf, which in 1910 represented less than 2%, amounted in 1924 to 32%, in 1925 to 41% and in 1926 to 37% of total values.

In the year 1938 the total imports amounted to 4,934,193,000 leva, and the total exports to 5,578,341,000 leva. Of the total imports 27% were machinery, iron bars, motor cars, etc., and 11% were textiles (cotton, wool, yarns). Among the exports tobacco held by far the first place, and was responsible for 42.3%; second place was held by eggs, 7.8%; the third place by wheat, 6.4%; followed by live animals, maize, prunes and attar of roses.

Public Finance.—In 1936 the total revenue of the Bulgarian government amounted to 7,965,155,000 leva. The expenditure was 7,642,819,000 leva. The total internal debt of Bulgaria stood, on June 30, 1939, at 8,805,687,000 leva; the total consolidated and non-consolidated foreign debt was at the same time 12,945,525,685 leva.

The Bulgarian currency, based upon the lev, which was equivalent to the gold franc or 19.3 cents, was much depreciated after the war of 1914–18. In 1928 the lev was revaluated at $.0072. The country had been badly affected by the fall in the prices of the agricultural products and the general economic difficulties which characterized the period. Vigorous measures were taken to increase revenue, to reduce expenditure and to re-establish the finances on a sound basis.

According to the settlement reached in March 1923, the reparations debt of Bulgaria was fixed at 2,250,000,000 gold francs, divided into two blocks. Block B, which is by far the greater, amounting to 1,700,000,000 gold francs, was to bear no interest and on it no payments were due until April 1953. Payments on account of Block A were to rise from 10,000,000 gold francs in the year 1927–28 slowly to 43,400,000 in yearly payments.

In 1926 a loan was raised of £3,300,000 for the settlement of the refugees from neighbouring lands, a general scheme of settlement having been elaborated by the League of Nations. This scheme differed from the parallel undertaking in Greece inasmuch as the majority of the refugees were placed in existing villages and not in new colonies. Their gradual return to production did much to accelerate the economic development of the countryside.

The Economic Mechanism.—In a country divided by mountain ranges, with relatively sparse railway connection and bad roads, with a peasant population which has not yet enjoyed half a century of independent national life, economic progress must necessarily depend largely on the tutelary activity of its government, and the economic mechanism is likely therefore to be state-controlled. So in Bulgaria the railways and the coal mines belong to the state, and the two most important credit institutions, the National bank and the Agricultural bank, as indeed also the Co-operative bank, are state institutions. The National Bank of Bulgaria, with a capital of 500,000,000 leva, disposed on Jan. 15, 1939, of 2,006,000,000 leva in gold and other assets of 5,525,000,000 leva. The note circulation on the same date amounted to 2,694,000,000 leva. The Agricultural bank supplies credit against crops, stock or personal guarantee to the peasants or the agricultural co-operative societies, having a considerable number of branches scattered throughout the country. Its capital is 760,000,000 leva. On Jan. 11, 1922, the Bulgarian International bank was founded, with an original capital of 75,000,000 leva, to facilitate and encourage international trade. It was amalgamated in 1935 with the Bulgarian United banks under the name Bulgarian Credit bank. The Central Co-operative bank, founded in 1910, centralized the credit activities of the institutions dealing with the productive and wholesale co-operative societies. The Agricultural bank and the Central Co-operative bank were fused at the end of 1934 into the Bulgarian Agricultural and Co-operative bank. (H. Ko.)

BULGARIA, EASTERN, formerly a powerful kingdom which existed from the 5th to the 15th century on the middle Volga, in the present territory of the provinces of Samara, Simbirsk, Saratov and North Astrakhan, perhaps extending also into Perm. The village Bolgari near Kanzañ, surrounded by numerous graves in which most interesting archaeological finds have been made, occupies the site of one of the cities—perhaps the capital—of that extinct kingdom. The history, *Tarikh Bulgar*, said to have been written in the 12th century by an Arabian cadi of the city

Bolgari, has not yet been discovered; but the Arabian historians, Ibn Foslan, Ibn Haukal, Abul Hamid Andalusi, Abu Abdallah Harnati, and several others, who had visited the kingdom, beginning with the 10th century, have left descriptions of it. The Bulgars of the Volga were of Turkish origin, but may have assimilated Finnish and, later, Slavonian elements. In the 5th century they attacked the Russians in the Black sea prairies, and afterwards made raids upon the Greeks. In 922, when they were converted to Islam, Ibn Foslan found them not quite nomadic, and already having some permanent settlements and houses in wood. Stone houses were built soon after that by Arabian architects. Ibn Dasta found amongst them agriculture besides cattle breeding. Trade with Persia and India, as also with the Khazars and the Russians, and undoubtedly with Biarmia (Urals), was, however, their chief occupation, their main riches being furs, leather, wool, nuts, wax and so on. After their conversion to Islam they began building forts, several of which are mentioned in Russian annals. Their chief town, Bolgari or Velikij Gorod (Great Town) of the Russian annals, was often raided by the Russians. In the 13th century it was conquered by the Mongols, and became for a time the seat of the khans of the Golden Horde. In the 15th century Bolgari became part of the Kazañ kingdom and was annexed to Russia after the fall of Kazañ. (P. A. K.)

BULGARIAN LANGUAGE: *see* SLAVONIC LANGUAGES and OLD SLAVONIC.

BULGARIAN LITERATURE. Literature, in the sense of free artistic creation, dates in Bulgaria from the second half of the 19th century. During the first half of the 19th century and part of the second half, a considerable number of writers and publicists devoted their lives and their works to the ideal of national re-birth. Of these, four stand out, in virtue of the quality of their literary work, of their practical activities, and of the importance of their achievements, which far transcended the narrow bounds of their time. Both as poets and as publicists, they laid the foundations of Bulgaria's national life, and later, after the liberation of Bulgaria, they became figures of popular veneration. These four men were G. S. Rakovski, L. Karavelov, C. Botev (*q.v.*) and P. R. Slaveikov.

The influence of the social and political conditions of their day, with its absence of any personal or national liberty, combined with that of certain Russian ideological tendencies, taught these writers to believe that literature should be subordinated and adapted to the needs of social life. Thus their poems and dramas, with very few exceptions, attack a definite social problem. Their inner lives and the technique of their poetical work were, for them, of secondary importance.

Karavelov laid the foundations of Bulgarian narrative prose. His genius created types which have excited the admiration of readers from the Liberation down to the present day, and are still imitated by later writers. Botev, one of the most brilliant of Bulgarian poets, set the Bulgarian nation the example of the most sublime devotion in the name of love of liberty and of his native soil. Of all the Bulgarian poets ("bards"), it was he who produced the best and the most fiery revolutionary songs; of all the revolutionary poets he accomplished the most noble and glorious feat: at the head of an armed band he crossed the Danube, after seizing the Austrian ship "Radetzky"; then he marched to the mountains of Vratsa to die there fighting against Turkish troops.

P. R. Slaveikov enriched Bulgarian literature with the treasures of national poetry, whose wealth he first revealed. His works were based on popular tradition and folk-lore. He was the father of the Bulgarian epic.

The liberation of Bulgaria in 1878 undoubtedly altered political and social conditions, and created an atmosphere infinitely more favourable to literary production than the era of Turkish domination had afforded. Towards the end of the second half of the century, Bulgaria had achieved complete stability as a State. At this time the country contained a considerable intellectual class, fitted for special work in every branch of intellectual and political life. Writers felt themselves released from their former duty of keeping literature the handmaid of civic training; they began to devote themselves to pure poetic meditation.

The Work of Vasov.—Ivan Vasov is the most typical, most popular and most productive of the Bulgarian writers who by their lives and works linked together the two epochs which respectively preceded and followed the revolution. He is known far beyond the frontiers of Bulgaria. His best novel, *Under the Yoke*, has been translated into almost every European language. During 50 years of literary activity (he lived 72 years, 1850–1922), Vasov excelled in every branch of literature. His immense output reflects every aspect of his nation's life. From his first poem *The Pine*, which appeared in 1870, a few years before the Liberation, down to his last collection of verse, *My Lilac's Fragrance*, which appeared in 1920, Vasov's lyrics are made up of an infinite variety of tones; echoes of the sorrows and the joys of a people's soul. Vasov hardly lived a life of his own. He feels his personality melt in the collective griefs and life of his nation. Thus social aspiration is an essential and characteristic feature of his lyric poetry. Vasov's epic work—stories, poems, sketches, novels—is immense in quantity and embraces Bulgarian national life in all its manifestations and in every age. His most characteristic novels, which show both his literary qualities and his creative tendencies, are *Under the Yoke*, *New Land* and *The Queen of Kazalar*. The subject matter of these novels represents the three most important moments in the history of the Bulgarian people's political and spiritual life. *Under the Yoke* gives us a vivid, attractive and impressive picture of the struggle of the Bulgars against the Turk. The principal hero of the novel is an intellectual and revolutionary, who devotes his life to the supreme end of lighting the torch of insurrection in the soul of the people. *Under the Yoke* is both a work of art and a faithful picture of the political situation, of social and family life, in Bulgaria at the most decisive moment of its history. Vasov's second and third novels, which are considered his best, thus illustrate the three successive stages of modern Bulgarian history. The few details of Bulgarian life not depicted in them are represented in his numerous short stories, poems and sketches. Vasov understood, however, that the aim which he had set himself, of reproducing a picture of Bulgarian life in its entirety, could not be achieved if he confined his writings to modern times. He therefore delved into tradition and resurrected the past of Bulgaria, before the coming of the Turk, in a series of dramas. While his primary aim was to present all Bulgarian history in his dramas, he set himself at the same time to teach the present a lesson through the past. Throughout his work, Vasov pursued the practical goal of showing a moral, social and national example. In this respect he maintained the tradition of national poetry bequeathed by the age which preceded the Liberation. The best known of his dramas are *Towards the Abyss*, *Borisslav* and *Ivailo*.

S. Michailovsky, who died in 1927, was Vasov's contemporary and spiritual brother. Without equalling the other's versatile genius or his imaginative power, Michailovsky was yet distinguished by remarkable insight, depth and wealth of thought, through which he expressed the ambitions of his ardent nature. He was Vasov's spiritual brother in so far as he, too, if in a different literary manner, devoted his talents to raising Bulgaria's spiritual life. Michailovsky in his satires scourged vice to show nobility and virtue rising triumphant. Educated in France, he was master of the subtleties of French literature and philosophy. His knowledge of French 17th and 18th century rationalism may have influenced his mind, which was often troubled by doubt. Towards the end of his life, this led to a Christian mysticism. His lay sermons are the product of this latest phase. Among his most important works are *Novissima Verba*, *The Book of the Bulgarian People*, and *To-day Hammer, To-morrow Anvil*. Among the other notable contemporaries of Vasov and Michailovsky may be mentioned Aleko Constantinov, author of a well-known and most humorous work, *Bai Gagno*, depicting the typical Bulgarian peasant, and Constantine Velitchkov, who, through his translations of Dante, Petrarch, Silvio Pellico and others, opened up to the intellectual world of Bulgaria the wealth of Latin and Italian poetry.

An Artistic Revival.—As was said above, from the '90s of the past century, Bulgarian literature shows two tendencies. First we have writers like Vasov, who have their roots in the literary tendencies of the pre-Liberation period; then the younger school, inspired by a burning desire to make a clean sweep of this slavery, to create work unencumbered by any moral, political or social tendencies. In the short story, Anton Strachimirov, P. U. Todorov, G. Stamatov and Eline-Peline have attained considerable success. Strachimirov studies the intimate life of certain social groups (artisans and peasants), analyses their relations to social evolution as a whole, and thus shows us persons leading a more or less individual life with their daily cares and daily joys. This writer later began to work on a broader scale, and gave us some novels which are considered, and rightly, to be among the better contemporary Bulgarian works. The national catastrophe resulting from the World War brought a certain disarray into his fiery soul, which was evidenced by the hurried novels which he produced after it. A. Strachimirov also produced several dramas which showed incontestable artistic qualities. The best known of his works are: *Autumn Days, A Meeting, Mother-in-Law, Beyond* and *The Vampire.* Eline-Peline has chosen to display his talents in a still narrower field: that of peasant life. He shows us characters which are at the same time true to life and softened by their creator's deep love for them. His latest work, which is of indisputable importance, is his story *The Earth;* both in subject and treatment this work is more local than universal. In his later period Eline-Peline has written chiefly children's songs and stories. He is considered to-day the most popular writer in this field. P. U. Todorov is at once the originator and the master of the Bulgarian short idyll. He borrowed his subjects from popular legends, but made them turn round psychological and human conflicts of interest to all. He also wrote numerous charming symbolical dramas, which were based on ancient, popular myths. Apart from the delicacy of his poetic touch, the chief characteristic of his work is his feeling for harmony and rhythm. He died young, before his talent had fully developed. His chief works are: *Idylls* (collected), *The Dragon's Marriage* and *The First.* Georgi Stamatov is an original psychologist and a realist with clearly marked leanings towards naturalism. In his numerous short stories he exposes vice with unusual power. The problem of sex occupies his mind particularly. His style charms us by an indefinable quality which ranges from light humour to the most biting irony. The first aim of these four writers in their artistic output was to express, above all things, truth and pure "poetry"—pure, that is, and unencumbered by any extraneous matter. This is the particular quality which distinguished them from Vasov. In lyric poetry, Pentcho Slaveikov, son of the P. R. Slaveikov mentioned above, set out to conquer the Liberation—spiritually speaking—by works of the most perfect technique. Some years before his death in 1912 foreign admirers were already considering his work with a view to the possible award of the Nobel prize. His poems are works of art sublimely woven on a canvas either profoundly national or simply human (*see* his *Ralitsa* and his *Boiko*), or universal moral conflicts, as *Chelli, Symphonies of Despair, Consoled,* etc. His greatest work, which achieves a degree of magic unapproached in Bulgarian literature, is his poem called *A Song of Blood.* This is the artistic expression of the most dramatic moment in Bulgarian history. Slaveikov is the first and the most powerful of the Bulgarian poets who in their poetry have truly followed a path emancipated from any influence of social tendencies. He was neither directly lyrical to an exaggerated degree nor exclusively individualist. His themes are always treated with a feeling as deep as it is fanatical for poetry and beauty, whether they are drawn from the eternal problems which perplex the human soul, or whether they spring from those born of national life. Slaveikov died in Italy in 1912. His chief works are: *Dream of Happiness, In the Island of the Blessed, Epic Songs* and *A Song of Blood.*

Poetry of the New Age.—P. K. Yavorov, one of the most brilliant Bulgarian lyric poets, was a younger contemporary of Slaveikov. His eyes remained fixed for ever on the life of his own soul, where the purest, but also the most violent, emotions mingled, giving birth to sublime suffering. The increasing intensity of his spiritual development can be clearly traced in his work. He began with humanitarian pity of his fellow-men to end in stormy and proud solitude. In 1902, at the moment when his great popularity had been sealed by solemn critical appreciation, Yavorov, like Botev, to whom he shows close affinities, bore his distracted dreams to the mountains of Macedonia, to sacrifice his work, his thoughts and his emotions on the altar of the Macedonian revolutionary movement. The wealth of his lyric motifs, the depth of his feeling, the sincerity and moving force of his expression make him the lyricist of the new age, and also its best loved poet. In a mystic longing towards union beyond the grave with the soul of her who, first in life, and then in death, drew him irresistibly to her, Yavorov ended his life at the beginning of 1914. His chief works are: *Poems, Waking Nights,* and *In the Shadow of the Clouds; At the Foot of Vitos* and *When the Thunder Growls* (dramas) and *A Heyduk's Hopes* (sketches of comitadji life). Cyril Christoc, a contemporary of Slaveikov, is a lyric poet who, owing to a weak heart, has been forced to live outside Bulgaria. He is master of sentimental, light and frivolous verse. The glorification of gay and careless life sings through his rhymes. His style is technically admirable for its suppleness, its vivacity and its lightness. His works include *Shadows of the Evening, Vibrations, Songs and Sighs,* etc. In more recent times a great number of writers and poets have been working with enthusiasm in the fields of lyric poetry, the short story and the novel, and revealing not only a new sense of literature, but also new forms. To-day the doors have been thrown wide open to the influence of the literatures of Western Europe. This influence is particularly apparent in the work of some of the younger lyric poets of Bulgaria. Under it a special school of the lyric has been developed with success by Nicolai Liliev, Todor Trainavov, Dimtcho Debelianov and Ludmil Stoyanov. Since about 1915 or 1920 these four poets, each with his particular qualities and potentialities, have represented the advance-guard of Bulgarian poetry. The work of this group of lyricists is marked by a purely individual sensibility, which sometimes gives rise to awkward and bizarre forms, new colours, new assonances and new groupings of words in the verse, new rhyme-schemes, and in general, new motifs, in opposition to the tradition.

In the work of two young Bulgarian women, Dora Gabe and Elisabeth Beltcheva, we find simplicity in the artistic sense of the word; that is to say, an absence of any searching or straining after artificial importance in choice of subject; originality in form; limpidity and sincerity pushed to the point of candour. A whole group of young poets, among whom we may mention Stoubel, Pantaleyev, Raztzvetnicov and others, are following in the footsteps of the writers whom we have already mentioned. Among the most talented writers of fiction, we should mention Jordan Yovcov, Dobre Nemirov, Georgi Ratchev, Nicolai Rainov and C. Constantinov. Rainov is a visionary by nature, and his work shows leanings toward mystic fantasy, and Ratchev sketches for choice the rare mental situations, which give his tales a naturalistic and sardonic character; the other three pursue a path of artistic realism. They portray scenes drawn from simple everyday life. Of the very young prose writers whose talent is undeniable, we should mention A. Karailyatchev and V. Polianov. (J. Br.)

BULGARUS, an Italian jurist of the 12th century, born at Bologna. He was sometimes erroneously called Bulgarinus, which was properly the name of a jurist of the 15th century. He was the most celebrated of the famous "Four Doctors" of the law school of the University of Bologna, and was regarded as the Chrysostom of the gloss-writers, being frequently designated by the title of the "Golden Mouth." He died in A.D. 1166, at a very advanced age. Martinus Gosia and Bulgarus were the chiefs of two opposite schools at Bologna, corresponding in many respects to the Proculians and Sabinians of imperial Rome, Martinus being at the head of a school which accommodated the law to what his opponents styled the equity of "the purse" (*aequitas bursalis*), while Bulgarus adhered more closely to the letter of the law. The school of Bulgarus ultimately prevailed, and it numbered among its adherents Joannes Bassianus, Azo and Accursius, each of whom in his turn exercised a commanding influence over the course of legal studies at Bologna. Bulgarus took the leading part among the Four Doctors at the Diet of Roncaglia in 1158 and was one of the most trusted advisers of the Emperor Frederick I. His most celebrated work is his commentary *De Regulis Iuris*, which was at one time printed among the writings of Placentius, but has been properly reassigned to its true author by Cujacius, upon the internal evidence contained in the additions annexed to it, which are undoubtedly from the pen of Placentius.

BULL, GEORGE (1634–1710), English divine, was born at Wells and educated at Tiverton school and Exeter college, Oxford. He had to leave Oxford in 1649 as he refused to take the oath of allegiance to the Commonwealth. He was ordained privately by Bishop Skinner in 1655, and, after holding various preferments, became in 1705 bishop of St David's. During the time of the Commonwealth he adhered to the forms of the Church of England, and under James II. preached strenuously against Roman Catholicism. His *Defensio Fidei Nicenae* (1685) tries to show that the doctrine of the Trinity was held by the ante-Nicene fathers of the church, and retains its value as a thorough-going examination of all the pertinent passages in early church literature. His other works include: *Harmonia Apostolica* (1670), *Judicium Ecclesiae Catholicae* (1694), and *Primitiva et Apostolica Traditio* (1710).

The best edition of Bull's works is that in 7 vols. published at Oxford by the Clarendon Press, under the superintendence of E. Burton, in 1827. This contains the *Life* by Robert Nelson. *The Harmonia, Defensio* and *Judicium* are translated in the Library of Anglo-Catholic Theology (1842–55).

BULL, JOHN (*c.* 1562–1628), English composer and organist, was born of a Somersetshire family about 1562. After being organist in Hereford cathedral, he joined the Chapel Royal in 1585 and in the next year became a Mus. Bac. of Oxford. In 1591 he was appointed organist in Queen Elizabeth's chapel in succession to Blitheman, from whom he had received his musical education. In 1592 he received the degree of doctor of music at Cambridge university; and in 1596 he was made music professor at Gresham college, London. As he was unable to lecture in Latin according to the foundation-rules of that college, the executors of Sir Thomas Gresham made a dispensation in his favour by permitting him to lecture in English. In 1601 Bull went abroad. He visited France and Germany, and was everywhere received with the respect due to his talents. Anthony Wood tells an impossible story of how at St. Omer Bull performed the feat of adding, within a few hours, forty parts to a composition already written in forty parts. Honourable employments were offered to him by ntal bu he declined the returned to England, where he was given the freedom of the Merchant Taylors' Company in 1606. He played upon a small pair of organs before King James I. on July 16, 1607, in the hall of the company, and he seems to have been appointed one of the king's organists in that year. In the same year he resigned his Gresham professorship, and married Elizabeth Walter. In 1613 he again went to the continent on account of his health, obtaining a post as one of the organists in the archduke's chapel at Brussels. In 1617 he was appointed organist to the cathedral of Notre Dame at Antwerp, and he died in that city on March 12, 1628. Little of his music has been published, and the opinions of critics differ much as to its merits (*see* Dr. Willibald Nagel's *Geschichte der Musik in England*, ii. (1897), p. 155, etc., and Dr. Seiffert's *Geschichte der Klaviermusik* (1899), p. 54 etc.). Contemporary writers speak in the highest terms of Bull's skill as a performer on the organ and the virginals, and there is no doubt that he contributed much to the development of harpsichord music. Jan Sweelinck (1562–1621), the great organist of Amsterdam, did not regard his work on composition as complete without placing in it a canon by John Bull. For the ascription to Bull of the British national anthem, *see* NATIONAL ANTHEMS.

Most of John Bull's work which has been preserved is still in ms., but some of his compositions appear in Leighton's *Teares or Lamentacions* (1614), and in the *Fitzwilliam Virginal Book* (Breitkopf and Härtel, Leipzig, 1899).

BULL, JOHN: *see* JOHN BULL.

BULL, OLE BORNEMANN (1810–1880), Norwegian violinist, was born in Bergen, Norway, on Feb. 5, 1810. He was sent to Christiania (now Oslo) to study theology, but his time was given instead to music and to political agitation. In 1829 he went to Cassel, on a visit to Spohr, who, however, gave him no encouragement. After a brief period of study at Göttingen and a visit to Norway during which he played at many concerts, he went to Paris. There he heard Paganini play and began a course of hard work in the hope of rivalling his virtuosity. Although he had been largely self-taught he acquired a wonderful technique and speedily achieved world-wide fame by his brilliant playing of his own pieces and arrangements. His first visit to the United States lasted from 1843 to 1845, and on his return to Norway he formed a scheme for the establishment of a Norse theatre in Bergen. This became an accomplished fact in 1850; but in consequence of harassing business complications he went again to America. During this visit (1852–57) he bought 125,000 acres in Potter county (Penn.), for a Norwegian colony, which was to have been called Oleana after his name, but his title turned out to be faulty and the troubles which resulted seriously affected his health. He died at Lysö, near Bergen, on August 17, 1880. Ole Bull never sought to play serious music, but he delighted all hearers by his brilliant rendering of the virtuoso works in which he excelled and also by his expressive playing of national airs.

See Sarah E. Bull, *Ole Bull, a Memoir* (1886).

BULL. (1) The male of animals belonging to the subfamily Bovinae of the family Bovidae (*q.v.*), particularly the uncastrated male of the domestic ox. (*See* CATTLE.) The word is also used of the males of other large animals such as the elephant, whale, etc. The O.E. diminutive form *bulluc*, a young bull, survives in bullock, now confined to a young castrated male ox kept for slaughter.

The term "bull's eye" is applied to many circular objects and particularly to the boss or protuberance left in the centre of a sheet of blown glass, which was formerly used for windows in small leaded panes (*cf.* French *œil de bœuf*, a circular window). Other circular objects to which the word is applied are the centre of a target, a plano-convex lens in a microscope, a lantern with a convex glass, a thick circular glass let into the deck or side of a ship for lighting, a ring-shaped block grooved round the outer edge, with a hole through which a rope can be passed, and a small lurid cloud which in certain latitudes presages a hurricane.

(2) The use of the word "bull," for a verbal blunder, involving a contradiction in terms, is of doubtful origin. It is used with a possible punning reference to papal bulls in Milton's *True Religion*, "and whereas the Papist boasts himself to be a Roman Catholick, it is a mere contradiction, one of the Pope's Bulls, as if he should say a universal particular, a Catholick schismatick." Although modern associations connect this type of blunder with the Irish, the early quotations show that in the 17th century, no special country was credited with them.

(3) *Bulla* (Lat. for "bubble") was the term used by the Romans for any boss or stud, such as those on doors, sword-belts, shields, and boxes. It was applied, more particularly, to a round or heart-shaped box, generally of gold, containing an amulet, worn suspended from the neck by children of noble birth until they assumed the *toga virilis*, when it was hung up and then dedicated to the household gods of the Etruscans. The custom of wearing the bulla as a charm against sickness and the evil eye was of Etruscan origin. After the Second Punic War all children of free birth were permitted to wear it. Its use was only permitted to grown-up men in the case of generals who celebrated a triumph. Young girls and even favourite animals also wore it. (*See* Ficoroni, *La Bolla d'Oro*, 1732; Yates *Archaeological Journal*, vi., 1849; viii., 1851.) In ecclesiastical and mediaeval Latin, *bulla* denotes the seal of oval or circular form, bearing the name and generally the image of its owner, which was attached to official documents. The best-known instances are the papal *bullae*, which have given their name to the documents (bulls) to which they are attached. (*See* DIPLOMATIC; SEALS; CURIA ROMANA; GOLDEN BULL.)

(4) "Bull" is also a term used in speculative markets, such as the Stock Exchange, to describe a speculator who buys in the hope of a rise in prices. The term is usually applied, not to those who buy and pay for stock but to those who buy "for the account" in the hope that a rise will take place before the settle-

ment, so that they can sell out at a profit without actually paying for their purchase. Thus, on the London Stock Exchange, where the settlements are fortnightly, this involves speculating for a rise within the fortnight, and when settling day comes the "bull" has either to sell, taking his marginal profit or meeting his marginal loss, or pay a rate for continuation into another fortnightly account. (*See* STOCK EXCHANGE; SETTLEMENT; CONTANGO.)

BULLARD, ROBERT LEE (1861–), American soldier, was born at Youngsboro, Ala., on Jan. 15, 1861. He graduated from West Point military academy in 1885 and was appointed first lieutenant in 1892. He served in various capacities in the Spanish-American War, and in the Philippines from 1902 to 1904. He was made lieutenant-colonel in 1906. In 1907 he was special investigator for the U.S. Provisional Government in Cuba, and the following year was superintendent of public instruction there. In 1911 he was promoted colonel, and in 1917 brigadier-general. He commanded the 2nd Brigade of the 1st Division of the American Expeditionary Force in France in 1917, and was made major-general, National Army. From the middle of Dec. 1917 to the middle of July 1918 he commanded the 1st Division; and from Oct. 1918 to the following July the II. Army. In Nov. 1918 he was appointed major-general in the regular army. At the opening of the second battle of the Marne, July 1918, which marked the turning-point of the war, Bullard wrote the message concluding with the words, "we are going to counter-attack." In 1925 he retired from active service. Besides numerous articles in magazines and military journals he wrote *Personalities and Reminiscences of the War* (1925).

BULLA REGIA, ancient city of Numidia, near modern Souk-el-Arba, on the railway between Tunis and the Algerian frontier. It was formerly the residence of the kings of Numidia. Under the Roman empire it was on the road from Carthage to Hippo Regius, and received benefits from various emperors, notably Hadrian. A theatre, a temple of Apollo facing on to a large courtyard, and some well-preserved houses have been found.

See A. Merlin, *Le Temple d'Apollon à Bulla Regia* (1908).

BULLEN, ARTHUR HENRY (1857–1920), British man of letters, was born in London on Feb. 9, 1857 and educated at the City of London school and Balliol college, Oxford. He was the son of George Bullen, sometime keeper of the printed books at the British Museum. He was an authority on 16th and 17th century literature, and discovered many lost poems of the period in the Bodleian and Christ Church libraries at Oxford; his greatest achievement was the rediscovery of Thomas Campion in 1889 after nearly 300 years of neglect (*see* CAMPION, THOMAS). For several years he was a partner in the publishing house of Lawrence and Bullen, and after its dissolution founded the Shakespeare Head Press at Stratford-on-Avon in 1904, which was sold to B. H. Blackwell of Oxford after his death. He died at Stratford-on-Avon on Feb. 29, 1920.

BULLER, CHARLES (1806–1848), English politician, born in Calcutta on Aug. 6, 1806; was educated at Harrow, then privately in Edinburgh by Thomas Carlyle, and afterwards at Trinity college, Cambridge. He sat in parliament from 1830 until his death in London on Nov. 29, 1848. An eager reformer and a friend of John Stuart Mill, Buller went to Canada with Lord Durham in 1838 as private secretary, and was for a long time supposed to have written Lord Durham's famous *Report on the Affairs of British North America.* It certainly shows signs of his influence. Buller was made judge-advocate-general in 1846 and became chief commissioner of the Poor Law about a year before his death. Buller was witty, popular, and generous, and is described by Carlyle as "the genialest radical I have ever met."

See T. Carlyle, *Reminiscences* (1881); S. J. Reid, *Life and Letters of the 1st earl of Durham* (1906).

BULLER, SIR REDVERS HENRY (1839–1908), British general, was born on Dec. 7, 1839, at Downes, Crediton, Devon, of a family settled in Cornwall for three centuries. He was educated at Eton, entered the army in 1858, and served with the 60th (King's Royal Rifles) in the China campaign of 1860. In 1870 he became captain, and went on the Red River expedition, where he was first associated with Colonel (afterwards Lord) Wolseley. In 1873–74 he accompanied the latter in the Ashantee campaign as head of the intelligence department. He served in the Kaffir War of 1878–79 and the Zulu War of 1879, and in the retreat at Inhlobane (March 28, 1879) he earned the V.C. In the Boer War of 1881 he served as Sir Evelyn Wood's chief of staff. In 1882 he was head of the field intelligence department in Egypt. In 1884 he commanded an infantry brigade in the Sudan under Sir Gerald Graham, and was at the battles of El Teb and Tamai, being promoted major-general for distinguished service. In the Sudan campaign of 1884–85 he was Lord Wolseley's chief of staff, and commanded the desert column when Sir Herbert Stewart was wounded. He distinguished himself by his conduct of the retreat from Gubat to Gakdul, and by his victory at Abu Klea (Feb. 16–17) and he was created K.C.B. In 1886 he was sent to Ireland to inquire into the "moonlighting" outrages, and for a short time he acted as under-secretary for Ireland; but he was too much in sympathy with the Irish peasants to find the position tolerable, and on Oct. 15, 1887 he was appointed quartermaster-general at the war office. In 1896 he was made a full general. From 1890 to 1897 he held the office of adjutant-general, being made lieutenant-general in 1891.

In 1898 he commanded the troops at Aldershot, and when the Boer War broke out in 1899 he commanded the South African field force (*see* SOUTH AFRICAN WAR), and landed at Cape Town on Oct. 31. Owing to the Boer investment of Ladysmith and the consequent gravity of the military situation in Natal, he left Methuen to relieve Kimberley, French and Gatacre to cover Cape Colony, and went to Natal himself. On Dec. 15 his first attempt to cross the Tugela at Colenso was repulsed. The Government, alarmed at the situation and the pessimistic tone of Buller's messages, sent out Lord Roberts to supersede him in the chief command, Sir Redvers being left in subordinate command of the Natal force. His second attempt to relieve Ladysmith (Jan. 10–27) proved another failure, the result of the operations at Spion Kop (Jan. 24), where Sir Charles Warren was in command, causing consternation in England. Responsibility was divided, and there was some argument. Buller's despatch was censored, and only appeared in full in 1902. A third attempt (Vaalkrantz, Feb. 5–7) was unsuccessful, but the Natal army finally accomplished its task in the series of actions which culminated in the victory of Pieter's Hill and the relief of Ladysmith on Feb. 27. Sir Redvers Buller remained in command of the Natal army till Oct. 1900, when he returned to England (being created G.C.M.G.), having in the meanwhile done a great deal of hard work in driving the Boers from the Biggarsberg (May 15), forcing Lang's Nek (June 12), and occupying Lydenburg (Sept. 6). But though these latter operations had done much to re-establish his reputation for dogged determination, and he had never lost the confidence of his own men, his capacity for an important command in delicate and difficult operations was now seriously questioned. The continuance, therefore, in 1901 of his appointment to the important Aldershot command met with a vigorous Press criticism, in which the detailed objections taken to his conduct of the operations before Ladysmith (and particularly to a message to Sir George White in which he provided for the contingency of surrender) were given new prominence. On Oct. 10, 1901, at a luncheon in London, Sir Redvers Buller made a speech in answer to these criticisms in terms which were held to be a breach of discipline, and he was placed on half-pay a few days later. A motion (July 17, 1902) by Sir Edward Grey in the House of Commons censuring government action in this case was defeated. For the remaining years of his life Buller lived as a country gentleman, accepting in dignified silence the prolonged attacks on his failures in South Africa; among the public generally, and particularly in his own county, he never lost his popularity. He died on June 2, 1908. He had married in 1882 Lady Audrey, daughter of the 4th Marquess Townshend, who survived him with one daughter.

See *South African Despatches* (1901), and Royal Comm. on the war in South Africa, *Evidence* ii., 169–223 and appendix J (1904); also a brief *Memoir,* by Captain Lewis Butler of Buller's own regiment (1909).

BULLET (Fr *boulet*, diminutive of *boule*, ball). The original meaning (a "small ball") has, since the end of the 16th century, been narrowed down to the special case of the projectile used with small arms of all kinds, irrespective of its size or shape. (For details *see* AMMUNITION; SMALL ARMS, DEVELOPMENT OF.)

BULL-FIGHTING, the national Spanish sport. The Spanish name is *tauromaquia* (Gr. ταῦρος, bull, and μαχή, combat). Combats with bulls were common in ancient Thessaly as well as in the amphitheatres of imperial Rome, but probably partook more of the nature of worrying than fighting, like the bull-baiting formerly common in England. The Moors of Africa also possessed a sport of this kind, and it is probable that they introduced it into Andalusia when they conquered that province. It is certain that they held bull-fights in the half-ruined Roman amphitheatres of Merida, Cordova, Tarragona, Toledo and other places, and that these constituted the favourite sport of the Moorish chieftains. Tradition is vague as regards the original Spanish bull-fighter. Possibly the first Spaniard to kill a bull in the arena was the great Cid, Don Rodrigo Diaz de Vivar, who about the middle of the 11th century, employing the lance, which remained for centuries the chief weapon used in the sport, proved himself superior to the flower of the Moorish knights. A spirited rivalry in the art between the Christian and Moorish warriors resulted, in which even the kings of Castile and other Spanish princes took an ardent interest. After the Moors were driven from Spain by Ferdinand II, bull-fighting continued to be the favourite sport of the aristocracy, the method of fighting being on horseback with the lance. At the time of the accession of the house of Austria it had become an indispensable accessory of every court function, and Charles V. ensured his popularity with the people by killing a bull with his own lance on the birthday of his son, Philip II. Philip IV. is also known to have taken a personal part in bull-fights. During this period the lance was discarded in favour of the short spear (*rejoncillo*), and the leg armour still worn by the *picadores* was introduced. The accession of the house of Bourbon witnessed a radical transformation in the character of the bull-fight, which the aristocracy began gradually to neglect, admitting to the combats professional subordinates who, by the end of the 17th century, had become the only active participants in the bull-ring. The first great professional *espada* (*i.e.*, swordsman, the chief bull-fighter, who actually kills the bull) was Francisco Romero, of Ronda in Andalusia (about 1700), who introduced the *estoque*, the sword still used to kill the bull, and the *muleta*, the red flag carried by the *espada* (*see* below), the spear falling into complete disuse.

The cruelty of the sport has prevented its taking root in France and Italy. In Portugal a kind of bull-baiting is practised, in which neither man nor beast is much hurt, the bulls having their horns truncated and padded and never being killed. Before the introduction of railways there were few bull-rings (*plazas de toros*) in Spain, but these have largely multiplied in recent years in both Spain and Spanish America. At the present day nearly every larger town and city in Spain has its *plaza de toros* (about 225 altogether), built in the form of the Roman circuses. The *plazas de toros* are of all sizes, from that of Madrid, which holds 12,000 spectators, down to those seating only two thousand.

The bulls used for fighting are invariably of well-known lineage and are reared in special establishments (*vacadas*), the most celebrated of which is now that of the duke of Veragua in Andalusia. When quite young they are branded with the emblems of their owners, and later are put to a test of their courage, only those that show a fighting spirit being trained further. When full grown, the health, colour, weight, character of horns, and action in attack are all objects of the keenest observation and study. The best bulls are worth from £40 to £60. About 1,300 bulls are killed annually in Spain. Bull-fighters proper, most of whom are Andalusians, consist of *espadas* (or *matadores*), *banderilleros* and *picadores*, in addition to whom there are numbers of assistants (*chulos*), drivers and other servants. For each bull-fight two or three *espadas* are engaged, each providing his own quadrille (*cuadrilla*), composed of several *banderilleros* and *picadores*. Six bulls are usually killed during one *corrida* (bull-fight), the *espadas* engaged taking them in turn. The *espada* must have passed through a trying novitiate in the art at the royal school of bull-fighting, after which he is given his *alternativa*, or licence.

The bull-fight begins with a grand entry of all the bull-fighters with *alguaciles*, municipal officers in ancient costume, at the head, followed, in three rows, by the *espadas*, *banderilleros*, *picadores*, *chulos*, and the richly caparisoned triple mule-team used to drag from the arena the carcasses of the slain bulls and horses. The greatest possible brilliance of costume and accoutrements is aimed at, and the picture presented is one of dazzling colour. The *espadas* and *banderilleros* wear short jackets and small-clothes of satin richly embroidered in gold and silver, with light silk stockings and heelless shoes; the *picadores* (pikemen on horseback) usually wear yellow, and their legs are enclosed in steel armour covered with leather as a protection against the horns of the bull.

The fight is divided into three divisions (*suertes*). When the opening procession has passed round the arena the president of the *corrida*, usually some person of rank, throws down to one of the *alguaciles*, the key to the *toril*, or bull-cells. As soon as the supernumeraries have left the ring, and the *picadores*, mounted upon blindfolded horses in wretched condition, have taken their places against the barrier, the door of the *toril* is opened, and the bull, which has been goaded into fury by the affixing to his shoulder of an iron pin with streamers of the colours of his breeder attached, enters the ring. Then begins the *suerte de picar*, or division of lancing. The bull at once attacks the mounted *picadores*, ripping up and wounding the horses, often to the point of complete disembowelment. As the bull attacks the horse, the *picador*, who is armed with a short-pointed, stout pike (*garrocha*), thrusts this into the bull's back with all his force, with the usual result that the bull turns its attention to another *picador*. Not infrequently, however, the rush of the bull and the blow dealt to the horse is of such force as to overthrow both animal and rider, but the latter is usually rescued from danger by the *chulos* and *banderilleros*, who, by means of their red cloaks (*capas*), divert the bull from the fallen *picador*, who either escapes from the ring or mounts a fresh horse. The number of horses killed in this manner is one of the chief features of the fight, a bull's prowess being reckoned accordingly. About 6,000 horses are killed every year in Spain. At the sound of a trumpet the *picadores* retire from the ring, the dead horses are dragged out, and the second division of the fight, the *suerte de banderillear*, or planting the darts, begins. The *banderillas* are barbed darts about 18in. long, ornamented with coloured paper, one being held in each hand of the bull-fighter, who, standing 20 or 30yds. from the bull, draws its attention to him by means of violent gestures. As the bull charges, the *banderillero* steps towards him, dexterously plants both darts in the beast's neck, and draws aside in the nick of time to avoid its horns. Four pairs of *banderillas* are planted in this way, rendering the bull mad with rage and pain. Should the animal prove of a cowardly nature and refuse to attack repeatedly, *banderillas de fuego* (fire) are used. These are furnished with fulminating crackers, which explode with terrific noise as the bull careers about the ring. During this division numerous manoeuvres are sometimes indulged in for the purpose of tiring the bull out, such as leaping between his horns, vaulting over his back with the *garrocha* as he charges, and inviting his rushes by means of elaborate flauntings of the cloak (*floréos*, flourishes).

Another trumpet-call gives the signal for the final division of the fight, the *suerte de matár* (killing). This is carried out by the *espada* alone, his assistants being present only in the case of emergency or to get the bull back to the proper part of the ring, should he bolt to a distance. The *espada*, taking his stand before the box of the president, holds aloft in his left hand sword and *muleta* and in his right his hat, and in set phrases formally dedicates (*brinde*) the death of the bull to the president or some other personage of rank, finishing by tossing his hat behind his back and proceeding bareheaded to the work of killing the bull. This is a process accompanied by much formality. The *espada*, armed with the *estoque*, a sword with a heavy flat blade, brings the bull into the proper position by means of passes with the *muleta,* a small red silk flag mounted on a short staff, and then essays to kill him with a single thrust, delivered through the back of the neck close to the head and downward into the heart. This stroke is a most difficult one, requiring long practice as well as great natural dexterity, and very frequently fails of its object, the killing of the bull often requiring repeated thrusts. The stroke (*estocada*) is usually given *à volapié* (half running), the *espada* delivering the thrust while stepping forward, the bull usually standing still. Another method is *recibiéndo* (receiving), the *espada* receiving the onset of the bull upon the point of his sword. Should the bull need a *coup de grâce,* it is given by a *chulo,* called *puntillèro,* with a dagger which pierces the spinal marrow. The dead beast is then dragged out of the ring by the triple mule-team, while the *espada* makes a tour of honour, being acclaimed, in the case of a favourite, with the most extravagant enthusiasm. The ring is then raked over, a second bull is introduced, and the spectacle begins anew. Upon great occasions, such as a coronation, a *corrida* in the ancient style is given by amateurs, who are clad in gala costumes without armour of any kind, and mounted upon steeds of good breed and condition. They are armed with sharp lances, with which they essay to kill the bull while protecting themselves and their steeds from his horns. As the bulls in these encounters have not been weakened by many wounds and tired out by much running, the performances of the amateur fighters are remarkable for dexterity.

See A. Chapman and W. T. Buck, *Wild Spain* (1893); Ella Bourne, "Ancient Bull Fights," *Art and Archaeology,* vol. v., pp. 142–153 (1917), Nicholas Rangel, *Historia del toro en Mexico, epoca colonial, 1529–1821* (1924); and Hermann Handke, *Spanische Stierkämpfe* (Braunschweig, 1928).

BULLFINCH, a finch of the genus *Pyrrhula,* especially the common European (*Pyrrhula pyrrhula*), bluish-grey and black above, and generally of a bright tile-red beneath, the female having its underparts chocolate-brown. It is a shy bird and frequents well-wooded districts. In May it builds a shallow nest of twigs lined with fibrous roots on low trees or thick underwood, and lays four or five bluish-white eggs speckled and streaked with purple. The young remain with their parents during autumn and winter, and pair in spring. In spring and summer they feed on the buds of trees and bushes, thus doing considerable injury to orchards and gardens. In autumn and winter they feed on wild fruits and on seeds. The note of the bullfinch, in the wild state, is soft and pleasant, but low; it possesses great powers of imitation, and can be taught to whistle tunes. The bullfinch breeds in northern Europe, occurring in southern parts only as a winter visitor. It rarely breeds in captivity. Black plumage can be induced by feeding solely with hemp-seed. Other subspecies are found in eastern Europe and Asia, and one which is native to southern and eastern Siberia (*P. p. cassini*) sometimes migrates to Alaska. The northern bullfinch (*P. p. pyrrhula*) breeds in northern Europe and western Siberia. The British bullfinch (*P. p. nesa*) is a breeding resident confined to the British Isles. Other races are found in the Azores Islands and Caucasus mountains.

BULLFROG (*Rana catesbeiana*), the largest frog (*q.v.*) of eastern North America, now widely introduced in irrigation ditches in the west. The body attains a length of 8 in. and the hind legs 10 in. The colour above is greenish brown, yellow or white beneath. It feeds on any living animal matter it can swallow, and is in turn devoured by snakes, fishes, herons, alligators, etc., besides being caught in large numbers for the table. The name is also applied to other large frogs, such as the Indian bullfrog, *Rana tigerina.* (K. P. S.)

BULLHEAD: *see* MILLER'S THUMB.

BULLI, one of a number of small coal-mining towns of the Illawarra district, New South Wales, Australia. It is situated some 40 m. S. of Sidney on a narrow coastal platform at the base of the abrupt scarp of the Illawarra coast "range" (plateau) across which a road leads through fine scenery via Bulli pass (*c.* 1,000 ft. high, Sublime point 1,330 ft.). Permo-Carboniferous rocks (Upper or Newcastle-Bulli Coal Measures and Upper Marine series) outcrop along this coast between Wollongong and Clifton (Coal cliff), being *c.* 1,000 ft. thick at Bulli; they represent the southern outcrop of the rim of the Sydney coal basin. Reserves of *c.* 500,000,000 tons of workable coal exist in the area (120 sq.m.) but of the seven existing seams only the top (Bulli) seam has been worked to any extent. The coal crops out on the scarp behind Bulli at *c.* 300 ft. It can be worked by horizontal adits; the coal trucks run down by gravity to the coast directly on to the wharves. The Bulli seam is 6 ft. thick and is good steam coal, nearly smokeless, and useful for naval, as well as for metallurgical purposes. The output of the southern field as a whole is normally about 2,000,000 tons per annum. The harbour is exposed to gales but, since 1901, Port Kembla (near Wollongong, 11 m. farther south) has been used as an exporting centre. The coal is conveyed by colliers to Sydney and to Queensland ports but is partly converted into coke on the fields and will doubtless be increasingly consumed in the growing industries of Port Kembla. Bulli lies on the coastal railway which runs from Sydney (59 m. by rail) south as far as Nowra. Pop. (1933) 2,251.

BULLINGER, HEINRICH (1504–1575), Swiss reformer, son of Dean Heinrich Bullinger by his wife Anna, was born at Bremgarten, Aargau, July 18, 1504. He studied at Emmerich and Cologne, where the teaching of Peter Lombard led him, through Augustine and Chrysostom, to first-hand study of the Bible; he then began to read the writings of Luther and Melanchthon. Appointed teacher (1522) in the cloister school of Cappel, he lectured on Melanchthon's *Loci Communes* (1521). He heard Zwingli at Zürich in 1527 and in 1528 accompanied him to the disputation at Berne. He was made pastor of Bremgarten in 1529, and married Anna Adlischweiler, a nun, by whom he had 11 children. After the battle of Cappel (Oct. 11, 1531), in which Zwingli fell, he left Bremgarten, and on Dec. 9 he was chosen to succeed Zwingli as chief pastor of Zürich. A strong writer and thinker, his spirit was essentially unifying and sympathetic, in an age when these qualities won little sympathy. His controversies on the Lord's Supper with Luther, and his correspondence with Lelio Sozini (*see* SOCINUS), exhibit, in different connections, his admirable mixture of dignity and tenderness. With Calvin he concluded (1549) the *Consensus Tigurinus* on the Lord's Supper. The (second) Helvetic Confession (1566), adopted in Switzerland, Hungary, Bohemia, and elsewhere, was his work. The volumes of the *Zürich Letters,* published by the Parker Society, testify to his influence on the English reformation in later stages. Many of his sermons were translated into English (reprinted, 1849). His works, mainly expository and polemical, have not been collected.

See Carl Pestalozzi, *Leben* (1858); Raget Christoffel, *H. Bullinger* (1875); Justus Heer, in Herzog-Hauck's *Realencyklopädie* (1897). (A. Go.)

BULLION, the name given to gold and silver considered solely as merchandise. When coin and specie are treated as bullion it is their weight and fineness which are reckoned, not their face value. Bullion thus means the gold and silver of the mines brought to a standard of purity. The word appears in an English act of 1336 in the French form "puissent sauvement porter à les exchanges ou bullion . . . argent en plate, vessel d'argent, etc."; and apparently it is connected with *bouillon,* the sense of "boiling" being transferred in English to the melting of metal, so that *bullion* in the passage quoted meant "melting-house" or "mint." The first recorded instance of the use of the word for precious metal as such in the mass is in an act of 1451.

From the use of gold and silver as a medium of exchange, it followed that they should approximate in all nations to a common degree of fineness; and though this is not uniform even in coins, yet the proportion of alloy in silver, and of carats alloy to carats fine in gold, has been reduced to infinitesimal differences in the bullion of commerce, and is a prime element of value even in gold and silver plate, jewellery, and other articles of manufacture. Bullion, whether in the form of coins, or of bars and ingots stamped, is subject, as a general rule of the London market, not only to weight but to assay, and receives a corresponding value. The work of weighing and assaying bullion is undertaken by the bullion brokers, who have to deal with parcels of very variable shape, for bullion may be bar-gold, or gold-dust, or coins of many different degrees of fineness.

BULL MOOSE, the symbol of the Progressive Party in the American presidential election of 1912. The bull moose is the male of the large, ungainly branch of the deer family inhabiting forested parts of Canada and north-eastern United States. It is closely allied to the European elk, standing over seven feet high, and often weighing over 1,000 pounds. The origin of the term as a symbol probably lies in the remark of ex-president Roosevelt: *"I feel as fit as a bull moose." The cartoonists seized the remark, and the animal quickly became the emblem of the Roosevelt forces, and then of the Progressive Party, popularly known as the* "Bull Moose Party." When the Progressive Republicans declared themselves opposed to the renomination of President Taft and brought about a three-cornered election, the bull moose became a very useful symbol as opposed to the elephant of the regular Republicans and the donkey of the Democrats.

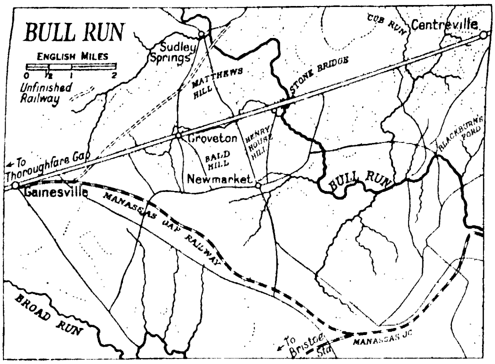
BULLOCK, WILLIAM (*c.* 1657–*c.* 1740), English actor, "of great glee and much comic vivacity," was the original Clincher in Farquhar's *Constant Couple* (1699), Boniface in *The Beaux' Stratagem* (1707), and Sir Francis Courtall in Taverner's *Artful Wife* (1717). He played at all the London theatres of his time, and in the summer at a booth at Bartholomew Fair. He had three sons, all actors. Christopher created a few original parts in comedies and farces of which he was the author or adapter —*A Woman's Revenge* (1715); *Slip; Adventures of Half an Hour* (1716); *The Cobbler of Preston; Woman's a Riddle; The Perjuer* (1717), and *The Traitor* (1718).

BULLROARER, the English name for an instrument made of a small flat slip of wood, through a hole in one end of which a string is passed; swung round rapidly it makes a booming, humming noise. Though treated as a toy by Europeans, the bullroarer has the highest mystic significance and sanctity among primitive people. In Australia it figures in the initiation ceremonies and is regarded with the utmost awe by the "blackfellows." Their bullroarers, or sacred "tunduns," are of two types, the "grandfather" or "man tundun," distinguished by its deep tone, and the "woman tundun," which, being smaller, gives forth a weaker, shriller note. Women or girls, and boys before initiation, are never allowed to see the tundun. At the Bora, or initiation ceremonies, the bullroarer's hum is believed to be the voice of the "Great Spirit," and on hearing it the women hide in terror. A Maori bullroarer is preserved in the British Museum, and in Africa it is known and held sacred. Thus among the Yoruba the principal sign of the Oro secret society is a bullroarer. The sanctity of the bullroarer was very widespread. The rhombus (Gr. *ῥόμβος*) which was whirled at the Greek mysteries was one. Among North American Indians it was common. At certain Moqui ceremonies the procession of dancers was led by a priest who whirled a bullroarer. The instrument has been traced among the Tusayan, Apache and Navaho Indians (J. G. Bourke, *Ninth Annual Report of Bureau of Amer. Ethnol.* 1892), among the Koskimo of British Columbia (Fr. Boas, "Social Organization, etc., of the Kwakiutl Indians," *Report of the U.S. National Museum for 1895*), and in Central Brazil. In New Guinea, in some of the islands of the Torres Straits it is swung as a fishing charm. In Ceylon it is used as a toy and figures as a sacred instrument at Buddhist festivals. In Sumatra it is used to induce the demons to carry off the soul of a woman, and so drive her mad. Sometimes, as among the Minangkabos of Sumatra, it is made of the frontal bone of a man renowned for his bravery. With the Ao Nagas, it is apt to bring sickness, while elsewhere in Assam it drives or keeps sickness away.

BIBLIOGRAPHY.—*See* A. Lang, *Custom and Myth* (1884); J. D. E. Schmeltz, *Das Schwirrholz* (Hamburg, 1896); A. C. Haddon, *The Study of Man*, and in the *Journ. Anthrop. Instit.* xix (1890); G. M. C. Theal, *Kafir Folk-Lore;* R. C. Codrington, *The Melanesians* (1891); A. B. Ellis, *Yoruba-Speaking Peoples* (1894); N. W. Thomas, *Timne-Speaking Peoples* (1916); P. A. Talbot, *The Peoples of Southern Nigeria*, vol. iii. (1926); J. P. Mills, *The Ao Nagas* (1926).

BULL RUN, a small river in Virginia, U.S.A., which gave the name to two famous battles in the American Civil War.

(1) The first battle of Bull Run (called by the Confederates Manassas) was fought on July 21, 1861, between the Union forces under McDowell and the Confederates under Gens. *Joseph E. Johnston*[1] and *Beauregard.* Both armies were newly raised and almost untrained. After a slight action on the 18th at Blackburn's ford, the two armies prepared for a battle. The Confederates were posted along Bull Run, guarding all the passages from the stone bridge down to the railway bridge. McDowell's forces concentrated around Centreville, and both commanders, sensible of the temper of their troops, planned a battle for the 21st. On his part McDowell ordered one of his four divisions to attack the stone bridge, two to make a turning movement via Sudley ford, 2m distant; the remaining division (which had a stiffening of regular troops) was to be in reserve and to watch the lower fords. The local Confederate commander, *Beauregard*, had also planned a turning movement by the lower fords against the Federal left, but *Johnston*, who arrived by rail on the evening of the 20th with reinforcements, now assumed command of the whole force. The change in control caused delay, orders miscarried, and the Federal attack opened before the movement had begun. *Johnston* and *Beauregard* then decided to fight a defensive battle, and hurried up troops to support the single demi-brigade of *Evans* which held the stone bridge. Thus there was no serious fighting at the lower fords of Bull Run throughout the day.



BULL RUN, SCENE OF TWO BATTLES DURING THE AMERICAN CIVIL WAR
The first battle was fought on July 21, 1861, the second on the last days of August, 1862

The Federal staff was equally inexperienced, and the divisions engaged in the turning movement were two hours late at Sudley ford. At 6 A.M., when the troops, told off for the frontal attack, appeared before the stone bridge, the turning movement was by no means well advanced. *Evans* had time to move 11 of his 15 companies to Matthews hill, covering Sudley springs, leaving the rest to hold the stone bridge, and he was promptly supported by the brigades of *Bee*, *Bartow* and *T. J. Jackson.* About 9:30 the leading Federal brigade from Sudley springs came into action; two hours later a flank threat by two other brigades, which had crossed at an intermediate ford, drove *Evans*, *Bee* and *Bartow* from Matthews hill in considerable confusion. But on the Henry House hill *Jackson's* brigade stood, as Gen. *Bee* said to his men, "like a stone wall," and the defenders rallied, though the Federals were continually reinforced. The fighting on the Henry House hill was very severe, but McDowell, who dared not halt to re-form his enthusiastic volunteers, continued to throw in piecemeal attacks. About 1:30 P.M. he brought up two regular batteries to the fighting line; but a Confederate regiment, being mistaken for friendly troops and allowed to approach, silenced the guns by close rifle fire, and the Federal attack, despite repeated efforts, made no further headway. By 4 P.M. some more of *Beauregard's* troops came up; *Jackson's* brigade charged with the bayonet, and at the same time the Federals were assailed in flank by the last brigade of *Johnston's* army, which arrived at the critical moment from the railway. They gave way at once, melting away slowly to the rear, the handful of regulars alone keeping their order. But when, at the bridge over the Cub Run, they came under shell fire the retreat became a panic flight to the Potomac. The victors were too exhausted to pursue, and the U.S. regulars of the reserve division formed a strong and steady rearguard. The losses were: Federals, 2,896 men out of about 18,500 engaged; Confederates, 1,982 men out of 18,000. (X.)

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[1] In this and other American Civil War articles the names of *Confederate* generals, statesmen, and ships are given in italics.

The second battle was fought (Aug. 29–30, 1862) between the Army of Northern Virginia under *R. E. Lee* and a Federal force commanded by Pope, who had been recently appointed to command a new army consisting of three corps, which had been conducting independent and unsuccessful operations against *Jackson* in the Shenandoah Valley. When Halleck, the newly appointed General-in-Chief, decided to withdraw McClellan's army from the Peninsula, it became Pope's duty to cover Washington until a junction of the two armies could be effected for a fresh campaign against Richmond. Pope retired from the Rapidan behind the Rappahannock (Aug. 19), followed by *Lee* from Gordonsville. As Halleck had directed that McClellan's troops should disembark at Aquia Creek, Pope was instructed to hold on to the line of the Rappahannock and prevent *Lee* from crossing. Pope had only 45,000 against *Lee's* 55,000, but aided by a sudden freshet in the river he was able to hold *Lee* in check till the 25th, when, screened by *Stuart's* cavalry, *Jackson* started his famous flank march round Pope's right flank. Passing through Thoroughfare Gap he marched 50m. in two days, reaching the railway at Bristoe before sunset (Aug. 26) and capturing Manassas Junction, Pope's supply depot, by midnight. Having rested and refreshed his troops (Aug. 27) he set fire to the depot in the night and withdrew his force north of the Warrenton turnpike, where by noon (Aug. 28) his three divisions were hidden in the woods, his right within 12m. of Thoroughfare Gap, and an alternative line of retreat open behind him to Aldie Gap. Federal signallers had early detected *Jackson's* march, but at first Pope believed that he was most probably bound for the Valley. When next day *Jackson* was reported coming through Thoroughfare Gap, Pope in the evening ordered a general concentration about Warrenton (Aug. 26). He had just been reinforced by two corps from the Army of the Potomac and had now fully 70,000 men under his command. But on hearing that his railway communications had been interrupted, later in the night he ordered a concentration of his right wing at Gainesville with three divisions in support at Greenwich, and sent Hooker's division up the railway to reopen communications with Alexandria. When Hooker's encounter with *Ewell* on Broad Run in the afternoon (Aug. 27) showed that *Jackson's* whole force was at Manassas, he ordered a general concentration on that place, expecting next morning to find *Jackson* holding the entrenchments. At noon (Aug. 28) he reached Manassas and found that *Jackson* had disappeared, but at 4:15 P.M. hearing that *A. P. Hill's* division had been seen at Centreville (Hill had marched there from Manassas and then recrossed Bull Run at the Stone Bridge) he ordered his whole army to march on Centreville. McDowell on his own initiative sent Rickett's division to hold Thoroughfare Gap, but Pope had entirely left *Longstreet* out of his calculations. *Lee* with *Longstreet's* wing (less *Anderson's* division left at Waterloo Bridge) followed *Jackson* (Aug. 26) but at nightfall (Aug. 27) was still west of the mountains. The next afternoon his advanced guard encountered Ricketts in the Gap. The Federals held their ground, but after dark retired to Gainesville. About 5:30 P.M. (Aug. 28) King's division of McDowell's corps was marching along the turnpike towards Centreville, when it was attacked by two of *Jackson's* divisions near Groveton. A fierce but indecisive engagement ensued. *Jackson* had deliberately revealed his position in order to lure Pope back into *Lee's* clutches. He supposed that Pope was in full retreat, and sought to prevent him getting behind Bull Run, where he could take a strong defensive position and await reinforcements. Pope fell into the trap. Believing that *Jackson* was retreating but had been intercepted by McDowell's corps, he ordered his forces to assemble on the Warrenton pike and attack *Jackson* next morning. But he had now lost touch with several of his units. During the night King and Ricketts withdrew to Manassas and Bristoe respectively. Only Sigel's corps and Reynolds' division were available to attack *Jackson* before noon (Aug. 29). Sigel made two ineffectual attacks in the morning. Then Pope arrived from Centreville with four divisions. These made three more attacks on *Jackson's* left, but from lack of coordination they all failed. *Jackson* held a strong position: his front line occupied the embankment of an unfinished railway; his artillery was posted on a ridge 500yd. in the rear; as his line was only 3,000yd. long, he could hold half of his 18,000 infantry in reserve and, when *Longstreet* came upon the field, draw troops from his own right to aid his hard-pressed left. All five Federal attacks had been directed against *Hill's* division, because on its front a belt of wood extended south of the railway cutting and afforded cover for the assailants. Reynolds' division on the left, which would have had to attack over open ground, was held in check by artillery fire. Pope had expected that while he was attacking *Jackson's* left Porter's and McDowell's corps would fall upon the enemy's right flank and rear. But these troops encountered *Longstreet*. The latter had marched through the Gap at sunrise (Aug. 29) and by noon had drawn up his line of battle across the turnpike. *Jones's* division he placed across the Manassas Gap R.R. to hold off any force advancing from Manassas. Thrice *Lee* urged him to attack down the pike. But *Longstreet* in *Anderson's* absence would only send late in the evening *Hood's* division to make a reconnaissance in force. Porter and McDowell were marching from Manassas to Gainesville, when they encountered *Jones's* division. It was plain that Pope when writing his "Joint-Order" at Centreville had entirely misread the situation. McDowell withdrew his corps and marched to join Pope on the turnpike, where King's division encountered *Hood* and was driven back some distance. Porter remained on *Longstreet's* front until dark, when he retired to Manassas. *Lee* did not intend to assume the offensive next day. Three divisions from Richmond had crossed the Rappahannock and till their arrival he would leave Pope the initiative. Pope believing that the enemy was retreating, at noon (Aug. 30) ordered a general pursuit under McDowell's charge. McDowell soon realized his commander's mistake and, whilst organizing an attack against *Jackson*, endeavoured to secure his exposed flank by occupying in force the Bald and Henry House Hills. Porter's corps and King's division attacked with such determination that *Jackson* signalled to *Lee* for help. *Longstreet* brought up more batteries on his left, and their fire enfilading the Federal lines quickly stopped the attack. At 4 P.M. *Lee* launched his counterstroke. *Longstreet* with all his five divisions bore down upon the Federal left, which he already overlapped. But the attack was made too late for *Lee* to achieve a complete victory. Bald Hill, only held by one brigade, because Pope had withdrawn Reynolds's division to take position in Porter's rear, was captured and all attempts to recapture it failed, and *Jackson* pressed the Federal right back towards the turnpike. But Sykes's two brigades of regulars and other troops held the Henry House Hill against all assaults, and in the gathering darkness Pope withdrew his beaten army across Bull Run and retreated to Centreville, where Franklin's corps from Alexandria had just arrived. *Lee* resorted to another outflanking movement and *Jackson* had a sharp but indecisive encounter at Chantilly (Sept. 1) with two Federal divisions sent by Pope to protect his retreat against a flank attack. Though reinforced at Centreville by Sumner's corps and still considerably outnumbering *Lee* in spite of the latter's reinforcements, Pope had lost heart and sought safety in the fortifications of Washington (Sept. 2). His losses from Aug. 28 to Sept. 1 amounted to over 14,000 men and 30 guns; *Lee's* were between 9,000 and 10,000. (W. B. Wo.)

BULLY, originally a fine, swaggering fellow, as in "Bully Bottom" in *A Midsummer Night's Dream;* later an overbearing ruffian, especially a coward who abuses his strength by ill-treating the weak; more technically a *souteneur*, a man who lives on the earnings of a prostitute. The term in its early use of "fine" or "splendid" survives in American slang.

BULOM, a people similar to the Timne, whose language is more nearly related to that of the Krim and the Kissi, living in the district between Freetown and Sherbro in Sierra Leone.

See N. W. Thomas, *Anthropological Report on Sierra Leone* (1916).

BÜLOW, BERNHARD, Prince von (1849–1929), was born at Flottbek on the lower Elbe on May 3, 1849, of a distinguished family. His father, Bernhard Ernst von Bülow, had begun his career in the service of Denmark, of which State Holstein at that time still formed part. He represented the king of Denmark in his capacity of duke of Holstein in the Federal Diet at Frankfurt. Here he came into close contact with Bismarck, at that time Prussian representative, who formed a high opinion of his colleague's abilities. Later, he became minister president of Mecklenburg-Strelitz, and afterwards plenipotentiary for Mecklenburg in the Federal Diet; *finally he was invited by Bismarck to enter the service of the German empire, and appointed secretary of State for foreign affairs in 1873. He died on Oct. 20, 1879.* The prince's mother came of a Hamburg merchant family of the name of Rücker

Early Years and Upbringing.—Bulow passed his early youth at Flottbek and Frankfurt-am-Main, attended the gymnasium there and in Neustrelitz, and completed his school years at Halle, where he passed his final examinations. He then studied law in Leipzig, Berlin and Lausanne. He fought as a volunteer in the Franco-German War of 1870. On his return he graduated at the bar and was then employed for a short time in Metz, at first in the Landgericht and afterwards ih an administrative capacity.

In 1874 Bulow determined to enter diplomacy. His first appointment was as attaché to the Embassy in Rome, under Herr von Keudell. After gaining first experience for his future career here and in St. Petersburg, he was transferred in 1877 to Vienna as second secretary. During the great eastern crisis of that year he acted for a time as Charge d'Affaires in Athens and took part in the negotiations at the Congress of Berlin in 1878. In the following year he became second secretary to the Embassy in Paris. Here he remained six years, being transferred to St. Petersburg in 1885 as councillor of Embassy. Here he married a lady of a noble Italian family, a Princess Camporeale by birth, whose mother had contracted a second marriage with the Italian minister, Minghetti. Three years later Bülow received his first independent diplomatic post as minister in Bucharest. In 1804 he was transferred from this modest sphere to the Embassy in Rome, one of the most important posts of German diplomacy. His connections with Italy through his wife seemed to fit him particularly well to represent Germany there. He remained, however, only three years in this post, being appointed in July 1897 acting head of the Foreign Office in Berlin.

Since Bismarck's dismissal, Freiherr von Marschall had been in charge of the Foreign Office. He was not a professional diplomat, and was hardly equal to the difficult situation which confronted him after Bismarck's departure In 1807 he exchanged his post for that of German Ambassador in Constantinople A substitute for him had to be found, and Baron von Holstein, at that time the most influential figure in the Foreign Office, drew the attention of the chancellor, Prince Hohenlohe, to Bulow. He had been acquainted with him personally for some time and believed him to be the man best fitted by his polished manners, his tact, and his brain to cope with the difficult task of handling the emperor Besides this, he certainly hoped that his own personal relations with Bülow would keep his influence predominant during the latter's tenure of office.

Bülow's Personality.—In the autumn of 1897, Bülow was definitely appointed secretary of state for foreign affairs. Three years later, in 1900, he also became imperial chancellor, and thus assumed the position previously held by Bismarck. He always looked on that great statesman, whom he had known personally and revered from his youth upwards, as his model, and often said so in his speeches and writings. He found the essence of his political theory in the doctrine that a state should be guided only by its own interests, and at times went so far as to deny altogether the applicability of any ethical standard in politics, *e.g.*, in his judgment of the Boer War But, however truly he remained Bismarck's pupil in his general ideas, between him and his great predecessor lay a profound difference, which was inherent in the innermost depths of his personality Bülow was undoubtedly an acute and dispassionate observer and a man of extraordinary diplomatic skill in the conduct of negotiations, both with the representatives of foreign Powers and with the party leaders in Germany itself; he was a brilliant parliamentary speaker, not so powerful and enthralling as Bismarck, but always subtle, cultivated, and witty. What he lacked, however, was the deep political passion which animated Bismarck. He was always, primarily, the cool, imperturbable man of the world, rather sceptical, rather ironical, an artist in treating of the most difficult matters in a light, conversational tone; but he lacked the strength to stake his whole personality at the critical moment for the course which he saw to be right. If his amiable character and the charm of his cultivated and adaptable nature enabled him to maintain his influence over the emperor for a decade, his confidence in the ultimate effect of these qualities also led him to avoid a definite decision when he feared that it would go against him, in the hope that by appearing to yield he would be able to get his way after all, gradually and almost imperceptibly. He was an excellent diplomat, but too essentially a diplomat to be a really great statesman. In questions of domestic politics, particularly, he always relied on his skill in temporizing and compromising without holding a definite and individual attitude towards the great questions of statecraft.

Situations and Problems on Assumption of Office.—The situation as Bülow found it on assuming office was as follows: After Bismarck's successor, Caprivi, had refused to renew the "reinsurance treaty" with Russia, the Russo-French treaty had been concluded; this threatened Germany with the potential danger of a simultaneous war on two fronts, the east and the west Caprivi and Marschall had believed the best safeguard against his danger to lie in the expansion and the maintenance at all costs of the Triple Alliance. They had, however, endeavoured at the same time to cultivate good relations between the Triple Alliance and England. In this they had been unsuccessful, since the British Government of that time was averse to making any treaty commitments in their foreign policy. Relations with England had actually grown worse, partly owing to colonial disputes and at the time of the Jameson raid in the Transvaal and the Kriiger telegram there had even been danger of a breach of diplomatic relations. At this period the emperor had become finally convinced that Germany needed a strong battle fleet if she was to keep her colonial empire and defend her coasts and her commerce in an emergency against England. Admiral von Tirpitz had been appointed head of the imperial naval ministry for this purpose about the same time as Bülow took over the Foreign Office. Tirpitz proposed to create so strong a battle fleet as to make war with Germany a very risky matter, even for England, the leading sea power. The emperor embraced this idea with enthusiasm. It became one of the few absolutely unalterable principles of his foreign policy. The great question was whether it would be possible to attain this end without forcing England into the camp of Germany's opponents. If this happened, if England adhered in any form to the Russo-French alliance, then the danger of the international situation must increase enormously for Germany. Bülow himself was never convinced of Germany's need for a strong navy; he would have preferred to concentrate on improved coast defence and on submarines. But he could not ignore the fact that the emperor thought otherwise, and that he would be unable to prevent the execution of this programme. Under the circumstances, he felt it his duty to carry on the policy of maintaining and strengthening the Triple Alliance and to see that Germany's naval programme did not injure relations with England. He was always convinced that Germany needed peace, in the interests of her economic development, and had nothing to gain from a war. It was the more important to preserve the good relations with England on which the maintenance of peace depended.

Bülow and the Negotiations for a Treaty with England.—In the spring of 1898 an attempt was made by England to reach a closer understanding with Germany. It was prompted by the situation of the British Empire at that time; its principal author was Joseph Chamberlain, the colonial secretary in Lord Salisbury's cabinet. Chamberlain became more and more convinced that England could not remain in her present isolation; that in view of the increased tension with Russia in the Far East and the absorption for a considerable period of all her own forces by the Boer War, she must seek the support of other Powers. He wished to begin by attempting an understanding with Germany, but from the first envisaged the possibility of a rapprochement with France and Russia even at the cost of some sacrifices should the German alliance prove impracticable. The first tentative suggestions in Berlin crystallized later into a proposal that a defensive alliance should be concluded which should come into force if either Germany or Great Britain were attacked by two great Powers. Bülow was now confronted with a decision of extraordinary difficulty. The whole tendency of his policy would have favoured acceptance of this suggestion, and an attempt, at least, to see whether peace could not be permanently ensured by this method without sacrifice of Germany's interest. The emperor was also at first very much inclined to agree to the English rapprochement. The last decision in this important question was taken by Baron von Holstein, for whose judgment Bülow had the greatest possible respect.

Holstein entertained the strongest mistrust of England's intentions. He believed that England was only interested in involving Germany in a struggle with Russia, thus to be quit of this dangerous opponent without risk to herself. He also thought that the advantages would be too unequal because Germany would have to help in defending the whole British Empire in all quarters of the globe, while England would only have to cover the much smaller and less threatened area of German possessions. Finally, he thought that England would not feel herself bound to support Germany in virtue of such an alliance if Germany found herself compelled, in virtue of her alliance with Austria-Hungary, to declare war on Russia in the event of a Russian attack against the Danube monarchy. For these reasons he found the proposal unacceptable in its existing form and thought it necessary to demand that Austria be included in the alliance and that its permanent validity should be ensured by ratification through the British Parliament. It is impossible to say whether Bülow entertained similar doubts from the first, or whether they were only evoked in him by Holstein's representations. It is only certain that he ended by adopting this chain of reasoning completely and basing his policy accordingly. It was probably due again to Holstein's advice that he conceived the plan of taking advantage of England's desire for a rapprochement to extract certain colonial concessions for Germany. He did not, therefore, reject the English offer unconditionally, but temporized, letting England hope that the plan might come to something after all. The negotiations dragged on for over two years. When, however, the British Government saw that Germany would not renounce her conditions, in particular the inclusion of Austria, they gave up the plan as hopeless and began to attempt to reach an understanding with Russia and France. The course of these negotiations was of decisive importance, not only for relations between England and Germany, but for the whole development of international relationships during the next decades. For the consequence of the rapprochement of England with France and Russia which now began was the conclusion of the entente between those three States and therewith the genesis of the situation which ended in the World War. Bülow and Holstein did not indeed foresee that their attitude would have such results. They believed that an English understanding with France and Russia would be wholly impossible, on account of the profoundly different views on international politics entertained by these States; they hoped that when England had seen the impossibility of such an enterprise she would approach Germany afresh and then be ready to accept her conditions. This misapprehension of the actual situation shows that they lacked that eye for the true relative relations of the different Powers which is so absolutely essential for any successful policy.

Bülow and the Morocco Question (1905).—Even after the failure of the negotiations for an Anglo-German alliance and the conclusion of the treaty between England and France in the spring of 1904, defining their respective spheres of influence in Africa, the situation for Germany was not so unfavourable as it was ten years later. Relations between England and France were still far from close, and acute differences still existed between England and Russia. It was only Germany's attitude during the first Morocco crisis of 1905 that altered the situation to her disadvantage. Under the above-mentioned Franco-British agreement, Morocco had been assigned to the French sphere of influence and the French began immediately to pave the way for the gradual subjection of Morocco to their suzerainty. As this grew more and more apparent during the first months of 1905 Bülow determined to intervene. The decisive advice again came from Baron von Holstein. In his opinion, Germany, in the interests of her international prestige, should not permit the partition of hitherto independent territories between the other colonial Powers without receiving compensation. Bülow, who but a short time before had declared that Germany had no political interests of her own in Morocco, let himself be persuaded by Holstein to oppose France's action. The moment seemed propitious; the outbreak of the Russo-Japanese War in the Far East had wholly engaged the forces of France's ally, Russia, for a considerable time, and the domestic situation in France at the moment was extremely difficult. Bülow persuaded the emperor to land in Tangier in April 1905 in the course of his Mediterranean cruise and there to declare in an address to the representatives of the Sultan of Morocco that he looked on Morocco as an entirely independent country, in which no European power enjoyed special rights of any sort. The emperor only took this step with great reluctance, and afterwards repeatedly declared that he had done so only at Bülow's urgent desire.

The first result of this step was that France approached Germany with a request to formulate her counter-demands in return for leaving Morocco to France. It is doubtful whether an agreement could have been reached on this basis. Germany, however, was not so much interested in herself acquiring a part of Morocco or compensation in the French colonial area, as in preventing France from effecting this increase of her African possessions. Bülow therefore refused to negotiate on this basis and demanded the dismissal of Delcassé, the French foreign minister, who was supposed to be particularly anti-German, and also the convocation of an international conference to regulate the Moroccan question on the basis of political independence for Morocco and complete equality of footing in economic matters for all European Powers. France agreed to these demands with the greatest reluctance and felt herself deeply humiliated. These incidents also further damaged Germany's relations with England. England felt bound, having expressly recognized Morocco as within the French sphere of influence, to support France should she become involved in a conflict with Germany over this question. Although no definite offer of military assistance was made by England at that time, it can hardly be doubted that England would have taken France's side had war broken out then. And as it was probable that similar conflicts would again arise over the Moroccan question, it was agreed, on the initiative of the French Government, that representatives of the British and French military and naval general staffs should meet and discuss methods of co-operation between the two Powers in the event of a possible conflict with Germany. The result was that, although no treaty change was made, the ties between the two western Powers were drawn much closer than previously.

The conference met in Algeciras at the beginning of 1906 but took quite a different course from that expected by Bülow. With the help of England and Russia, France secured the grant to herself of extensive privileges both in the organization of the Moroccan police and in financial and economic respects in the territory in question, although the nominal independence of Morocco was upheld. Germany was obliged to accept these resolutions, unless she were willing to accept the sole blame in the eyes of Europe for a breakdown of the conference, with all the disastrous consequences to which this might have given rise. The grave failure of the German policy led to the dismissal of Baron Holstein; he remained, however, in close relations with Bülow, who often consulted him.

Bülow and the Treaty of Björkö (1905).—While the Morocco negotiations were still in progress, the great war in the Far East had come to an end. Russia had been completely defeated. When the Tsar met Emperor William II. in Finland in July 1905, he was so broken down by this failure that he agreed to a proposal of the German emperor which he had rejected, on the advice of his ministers, in the previous autumn. The German emperor felt that the victory of the Japanese, who were England's allies, had increased the power of Great Britain to such an extent as to necessitate a coalition of all great Powers on the continent of Europe against her. The idea of such a continental league had been broached by him before and, strangely enough, had been approved by Bülow. It is hard to see how it could have been effected, in view of the existing tension between Germany and France. Starting with this idea, the emperor laid a draft treaty before the Tsar in Björkö which provided as a first step for a close offensive and defensive alliance between Germany and Russia, the Tsar undertaking further to attempt to persuade France to adhere to this alliance. Bülow agreed with this move of the emperor's and had even transmitted to him by wire the text of the first proposed draft. After the Tsar had signed the treaty, however, Bülow utilized the pretext that the emperor had changed a few words in the text transmitted to him to declare that he could no longer assume responsibility for the conduct of German policy if the emperor took decisions in important questions without previously consulting him. The emperor, who looked on the fact that he had persuaded the Tsar to sign the treaty of Björkö as a great success and a great personal achievement of his own, was absolutely disconcerted by Bülow's totally unexpected threat of resignation. He begged him to remain in office and not to desert him. Bülow remained, after exacting from the emperor a promise to take no important political decision in the future without consulting him.

The treaty of Björkö itself remained without serious consequences, because the Tsar, when enlightened by his ministers on his return to St. Petersburg as to the extent of the obligations he had undertaken, refused to acknowledge it as binding. Yet this incident had its importance as casting a vivid light on Bülow's relations with the emperor. In the first years of his chancellorship, Bülow had often had to temporize; but now he obviously felt that the time was come when he would be able to restrict the emperor's influence in politics within much narrower limits. He took advantage of an incident, unimportant in itself, to raise the question of confidence and demand an assurance from the emperor. The success which he had scored by this action was, however, only temporary. In reality, his position after this incident was less safe than before. The emperor, who had hitherto felt a personal attachment to this always pleasant-mannered and (on the surface) very accommodating diplomat, now began to look on him as a secret enemy of his imperial authority and to turn away from him in his heart.

After the failure of the continental league, it was no longer possible to prevent Russia from becoming a party to the Anglo-French entente. Defeated in Asia, Russia was in any case obliged to give up her hopes of extending her power in North China and Central Asia; this left the way clear for an understanding with England and a delimitation of the rival spheres of influence in Asia. This was effected by the treaty of Aug. 31, 1907. From this time on the combination of France, England and Russia in a closely-allied group of Powers was complete, while through the Anglo-Japanese alliance the group enjoyed further special support outside Europe.

Bülow followed this development with the gravest concern. He saw that this division of Europe into two groups of Powers, the Entente on the one hand, the Triple Alliance on the other, involved a grave danger for the peace of the world, since any conflict between two members of the group must draw in their allies, and might easily develop into a trial of strength between the rival coalitions. He had already discussed the danger of an encirclement of Germany in his speech before the Reichstag on Nov. 5, 1906. Events were soon to occur which cast a vivid light on the difficulties of the new situation.

Bülow and Russia; Balkan Questions.—After abandoning her policy of expansion in the Far East, Russia again devoted more interest than had been the case for some decades to Balkan problems. In particular, she encouraged Serbia's efforts to found a great southern Slav State to embrace Bosnia and the Herzegovina. As these ambitions could not be realized without a conflict with Austria, new and grave complications were to be foreseen here. The outbreak of the conflict was accelerated by the Young Turk revolution in the summer of 1908, which threatened to shatter the whole frame-work of the Ottoman empire. The prince of Bulgaria took advantage of this opportunity to repudiate the suzerainty of Turkey and declare himself independent, and at the same time Austria formally incorporated Bosnia and the Herzegovina into her dominions, these two provinces having previously been legally part of the Ottoman empire, occupied by Austria in virtue of the decisions of the Congress of Berlin. These two events aroused the most violent excitement in Serbia, and for a time it looked as though it would come to war between Austria and Serbia. As Russia felt that her prestige among the Balkan peoples obliged her to support the cause of Serbia, the crisis might easily have led to a conflict between Austria and Russia, which would most probably have resulted in war between the Triple Entente and the Triple Alliance. If this was averted, it was due solely to the fact that Russia, after her severe defeat in the Far East, combined with the internal unrest which had followed it, was not ready for war at that moment. Bülow gave the Russian Government clearly to understand that Germany would throw her whole forces on the side of Austria if such a war broke out, and summoned Russia to recognize without reservation Austria's annexation of Bosnia. Russia was forced to give the required declaration, but felt the humiliation deeply, and was much offended by the interference of the German Government. It would indeed have been wiser to leave Russia to find out for herself an acceptable form of withdrawal, since in any case she would have had to withdraw. As it was, the Russian Government was able to advance the pretext to the world at large that they had to submit to the German group. Thus, although this crisis ended with an apparent victory for Germany and Austria, it made the general situation still more acute and brought grist to the mills of the growing anti-German party in Russia. During this Balkan crisis, when there seemed a danger of a European war, the emperor insisted that at least the points of friction with France should be reduced to a minimum. Largely at his wish, Bülow consented to conclude a new Morocco agreement with France on Feb. 9, 1909, expressly recognizing France's political rights in Morocco. One may, indeed, doubt whether this concession would have kept France from intervention if war had broken out at the time.

Bülow and England.—Bülow was quite aware that the situation would become extremely dangerous as soon as Russia had recovered from the consequences of her defeat and had regained sufficient strength to participate in a war. He therefore considered his most important task to be the re-establishment of better relations with England. Meanwhile, however, the expansion of the German navy according to Admiral Tirpitz's programme had begun, and had awakened much concern in England. As England had, in 1906, introduced a new type of battleship far superior in fighting force to any earlier models, all old ships seemed to have lost their value, and the fighting force of a fleet now depended, apparently, solely on its strength in these new great battleships. The superiority of Great Britain's fighting fleet, hitherto unquestioned, thus became doubtful; her lead over the other Powers in the construction of these new battleships being comparatively small. She feared that if Germany expanded her fleet according to Tirpitz's programme she would in a few years have a fleet almost as large as the British, unless Britain made enormous efforts to expand her own fleet much more quickly than had been intended. These considerations were responsible for several suggestions from British quarters that Britain and Germany might possibly be able to reach an understanding on the number of battleships to be built by each State during the course of the next few years.

A great difference of opinion soon arose on this question between the emperor and Tirpitz on the one hand and Bülow on the other. The emperor and Tirpitz held that Germany's naval armaments must be determined exclusively by her own needs and interests, and that any interference by foreign Powers in these questions should be categorically repudiated. Bülow, on the other hand, was inclined to accept an arrangement such as that suggested and in certain circumstances to modify the German navy law, conditional on a political rapprochement between Great Britain and Germany, to be expressed in a treaty guaranteeing to Germany Britain's neutrality in case of a war with France. A very violent dispute took place between Bülow and the emperor, who sent word to the chancellor that he must resign office unless he declared openly for the principle that no modification of the German naval programme was admissible in any circumstances. Bülow hesitated to insist on his opinion, in view of the possible consequences, preferring to make a declaration satisfactory to the emperor, but indubitably not in full accordance with his own views. Hereby he put himself in a false position. The desire to extricate himself was perhaps not without its effect in the event which followed immediately afterwards and caused the greatest sensation throughout the world.

Bülow and the "Daily Telegraph" Interview (1908).—On Oct. 27, 1908, the *Daily Telegraph* printed an interview by Col. Stuart Worseley with the emperor, secured during the latter's recent visit to England. According to the paper, the emperor had laid especial stress on his friendly feelings towards England; and among the various proofs which he adduced, he included the advice which he had given during the Boer War. It might appear as though he wished to arouse the impression that it was only by following this advice that Great Britain had carried the war to a successful close. The manuscript of this article was submitted by its author before publication to the emperor, and by him to the German foreign office for approval. The chancellor was away at Norderney, and it was forwarded on to him, but by an oversight (as he afterwards declared) he failed to read it; consequently no objections were raised, and it was allowed to appear. As its appearance evoked great indignation in England, the question as to the responsibility for allowing the interview to be published was raised in Germany. A question was asked in the Reichstag, and in the ensuing debate violent attacks were made on the emperor for his personal interference in politics. Bülow excused his conduct as stated above, but at the same time tendered his resignation, which he withdrew only after the emperor had repeated his promise not to take any step of political importance without the chancellor's advice. The emperor always believed that Bülow had actually read the article and allowed it to be published with the deliberate intention of exploiting the public excitement, which he foresaw, to put pressure on his master, whom he had attempted by this means to force into submission.

At all events, after this incident Bülow felt his position secure enough to join issue with Tirpitz on the naval programme and relations with England. On Nov. 30, 1908, he asked Tirpitz officially whether he considered Germany's defensive preparations against possible attack from Great Britain to be sufficient. Tirpitz replied that they were not, and that was his very reason for considering the construction of as strong a navy as possible to be indispensable. He added that he could not take the responsibility for retarding the programme, and must offer his resignation were this attempted. Bülow again abandoned the execution of his idea, partly perhaps because the reports from the German ambassador in London had not given him sufficient assurance that Britain would accord the desired political rapprochement in return for a modification of the German naval programme. Nevertheless, he never abandoned the idea of bringing about such a rapprochement so long as he remained chancellor; it is impossible to say whether he would have come nearer than his successor to its practical realization had he remained longer in office.

Domestic Politics.—In domestic politics Bülow was deficient in exact knowledge on economic questions and of the individual branches of the administration. He was mainly interested in foreign policy; domestic questions he generally left to his colleagues. In this field there was only one broad principle which he attempted to establish. His latter years of office were notable for his effort to bring about a new and permanent grouping of the parties. The steadily increasing hostility between the social democrats on the one hand and the parties of the right (conservatives and national liberals) on the other, had in recent years resulted in giving increasing influence to the catholic party of the centre. The centre took advantage of this position to sell its consent to the Government's various measures in return for concessions in ecclesiastical or educational questions, or personal advantages. Bülow had long chafed under this situation. When the centre defeated the Government's budget for colonial development in the winter of 1906–7, because in its opinion catholic interests were not sufficiently considered in colonial policy, Bülow dissolved the Reichstag. The composition of the new Reichstag after the elections enabled him to unite all elements outside the centre and the social democrats in a coalition. This "Bülow *bloc*," as it was commonly called, included not only the old cartel parties of Bismarck's day (the conservatives and national liberals) but also the left-wing liberals and democrats united in the progressive people's party. Bülow hoped to find in this coalition a firm support for his whole policy. This hope proved, however, delusive. The incompatibility of views between the right and left wings of the *bloc* was much too great; this was apparent for example, in the different attitude of the conservatives and the progressives towards the question of the extension of the Prussian franchise. As Bülow himself had no definite programme in domestic policy on which to unite the parties of his *bloc* this loose coalition was in danger of breaking up every moment, and incessant wearisome negotiations were necessary to keep it together after a fashion. It finally broke up over the question of fiscal reform.

Resignation.—The Budget brought in by the Government in 1909 included, besides a number of indirect taxes, an imperial succession duty. The conservatives declared against the latter, while the liberals objected to some of the indirect taxes. Bülow informed the conservatives that he would resign if they threw out the budget, and broke up the *bloc* by rejecting the succession duty. They rejected it none the less, and Bülow handed in his resignation, which was accepted by the emperor on July 14, 1909. William II.'s confidence in Bülow had long been shaken, and he was not sorry to see him leave office. Bülow himself felt it impossible to remain chancellor if he could reckon neither on the monarch's confidence nor on a secure majority in the Reichstag. Bülow's public career seemed at an end. He retired altogether into private life, and never expressed an opinion in public regarding current political questions. He departed from this rule only once when the publishers of *Deutschland unter Kaiser Wilhelm II.*, a compilation by various hands, to be published in commemoration of the 25th year of William II.'s reign, asked him to write the account of foreign policy for this book. This he did, afterwards reprinting his contribution in book form under the title *Deutsche Politik*. In it he concerned himself chiefly with justifying his own conduct of foreign policy, but was of course obliged to speak with great reserve, as all diplomatic details of the period under review were still kept strictly secret. His account therefore contributes but little to our real knowledge of events.

The War.—Quite unexpectedly, Prince Bülow was brought into public life once more on the outbreak of the World War. Italy preserved neutrality in the summer of 1914. Although not recognizing any obligation under the terms of the Triple Alliance to join Germany and Austria, neither did she immediately make common cause with the Entente. As the German Government was always obliged to reckon with the possibility that she would yet do so, it determined to beg Prince Bülow to take over the post of German ambassador in Rome, which he had already held once, and attempt to bring over Italy after all to the side of the Central Powers. Bülow went to Rome in Dec. 1914. He hoped to persuade Austria to agree to cede the Trentino to Italy, and thus prevent Italy from joining the enemy camp. It took long, however, to persuade the Austrian statesmen to consent to this concession: and when they did so, at last, it was too late.

The impression was prevalent in Rome that Austria, under pressure from Germany, would in her hour of need give the promise but would make difficulties about fulfilling it after the Central Powers had proved victorious. In spite of all his efforts, Prince Bülow was unable to dispel Italy's mistrust of the sincerity of Austrian policy, or to prevent her entering the ranks of Austria's and Germany's enemies in May 1915. He probably doubted from the first whether anything could be achieved in Rome, but thought it his duty not to refuse his services for the last attempt.

After the War.—After the summer of 1915 Prince Bulow lived in quiet retirement, mostly in Klein-Flottbek; his public utterances were very few indeed. The most interesting of them was his letter to the editor of the *Hamburger Fremdenblatt*, printed in that journal on Aug. 4, 1919. Here Bulow expressed his views on the policy of his successor, Bethmann-Hollweg, and on the events which led up to the World War. He was concerned particularly to defend himself against the statement made by Bethmann-Hollweg in his recollections that the international situation in the summer of 1909, when he succeeded Bülow, was already so involved that no issue could be found, and that the World War had thus really been already inevitable. Bülow protested, and certainly rightly, against this "theory of fatality," as he called it. It is, however, undeniable that Prince Bülow's policy was largely responsible for bringing about the difficult situation in which Germany found herself in the decade preceding the World War. He died at Rome on Oct. 28, 1929.

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BÜLOW, BERNHARD ERNST von (1815–1879), Danish and German statesman, was the son of Adolf von Bülow, a Danish official, and was born at Cismar, Holstein, on Aug. 2, 1815. He studied law at Berlin, Göttingen and Kiel, and began his political career in the service of Denmark, in the chancery of Schleswig-Holstein-Lauenburg at Copenhagen, and afterwards in the foreign office. In 1842 he became councillor of legation, and in 1847 Danish *chargé d'affaires* in the Hanse towns. In 1850 he was sent to represent the duchies of Schleswig and Holstein at the restored federal diet of Frankfort. Here he came into intimate touch with Bismarck, who admired his statesmanlike handling of the growing complications of the Schleswig-Holstein Question. With the radical "Eider-Dane" party he was utterly out of sympathy; and when, in 1862, this party gained the upper hand, he was recalled from Frankfort. He now entered the service of the grand duke of Mecklenburg-Strelitz, and remained at the head of the grand-ducal government until 1867, when he became plenipotentiary for the two Mecklenburg duchies in the council of the German Confederation (Bundesrat), where he defended the mediaeval constitution of the duchies against Liberal attacks. In 1873 Bismarck persuaded him to enter the service of Prussia as secretary of state for foreign affairs. In 1875 he was appointed Prussian plenipotentiary in the Bundesrat; in 1877 he became Bismarck's lieutenant in the secretaryship for foreign affairs of the Empire; and in 1878 he was, with Bismarck and Hohenlohe, Prussian plenipotentiary at the congress of Berlin. He died at Frankfort on Oct 20, 1879. Of his six sons the eldest, Bernhard Heinrich Karl (*see* above), became chancellor of the Empire.

BÜLOW, DIETRICH HEINRICH, Freiherr von (1757–1807), Prussian soldier and military writer, and brother of General Count F. W. Bülow; entered the Prussian army in 1773 and remained in the service for 10 years. He wrote *Geist des Neueren Kriegssystems* (Hamburg, 1709; revised ed., 1805) and *Der Feldzug 1800* (1801), *Lehrsätze des Neueren Kriegs* (1805), *Geschichte des Prinzen Heinrich von Preussen* (1805), *Neue Taktik der Neuern wie sie sein sollte* (1805), and *Der Feldzug 1805* (1806). He also edited, with G. H. von Behrenhorst (1733–1814) and others, *Annalen des Krieges* (1806). These brilliant but unorthodox works, distinguished by an open contempt of the Prussian system, cosmopolitanism hardly to be distinguished from high treason, and the mordant sarcasm of a disappointed man, brought upon Bülow the enmity of the official classes and of the Government. He was arrested as insane, but medical examination proved him sane and he was then lodged as a prisoner in Colberg, where he was harshly treated, though Gneisenau obtained some mitigation of his condition. Thence he passed into Russian hands and died in prison at Riga in 1807, probably as a result of ill-treatment.

Bülow has often been styled the "father of Modern tactics." His early training had shown him merely the pedantic *minutiae* of Frederick's methods, and, in the absence of any troops capable of illustrating the real linear tactics, he became an enthusiastic supporter of the methods, which (more of necessity than from judgment) the French revolutionary generals had adopted, of fighting in small columns covered by skirmishers. Battles, he maintained, were won by skirmishers. "We must organize disorder," he said; indeed, every argument of writers of the modern "extended order" school is to be found *mutatis mutandis* in Bülow, whose system acquired great prominence in view of the mechanical improvements in armament. But his tactics, like his strategy, were vitiated by his absence of "friction," and their dependence on the realization of an unattainable standard of bravery.

See von Voss, *H. von Bülow* (Köln, 1800); P. von Bülow, *Familienbuch der v. Bulow* (1850); Ed. von Bülow, *Aus dem Leben Dietrichs v. Bülow*, also *Vermischte Schriften aus dem Nachlass von Behrenhorst* (1845); Ed. von Bülow and von Rüstow, *Militärische und vermischte Schriften von Heinrich Dietrich v. Bülow* (1853).

BÜLOW, FRIEDRICH WILHELM, Freiherr von, count of Dennewitz (1755–1816), Prussian general, was born on Feb. 16, 1755, at Falkenberg in the Altmark; he was the elder brother of D. H. Bülow (*q.v.*). He entered the Prussian army in 1768. In 1792 he was made military instructor to the young prince Louis Ferdinand, and accompanied the prince in the campaigns of 1792–93–94 on the Rhine. The disasters of the campaign against Napoleon in 1806 aroused his energies. He did excellent service under Lestocq's command in the latter part of the war, was wounded in action, and finally designated for a brigade command in Blücher's force. He was governor-general of East and West Prussia in 1812, and defended the marches in 1813, fought at Möckern, took Halle, and defended Berlin against Oudinot by his victory at Lückau. In the summer of 1813 he was placed under the command of Bernadotte, crown prince of Sweden. Bülow commanded a corps in the battle of Grossbeeren, defeated Ney at Dennewitz, played a part in the overthrow of Napoleon at Leipzig, and was then entrusted with the task of evicting the French from Holland and Belgium. He won a signal victory at Hoogstraaten, and in the campaign of 1814 he invaded France from the north-west, joined Blücher, and took part in the brilliant victory of Laon in March. He was next made general of infantry and received the title of Count Bülow von Dennewitz. In the short peace of 1814–15 he was at Königsberg as commander-in-chief in Prussia proper. He was soon called to the field again, and in the Waterloo campaign commanded the IV. corps of Blücher's army. He was not present at Ligny, but his corps headed the flank attack upon Napoleon at Waterloo, and bore the heaviest part in the fighting of the Prussian troops. He took part in the invasion of France, but died suddenly on Feb. 25, 1816, a month after his return to the Königsberg command.

See *General Graf Bülow von Dennewitz, 1813–14* (Leipzig, 1843); Varnhagen von Ense, *Leben des G. Grafen B. von D.* (Berlin, 1854); *Biographie*, vol. iii. (Leipzig, 1876), and "Behrenhorst und Bülow" (*Historische Zeitschrift*, 1861, vi.); Max Jahns, *Geschichte der Kriegswissenschaften*, vol. iii., pp. 2133–2145 (Munich, 1801); General von Kammerer (transl. Donat), *Development of Strategical Science* (1905).

BÜLOW, HANS von (1830–1894), German pianist and conductor, was born at Dresden on Jan. 8, 1830, the son of Eduard von Bülow (1803–1858), a well-known author. He received his first lessons in pianoforte-playing from Friederich Wieck, the father of Clara Schumann, but there was no intention of his adopting music as a profession, and in due course he became a law student at Leipzig, though he continued his musical studies, working at counterpoint under Moritz Hauptmann. In 1848 he was already an enthusiast for Wagner's work, and in 1849 was contributing to the *Abendpost* in Berlin (where he was continuing his legal studies) articles in support of his music and that of Liszt. In the years 1850–51 he studied in Zürich the art of conducting under Wagner himself. He then returned to Weimar to work at the pianoforte under Liszt, of whose style and school of playing he became in due course one of the leading exponents. In 1857 he married Liszt's brilliant daughter, Cosima. In the meantime, after two years at Weimar, he began to play in the chief musical centres in Central Europe. He then spent nine years (1855–64) in Berlin as professor of pianoforte playing at the Stern conservatorium, working also as a conductor and writing on musical subjects. In 1864, Wagner helped him to secure the positions of *Hofkapellmeister* to Louis II. of Bavaria and director of the royal school of music at Munich. There he conducted the historic first performances of *Tristan* and the *Meistersinger*. His intimacy with Wagner was now broken by the desertion of his wife Cosima, who left him to marry the composer, but his admiration and enthusiasm for Wagner's work remained unchanged in spite of the severance of their personal relations. After a long concert tour, Bülow settled as conductor at Hanover (1877–80), and then at Meiningen (1880–85). At Meiningen, where he made the orchestra one of the first in Europe, he married, in 1882, Marie Schanzer. From 1885 onwards he conducted in many centres in Russia, in Germany, and in England, and gave classes in pianoforte-playing at the Raff conservatorium in Frankfurt and the Klindworth school in Berlin. He went to live in Hamburg in 1888, though he still conducted the Philharmonic concerts in Berlin, and that year he made his last appearance in England. He died in Cairo on Feb. 13, 1894.

Bülow was a great artist, with complete intellectual mastery of the music he played or conducted. As a conductor he was perhaps greatest in Beethoven, but he was also a great exponent of contemporary music, of Wagner, Liszt, Tchaikovski and Brahms. He had a remarkable musical memory, and had by heart practically all the pianoforte works of the great composers. His mastery of the content of the works of the masters made his editions, especially of the pianoforte works of Beethoven, of great value to students, though they have been criticized by some in respect of their arbitrariness and even inaccuracy. His own music has not lived, but among his more ambitious productions may be mentioned an orchestral work *Nirwana*, incidental music to *Julius Caesar*, and *Vier Charakterstücke für Orchester*.

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BÜLOW, KARL VON (1846–1921), German soldier, was born in Berlin March 24, 1846. Commissioned to the 2nd Guards regiment in 1864, he served in the campaign of 1866 and the Franco-Prussian War of 1870. After a distinguished career, he was placed in charge of the II. Army on the outbreak of the World War, and was at the head of the invasion of Belgium. During the subsequent advance into France, von Kluck's I. Army was also placed under his direction, a faulty arrangement soon abandoned, but not replaced by effective control from German headquarters. From this time the two armies were repeatedly taking divergent action, a confusion which ended in the retreat from the Marne. The responsibility for this strategical disaster was the subject of acute controversy, and public opinion in Germany was induced to fix the blame on von Bülow. But the view of the Supreme Army Command was shown by their placing von Kluck on the retired list and promoting von Bülow to field-marshal in Jan. 1915, and post-war knowledge has confirmed this verdict. In June 1916 von Bülow was, at his own request, placed on the retired list. He died in Berlin Aug. 31 1921.

BULRUSH, a name given in England to *Typha latifolia*, the reed-mace or club-rush, a plant growing in lakes, by edges of rivers and similar localities, with a creeping underground stem, narrow, nearly flat leaves, 3 to 6ft. long, arranged in opposite rows, and a tall stem ending in a cylindrical spike, half to one foot long, of closely packed male (above) and female (below) flowers. The familiar brown spike is a dense mass of minute one-seeded fruits, each on a long hair-like stalk and covered with long downy hairs, which render the fruits very light and readily carried by the wind. The name bulrush is more correctly applied to *Scirpus lacustris*, a member of a different family (Cyperaceae), a common plant in wet places, with tall spongy, usually leafless stems, bearing a tuft of many-flowered spikelets. The stems are used for matting, etc. In the United States the name bulrush is commonly given to species of *Scripus*, especially *S. validus*, while species of *Typha* are usually called cat-tail. The bulrush of Scripture, associated with the hiding of Moses, was *Cyperus Papyrus*, which was abundant in the Nile.

BULSTRODE, SIR RICHARD (1610–1711), English author and soldier, is chiefly known by his *Memoirs and Reflections upon the Reign and Government of King Charles I. and King Charles II.*, published in 1721 after his death. He also wrote *Life of James II.* and *Original Letters written to the Earl of Arlington* (1712).

His second son, WHITELOCKE BULSTRODE (1650–1724), published *A Discourse of Natural Philosophy*, and was a prominent Protestant controversialist.

BULWARK, a barricade of beams, earth, etc. (possibly from *bole*, a tree-trunk, and *werk*, work; Ger. *Bollwerk*), a work in 15th and 16th century fortifications designed to mount artillery (*see* BOULEVARD). The term is used of the woodwork running round the ship above the level of the deck. Figuratively it means anything serving as a defence.

BUMBLEBEE or **HUMBLEBEE,** the common name for bees (*q.v.*), of the genus *Bombus*, which have a thick hairy body, often banded with bright colours. There are numerous species, found generally throughout the world except the Australian region, where, however, they have been introduced as their presence is necessary to fertilize some of the cultivated species of clover (*see* SOCIAL INSECTS; HYMENOPTERA).

BUMBOAT, a small boat which carries vegetables, provisions, etc., to ships lying in port or off the shore. The word is probably connected with the Dutch *bumboat* or *boomboot*, a broad Dutch fishing-boat, the derivation of which is either from *boom*, *cf.* Ger. *Baum*, a tree, or from *bon*, a place in which fish is kept alive, and *boot*, a boat. It appears first in English in the Trinity House by-laws of 1685 regulating the scavenging boats attending ships lying in the Thames.

BUMBULUM, BOMBULUM or **BUNIBULUM,** a musical instrument described in an apocryphal letter of St Jerome to Dardanus. There is no evidence at all of such an instrument—described as consisting of an angular frame from which metal plates and small bells depended—having ever existed.

BUMPERS: *see* BUFFER.

BUN, a small cake, usually sweet and round. In Scotland it is a rich spiced cake and in the north of Ireland a round loaf of ordinary bread. In the U.S.A., the word also means a "roll." The derivation of the word has been much disputed.

Like the Greeks, the Romans ate bread marked with a cross (possibly in allusion to the four quarters of the moon) at public sacrifices, such bread being usually purchased at the doors of the temple and taken in with them—a custom alluded to by St Paul in I. Cor. x. 28. The cross-bread was eaten by the pagan Saxons in honour of Eoster, their goddess of light. The Mexicans and Peruvians had a similar custom. The custom, in fact, was practically universal, and the early Church adopted the pagan practice, grafting it on to the Eucharist and so giving us the "hot-cross bun."

BUNA: *see* RUBBER.

BUNBURY, HENRY WILLIAM (1750–1811), English caricaturist, second son of Sir William Bunbury, 5th baronet, of Mildenhall, Suffolk, was educated at Westminster School and St. Catharine's Hall, Cambridge, and soon showed a talent for drawing, and especially for humorous subjects. His caricatures are as famous as those of his contemporaries Rowlandson and Gillray, good examples being his "Country Club" (1788), "Barber's Shop" (1811) and "A Long Story" (1782). He was colonel of the West

Suffolk Militia, and was appointed equerry to the duke of York in 1787.

His son SIR HENRY EDWARD BUNBURY, Bart. (1778–1860), wa a distinguished soldier, and rose to be a lieutenant-general; he was an active member of parliament, a pioneer of the volunteer movement and the author of several historical works of value, notably *Narrative of certain Passages in the late war with France* (1852) valuable for the light thrown on internal history just before the Peninsular War. His second son, SIR EDWARD HERBERT BUNBURY (1811–95), also a member of parliament, was well known as a geographer and archaeologist, and author of a *History of Ancient Geography* (1879) and a *Memoir* (1868) of his father.

BUNBURY, seaport and municipal town (pop. 1933, 5,140) situated on the south-west coast of Western Australia 90 m. S. of Fremantle and 115 m. (by rail) from Perth. The climate is equable and bracing (mean ann. temp.: 68°–54° F; av. ann rainfall: about 38 in., mainly in winter). The bay (Koombana) on which it stands is open to the sea and the harbour is liable to silting. A granite mole and a timber jetty afford 5,000 ft. berthing space with railway facilities and depths of 15–27 ft. The hinterland of Bunbury is noted for its timber (mainly jarrah). The supplies of this are diminishing, but wheat, wool and fruit (mainly apples) are grown. Bunbury is also an outlet for a good deal of coal from the Collie field (40 m. by rail). It is the second port of Western Australia and has a considerable, but fluctuating, export trade in timber (about 150,000 tons per ann.), wheat, coal, wool and fruit amounting to about 280,000–290,000 tons (£1,000,000–£1,500,000) carried in about 320,000 tons of shipping.

BUNCOMBE or **BUNKUM** (from Buncombe county, N.C., U.S.A.), a term used for insincere political action or speaking to gain support or the favour of a constituency, and so any humbug or clap-trap. The phrase "to talk for (or to) Buncombe" arose in 1820, during the debate on the Missouri compromise in the U.S. Congress; the member for the district containing Buncombe county confessed that his long and much interrupted speech was only made because his electors expected it, and that he was "speaking for Buncombe."

BUNCRANA, market town and urban district of Co. Donegal, Eire, on the Londonderry and Lough Swilly railway. Pop. (1936) 2,295. There is a trade in agricultural produce, a salmon fishery, sea fisheries and a manufacture of linen. The town is flanked on the east and south by hills exceeding 1,000 ft. The square keep of an ancient castle remains, but the present Buncrana castle is a residence erected in 1717.

BUNDABERG, a municipal town and river port of Cook county, Queensland, Australia, 10 m. from the mouth of the river Burnett. Pop. (1933), 11,466. It lies on both sides of the river, and connection between the two ports is maintained by road and railway bridges. There are saw-mills, breweries, brickfields and distilleries in the town, and numerous sugar factories in the vicinity. The staple exports are sugar, golden-syrup and timber.

BUNDELKHAND, a tract of country in Central India, lying between the United and the Central Provinces. Historically it includes the British districts of Hamirpur, Jalaun, Jhansi and Banda, which now compose the Jhansi division of the United Provinces, but politically it is restricted to a collection of Indian States, under the Bundelkhand agency. There are nine States, the most important of which are Orchha, Panna, Samthar, Charkhari, Chhatarpur, Datia, Bijawar and Ajaigarh: there are also 13 small estates in the agency, and a *pargana* (Alampur) belonging to Indore. A garrison of all arms is stationed at Nowgong.

The surface of the country is uneven and hilly, except in the north-east part, which forms an irregular plain cut up by ravines. There are three ranges of hills, the Bindhachal, Panna and Bander chains, the highest elevation not exceeding 2,000 feet. The country is further diversified by isolated hills rising abruptly from a common level, and presenting from their steep and nearly inaccessible scarps eligible sites for castles and strongholds, whence the mountaineers of Bundelkhand have frequently set at defiance the most powerful of the Indian States. The general slope of the country is towards the north-east, as indicated by the course of the rivers which traverse or bound the territory, and finally discharge themselves into the Jumna. The chief streams, enumerating them from the western boundary, are the Sind, Betwa, Ken, Baighin, Paisuni, Tons, Pahuj and Dhasan. They flow in deep ravine-fringed channels and are of little use for irrigation; though the waters of the Betwa have been impounded for an important canal. The main sources of irrigation are numerous artificial lakes, formed centuries ago by throwing massive embankments across drainage lines. Many of them, like Barwa Sagar near Jhansi, which is 2½m. in diameter, are set in surroundings of singular natural beauty, and enhance the picturesque variety of the Bundelkhand landscape.

The people are almost as picturesque as their country. The true Bundela—the race which gives its name to the land—is generally impoverished and in debt; but he has an inextinguishable pride in his descent and a great aversion to hard work. In his raiment he displays an attractive sense of colour; and a touch of the swashbuckler is added to his mien by the velvet-sheathed *talwar* or other mediaeval weapon which he generally carries about with him. He is a keen sportsman, and the low jungle with which the country is covered abounds in game, tiger, leopard, hyena, wild boar, nilgai and antelope.

Diamonds are found over a considerable area of country, but particularly near Panna. The output in Akbar's time is said to have been worth £100,000 a year: and some fine specimens were obtained: a magnificent jewel from the Gadasia mine was among the treasures in Kalinjar fort. Though the quality is good, the size of the finds is now small. The diamonds lodge in a conglomerate, not unlike the diamondiferous rock of South Africa, but lose to the surface, and they are worked in shallow irregular pits.

The earliest dynasty recorded to have ruled in Bundelkhand were the Gaharwárs, who were succeeded by the Parihars. About A.D. 800 the Parihars are said to have been ousted by the Chandels, whose chief, Dangha Varma, appears to have established the earliest paramount power in Bundelkhand towards the close of the 10th century A.D. Under his dynasty the country attained its greatest splendour in the early part of the 11th century, when its rajah, whose dominions extended from the Jumna to the Nerbudda, marched at the head of 36,000 horse and 54,000 foot, with 640 elephants, to oppose the invasion of Mahmud of Ghazni. In 1182 the Chandel dynasty was overthrown by Prithwi Raj, the ruler of Ajmer and Delhi, after which the country remained in ruinous anarchy until the close of the 14th century, when the Bundelas, who are supposed to be a left-handed branch of either the Gaharwárs or the Chandels, established themselves on the right bank of the Jumna. One of these took possession of Orchha by treacherously poisoning its chief; and his successor it was who assassinated the celebrated Abul Fazl, the prime minister and historian of Akbar. The struggles of the Bundelas for independence resulted in the withdrawal of the royal troops, and the admission of several petty States as feudatories of the empire on condition of military service. On the occasion of a Mohammedan invasion in 1732, Chhatar Sal asked and obtained the assistance of the Mahratta peshwa, whom he adopted as his son, giving him a third of his dominions. The Mahrattas gradually extended their influence over Bundelkhand, and in 1792 the peshwa was acknowledged as the lord paramount of the country. The Mahratta power was, however, on the decline; and by the treaty concluded between the peshwa and the British Government, the districts of Banda and Hamirpur were transferred to the latter. In 1809 Ajaigarh was besieged by a British force, and again three years later Kalinjar was besieged and taken after a heavy loss. In 1817, by the Treaty of Poona, the British Government acquired from the peshwa all his rights, interests and pretensions, feudal, territorial or pecuniary, in Bundelkhand. In carrying out the provisions of the treaty, an assurance was given by the British Government that the rights of those interested in the transfer should be scrupulously respected, and the host of petty principalities in the province is the best proof of the sincerity and good faith with which this clause has been carried out.

BUNDI, an Indian State in the Rajputana agency, lying on the north-east of the river Chambal, in a hilly tract historically known as Haraoti. It has an area of 2,205 sq.mi. Many parts of the state are wild and hilly, inhabited by a large Mina population, formerly notorious as a race of robbers. Two rivers, the Chambal and the Mej, water the state. In 1941 the population was 249,374. The town of Bundi had a population in 1941 of 20,846. A school for boys of high rank was opened in 1897.

The state of Bundi was founded about A.D. 1342 by the Chauhan rajput chief, Rao Dewa or Deoraj, who captured the town from the Minas. Its importance, however, dates from the time of Rao Surjan, who succeeded to the chieftainship in 1554 and by throwing in his lot with the Mohammedan emperors of Delhi (1569) received a considerable accession of territory. In the 17th century their power was curtailed by the division of Haraoti into the two States of Kotah and Bundi; but the title of maharao raja was conferred on Budh Singh for the part played by him in securing the imperial throne for Bahadur Shah I after the death of Aurangzeb in 1707. In 1804 the maharao raja, Bishan Singh, gave valuable assistance to Col. Monson in his disastrous retreat before Holkar, and in 1818, by a treaty concluded with Bishan Singh, Bundi was taken under British protection. In 1821 Bishan Singh was succeeded by his son, Ram Singh, who ruled till 1889, and was known as "the most conservative prince in conservative Rajputana." His rule was popular and beneficent; and his grandson, the present maharao raja (succeeded in 1927), continues the same traditions. He enjoys a salute of 17 guns.

BUNER, a valley on the Peshawar border of the North-west frontier province of India. It is a small mountain valley, dotted with villages and divided into seven sub-divisions. The Mora hills and the Ilam range divide it from Swat, the Smawar range from Yusafzai, the Guru mountains from the Chamla valley, and the Duma range from the Puran valley. It is inhabited by the Niaszai and Malizai divisions of the Pathan tribe of Yusafzais, who are called after their country the Bunerwals. They are a powerful and warlike tribe, numbering 27,000 fighting men. The Umbeyla expedition of 1863, under Sir Neville Chamberlain, was occasioned by the Bunerwals siding with the Hindustani fanatics, who had settled down at Malka in their territory. In the end the Bunerwals were subdued by a force of 9,000 British troops, and Malka was destroyed, but they made so fierce a resistance, in particular in their attack upon the "Crag" picket, that the Indian medal with a clasp for "Umbeyla" was granted in 1869 to the troops taking part. The government of India refrained from interfering with the tribe again until the Buner campaign of 1897 under Sir Bindon Blood. Many Bunerwals took part in the attack of the Swatis on the Malakand fort, and a force of 3,000 British troops was sent to punish them; but the tribe speedily handed in the arms demanded of them and made complete submission.

BUNGALOW, the Anglo-Indian form of the vernacular name of the typical one-storied house lived in by Europeans in India. It is now generally used for houses of one story, or of low design giving this effect. A *dak* bungalow is a rest house provided in India by the public authorities for the use of travellers.

BUNGAY, urban district of East Suffolk, England; 113 mi. N.E. of London by the L.N.E.R. from Beccles. Pop. (1938) 3,072. Area 4.1 sq.mi. It is placed in a deep bend of the river Waveney, the boundary with Norfolk. The parish church of St. Mary has a fine Perpendicular tower, and that of Holy Trinity a round tower of which the lower part is Norman. St. Mary's was attached to a Benedictine nunnery founded in 1160. The castle, of which massive ruins remain, was a stronghold of the powerful family of Bigod, being granted to Roger Bigod, a Norman follower of the Conqueror, in 1075. A grammar school was founded in 1592. There are large printing-works, and a considerable carrying trade on the Waveney, in corn, flour and lime.

BUNIN, IVAN ALEXEYEVICH (1870–), Russian poet and novelist, was born Oct. 10, 1870, of noble family in Voronesh. His first poems were published in 1889. His poems were awarded the Pushkin prize, the highest academic distinction in Russia, and the same distinction was awarded to his translation of Longfellow's "Hiawatha." His other masterly translations from English poets include those of Byron's "Manfred" and "Cain," and of Tennyson's "Lady Godiva." In 1909 he was elected a member of the Russian Academy.

Bunin's poetry is mainly descriptive—not lyric—impassive, of classic simplicity and harmony, of jewelled perfection, minute observation and vivid perception of colour. He ranks highest, however, as a prose writer. The best known among his novels, tales and short stories are *The Village*, *A Gentleman from San Francisco*, *Suchodol*, *An Evening in the Spring*. The first two have been translated into English, as also *Dreams of Chang and other Stories*. There is much affinity in his novels with Turgeniev and Chekhov, but perhaps more with Flaubert. In 1933 he was awarded the Nobel prize for literature.

See Prince D. Svyatopolk-Mirsky, *Modern Russian Literature*, p. 96. (1925).

BUNION, an inflamed swelling of the sac containing synovial fluid on the metatarsal joint of the big toe, or, more rarely, of the little toe. This may be accompanied by corns or suppuration. The cause is prolonged compression of the toes in a narrow and pointed boot so that the great toe is deflected outwards instead of pointing directly forwards. Use of sufficiently wide footwear and palliative treatment by dressings, etc., are usually effective, but in obstinate cases a surgical operation may be considered.

BUNKER HILL, the name of a small hill in Charlestown, Boston (Mass.), U.S.A., famous as the scene of the first considerable engagement June 17, 1775, in the American Revolution (*q.v.*). Bunker Hill (110ft.) was connected by a ridge with Breed's Hill (75ft.), both being on a narrow peninsula a short distance to the north of Boston, joined by a causeway with the mainland. Since the affair of Lexington (April 19, 1775) General Gage, who commanded the British forces, had remained inactive at Boston awaiting reinforcements from England. The headquarters of the Americans were at Cambridge, with advanced posts occupying much of the 4m. separating Cambridge from Bunker Hill. When Gage received his reinforcements at the end of May, he determined to repair his strange neglect by which the hills on the peninsula had been allowed to remain unoccupied and unfortified. As soon as the Americans became aware of Gage's intention they determined to frustrate it, and accordingly, on the night of June 16, a force of about 1,200 men, under Colonel William Prescott and Maj.-General Israel Putnam, with some engineers and a few field-guns, occupied Breed's Hill (to which the name Bunker Hill is itself now popularly applied). When daylight disclosed their presence to the British they had already strongly entrenched their position. Gage lost no time in sending troops across from Boston with orders to assault. The British force, between 2,000 and 3,000 strong, under (Sir) William Howe, supported by artillery and by the guns of men-of-war and floating batteries stationed in the anchorage on either side of the peninsula, were fresh and well disciplined. The American force consisted for the most part of inexperienced volunteers, numbering about 1,500 men. The village of Charlestown, from which a galling musketry fire was directed against the British, was by General Howe's orders almost totally destroyed by hot shot during the attack. Instead of attempting to cut off the Americans by occupying the neck to the rear of their position, Gage ordered the advance to be made up the steep and difficult ascent facing the works on the hill. Whether or not in obedience (as tradition asserts) to an order to reserve fire until they could see the whites of their assailants' eyes, the American volunteers with admirable steadiness waited till the attack was on the point of being driven home, when they delivered a fire so sustained and deadly that the British line broke in disorder. A second assault, made like the first, with the precision and discipline of the parade-ground met the same fate, but Gage's troops had still spirit enough for a third assault, and this time they carried the position with the bayonet, capturing five pieces of ordnance and putting the enemy to flight. The loss of the British was 1,054 men killed and wounded, among whom were 89 commissioned officers; while the American casualties amounted to 420 killed and wounded, including General Joseph Warren, and 30 prisoners.

The significance of the battle of Bunker Hill is not, however, to be gauged by the losses on either side, heavy as they were in proportion to the numbers engaged, nor by its purely military results, but by its moral effect. "It roused at once the fierce instinct of combat in America . . . and dispelled . . . the almost superstitious belief in the impossibility of encountering regular troops with hastily levied volunteers. . . . No one questioned the conspicuous gallantry with which the provincial troops had supported a long fire from the ships and awaited the charge of the enemy, and British soldiers had been twice driven back in disorder before their fire."[1] The pride which Americans naturally felt in such an achievement, and the self-confidence which it inspired, were increased when they learnt that the small force on Bunker Hill had not been properly reinforced, and that their ammunition was running short before they were dislodged from their position.[2] Had the character of the fighting on that day been other than it was; had the American volunteers been easily, and at the first assault, driven from their fortified position by the troops of George III., it is not impossible that the resistance to the British Government would have died out in the North American colonies through lack of confidence in their own power on the part of the colonists. Bunker Hill, whatever it may have to teach the student of war, taught the American colonists in 1775 that the odds against them in the enterprise in which they had embarked were not so overwhelming as to deny them all prospect of ultimate success.

See R. Frothingham, *The Centennial: Battle of Bunker Hill* (Boston, 1895), and *Life and Times of Joseph Warren* (Boston, 1865); Boston City Council, *Celebration of Centen. Aniv. of Battle of Bunker Hill* (Boston, 1875); G. E. Ellis, *Hist. of Battle of Bunker's* (Breed's) *Hill* (Boston, 1875); S. Sweet, *Who was the Commander at Bunker Hill?* (Boston, 1850); W. E. H. Lecky, *History of England in the Eighteenth Century*, vol. iii. (1883); Sir George O. Trevelyan, *The American Revolution* (1899); Fortescue, *Hist. of the Brit. Army*, vol. iii. (1902). (C.)

BUNKERING OF SHIPS. Coal bunkering has naturally been in use ever since steamships came into existence. In the early days it was performed by hand, which was an extremely slow process. It is no uncommon sight to see, even to-day, gangs of from 50 to 150 men and women, carrying baskets of coal and handing them up the ship's side, *see* fig. 1; the output is 3 to 4 tons per carrier per day. Apart from the economic aspect, hand bunkering was not so bad when the loading and unloading of vessels was slow, but with modern devices for handling cargo, coal bunkering becomes a more important proposition.

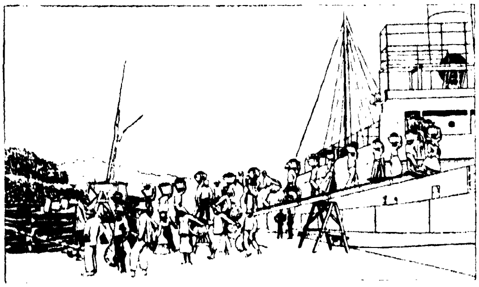

FIG. 1.—NATIVE MEN AND WOMEN COALING A SHIP AT ST. LUCIA, B.W.I.
The coal is carried in baskets and tallied at the foot of the gangway by the coaling agent and a ship's officer

Before discussing the different methods and devices in use, it must be mentioned that there are fundamental differences, depending upon the particular port concerned, its traffic, and the nature of the fuel employed.

At the Welsh ports, at Liverpool and at ports on the Tyne and Humber, the coal loaded is almost exclusively cargo; it is all railborne, and is transferred from the sidings by huge steel structures on the quayside, known as coal hoists. By raising the trucks individually and tipping them, the coal is loaded by means of a telescopic chute. These coal hoists are also occasionally used at these ports for bunkering vessels. On the other hand, at ports where general cargo is principally handled, water-borne coal is almost exclusively used for bunkering purposes, because the quay space is too valuable for the provision of coal hoists. The coal is unloaded into barges, and then transferred by manual labour or mechanical devices into the bunkers of the steamers.

At the Victoria and Albert docks—which may be taken as a typical example—about 30% of the coal is still loaded by manual labour, while about 70% is mechanically bunkered. The former process is performed by winch barges by the "whip and skip" method. An average of 100 tons per day of 8 hours can thus be transferred by a gang of 9 men.

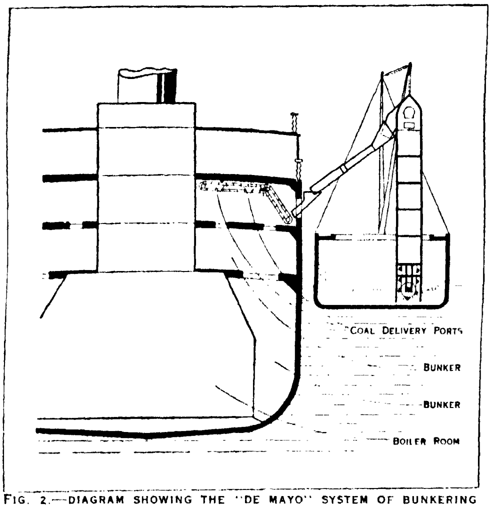

FIG. 2.—DIAGRAM SHOWING THE "DE MAYO" SYSTEM OF BUNKERING
This device discharges coal from barges through the intake port hole either direct or, as shown, by convoyor to the bunkers

Mechanical Bunkering Plants may be divided under two heads:—

A.—Portable loading devices, self-contained, but with no supporting structure. They are attached temporarily to the ship to be coaled; and

B.—Floating loading devices mounted on pontoons.

A. The "De Mayo" bunkering device, which is more particularly used in America, is a completely enclosed bucket elevator, suspended singly, or in series, from ships' tackle or from the boom of a coaling barge; it discharges coal from barges alongside, both in and off shore, and at the intake port-hole. With this system, portable conveyors are sometimes employed for trimming the coal in the bunkers, or for loading through deck hatches in connection with an adjustable portable elevator. Such a combination is shown in fig. 2. This device is used in the Panama Canal for bunkering vessels which do not touch at the piers.

The "Michener" coaling elevator (see fig. 3) consists of a special type of bucket elevator, suspended from the side of the vessel, with the feeding end in the coal barge and the delivery end reaching right into the bunker port of the vessel. By an ingenious device the elevator can be dipped farther into the barge as the coal is unloaded, without altering the position of the delivery end. The receiving terminal revolves in the opposite direction to that usual in elevators; it is, therefore, termed under-fed. After a vertical run, beginning at the lower terminal, the chain forms a bight, negotiates the guide idler G, and assumes an essentially horizontal position towards the power-driven sprocket E. During this short run the coal leaves the buckets, dropping into a slightly hoppered, bifurcated receptacle, from which it is led, by means of telescopic chutes, into the bunkers. The average capacity of one unit is 125 tons per hour, with an expenditure of 10 h.p.

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[1] W. E. H. Lecky, *History of England in the Eighteenth Century*, iii. 428.

[2] General Gage's despatch. *American Remembrancer* 1776, part II., p. 132.

B. The "Temperley" transporter is used either slung from the ship's tackle or from special coaling barges. It is self-contained and consists essentially of an I-shaped boom having a traveller running on the lower flange. The boom is triced up to the movable framework or shear legs and the traveller is worked by two ropes engaging with the two drums of a double-barreled winch. The boom is so arranged as to reach athwart the coaling barge and the vessel to be bunkered, in which coal can be dumped at any number of predetermined points.

The "Suisted" bunkering elevator (*see* fig. 4) consists essentially of a bucket elevator and band conveyor, mounted on two pontoons with room between for the coal barges; one of the pontoons contains the generating plant for power and light, while in the other is provided accommodation for the crew. It is so built that the upper structure straddles the barges to be unloaded, devouring their contents, and disgorging them into the bunkers of a vessel. The important feature is the way in which the bucket elevator is mounted between the two pontoons, so that it can be raised and lowered, as well as racked mechanically from side to side, in order to pick up the coal with the minimum amount of trimming. The 58ft. elevator is driven by a 60h.p. electric motor. Each bucket holds 4 cwt. of coal. The 48ft. band conveyor is 3ft. wide and runs at 400ft. per minute. The plant has a capacity of 300 tons per hour and requires nine men to work it. Since the racking of the elevator is limited by the hatch coamings, some trimming of the coal is necessary and this is performed by four of the nine men.

In some instances devices of this type have been built with a single large trimming pontoon to carry the coal and thus dispense with the barges, but since the economy of such expensive bunkering devices depends largely upon their being fully employed, it is short-sighted policy to use them for carriers also, unless they are of very large capacity. The best known of such devices are built in Holland by the firms of Schmulder, and Werft Conrad (*see* fig. 5); others are built by William Doxford & Sons, Ltd., Sunderland.

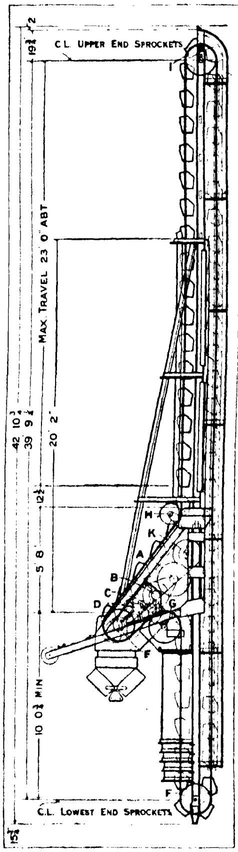


FIG. 3.—"MICHENER" MACHINE
This elevator, suspended from the side of the vessel, delivers coal directly into the bunkers. Buckets shown in thick lines are visible, while those in thin lines are enclosed. Letters A to K indicate the location of the idlers and sprockets determining the path of the chain of buckets

At Rotterdam, where the harbour is exceptionally spacious, the mechanical devices used are floating hoists on high steel structures which are fitted with grabs, but a great deal of dust is created during operation.

Harrisons (London) Ltd.'s bunkering pontoon (*see* fig. 6), is a device, unlike the "Suisted," mounted on one large pontoon, which, for the sake of stability, also carries the generating plant, including the motors and winches for the various movements. It consists of a 2-ton grab and bogie, which travel on a horizontal boom; a 30-ton bunker on board the pontoon, into which the grab discharges; a measuring device which doles out the coal from the bunker alternatively into the twin vertical skip hoists with bottom door discharge; these raise the loads to a smaller receiving chamber which can be elevated sufficiently high for bunkering the biggest ships. Each of the two skip hoist units has a capacity of one ton, and they discharge alternatively into the receiving chamber, whence the coal is led, by means of a gravity chute, to any of the bunkering hatches, side or amidship. The measuring chamber and the skip hoists when in their lowest position are so enclosed as to exclude dust production; the coal-receiving chamber, high up in the structure, is also similarly enclosed.

When the bunkering device has been placed close up against the vessel to be coaled and a coal barge brought into position on the other side, the boom, on which the grab runs, is brought from its upright housed position to its horizontal working position; the grab is run out over the barge, lowered into the coal, and a charge lifted and deposited into the receiving bunker. The gravity chute is telescoped at the delivery end and can be slewed in either direction from the receiving chamber to the bunkers of a vessel. The upper terminal of the hoist is practically a compensating dumping frame which may be adjusted to any desired position by a separate motor and winding gear without stopping the working of the plant. In that position each skip is arrested for a few seconds, the bottom door automatically opened and the coal delivered into the receiving chamber. The door is then automatically closed as the skip returns to be refilled. The plant is worked by four men only. Perhaps the greatest advantage of this type of plant is the exclusion of dust during the bunkering process.

BUNKERING ON THE OPEN SEA

This was formerly much practised by the navies of different nations, but has now been almost entirely superseded by oil-fuel bunkering in port. The method is very complex, and it is not necessary to describe it in detail here: it is similar to that employed in rope and cableways. One terminal trestle is on the collier and the other on the ship to be bunkered. One vessel tows the other, keeping taut the connecting cable, which is well above the water; the coal in sacks is transferred along the cable by an endless hauling rope.

For oil-fuel bunkering at sea while under way, cable communication is similarly established between the vessels, but on a lower level. A hose-pipe is festooned on the cable so that the oil fuel can be pumped from one vessel direct to the bunkers of the other.

Trimming the Bunkers.—Since the capacity of these mechanical bunkering devices has frequently to be curtailed because the rate of trimming to the bunkers cannot keep pace with the rate of delivery, mechanical trimming devices are often employed. One method has already been alluded to in the description of the "De Mayo" plant, but a more efficient system, used particularly for loading coal on to big liners, is the "Lane-Galloway" trimming machine. This was originally installed at Curtis Bay (Md.), U.S.A., where large quantities of coal are loaded into vessels. The principle embodied is that of an endless band conveyor, sometimes fitted with cross cleats, on to which the coal is delivered. The speed of this band—2,700ft. per minute—is such as to impart to the coal when leaving the belt a velocity sufficient to throw it right across the bunker. The length of the belt is 3ft. to 4ft. from centre to centre and the width 48in. A machine on a similar principle is used in Scotland, the action of which is shown in fig. 7.

OIL FUEL BUNKERING

Owing to the many advantages of oil fuel, oil bunkering has become a most important factor. Compared with coal it takes but a tithe of the time to bunker; dust and smoke are avoided; trimming is no longer necessary; no ashes have to be disposed of; moreover, for equal fuel value, oil takes less bunkering space. The loss of heat which, in the case of coal, is occasioned by the cleaning of the fires, is avoided, since oil fuel can be supplied continuously and a constant pressure of steam maintained all the time.

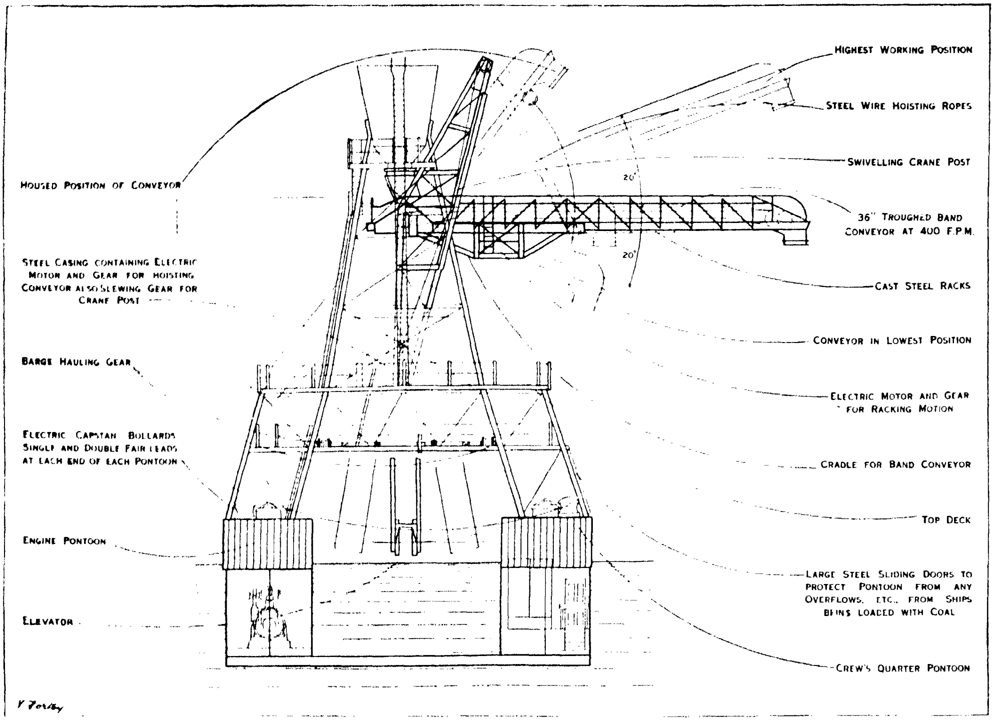
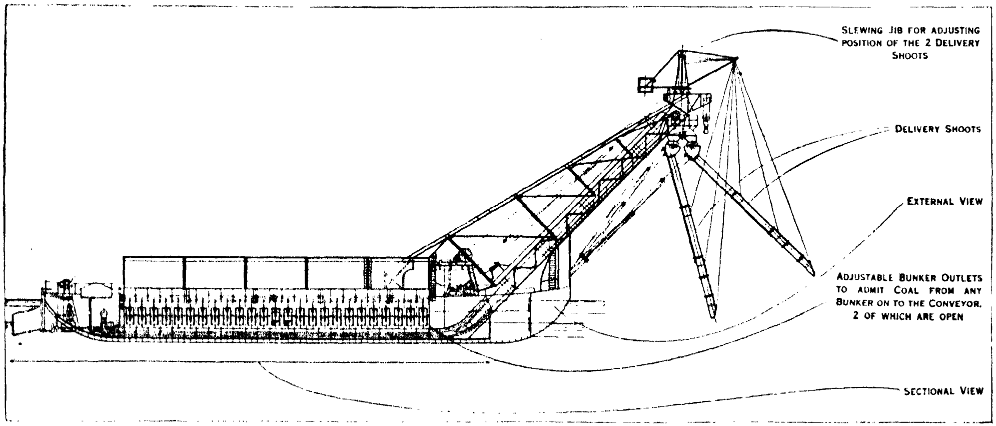

HIGHEST WORKING POSITION
STEEL WIRE HOISTING ROPES
SWIVELLING CRANE POST
20°
20°
36" TROUGHED BAND CONVEYOR AT 400 F.P.M.
CAST STEEL RACKS
CONVEYOR IN LOWEST POSITION
ELECTRIC MOTOR AND GEAR FOR RACKING MOTION
CRADLE FOR BAND CONVEYOR
TOP DECK
LARGE STEEL SLIDING DOORS TO PROTECT PONTOON FROM ANY OVERFLOWS, ETC., FROM SHIPS BEING LOADED WITH COAL
CREW'S QUARTER PONTOON
HOUSED POSITION OF CONVEYOR
STEEL CASING CONTAINING ELECTRIC MOTOR AND GEAR FOR HOISTING CONVEYOR ALSO SLEWING GEAR FOR CRANE POST
BARGE HAULING GEAR
ELECTRIC CAPSTAN BOLLARDS SINGLE AND DOUBLE FAIR LEADS AT EACH END OF EACH PONTOON
ENGINE PONTOON
ELEVATOR

FIG 4 · END VIEW OF THE "SUISTED" BUNKERING MACHINE. DESIGNED BY THE SUISTED ELEVATOR COMPANY. THIS DEVICE IS MADE UP OF A BUCKET ELEVATOR AND A BAND CONVEYOR, MOUNTED ON PONTOONS, BETWEEN WHICH THE COAL BARGES (NOT SHOWN) ARE ACCOMMODATED. THE ELEVATOR DELIVERS ON TO THE BAND CONVEYOR WHICH TAKES THE COAL TO THE PORT HOLES

Oil fuel bunkering is an extremely simple process and may be performed either on the quay or, more frequently, from the waterside, from floating tanks or "hulks." There are three possible means of dealing with the problem: The oil may be pumped into the vessel; or, if the storage receptacles are overhead, it may be delivered by gravity; or air pressure can be applied to closed tanks and the oil thus forced through pipe-lines to the bunkers of the vessel to be served. Owing to the inflammable nature of the oil it is preferable not to supply it from the quay of a general dock, but this is, none the less, frequently the practice. In some cases, the oil mains from the depôts are floating, but submerged under water, as in the method employed by the Anglo-Mexican


SLEWING JIB FOR ADJUSTING POSITION OF THE 2 DELIVERY SHOOTS
DELIVERY SHOOTS
EXTERNAL VIEW
ADJUSTABLE BUNKER OUTLETS TO ADMIT COAL FROM ANY BUNKER ON TO THE CONVEYOR, 2 OF WHICH ARE OPEN
SECTIONAL VIEW

BY COURTESY OF MESSRS. WERF CONRAD, LIMITED

FIG. 5. GENERAL DESIGN OF A MOTOR DRIVEN BUNKERING BOAT, CARRYING 900 TONS OF COAL WHICH IT TRANSSHIPS AT THE RATE OF 200 TONS PER HOUR. IT IS FITTED WITH FORE AND AFT DRAUGHT INDICATORS WHICH DETERMINE THE QUANTITY OF COAL DISCHARGED

Oil Company. Conveyance through measuring pumps is the practice commonly in vogue, through mains ranging from 8in. to 10in. and even 12in. diameter. Pumps of the Worthington-Simpson, and Hall types, etc., have been used for this purpose, having capacities up to 250 tons per hour, employing a 10in. pipe-line. As a rule the pumps are located at the depôt, but many of the oil-bunkering steamers carry their own pumps for taking in fuel from floating depôts.

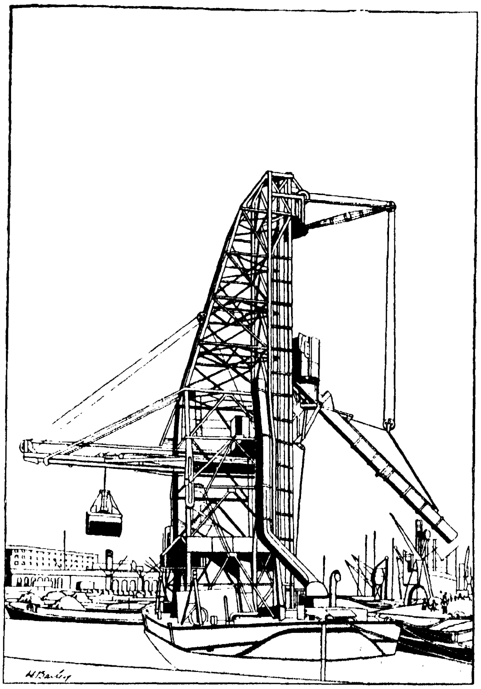


FIG 6.—"VULCAN" BUNKERING MACHINE AT VICTORIA AND ALBERT DOCKS, LONDON. IN THIS PLANT THE COAL IS UNLOADED FROM THE BARGES BY GRAB—SEE LEFT—AND TRANSFERRED TO THE VESSEL BY A SKIP HOIST THROUGH A TELESCOPIC SHOOT—SEE RIGHT

At the Immingham Dock, where the largest ships are bunkered and where the largest tankers can unload, the oil storage tanks, of a total capacity of 2,280,000 gal., have connecting pipe-lines running from the tank into the dock and also to the eastern and western jetties, which afford excellent advantages for bunkering from the main store. These pipe-lines are of 10in. and 12in. diameter and are equipped with a number of oil delivery connections.

Such vessels as the "Aquitania" take in the whole of their oil fuel—about 2,000 tons—from a tanker in six hours, through two pipe-lines; one such vessel has been bunkered in the Armstrong yard in four hours. (G. F. Z.)

BUNN, ALFRED (1796–1860), English theatrical manager, was stage-manager of Drury Lane theatre, London (1823), of the Theatre Royal, Birmingham (1826), and joint manager of Drury Lane and Covent Garden, London (1833). He had difficulties first with his company, then with the lord chamberlain, and had a long-standing quarrel with Macready, which resulted in the tragedian assaulting the manager. In 1840 Bunn was declared a bankrupt, but he continued to manage Drury Lane till 1848. Artistically his control of the two chief English theatres was highly successful. He made a courageous attempt to establish English opera, producing the principal works of Balfe. He had some gift for writing, and most of the libretti of these operas were translated by himself.

See his *The Stage Before and Behind the Curtain* (3 vols., 1840).

BUNNER, HENRY CUYLER (1855–1896), American writer, was born in Oswego, N.Y., Aug. 3, 1855, and died in Nutley, N.J., May 11, 1896. Educated in New York city, Bunner, after a brief experience as clerk in an importing house, turned to journalism, serving on the staff of the *Arcadian*, at twenty-two becoming assistant editor and later editor of *Puck*. Since the staff of the comic weekly was very small and the funds were limited, there were many weeks when he wrote nearly half the issue. He refused, however, to republish this work, and is judged as a man of letters by his fiction and his charming *vers de société*. In both these lines French influence is dominant. Like his friend Brander Matthews and like Austin Dobson, he was inspired by the intricate and graceful verse forms of the 15th century. *"Made in France," French Tales Retold with a United States Twist* (1893), and to a

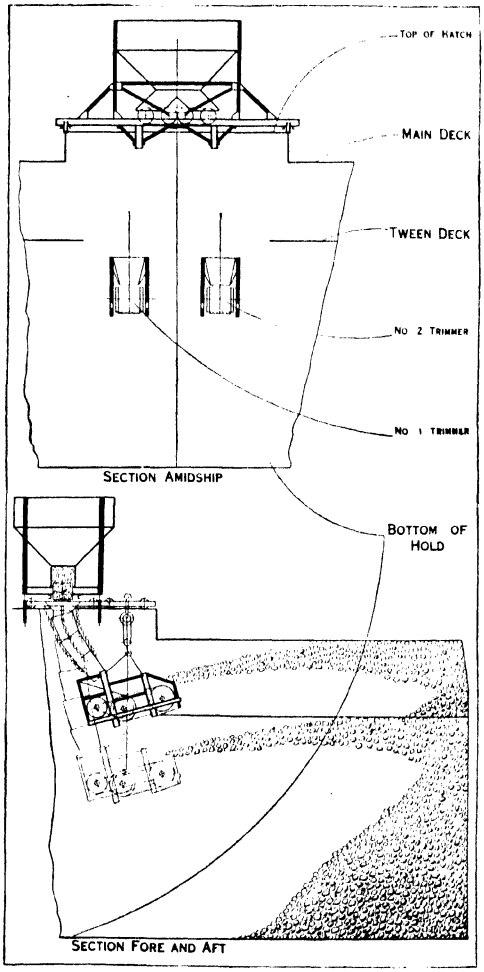


FIG 7.—METHOD OF MECHANICAL TRIMMING IN WHICH THE COAL IS SPOUTED ON TO A FAST-RUNNING BAND CONVEYOR, WHICH THROWS IT TO THE REMOTEST ENDS OF THE BUNKERS

lesser extent his other stories reveal his indebtedness to Maupassant and other French masters. Technical dexterity, playfulness, and smoothness of finish mark his prose as well as his verse—*Airs from Arcady and Elsewhere* (1884), *Rowen* (1892), and *Poems* (1896)

Bunner published several novels, including *The Midge* (1886) and *The Story of a New York House* (1887), but these are surpassed by his stories and sketches, *"Short Sixes"* (1891), *More "Short Sixes"* (1894), *In Partnership* (with Brander Matthews, 1884), *Zadoc Pine* (1891), *Love in Old Cloathes* (1896), and *Jersey Street and Jersey Lane* (1896). A collected edition of his *Poems*, with an introductory note by Brander Matthews, appeared in 1896. The best of his *Stories* were republished in 1916. An edition of his stories in 1917 included *"Short Sixes"* and *The Suburban Sage*, the latter originally published in 1896. Of several plays (chiefly written in collaboration) the best was *The Tower of Babel* (1883).

BUNSEN, CHRISTIAN CHARLES JOSIAS, Baron von (1791–1860), Prussian diplomatist and scholar, was born on Aug. 25, 1791, at Korbach, Waldeck, and studied at Göttingen. In 1813 he travelled with W. B. Astor in Germany, and then turned to the study of the religion, laws, language and literature of the Teutonic races. He had read Hebrew when a boy, and now worked at Arabic, Persian and Norse. In 1815 he went to Berlin, to lay before Niebuhr the plan of research which he had mapped out. Niebuhr was so impressed with Bunsen's ability that, two years later, when he became Prussian envoy to the papal court, he made the young scholar his secretary. The intervening years Bunsen spent in assiduous labour among the libraries and collections of Paris and Florence. In July 1817 he married Frances Waddington, eldest daughter of B. Waddington of Llanover, Monmouthshire.

As secretary to Niebuhr, Bunsen was brought into contact with the Vatican movement for the establishment of the papal church in the Prussian dominions to provide for the largely increased Catholic population, and was among the first to realize the importance of this new vitality on the part of the Vatican. He pursued a conciliatory policy on the mixed marriages question, when he was put in charge of the legation on Niebuhr's resignation. But the brief (1830) in which the papal concessions were made was ambiguous. Count Spiegel, archbishop of Cologne, accepted a compromise at Berlin, but in 1835 he died, and was succeeded by the ultramontane Baron von Droste-Vischering, who adopted the extreme Catholic position and was removed from his diocese by the government. Bunsen, who was said to have recommended this coup, was then refused audience by the pope. The Prussian government, in this *impasse*, took the safest course, refused to support Bunsen, and accepted his resignation in April 1838.

After leaving Rome Bunsen spent two years as ambassador in Berne, and was transferred in 1842 to the London Embassy where he spent the rest of his official life. The accession to the throne of Prussia of Frederick William IV (June 7, 1840) made a great change in Bunsen's career. Ever since their first meeting in 1828 the two men had exchanged ideas in an intimate correspondence. Enthusiasm for evangelical religion and admiration for the Anglican Church they held in common, and Bunsen was selected for realizing the king's fantastic scheme of setting up at Jerusalem a Prusso-Anglican bishopric as a sign of the unity and aggressive force of Protestantism. The bishopric was established, endowed with Prussian and English money, and was for some forty years an isolated symbol of Protestant unity and a rock of stumbling to Anglican Catholics. His tenure of the London embassy coincided with the critical period in Prussian and European affairs which culminated in the revolutions of 1848. Bunsen realized the significance of the signs that heralded the coming storm, and tried in vain to move the king to a policy which would have placed him at the head of a Germany united and free. He felt bitterly the humiliation of Prussia by Austria after the victory of the reaction, and in 1852 he set his signature reluctantly to the treaty which, in his view, surrendered the "constitutional rights of Schleswig and Holstein." On the outbreak of the Crimean War he urged Frederick William to throw in his lot with the western powers, and create a diversion in the north-east which would have forced Russia at once to terms. The rejection of his advice, and the proclamation of Prussia's attitude of "benevolent neutrality," led him in April 1854 to offer his resignation, which was accepted.

Bunsen retired to Bonn and in 1855 published *Die Zeichen der Zeit: Briefe, etc.* (2 vols.), which exercised an immense influence in reviving the Liberal movement which the failure of the revolution had crushed. Frederick William made him a baron in 1857. In 1858, at the special request of the regent (afterwards the emperor) William, he took his seat in the Prussian Upper House. Bunsen died on Nov. 28, 1860.

His *Memoirs* in 1868, contain much of his private correspondence. The German translation (3 vols. 1868–71) of these *Memoirs*, published by his wife, has added extracts from unpublished documents. Baron Humboldt's letters to Bunsen were printed in 1869. His works include *The Church of the Future* (Eng. ed 1847); *Aegyptens Stelle in der Weltgeschichte* (5 vols. 1845–57); *Ignatius von Antiochen* (1847); *God in History* (3 vols. Leipzig, 1857–58, Eng. trans. 1870). His grandson, Sir Maurice de Bunsen (b. 1852), entered the English diplomatic service in 1877, was minister at Lisbon (1905), ambassador at Madrid (1906), Vienna (1913) and special representative in the United States (1918–19).

See also L. von Ranke, *Aus dem Briefwechsel Friedrich Wilhelms IV. mit Bunsen* (1873); Bühring, *Christian K. J. von Bunsen* (1892); and Ulbricht, *Bunsen und die deutsche Einheits bewegung* (1910).

BUNSEN, ROBERT WILHELM VON (1811–1899), German chemist, was born at Göttingen on March 31, 1811. He was professor of chemistry at Kassel, Marburg, Breslau, and from 1852 to a few months before his death on Aug. 16, 1899, at Heidelberg. His first important research work was concerned with the cacodyl compounds, though he had already, in 1834, discovered the virtues of freshly precipitated hydrated ferric oxide as an antidote to arsenical poisoning. It was begun in 1837 at Kassel, and during the six years he spent upon it he not only lost the sight of one eye through an explosion, but nearly killed himself by arsenical poisoning. It represents almost his only excursion into organic chemistry, and is of historical interest as being the forerunner of the fruitful investigations on the organo-metallic compounds subsequently carried out by his English pupil, Edward Frankland. Simultaneously with his work on cacodyl, he was studying the composition of the gases given off from blast furnaces. He showed that in German furnaces nearly half the heat yielded by the fuel was being allowed to escape with the waste gases, and when he came to England, and with Lyon Playfair investigated the conditions in English furnaces, he found the waste to amount to over 80%. These researches led to the elaboration of Bunsen's famous methods of measuring gaseous volumes, etc., which form the subject of the only book he ever published (*Gasometrische Methoden*, 1857). In 1841 he invented the carbon-zinc electric cell which is known by his name; he first employed it to produce the electric arc, and showed that from 44 cells a light equal to 1,171·3 candles could be obtained with the consumption of one pound of zinc per hour. To measure this light he designed in 1844 the grease-spot photometer. In 1852 he began to carry out electrolytical decompositions by the aid of the battery. He obtained magnesium for the first time in the metallic state, and studied its chemical and physical properties, among other things demonstrating the brilliance and high actinic qualities of the flame it gives when burnt in air. From 1855 to 1863 he published with Roscoe a series of investigations on photo-chemical measurements, which W. Ostwald has called the "classical example for all future researches in physical chemistry." He is generally credited with the invention of the Bunsen Burner (*q.v.*). Other appliances invented by him were the ice-calorimeter (1870), the vapour calorimeter (1887), and the filter pump (1868). In 1846 he paid a visit to Iceland. There he investigated the phenomena of the geysers.

But the most far-reaching of his many achievements was the elaboration, about 1850, jointly with G. R. Kirchhoff, of spectrum analysis. It led Bunsen himself almost immediately to the isolation of two new elements of the alkali group, caesium and rubidium. Having noticed some unknown lines in the spectra of certain salts he was examining, he set to work to obtain the substance or substances to which these were due. To this end he evaporated large quantities of the Dürkheim mineral water; he dealt with 40 tons of the water to get about 17 grammes of the mixed chlorides of the two substances, and with about one-third of that quantity of caesium chloride was able to prepare the most important compounds of the element and determine their characteristics, even making goniometrical measurements of their crystals. He instituted a regular course of practical work at Marburg so far back as 1840.

See Sir Henry Roscoe's "Bunsen Memorial Lecture," *Trans. Chem. Soc.*, 1900, which is reprinted (in German) with other obituary notices in an edition of Bunsen's collected works published by Ostwald and Bodenstein in 3 vols. at Leipzig in 1904.

BUNSEN BURNER, a burner so designed that it mixes a predetermined quantity of air with the stream of gas before it is ignited. If the proportions of gas and air are correct the resulting flame is hot and non-luminous. The invention of this widely used burner is ascribed to Robert Wilhelm von Bunsen (*q.v.*), though recent investigations prove that the credit for the actual design should go to Peter Desdga, if not to Michael Faraday (*q.v.*) who had previously designed an adjustable burner on this principle.

The simple idea, attributed to Bunsen, of admitting air into a tube along with gas to produce a hot non-luminous flame, is incorporated in the construction of millions of burners for heating and lighting purposes. The Bunsen flame results when air and gas are admitted in the proportion of about three volumes of air to one of gas; these produce the inner lower cone of the flame, evolving a mixture of water-vapour, carbon monoxide, hydrogen, carbon dioxide and nitrogen. The water-gas and nitrogen reach the outer combustion zone where the water-gas becomes burned up by the ordinary, or secondary, air supply. Various effects, as fusion, oxidation and reduction are obtainable with the flame and blowpipe. Certain metallic salts impart characteristic coloration to the colourless flame.

Varieties of laboratory Bunsens are chiefly distinguished by improvements in the control and mixing of the air and gas, giving greater heating powers and enabling different sizes of flames to be obtained. Among the most efficient of these are the Meker and the Fisher burners. Numerous fitments are made to go on the top of the tube for spreading the flame, or taking special holding devices. Several designs avoid the fault of the ordinary central gas jet, which may become choked up by matter falling down the tube, the gas being brought in at the side and the air at the bottom, with a coned regulator raised and lowered by a knob. Marshall's burner has a flat regulator working beneath the base, as seen in the sectional view. Burners may be constructed to burn coal-gas, oil-gas, acetylene or natural gas.

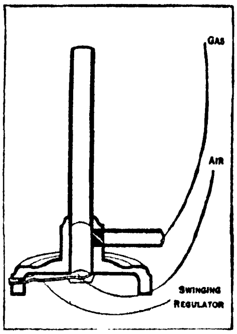


DIAGRAM OF A BUNSEN BURNER
Before the gas is ignited a correct proportion of air is mingled with it producing a hot and non-luminous flame

The Bunsen burners fitted to incandescent lights, the so-called Welsbach burner, require careful manufacture to ensure satisfactory results. The jet or injector must be exactly central with the Bunsen tube, and the interior surfaces finished smoothly and straight, with no raggedness at the orifice, otherwise the flame will not "fit" and heat the mantle properly. Passage through gauze or several fine holes assists in mixing, while a special mixing chamber is often included. A Venturi tube has the effect of increasing the velocity of the flow of gas, so enabling it to suck in more air. High-pressure gas lighting has given increased efficiency by reason of the increased velocity also secured. Air-blast for furnaces constitutes another way of increasing air supply and obtaining higher temperatures. The practice of preheating is another advance in aiding perfect combustion; instead of passing cold air into the Bunsen tube the lamp has a heating tube or chamber, while in some the mixture is preheated. Furnaces are built with recuperative action to heat the air supply from the furnace itself.
(F. H.)

BUNTING, JABEZ (1779–1858), English Wesleyan divine, was born in Manchester on May 13, 1779. He was educated at Manchester grammar school, and at the age of 10 began to preach, being received into full connection in 1803. In 1835 he was appointed president of the first Wesleyan theological college (at Hoxton). He was four times chosen to be president of the conference, was repeatedly secretary of the "Legal Hundred," and for 18 years was secretary to the Wesleyan Missionary Society. Bunting was a popular preacher, and an effective platform speaker. He died on June 16, 1858. His eldest son, William Maclardie Bunting (1805–1866), was also a distinguished Wesleyan minister; and his grandson Sir Percy William Bunting (1836–1911), son of T. P. Bunting and editor of the *Contemporary Review* from 1882, was knighted in 1908. He died on July 22, 1911.

See T. P. Bunting, *Life of Jabez Bunting* (1859–87), and G. S. Rowe, *Memorials of W. M. Bunting*, with biographical introduction by T. P. Bunting (1870).

BUNTING, the common English name of birds of the genus *Emberiza*, members of the family Fringillidae and distinguished by the angular gape, bony knob on the palate and hairlike streaks on the eggs. The corn bunting (*E. calandra*) inhabits Europe and most of Asia, nesting on the ground and forming flocks in winter. The voice is harsh. The even commoner yellow-bunting (*E. citrinella*) is widely distributed and its monotonous song (often rendered as "A-little-bit-of-bread-and-*no*-cheese") is very familiar in Britain. The cirl bunting (*E. cirlus*), with an olive-green head, is somewhat more southerly. The reed bunting (*E. schoeniclus*), recognized by its black head and white collar, is common in marshy places, to the exclusion of the other species. The snow bunting (*Plectrophenax nivalis*) breeds further north than any other passerine bird, reaching Spitzbergen. Of the American forms, the black-throated bunting or dickcissel (*Spiza americana*) inhabits the open country in central states, where it is migratory; the bay-winged bunting, vesper sparrow or grass finch (*Pooecetes gramineus*) of eastern Canada and U.S.A. is distinguished by its chestnut wings; the lark bunting (*Calamospiza melanocorys*) of the western states resembles a lark in habits and has a brilliant song. American buntings in general are brilliantly coloured. *See* also BOBOLINK; ORTOLAN; NONPAREIL; INDIGO BIRD.

Bunting is a word of doubtful origin, possibly connected with *bunt*, to sift, or with the German *bunt*, of varied colour, also indicates a loosely woven woollen cloth for making flags, and is also used of a collection of flags, and particularly those of a ship.

BUNYAN, JOHN (1628–1688), English religious writer, was born at Elstow, about a mile from Bedford, in Nov. 1628. His father, Thomas Bunyan,[1] was a tinker, or, as he described himself, a "brasier." The tinkers then formed a hereditary caste, which was held in no high estimation. Bunyan's father had a fixed residence, and was able to send his son to a village school, where reading and writing were taught.

The years of John's boyhood were those during which the Puritan spirit was in the highest vigour all over England, and nowhere had that spirit more influence than in Bedfordshire. It is not wonderful, therefore, that a lad to whom nature had given a powerful imagination and sensibility which amounted to a disease, should have been early haunted by religious terrors. Before he was ten his sports were interrupted by fits of remorse and despair; and his sleep was disturbed by dreams of fiends trying to fly away with him. As he grew older his mental conflicts became still more violent. The strong language in which he described them strangely misled all his earlier biographers except Southey. It was long an ordinary practice with pious writers to cite Bunyan as an instance of the supernatural power of divine grace to rescue the human soul from the lowest depths of wickedness. He is called in one book the most notorious of profligates, in another, the brand plucked from the burning. Many excellent persons, whose moral characters from boyhood to old age have been free from any stain discernible to their fellow-creatures, have, in their autobiographies and diaries, applied to themselves, and doubtless with sincerity, epithets as severe as could be applied to Titus Oates or Mrs. Brownrigg.

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[1] The name, in various forms as Buignon, Buniun, Bonyon or Binyan, appears in the local records of Elstow and the neighbouring parishes at intervals from as far back as 1199. They were small freeholders, but all the property except the cottage had been lost in the time of Bunyan's grandfather. Bunyan's own account of his family as the "meanest and most despised of all the families of the land" must be put down to his habitual self-depreciation. Thomas Bunyan had a forge and workshop at Elstow.

It is quite certain that Bunyan was, at 18, what, in any but the most austerely puritanical circles, would have been considered as a young man of singular gravity and innocence. Indeed, it may be remarked that he, like many other penitents who, in general terms, acknowledge themselves to have been the worst of mankind, fired up, and stood vigorously on his defence, whenever any particular charge was brought against him by others. He declares, it is true, that he had let loose the reins on the neck of his lusts, that he had delighted in all transgressions against the divine law, and that he had been the ringleader of the youth of Elstow in all manner of vice. But when those who wished him ill accused him of licentious amours, he called on God and the angels to attest his purity. No woman, he said, in heaven, earth, or hell could charge him with having ever made any improper advances to her. Not only had he been strictly faithful to his wife; but he had, even before his marriage, been perfectly spotless. It does not appear from his own confessions, or from the railings of his enemies, that he ever was drunk in his life. One bad habit he contracted, that of using profane language; but he tells us that a single reproof cured him so effectually that he never offended again. The worst that can be laid to his charge is that he had a great liking for some diversions, quite harmless in themselves, but condemned by the rigid precisians among whom he lived, and for whose opinion he had a great respect. The four chief sins of which he was guilty were dancing, ringing the bells of the parish church, playing at tipcat and reading the history of Sir Bevis of Southampton. A rector of the school of Laud would have held such a young man up to the whole parish as a model. But Bunyan's notion of good and evil had been learned in a very different school; and he was made miserable by the conflict between his taste and his scruples.

When he was about 17 the ordinary course of his life was interrupted by an event which gave a lasting colour to his thought. He enlisted in the Parliamentary army, and served during the decisive campaign of 1645.[1] All that we know of his military career is, that, at the siege of some town, one of his comrades, who had marched with the besieging army instead of him, was killed by a shot. Bunyan ever after considered himself as having been saved from death by the special interference of Providence. It may be observed that his imagination was strongly impressed by the glimpse which he had caught of the pomp of war. To the last he loved to draw his illustrations of sacred things from camps and fortresses, from guns, drums, trumpets, flags of truce, and regiments arrayed each under its own banner. His Greatheart, his Captain Boanerges and his Captain Credence are evidently portraits, of which the originals were among those martial saints who fought and expounded in Fairfax's army.

In 1646 Bunyan returned home and married about two years later. His wife had some pious relations, and brought him as her only portion some pious books. His mind, excitable by nature, very imperfectly disciplined by education, and exposed to the enthusiasm which was then epidemic in England, began to be fearfully disordered. The story of the struggle is told in Bunyan's *Grace Abounding*.

In outward things he soon became a strict Pharisee. He was constant in attendance at prayers and sermons. His favourite amusements were, one after another, relinquished, though not without many painful struggles. In the middle of a game of tipcat he paused, and stood staring wildly upwards with his stick in his hand. He had heard a voice asking him whether he would leave his sins and go to heaven, or keep his sins and go to hell; and he had seen an awful countenance frowning on him from the sky. The odious vice of bell-ringing he renounced; but he still for a time ventured to go to the church tower and look on while others pulled the ropes. But soon the thought struck him that, if he persisted in such wickedness, the steeple would fall on his head; and he fled in terror from the accursed place. To give up dancing on the village green was still harder; and some months elapsed before he had the fortitude to part with his darling sin. When this last sacrifice had been made, he was, even when tried by the maxims of that austere time, faultless. All Elstow talked of him as an eminently pious youth. But his own mind was more unquiet than ever. Having nothing more to do in the way of visible reformation, yet finding in religion no pleasures to supply the place of the juvenile amusements which he had relinquished, he began to apprehend that he lay under some special malediction; and he was tormented by a succession of fantasies which seemed likely to drive him to suicide or to bedlam. At one time he took it into his head that all persons of Israelite blood would be saved, and tried to make out that he partook of that blood; but his hopes were speedily destroyed by his father, who seems to have had no ambition to be regarded as a Jew. At another time Bunyan was disturbed by a strange dilemma: "If I have not faith, I am lost; if I have faith, I can work miracles." He was tempted to cry to the puddles between Elstow and Bedford, "Be ye dry," and to stake his eternal hopes on the event. Then he took up a notion that the day of grace for Bedford and the neighbouring villages was past; that all who were to be saved in that part of England were already converted; and that he had begun to pray and strive some months too late. Then he was harassed by doubts whether the Turks were not in the right and the Christians in the wrong. Again, he was troubled by a maniacal impulse which prompted him to pray to the trees, to a broomstick, to the parish bull.

As yet, however, he was only entering the valley of the shadow of death. Soon the darkness grew thicker. Hideous forms floated before him. Sounds of cursing and wailing were in his ears. His way ran through stench and fire, close to the mouth of the bottomless pit. He began to be haunted by a strange curiosity about the unpardonable sin, and by a morbid longing to commit it. But the most frightful of all the forms which his disease took was a propensity to utter blasphemy, and especially to renounce his share in the benefits of the redemption. Night and day, in bed, at table, at work, evil spirits, as he imagined, were repeating close to his ear the words, "Sell him, sell him." He struck at the hobgoblins; he pushed them from him; but still they were ever at his side. He cried out in answer to them, hour after hour, "Never, never; not for thousands of worlds; not for thousands." At length, worn out by this long agony, he suffered the fatal words to escape him, "Let him go if he will." Then his misery became more fearful than ever. He had done what could not be forgiven. He had forfeited his part of the great sacrifice. Like Esau, he had sold his birthright; and there was no longer any place for repentance. "None," he afterwards wrote, "knows the terrors of those days but myself." He has described his sufferings with singular energy, simplicity and pathos. He envied the brutes; he envied the very stones on the street, and the tiles on the houses. The sun seemed to withhold its light and warmth from him. His body, though cast in a sturdy mould, and though still in the highest vigour of youth, trembled whole days together with the fear of death and judgment. He fancied that this trembling was the sign set on the worst reprobates, the sign which God had put on Cain. The unhappy man's emotion destroyed his power of digestion. He had such pains that he expected to burst asunder like Judas, whom he regarded as his prototype.

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[1] A pamphlet entitled "New Documentary Evidence of John Bunyan as a Soldier," reprinted from the *Bedfordshire Times* of Dec. 26 1924, shows that Bunyan joined the Newport Pagnell garrison on Nov. 30 1645. The town where one of his comrades, who had marched with the besieging army instead of him, was shot, was probably Leicester, to which a part of the Newport Pagnell garrison was sent in 1645. An order was issued in Aug. 1646 that the Newport garrison should be disbanded and the soldiers "employed for the service of Ireland." Perhaps Bunyan was one of these, for his name occurs in the troop of an Irish officer, Lieut.-col. Charles O'Hara, which was mustered at Newport on Jan. 17 1647. If so, the date of his return home would be 1647, not 1646. (Ed. E. B.)

Neither the books which Bunyan read, nor the advisers whom he consulted, were likely to do much good in a case like his. His small library had received a most unseasonable addition, the account of the lamentable end of Francis Spira. One ancient man of high repute for piety, whom the sufferer consulted, gave an opinion which might well have produced fatal consequences. "I am afraid," said Bunyan, "that I have committed the sin against the Holy Ghost." "Indeed," said the old fanatic, "I am afraid that you have."

At length the clouds broke; the light became clearer and clearer; and the enthusiast who had imagined that he was branded with the mark of the first murderer, and destined to the end of the arch-traitor, enjoyed peace and a cheerful confidence in the mercy of God. Years elapsed, however, before his nerves, which had been so perilously overstrained, recovered their tone. When he had joined a Baptist society at Bedford, and was for the first time admitted to partake of the eucharist, it was with difficulty that he could refrain from imprecating destruction on his brethren while the cup was passing from hand to hand. After he had been some time a member of the congregation he began to preach; and his sermons produced a powerful effect. He was indeed illiterate; but he spoke to illiterate men. The severe training through which he had passed had given him such an experimental knowledge of all the modes of religious melancholy as he could never have gathered from books, and his vigorous genius, animated by a fervent spirit of devotion, enabled him not only to exercise a great influence over the vulgar, but even to extort the half-contemptuous admiration of scholars. Yet it was long before he ceased to be tormented by an impulse which urged him to utter words of horrible impiety in the pulpit.[1]

Bunyan was finally relieved from the internal sufferings which had embittered his life by sharp persecution from without. He had been five years a preacher when the Restoration put it in the power of the Cavalier gentlemen and clergymen all over the country to oppress the dissenters. In Nov. 1660 he was flung into Bedford gaol; and there he remained, with some intervals of partial and precarious liberty, during 12 years. The authorities tried to extort from him a promise that he would abstain from preaching; but he was convinced that he was divinely set apart and commissioned to be a teacher of righteousness, and he was fully determined to obey God rather than man. He was brought before several tribunals, laughed at, caressed, reviled, menaced, but in vain. He was facetiously told that he was quite right in thinking that he ought not to hide his gift; but that his real gift was skill in repairing old kettles. He was compared to Alexander the coppersmith. He was told that if he would give up preaching he should be instantly liberated. He was warned that if he persisted in disobeying the law he would be liable to banishment, and that if he were found in England after a certain time his neck would be stretched. His answer was, "If you let me out to-day, I will preach again to-morrow." Year after year he lay patiently in a dungeon, compared with which the worst prison now to be found in the island is a palace.[2] His fortitude is the more extraordinary because his domestic feelings were unusually strong. Indeed, he was considered by his stern brethren as somewhat too fond and indulgent a parent. He had four small children, and among them a daughter who was blind, and whom he loved with peculiar tenderness. He could not, he said, bear even to let the wind blow on her; and now she must suffer cold and hunger; she must beg; she must be beaten; "yet," he added, "I must, I must do it."

His second wife, whom he had married just before his arrest, tried in vain for his release; she even petitioned the House of Lords on his behalf. While he lay in prison he could do nothing in the way of his old trade for the support of his family. He determined, therefore, to take up a new trade. He learned to make long-tagged thread laces; and many thousands of these articles were furnished by him to the hawkers. While his hands were thus busied he had other employments for his mind and his lips. He gave religious instruction to his fellow-captives, and formed from among them a little flock, of which he was himself the pastor. He studied indefatigably the few books which he possessed. His two chief companions were the Bible and Fox's *Book of Martyrs.* His knowledge of the Bible was such that he might have been called a living concordance; and on the margin of his copy of the *Book of Martyrs* are still legible the ill-spelt lines of doggerel in which he expressed his reverence for the brave sufferers, and his implacable enmity to the mystical Babylon.

Prison life gave him leisure to write, and during his first imprisonment he wrote, in addition to several tracts and some verse, *Grace Abounding to the Chief of Sinners*, the narrative of his own religious experience. The book was published in 1666. A short period of freedom was followed by a second offence and a further imprisonment. Bunyan's works were coarse, indeed, but they showed a keen mother wit, a great command of the homely mother tongue, an intimate knowledge of the English Bible, and a vast and dearly bought spiritual experience. They were well received, therefore, when the corrector of the press had improved the syntax and the spelling.

Much of Bunyan's time was spent in controversy. He wrote sharply against the Quakers, whom he seems always to have held in utter abhorrence. He wrote against the liturgy of the Church of England. No two things, according to him, had less affinity than the form of prayer and the spirit of prayer. Those, he said with much point, who have most of the spirit of prayer are all to be found in gaol; and those who have most zeal for the form of prayer are all to be found at the alehouse. The doctrinal Articles, on the other hand, he warmly praised and defended. The most acrimonious of all his works is his *Defence of Justification by Faith*, an answer to what Bunyan calls "the brutish and beastly latitudinarianism" of Edward Fowler, afterwards bishop of Gloucester, an excellent man, but not free from the taint of Pelagianism.

Bunyan had also a dispute with some of the chiefs of the sect to which he belonged. He doubtless held with perfect sincerity the distinguishing tenet of that sect, but he did not consider that tenet as one of high importance, and willingly joined in communion with pious Presbyterians and Independents. The sterner Baptists, therefore, loudly pronounced him a false brother. A controversy arose which long survived the original combatants. The cause which Bunyan had defended with rude logic and rhetoric against Kiffin and Danvers has since been pleaded by Robert Hall with an ingenuity and eloquence such as no polemical writer has ever surpassed.

During the years which immediately followed the Restoration, Bunyan's confinement seems to have been strict. But as the passions of 1660 cooled, as the hatred with which the Puritans had been regarded while their reign was recent gave place to pity, he was less and less harshly treated. The distress of his family, and his own patience, courage and piety, softened the hearts of his judges. Like his own Christian in the cage, he found protectors even among the crowd at Vanity Fair. The bishop of the diocese, Dr. Barlow, is said to have interceded for him. At length the prisoner was suffered to pass most of his time beyond the walls of the gaol, on condition, as it should seem, that he remained within the town of Bedford.

He owed his complete liberation to one of the worst acts of one of the worst governments that England has ever seen. In

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[1] Bunyan had joined, in 1653, the nonconformist community which met under a certain Mr. Gifford at St. John's church, Bedford. This congregation was not Baptist, properly so called, as the question of baptism, with other doctrinal points, was left open. When Bunyan removed to Bedford in 1655, he became a deacon of this church, and two years later he was formally recognized as a preacher, his fame soon spreading through the neighbouring counties. His wife died soon after their removal to Bedford, and he also lost his friend and pastor, Mr. Gifford. His earliest work was directed against Quaker mysticism and appeared in 1656. It was entitled *Some Gospel Truths Opened;* it was followed in the same year by a second tract in the same sense, *A Vindication of Gospel Truths.*

[2] He was not, however, as has often been stated, confined in the old gaol which stood on the bridge over the Ouse, but in the county gaol.

1671 the Cabal was in power. Charles II had concluded the treaty by which he bound himself to set up the Roman Catholic religion in England. The first step which he took towards that end was to annul, by an unconstitutional exercise of his prerogative, all the penal statutes against the Roman Catholics; and in order to disguise his real design, he annulled at the same time the penal statutes against Protestant nonconformists. Bunyan was consequently set at large.[1] In the first warmth of his gratitude he published a tract, in which he compared Charles to that humane and generous Persian king, who, though not himself blest with the light of the true religion, favoured the chosen people, and permitted them, after years of captivity, to rebuild their beloved temple

Before he left his prison, he had begun the book which has made his name immortal.[2] The history of that book is remarkable The author was, as he tells us, writing a treatise, in which he had occasion to speak of the stages of the Christian progress. He compared that progress, as many others had compared it, to a pilgrimage. Soon his quick wit discovered innumerable points of similarity which had escaped his predecessors. Images came crowding on his mind faster than he could put them into words, quagmires and pits, steep hills, dark and horrible glens, soft vales, sunny pastures, a gloomy castle, of which the courtyard was strewn with the skulls and bones of murdered prisoners, a town all bustle and splendour, like London on the Lord Mayor's day, and the narrow path, straight as a rule could make it, running on up hill and down hill, through city and through wilderness, to the Black River and the Shining Gate. He had found out, as most people would have said, by accident, as he would doubtless have said, by the guidance of Providence, where his powers lay. He had no suspicion, indeed, that he was producing a masterpiece. He could not guess what place his allegory would occupy in English literature; for of English literature he knew nothing. Those who suppose him to have studied the *Faerie Queene* might easily be confuted, if this were the proper place for a detailed examination of the passages in which the two allegories have been thought to resemble each other. The only work of fiction, in all probability, with which he could compare his Pilgrim was his old favourite, the legend of Sir Bevis of Southampton. He would have thought it a sin to borrow any time from the serious business of his life, from his expositions, his controversies, and his lace tags, for the purpose of amusing himself with what he considered merely a trifle. It was only, he assures us, at spare moments that he returned to the House Beautiful, the Delectable Mountains and the Enchanted Ground. He had no assistance. Nobody but himself saw a line till the whole was complete.

He then consulted his pious friends. Some were pleased. Others were much scandalized. It was a vain story, a mere romance, about giants, and lions, and goblins, and warriors, sometimes fighting with monsters, and sometimes regaled by fair ladies in stately palaces. The loose atheistical wits at Will's might write such stuff to divert the painted Jezebels of the court; but did it become a minister of the gospel to copy the evil fashions of the world? There had been a time when the cant of such fools would have made Bunyan miserable. But that time was past; and his mind was now in a firm and healthy state. He saw that in employing fiction to make truth clear and goodness attractive, he was only following the example which every Christian ought to propose to himself; and he determined to print.

The *Pilgrim's Progress* was published in Feb. 1678. Soon the irresistible charm of a book which gratified the imagination of the reader with all the action and scenery of a fairy tale, which exercised his ingenuity by setting him to discover a multitude of curious analogies, which interested his feelings for human beings, frail like himself, and struggling with temptations from within and from without, which every moment drew a smile from him by some stroke of quaint yet simple pleasantry, and nevertheless left on his mind a sentiment of reverence for God and of sympathy for man, began to produce its effect. In puritanical circles, from which plays and novels were strictly excluded, that effect was such as no work of genius, though it were superior to the *Iliad*, to *Don Quixote* or to *Othello*, can ever produce on a mind accustomed to indulge in literary luxury. A second edition came out in the autumn with additions; and the demand became immense. The eighth edition, which contains the last improvements made by the author, was published in 1682, the ninth in 1684, the tenth in 1685. The help of the engraver had early been called in; and tens of thousands of children looked with terror and delight on execrable copperplates, which represented Christian thrusting his sword into Apollyon, or writhing in the grasp of Giant Despair. In Scotland, and in some of the colonies, the Pilgrim was even more popular than in his native country. Bunyan has told us, with very pardonable vanity, that in New England his dream was the daily subject of the conversation of thousands, and was thought worthy to appear in the most superb binding. He had numerous admirers in Holland and amongst the Huguenots of France.

He continued to work the gold-field which he had discovered, and to draw from it new treasures, not indeed with quite such ease and in quite such abundance as when the precious soil was still virgin, but yet with success, which left all competition far behind. In 1680 appeared the *Life and Death of Mr. Badman;* in 1684 the second part of the *Pilgrim's Progress.* In 1682 appeared the *Holy War,* relating the attempt of the powers of evil to gain the city of Man's soul, and which if the *Pilgrim's Progress* did not exist, would be the best allegory ever written.

Bunyan's place in society was now very different from what it had been. There had been a time when many dissenting ministers, who could talk Latin and read Greek, had affected to treat him with scorn. But his fame and influence now far exceeded theirs. He had so great an authority among the Baptists that he was popularly called Bishop Bunyan. His episcopal visitations were annual. From Bedford he rode every year to London, and preached there to large and attentive congregations. From London he went his circuit through the country, animating the zeal of his brethren, collecting and distributing alms and making up quarrels. The magistrates seem in general to have given little trouble. But there is reason to believe that, in the year 1685, he was in some danger of again occupying his old quarters in Bedford gaol.

In that year the rash and wicked enterprise of Monmouth gave the government a pretext for prosecuting the nonconformists; and scarcely one eminent divine of the Presbyterian, Independent or Baptist persuasion remained unmolested. Baxter was in prison; Howe was driven into exile; Henry was arrested. Two eminent Baptists, with whom Bunyan had been engaged in controversy, were in great peril and distress. Danvers was in danger of being hanged; and Kiffin's grandsons were actually hanged. The tradition is that, during those evil days, Bunyan was forced to disguise himself as a wagoner, and that he preached to his congregation at Bedford in a smock-frock, with a cart-whip in his hand. But soon a great change took place. James II. was at open war with the church and found it necessary to court the dissenters. Some of the creatures of the Government tried to secure the aid of Bunyan. They probably knew that he had written in praise of the Indulgence of 1672, and therefore hoped that he might be equally pleased with the Indulgence of 1687. But 15 years of thought, observation, and commerce with the world had made him wiser. Nor were the cases exactly parallel. Charles was a professed Protestant; James was a professed Papist. The object of Charles's indulgence was disguised; the object of James's indulgence was patent. Bunyan was not deceived. He exhorted his hearers to prepare themselves by fasting and prayer for the danger which menaced their civil and religious liberties, and refused even to speak to the courtier who came down to remodel the corporation of Bedford, and who, as was supposed, had it in charge to offer some municipal dignity to the bishop of the Baptists.

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[1] His formal pardon is dated Sept. 13 1672; but five months earlier he had received a royal licence to preach, and acted for the next three years as pastor of the non-conformist body to which he belonged, in a barn on the site of which stands the present Bunyan Meeting.

[2] It is now generally supposed that Bunyan wrote his *Pilgrim's Progress*, not during his 12 years' imprisonment, but during a short period of incarceration in 1675, probably in the old gaol on the bridge.

Bunyan did not live to see the Revolution.[1] In the summer of 1688 he undertook to plead the cause of a son with an angry father, and at length prevailed on the old man not to disinherit the young one. This good work cost the benevolent intercessor his life. He had to ride through heavy rain. He came drenched to his lodging on Snow Hill, was seized with a violent fever, and died in a few days (Aug. 31). He was buried in Bunhill Fields; and many Puritans, to whom the respect paid by Roman Catholics to the reliques and tombs of saints seemed childish or sinful, are said to have begged with their dying breath that their coffins might be placed as near as possible to the coffin of the author of the *Pilgrim's Progress.*

The fame of Bunyan during his life, and during the century which followed his death, was indeed great, but was almost entirely confined to religious families of the middle and lower classes. Very seldom was he during that time mentioned with respect by any writer of great literary eminence. Young coupled his prose with the poetry of the wretched D'Urfey. In the *Spiritual Quixote*, the adventures of Christian are ranked with those of Jack the Giant-Killer and John Hickathrift. Cowper ventured to praise the great allegorist, but did not venture to name him. It is a significant circumstance that, for a long time all the numerous editions of the *Pilgrim's Progress* were evidently meant for the cottage and the servants' hall. The paper, the printing, the plates, were all of the meanest description. In general, when the educated minority and the common people differ about the merit of a book, the opinion of the educated minority finally prevails. The *Pilgrim's Progress* is perhaps the only book about which the educated minority has come over to the opinion of the common people.

The attempts which have been made to improve and to imitate this book are not to be numbered. It has been done into verse; it has been done into modern English. The *Pilgrimage of Tender Conscience*, the *Pilgrimage of Good Intent*, the *Pilgrimage of Seek Truth*, the *Pilgrimage of Theophilus*, the *Infant Pilgrim*, the *Hindoo Pilgrim*, are among the many feeble copies of the great original. But the peculiar glory of Bunyan is that those who most hated his doctrines have tried to borrow the help of his genius. A Roman Catholic version of his parable may be seen with the head of the virgin in the title-page. On the other hand, those Antinomians for whom his Calvinism is not strong enough, may study the *Pilgrimage of Hephzibah*, in which nothing will be found which can be construed into an admission of free agency and universal redemption. But the most extraordinary of all the acts of vandalism by which a fine work of art was ever defaced was committed in the year 1853. It was determined to transform the *Pilgrim's Progress* into a Tractarian book. The task was not easy; for it was necessary to make two sacraments the most prominent objects in the allegory, and of all Christian theologians, avowed Quakers excepted, Bunyan was the one in whose system the sacraments held the least prominent place. However, the Wicket Gate became a type of baptism, and the House Beautiful of the eucharist. The effect of this change is such as assuredly the ingenious person who made it never contemplated. For, as not a single pilgrim passes through the Wicket Gate in infancy, and as Faithful hurries past the House Beautiful without stopping, the lesson which the fable in its altered shape teaches, is that none but adults ought to be baptized, and that the eucharist may safely be neglected. Nobody would have discovered from the original *Pilgrim's Progress* that the author was not a Paedobaptist. To turn his book into a book against Paedobaptism, was an achievement reserved for an Anglo-Catholic divine. Such blunders must necessarily be committed by every man who mutilates parts of a great work, without taking a comprehensive view of the whole. (M.)

The above article has been slightly corrected as to facts, as compared with its form in the 9th edition. Bunyan's works were first partially collected in a folio volume (1692) by his friend Charles Doe. A larger edition (1736–37) was edited by Samuel Wilson of the Barbican. In 1853 a good edition was produced by George Offer. Southey's edition (1830) of the *Pilgrim's Progress* contained his *Life* of Bunyan. Since then various editions of the *Pilgrim's Progress*, many illustrated (by Cruikshank, Byam Shaw, W. Strang and others), have appeared. An interesting life by W. Hale White was published in 1904. Other lives are by J. A. Froude (1880) in the "English Men of Letters" series, and E. Venables (1888); but the standard work is *John Bunyan; His Life, Times and Work* (1885), by the Rev. J Brown of Bedford. A bronze statue, by Boehm, was presented to the town by the duke of Bedford in 1874. *See* also R. H. Coats, *John Bunyan* (1927); G. O. Griffith, *John Bunyan* (1927); and W. Y. Tindall, *John Bunyan, Mechanick Preacher* (1934).

BUNYAN, PAUL, a mythical hero of the lumber camps of the American north-west. According to James Stevens, the author of one version of the legends (*Paul Bunyan*, 1925) the stories which have been told in American timber lands for generations are of Canadian origin, but "It was the American loggers below the Border who made of Paul Bunyon a true hero of camp nights' entertainment. They gave him Babe, the blue ox, who measured forty-two ax handles and a plug of chewing tobacco between the horns. They created the . . . mythical logging camp with its cookhouse of mountainous size and . . . they peopled this camp with astounding minor heroes. They made their Paul *Bunyan* an inventor and orator, and an industrialist whose labors surpassed those of Hercules. They devised a chronology for him; he ruled American life in the period between the Winter of the Blue Snow and the Spring That the Rain Came Up From China." In any case, the legend which is said to have begun in the Papineau rebellion in Canada in 1837, when a "mighty-muscled, bellicose, bearded giant named Paul Bunyon . . . raged among the Queen's troops like Samson among the Philistines," had, by 1860, spread throughout the northwest, and perhaps even into the south where under the name of John Henry he became "the man worth talking about" in the work camp gang. According to Esther Shephard in her *Paul Bunyan* (1924) "Some evidence points to a French-Canadian origin among the loggers of Quebec or northern Ontario, who may even have brought them from the old country. But other evidences point just as strongly to an American beginning, possibly in Michigan or Wisconsin." "In the Minnesota camps, . . . the loggers were undoubtedly enriched by Scandinavian myth, and there Paul Bunyan assumed some of the characteristics of a modern Thor." At other places he became coloured by Indian legend But whatever his habitat, he is best known and enjoyed in the stories of *Babe, the Blue Ox; The Winter of the Blue Snow; Digging Puget Sound* and *Paul's Hunting*, which are found in the books mentioned above.

BUNZLAU, a town of Germany, in Prussian Silesia, on the right bank of the Bober, a tributary of the Oder, 27 mi. W. of Liegnitz. Pop. (1939) 22,119. Bunzlau (Boleslavia) received its name in the 12th century from Duke Boleslav, who separated it from the duchy of Glogau. Its importance was increased by numerous privileges and the possession of extensive mining works. It was frequently captured and recaptured in the wars of the 17th century, and in 1739 was completely destroyed by fire. The Bunzlau pottery is famous; woollen and linen cloth are manufactured, and there are quarries in the vicinity.

BUONAFEDE, APPIANO (1716–1793), Italian philosopher, was born at Comacchio, in Ferrara province, and died in Rome. He became professor of theology at Naples in 1740, and entering the religious body of the Celestines, rose to be general of the order. His *Della Restaurazione di ogni Filosofia ne' Secoli*, xvi. xvii, xviii, 1789 (German trans. by C. Heydenreich) gives a valuable account of 16th century Italian philosophy

BUOY, a floating body employed to mark the navigable limits of channels, their fairways, sunken dangers or isolated rocks, mined or torpedo grounds, telegraph cables, or the position of a ship's moorings when they have been slipped; buoys also serve for a vessel to make fast to instead of anchoring. They vary in size and construction from a log of wood to steel mooring buoys for warships or a steel gas buoy. The origin of the word may be traced through O.Fr. boie, or Dutch boei, and English 15th Century "boye" from Lat. boia, fetter: it is now usually pronounced as "boy," and it has been spelt in that form; but Hakluyt's Voyages spells it "bwoy," and this seems to indicate a different pronunciation which is also given in some modern dictionaries. The date when the first navigation buoy was laid off the coasts of the British Isles cannot be traced, but the regular marking by buoys of such places as the Thames estuary and the river Tees is known to have been in existence nearly 300 years ago. (*See* LIGHTHOUSES.)

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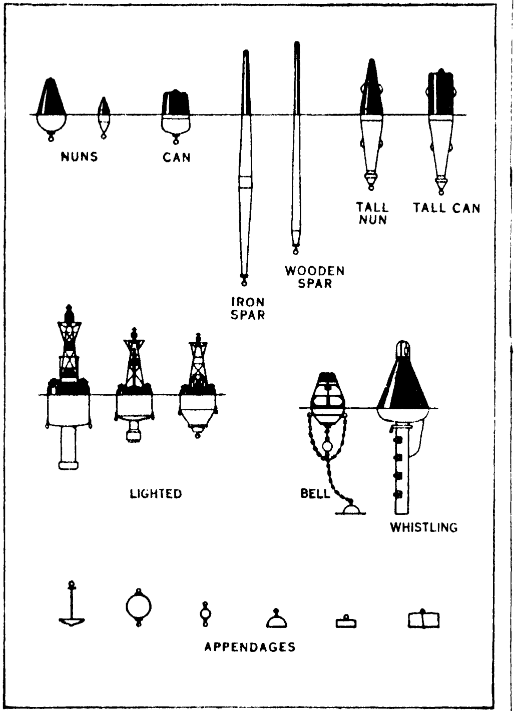
[1] He had resumed his pastorate in Bedford after his imprisonment of 1675, and, although he frequently preached in London to crowded congregations, and is said in the last year of his life to have been, of course unofficially, chaplain to Sir John Shorter, lord mayor of London, he remained faithful to his own congregation.

Uniform Systems of Marking Buoys.—In 1882 a conference was held at Trinity House with H.R.H. the Duke of Edinburgh, as president to investigate a proposal for the establishment of a uniform system of buoyage. The conference consisted of representatives from various bodies interested, and the questions of colour, visibility, shape and size of buoys were considered and a system of buoyage evolved which subsequently was adopted as the uniform system of buoyage for the United Kingdom and extended to India and the Dominions.



SELECTED TYPES OF BUOYS MAINTAINED BY THE U.S. COAST GUARD

Each is characteristically coloured and numbered so as to give to mariners the most definite information possible concerning position of rocks, shoals, channels and abrupt turning points in channels

In 1889 an International Marine Conference was held at Washington, U.S.A., including representatives from most of the principal maritime nations of the world, as well as from countries as remote as China, Siam and Uruguay; it recommended the adoption of an international "lateral" system based primarily on colour, *i.e.*, starboard-hand buoys were to be red and port-hand buoys black or parti-coloured, while the use of spherical-shaped buoys to mark middle-grounds was definitely excluded. So far as the United Kingdom was concerned, the reasons advanced were not sufficiently strong to induce the authorities to depart from the uniform system arranged for Great Britain at the 1882 Conference.

Another Maritime Conference was held in St. Petersburg in March 1912, but Great Britain was not represented, and although the Conference proposed the reversal of the buoyage colouring recommended by the Washington Conference, only South Russia, Spain and Italy adopted its suggestions.

The coasts of some countries, in particular those in the Baltic, are not well suited to a "lateral" system of buoyage and a system known as the "compass" or "cardinal" system has been adopted, under which a combination of the shape, colour and topmark of the buoy indicates the compass bearing of the danger from the buoy. The countries using the cardinal system are Norway, Sweden, North Russia, Germany, Italy and Turkey (the last three use a "lateral" system as well).

As regards systems of buoyage in general, the British view is that buoys, not being essentially reliable seamarks, are only additional aids to the mariner, and so long as they conform in shape to some more or less simple general system and can easily be identified from the chart, uniformity in colouring is a secondary consideration, particularly as variations in colouring to distinguish different channels in the same estuary are a help to the mariner. As regards the colours of lights on lighted buoys, the system in the United States is to have red on starboard-hand buoys in consonance with the colour of the buoy and green lights on port-hand buoys. White lights may be used on either side. Under the system followed in the British Isles red is usually for lights on port-hand buoys and white for starboard-hand buoys in narrow waters, but for positions in the open sea a red light has the disadvantage inherent in reduced intensity and is only adopted when some distinctive character other than white is essential and then generally is confined to port-hand buoys; in any case, buoys with green lights are used exclusively for marking wrecks.

Buoyage System in the British Isles.—The uniform system of buoyage (which is of the type known as "lateral") adopted in the United Kingdom after the Conference in 1882 continued without modification until 1922 when a further conference was held at Trinity House to review the section of the uniform system relating to the "buoying and marking of wrecks"; this conference prepared a scheme for wreck-marking which has been adopted as the uniform system throughout the British Isles, while at the same time it made a few other modifications in the uniform system of buoyage, the principal one being a definition of the direction of the main stream of flood tide for the various districts around the coast, which put briefly is, in the case of the North Sea and English Channel towards the Thames and on the West Coast in a northerly direction.

The uniform system of buoyage for the British Isles, including the system of buoying and marking of wrecks adopted in 1922, is now as follows:—

(1) The mariner when approaching the coast must determine his position on the chart, and note the direction of the main stream of flood tide. (2) The term "starboard-hand" shall denote that side which would be on the right hand of the mariner either going with the main stream of the flood, or approaching a harbour, river or estuary from seaward; the term "port-hand" shall denote the left hand of the mariner in the same circumstances. (3) Buoys showing the pointed top of a cone above water shall be called *Conical* and they shall always be starboard-hand buoys, as above defined. (4) Buoys showing a flat top above water shall be called *Can* and they shall always be port-hand buoys, as above defined. (5) Buoys showing a domed top above water shall be called *Spherical* and they shall mark the ends of middle grounds, *i.e.*, shoals in the middle of a channel. (6) Buoys having a tall central structure on a broad base shall be called *Pillar* buoys, and like all other special buoys, such as bell buoys, gas buoys, and automatic sounding buoys, shall be placed to mark special positions either on the coast or in the approaches to harbours. (7) Buoys showing only a mast above water shall be called *Spar buoys*. (Useful where floating ice is encountered or the current velocities are high.) (8) Starboard-hand buoys shall always be painted in one colour only. (In Scotland, red is invariably used.) (9) Port-hand buoys shall be painted of another characteristic colour, either single or parti-colour. (In Scotland, black is invariably used.) (10) *Spherical* buoys at the ends of middle grounds shall always be distinguished by horizontal stripes of white colour. (11) Surmounting beacons (on buoys) such as "staff and globe" and others, shall always be painted of one dark colour. (12) Staff and globe shall only be used on starboard-hand

buoys, staff and cage on port-hand; diamonds at the outer ends of middle grounds; and triangles at the inner ends. (St. George and St. Andrew crosses are principally employed to surmount shore beacons.) (13) Buoys on the same side of a channel, estuary or tideway may be distinguished from each other by names, numbers or letters, and where necessary by a staff surmounted with the appropriate beacon. (14) Buoys intended for moorings may be of any colour (other than green) and shape according to the discretion of the authority within whose jurisdiction they are laid, but for marking submarine telegraph cables the colour shall be black with the word "Telegraph" painted thereon in white letters. Spherical and Pillar buoys are not used by the United States and its possessions. (J. M. N.)

Buoyage System in the United States.—The colouring and numbering of buoys is determined by their position with respect to the navigable channel as such channels are entered and followed from seaward toward the head of navigation. This method, known as the lateral system, is uniform in all United States waters. As all channels do not lead from seaward, arbitrary assumptions must be made in order that the system may be consistently applied.

Distinctive colours are painted on all buoys to indicate their purpose or the side of the channel which they mark. Red buoys mark the right-hand sides of channels, entering from seaward. Black buoys mark the left-hand sides of channels, entering from seaward. Red and black horizontally-banded buoys mark obstructions, or a junction of two channels, and indicate that there is a channel on either side. Black and white vertical-striped buoys indicate the middle of a channel, and should be passed close to, but on either side, for safety; white buoys mark anchorages; yellow buoys mark quarantine anchorages; white buoys with green tops mark areas in which dredging is being carried on. Black and white horizontally-banded buoys mark the limits of areas in which there are fish nets and traps. Red or black (unlighted) buoys with white tops have the same significance as similar buoys without white top.

Numbers are painted conspicuously upon most buoys. These numbers serve to indicate which side of the channel the buoys mark, and also facilitate the locating of the buoys upon the charts. Numbers increase from seaward and are kept in approximate sequence on the two sides of the channel by omitting numbers as required.

Odd-numbered buoys mark the left-hand sides of channels entering from seaward. Even-numbered buoys mark the right-hand sides of channels entering from seaward. Numbers followed by letters, such as 24A, 24B, 24C, indicate that buoys have been added to a channel and the series not at once renumbered. Numbers followed by letters, such as 1 DR, are used on important buoys, particularly those marking isolated offshore dangers. The letters are the initials of the station name, in this instance Duxbury reef, and the number has the usual significance. Letters without numbers are applied in some cases to black and white vertically-striped buoys marking fairways, and to red and black horizontally-banded buoys marking junctions or bifurcations.

Definite shape characteristics have been given to a large portion of the unlighted buoys used in United States waters, to indicate, as in the British system, which sides of the channels they mark. Cylindrical buoys with flat tops are known as can buoys, and if painted black, mark the left-hand sides of channels entering from seaward. Conical buoys with pointed tops are known as nun buoys, and if painted red, mark the right-hand sides of channels entering from seaward. Cylindrical or can buoys, painted in red and black horizontal bands, with the topmost band black, are used to indicate an obstruction or a junction of one channel with another, where the principal channel entering from seaward lies to the right of the buoy. Conical or nun buoys, painted in red and black horizontal bands, with the topmost band red, indicate an obstruction or a junction of one channel with another, where the principal channel entering from seaward lies to the left of the buoy. Conical or nun buoys with black and white vertical stripes indicate the middle of a channel, and may be passed on either side. No special significance is to be attached to the shapes of spar buoys, bell buoys, whistle buoys, gong buoys, lighted buoys, or combination buoys, their purpose being indicated by their colouring, numbering, or light.

For all buoys with lights, the following system of colouring is used. Green lights are used only on buoys marking the left-hand sides of channels entering from seaward. Red lights are used only on buoys marking the right-hand sides of channels entering from seaward. White lights may be used on either side of the channel, and such lights are frequently employed in place of coloured lights at points where a light of considerable brilliance is required, particularly as leading or turning lights.

Fixed lights (lights that do not flash) may be found on either black or red buoys. Flashing lights (flashing at regular intervals and at the rate of not more than 30 flashes per minute) are placed on either black buoys or on red buoys. Quick-flashing lights (not less than 60 flashes per minute) are placed on black buoys and on red buoys at points where it is desired to indicate that special caution is required, as at sharp turns or sudden constrictions. Interrupted quick-flashing lights (the groups consisting of a series of quick flashes, with dark intervals between groups of about 4 seconds) are placed on buoys painted in red and black horizontal bands, indicating obstructions or a junction of one channel with another. Short-long flashing lights (groups consisting of a short flash and a long flash, the groups recurring at a rate of about 8 times per minute) are placed on buoys painted in black and white vertical stripes, indicating a fairway or the middle of a channel where the buoy should be passed close to. The light is always white. Occulting lights, in which the light period is equal to or longer than the dark period, are placed on either black buoys or red buoys, and have the same significance as the ordinary flashing lights, being used principally where a distinction is desirable between two or more buoys. (X.)

Buoy Moorings and Buoys for Special Purposes.—Buoys are moored with specially tested cables secured, as a rule, to blocks of cast iron or concrete known as sinkers, the length of chain and weight of mooring depending on the depth of water and the strength of tide: in narrow waters the length of chain is also governed by the scope of the limits within which the buoy can be allowed to swing. Buoys are ordinarily constructed of steel. Buoys provided with oil-gas lights were first used about 1878; automatic apparatus for giving an occulting or flashing characteristic to the light was introduced in 1883. Further improvements in the lighting of buoys have followed the introduction early in the present century of dissolved acetylene gas. (*See* LIGHTHOUSE.)

Buoys, both lighted and unlighted, fitted with automatic whistles on the Courtenay principle are sometimes used in positions where it is desirable to provide a sound-signal as well as a marking buoy, and where the depth of water is sufficient for the special type of buoy employed. The lower end of the air cylinder in the Courtenay buoy is open to the water which, rising relatively to the cylinder as the buoy descends in the trough of a wave, compresses the imprisoned air which is forced through the whistle at the top of the buoy. As the buoy rises on the crest of a wave, air is drawn into the cylinder through two tubes fitted with non-return valves at the upper part of the buoy. Bells whose clappers are moved by the motion of the buoy are also used as fog signals in connection with marking buoys. Sound signalling apparatus which depends for its functioning on the movement of a buoy cannot be relied on in calm weather, and as this so often coincides with fog conditions it militates against the efficiency of such apparatus as fog-signals.

Boat-shaped buoys carrying a light and also a bell are sometimes used in positions where there are strong currents, as in the Humber and Mersey. They have also been employed in similar conditions in other countries. A Nun buoy is one whose form is that of two cones joined together at the base and is ordinarily used for marking positions when surveying work is in progress and also for buoying temporarily the positions of sunken objects such as anchors, slipped moorings, etc. Small buoys lighted with dissolved acetylene gas are used by cable ships for marking temporary positions during cable laying operations.

Mooring Buoys.—Buoys secured to permanent moorings are placed in many harbours and anchorages for enabling ships entering a port to moor at specified positions instead of having to drop anchor when they do not make fast alongside a quay wall or wharf, and also for enabling them to slip their moorings readily when required. A typical mooring buoy is of steel construction, pear-shaped with a central vertical tube through which passes a spindle fitted with a mooring shackle at either end. The upper shackle is provided for receiving the ship's hawser or cable. To the lower shackle is connected the main buoy chain which itself is joined by bridles and ground chains to two or more cast iron mooring screws, 4ft. in diameter, which are screwed into the river bed. The buoy chains are 3½in. stud-link cable and the ground chains 4in. long-link chain. On the Thames where there are more than 300 sets of moorings in existence buoys of a drum shaped pattern with a trunk tube are used. As many as five legs of ground chain with screws at each end are sometimes provided for moorings for heavy ships; the Cunard mooring in the Mersey probably exceeded in strength any others previously laid in order to combat the swift tide in which vessels of the "Aquitania" Class had to ride and swing; these moorings consisted of four legs of 120 fathoms of 3¾in. square link chain and one leg of 100 fathoms of 3¾in. stud link cable; the moorings were secured to a centre piece to which a large conical shaped buoy was attached.

On the Thames and the Tyne and in other narrow anchorages in rivers and in harbours of restricted area ships are moored fore and aft to two buoys. Where, however, there is ample scope for swinging a single mooring buoy suffices. Mooring buoys are also commonly made in the form of shallow drums. Those used by the Royal Navy are of steel. Heavy mooring anchors of various forms are also used for permanent buoy moorings, and occasionally large concrete blocks sunk in holes dredged in the harbour bed are employed in the place of anchors or screws. (J. M. N.)

See E. C. Shankland, ***Modern Harbours*** and publications of the International Hydrographic Bureau Monaco.

BUPALUS and **ATHENIS,** sons of Archermus, and members of the school of sculpture in marble which flourished in Chios in the 6th century B.C. They were contemporaries of the poet Hipponax (about 540 B.C.). Their works consisted almost entirely of draped female figures, Artemis, Fortune, the Graces. Augustus brought many of their works to Rome and placed them on the gable of the temple of Apollo Palatinus.

BUPHONIA, in Greek antiquities, a sacrificial ceremony, forming part of the *Diipolia* or *Diipoleia*, a religious festival held on the 14th of the month Skirophorion (June-July) at Athens, when a labouring ox was sacrificed to Zeus Polieus as protector of the city. A number of oxen were driven to his altar on the Acropolis, on which grain was spread; and when one of the oxen began to eat, the priest slew it with an ax, which he immediately threw away and fled. The ax, being polluted by murder, was now carried before the court of the Prytaneum (which tried inanimate objects for homicide) and there charged with having caused the death of the ox, for which it was thrown into the sea. Apparently this is an early instance analogous to deodand (*q.v.*). The ox itself was probably the embodiment of the corn-spirit, and therefore its slaughter was regarded as murder.

BIBLIOGRAPHY.—*See* W. Robertson Smith, *The Religion of the Semites* (1894); J. G. Frazer, *The Golden Bough* (abridged edition, 1922); J. E. Harrison, *Prolegomena to the Study of Greek Religion* (1922).

BUR or **BURR,** a prickly fruit or head of fruits, as of the burdock. Also a woody outgrowth on the trunk of a tree, the effect of a crowded bud-development.

BURAUEN, a municipality (with administrative centre and 31 *barrios* or districts) of the province and island of Leyte, Philippine Islands, on the Dagitan river, 21 mi. S. by W. of Tacloban, the provincial capital. Pop. (1939), 33,505, of whom 16,576 were males, and 6 were whites. The chief product of the surrounding region is abacá (Manila hemp). The gain in population since 1918 was 7,858. Of those between the ages of 6 and 10, 25·0% were reported as attending school, and of those aged ten and over 43·0% were reported as literates. The vernacular is a dialect of Bisayan. (C. S. L.)

BURBAGE, JAMES (d. 1597), English actor, is said to have been born at Stratford-on-Avon. He was a member of the earl of Leicester's players, probably for several years before he is first mentioned (1574), as being at the head of the company. In 1576, having secured the lease of land at Shoreditch, Burbage erected there the successful house which was known for 20 years as *The* Theatre from the fact that it was the first ever erected in London. He seems also to have been concerned in the erection of a second theatre in the same locality, the Curtain, and later, in spite of all difficulties and a great deal of local opposition, he started what became the most celebrated home of the rising drama—the Blackfriars theatre, built in 1596 near the old Dominican friary.

His son RICHARD BURBAGE (*c.* 1567–1619), more celebrated than his father, was the Garrick of the Elizabethan stage, and acted every one of the great parts in Shakespeare's plays. He had established a reputation by the time he was 20, and in the next dozen years was the most popular English actor, the "Roscius" of his day. At the time of his father's death, a lawsuit was in progress against the lessor from whom James Burbage held the land on which The Theatre stood. This suit was continued by Richard and his brother Cuthbert, and in 1599 they pulled down the Shoreditch house and used the materials to erect the Globe theatre, famous for its connection with Shakespeare. They occupied it as a summer playhouse, retaining the Blackfriars, which was roofed in, for winter performances. In this venture Richard Burbage had Shakespeare and others as his partners, and it was in one or the other of these houses that he gained his greatest triumphs, taking the leading part in almost every new play. He was specially famous for his impersonation of Richard III. and other Shakespearian characters, and it was in tragedy that he especially excelled. Every playwright of his day endeavoured to secure his services. He died on March 13 1619. Richard Burbage was a painter as well as an actor. The Felton portrait of Shakespeare is attributed to him, and there is a portrait of a woman, undoubtedly by him, preserved at Dulwich college, London.

BURBANK, LUTHER (1849–1926), famous American plant breeder, was born at Lancaster, Mass., on March 7, 1849. He attended the public schools until 15 years of age, and then spent four winters in Lancaster academy. Outside of school he learned much about plant life on a farm, and found in the Lancaster library a copy of Darwin's *Variation of Animals and Plants under Domestication*, the reading of which marked a turning point in his career. Under its stimulus he obtained and read other books by Darwin as well as a number of miscellaneous scientific books. At the age of 21 he bought a 17 ac. tract of land near Lunenberg, Mass., and began his life-work of plant breeding. His most important early achievement was the development of the Burbank potato (1872).

He continued his work at Lunenberg until 1875, when he removed to California, where his three elder brothers had already gone. He settled in Santa Rosa, which he describes, in a letter to his mother, as "the chosen spot of all this earth as far as Nature is concerned." In this earthly paradise he soon established a little nursery garden with greenhouse, which was to become famous the world over and in which, with certain added acres near another town a few miles away, he was to carry on uninterruptedly his experimental and creative work for 50 years. Here he developed that long series of "new creations," as he called them, of fruits, flowers, vegetables, grains and grasses which are associated with his name.

Burbank's work involved experimentation with thousands of kinds of plants and the experimental rearing of hundreds of thousands of plant individuals. It was not conducted to prove or test any particular scientific theories or to make scientific discoveries, but had for its sole aim the production of more and better varieties of cultivated plants. "I shall be contented if, because of me, there shall be better fruits and fairer flowers," said Burbank.

Perhaps Burbank's longest attention was given to the development of new varieties of plums and prunes. This work ran through 40 years of experimentation. Next came his work with berries, which ran through about 35 years and involved the use of over 50 different species of the genus *Rubus* and resulted in the origination and commercial introduction of ten or more useful new varieties. Among other fruits Burbank introduced numerous notable varieties of apples, cherries, peaches, quinces and nectarines. Among flowers he worked especially with lilies, using more than half a hundred varieties in his hybridizations and producing a brilliant array of new forms. Among vegetables, besides producing the Burbank and other new potatoes, he produced new tomatoes, sweet and field corn, squash, asparagus, peas, etc. One of his most extensive experiments was that extending through 16 years and resulting in the production of a series of luxuriantly growing spineless cacti, useful for feeding cattle in arid regions.

He became special lecturer on evolution at Stanford university and published *Luther Burbank, His Methods and Discoveries* (1914–15); *How Plants are Trained to Work for Man* (1921); and, with Wilbur Hall, *The Harvest of the Years* (1927). Of peculiar interest is Burbank's brief series of descriptive catalogues of his offered new plant varieties entitled *New Creations* (1893–1901).

He died at Santa Rosa, Calif., on April 11, 1926.

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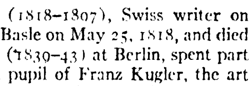
BURBANK, a city of Los Angeles county, California, U.S.A., in the San Fernando valley, 11m. northwest of Los Angeles. It is served by the Southern Pacific railway and federal highway 99. There are many diversified industries, the principal ones being aeroplane manufacturing and motion picture production. The city was incorporated in 1911. The population in 1920 was 2,913 and in 1930 it was 16,662; in 1940, it was 34,337 by the federal census.

BURBIDGE, SIR RICHARD (1847–1917), British merchant, was born in Wiltshire March 2, 1847. At the age of 13 he was apprenticed to a provision merchant in Oxford street, London, and at 19 started in business of his own. Fourteen years later he became general superintendent of the Army and Navy Auxiliary Stores. In 1882 he was appointed general manager of Whiteley's, Westbourne Grove, and in 1891 entered the service of Harrods, Brompton road, of which he became managing director. Under him the stores became one of the largest in London. He anonymously presented about £30,000 to the fund for acquiring the Crystal Palace for the public in 1913. During the World War he was a member of the advisory committee of the Ministry of Munitions. He was created a baronet in 1916 and died in London May 31 1917.

See Mrs. A. C. Stuart Menzies, *Modern Men of Mark* (1920).

BURBOT or **EEL-POUT** (*Lota lota*), the only freshwater fish of the cod family. It is elongate, with long dorsal and anal fins meeting the rounded caudal; the head is broad and flat, the mouth wide; the body is spotted or marbled with brown or black. It inhabits Europe, Siberia, Alaska and Canada; in England it is found in east coast rivers from Durham to Norfolk. In Alaska it grows to 60 lb. It is a voracious fish, and most active at night.



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THE AMERICAN BURBOT, A SPECIES OF THE COD FAMILY FOUND IN FRESH WATERS OF NORTH AMERICA

BURCKHARDT, JAKOB (1818–1897), Swiss writer on art and social history, was born at Basle on May 25, 1818, and died there on Aug. 8, 1897. He studied (1839–43) at Berlin, spent part of 1841 at Bonn, where he was a pupil of Franz Kugler, the art historian, and in 1845 became professor of history in his native city. This position he held, with short intervals, until 1893. His principal works, all of which are important in the history of art criticism, are *Die Zeit Konstantins des Grossen* (1853; 4th ed. 1924); *Der Cicerone, eine Anleitung zum Genuss der Kunstwerke Italiens* (1855; reprint 3 vols. 1925; Eng. trans. of part, 1873); *Die Kultur der Renaissance in Italien* (1860; 14th ed. 1925; Eng. trans. 1878); *Geschichte der Renaissance in Italien* (1867; 7th ed. 1924). Burckhardt's great book on the Italian Renaissance, was the first comprehensive survey of its kind.

See a biographical sketch by Hans Trog in the *Basler Handbuch* (1898); Joel, *Jakob Burckhardt als Geschichtsphilosoph* (1918); two volumes of correspondence posthumously published: *Briefe an einen Architekten* (1913), and *Briefwechsel mit Paul Heyse* (1916). An important posthumous work is *Griechische Kulturgeschichte* (1898–1902).

BURCKHARDT, JOHN LEWIS (JOHANN LUDWIG) (1784–1817), Swiss traveller and orientalist, was born at Lausanne on Nov. 24, 1784. After studying at Leipzig and Göttingen he visited England in the summer of 1806, carrying a letter of introduction from the naturalist Blumenbach to Sir Joseph Banks, who, with the other members of the African Association, accepted his offer to explore the interior of Africa. After studying in London and Cambridge, and inuring himself to all kinds of hardships and privations, Burckhardt left England in March 1809 for Malta, whence he proceeded, in the following autumn, to Aleppo. He disguised himself as a Muslim, and took the name of Ibrahim Ibn Abdallah. He mastered Arabic and acquired such accurate knowledge of the Koran, and of the commentaries upon its religion and laws, that the most learned Muslims entertained no doubt of his being really what he professed to be, a learned doctor of their law. During his residence in Syria he visited Palmyra, Damascus, Lebanon and thence journeyed via Petra to Cairo with the intention of joining a caravan to Fezzan, and of exploring from there the sources of the Niger. In 1813 whilst waiting for the departure of the caravan, he travelled up the Nile as far as Dar Mahass; and then, finding it impossible to penetrate westward, he made a journey through the Nubian desert in the character of a poor Syrian merchant, passing by Berber and Shendi to Suakin, on the Red sea, whence he performed the pilgrimage to Mecca by way of Jidda. At Mecca he stayed three months and afterwards visited Medina. He returned to Cairo in June 1815 in a state of great exhaustion; but in the spring of 1816 he travelled to Mt. Sinai, whence he returned to Cairo in June, and there again made preparations for his intended journey to Fezzan. Finally, in April 1817, when the long-expected caravan prepared to depart, he was seized with illness and died on Oct. 15. He bequeathed his collection of 800 vols. of oriental mss. to the library of Cambridge university.

His works were published by the African Association in the following order: *Travels in Nubia* (to which is prefixed a biographical memoir, 1819); *Travels in Syria and the Holy Land* (1822); *Travels in Arabia* (1829); *Arabic Proverbs, or the Manners and Customs of the Modern Egyptians* (1830); *Notes on the Bedouins and Wahabys* (1830).

BURDEN or BURTHEN. (1) A load, both literally and figuratively (A.S. *byrthen*, from *beran*, to bear); the carrying capacity of a ship; in mining and smelting, the tops or heads of streamwork which lie over the stream of tin, and the proportion of ore and flux to fuel in the charge of a blast-furnace. In Scots and English law, an encumbrance on real or personal property. (2) An accompaniment to a song, or the refrain of a song (Fr. *bourdon*, a droning, humming sound); hence a recurrent topic, as "the burden of a speech."

BURDER, GEORGE (1752–1832), English divine, was born in London. He held charges at Lancaster (1778–83), Coventry (1784–1803), and at Fetter Lane, London (1803–32). He was one of the founders of the British and Foreign Bible Society the Religious Tract Society, and the London Missionary Society, and was secretary to the last-named for several years. As author of *Village Sermons*, which had a vast circulation, he commanded a wide influence.

See his *Life* by H. Burder (1833).

BURDETT, SIR FRANCIS (1770–1844), English politician, was born on Jan. 25, 1770. He was in Paris during the earlier days of the French Revolution, a visit which doubtless influenced his political opinions. Returning to England he married in 1793 Sophia the enormously rich daughter of Thomas Coutts the banker. In 1796 he became member of parliament for Boroughbridge, having purchased this seat from the representatives of the 4th duke of Newcastle, and in 1797 succeeded his grandfather as fifth baronet. In parliament he denounced the war with France, the suspension of the Habeas Corpus act, the proposed exclusion of John Horne Tooke from parliament, and quickly became the idol of the people. He was instrumental in securing an enquiry into the condition of Coldbath Fields prison, but as a result of this step he was for a time prevented by the government from visiting any prison in the kingdom. Between 1802 and 1805 he twice took his seat for Middlesex and was twice unseated. In 1806 he was wounded in a duel with James Paull, radical candidate for Westminster. In 1807 Burdett, in spite of his reluctance, was elected for Westminster. He took up again his work of attacking abuses and agitating for reform, and in 1810 came sharply into collision with the House of Commons. A radical named John Gale Jones had been committed to prison by the House, a proceeding which was denounced by Burdett, who questioned the power of the House to take this step. A revised edition of his speech on this occasion was published by William Cobbett in the *Weekly Register*. The House voted this action a breach of privilege, and the speaker issued a warrant for Burdett's arrest. Barring himself in his house, he defied the authorities, while the Londoners gathered in his defence. Preparations, including a large supply of gunpowder, were made for fierce conflict with the authorities, which it was suggested Lord Cochrane would conduct. Sir Francis, however, refused to countenance armed conflict, and permitted the entry of the government troops. The soldiers marched into his room where he was discovered instructing his son in the Latin of *Magna Carta;* they surrounded him and conveyed him dramatically to the Tower. Released when parliament was prorogued, he caused his supporters much disappointment by returning to Westminster by water, and so avoiding a demonstration in his honour. He then brought actions against the Speaker and the serjeant-at-arms, but the courts upheld the action of the House. In parliament Burdett denounced corporal punishment in the army, and supported all attempts to check corruption, but his principal efforts were directed towards procuring a reform of parliament, and the removal of Roman Catholic disabilities. In 1809, 1817 and 1818, he in vain pressed for parliamentary reform, and in 1825, 1827 and 1828 continued his efforts on behalf of the Roman Catholics, which were successful in 1829. In 1820 Burdett severely censured the government's action at Peterloo (*q.v.*); he was prosecuted at Leicester assizes, fined £1,000, and committed to prison for three months. Long before the passing of the Reform Bill of 1832 Sir Francis' zeal for reform and his enthusiasm for extirpating abuses had diminished. He separated himself from the reformers in personal intercourse and lost the confidence of his one-time colleagues. In 1837 he left Westminster and was elected for North Wiltshire. Thereafter he voted and worked with the Conservatives in Parliament until his death on Jan. 23, 1844.

BURDETT-COUTTS, ANGELA GEORGINA BURDETT-COUTTS, BARONESS (1814–1906), English philanthropist, youngest daughter of Sir Francis Burdett, was born on April 21, 1814 at 80, Piccadilly, London. Much of her girlhood was spent at her father's town house in St. James's place, and there she met Disraeli, Tom Moore, Samuel Rogers, and others who became life-long friends. When she was 23, she inherited practically the whole fortune of her grandfather, Thomas Coutts, by the will of the duchess of St. Albans, who, as the actress Henrietta Mellon, had been his second wife and had been left it on his death in 1821. Miss Burdett then took the name of Coutts in addition to her own. "The faymale heiress, Miss Anjaley Coutts," as the author of the *Ingoldsby Legends* called her in his ballad on the queen's coronation in that year (1837), devoted herself and her riches to philanthropic work. She had removed in 1837 to the famous house at 1, Stratton street, Piccadilly, taking with her her friend and inseparable companion, Hannah Meredith (Mrs. Brown). In May 1871 she was created a peeress, as Baroness Burdett-Coutts of Highgate and Brookfield, Middlesex. On July 18, 1872 she was presented at the Guildhall with the freedom of the city of London, the first case of a woman being admitted to that fellowship. In 1881, at the age of 67, she married William Lehman Ashmead-Bartlett, an American by birth, afterwards Unionist member of parliament. Mr. Ashmead-Bartlett assumed his wife's name. He had been closely associated with her philanthropic work before his marriage, and for the rest of her life continued to assist her. The baroness lived to the great age of 92, dying at her house in Stratton street, Piccadilly, on Dec. 30, 1906. She was buried in Westminster Abbey.

The baroness was an extremely able business woman, and conducted her various great philanthropic enterprises herself. Moreover, she sought to do real constructive work in housing, markets, and the establishment of industries. She carefully avoided taking any side in party politics, but she was actively interested in phases of Imperial extension which were calculated to improve the condition of the black races, as in Africa, or the education and relief of the poor or suffering in any part of the world. Though she made no special distinction of creed in her charities, she was a notable benefactor of the Church of England, building and endowing churches and church schools, endowing the bishoprics of Cape Town and of Adelaide (1847), and founding the bishopric of British Columbia (1857). Among her many educational endowments may be specified the St. Stephen's institute in Vincent square, Westminster (1846); she started sewing schools in Spitalfields when the silk trade began to fail; helped to found the shoe-black brigade; and placed hundreds of destitute boys in training-ships for the navy and merchant service. She established Columbia fish market (1869) in Bethnal Green and presented it to the city, but owing to the rivalry of existing vested interests this effort, which cost her over £200,000, proved abortive. She supported various schemes of emigration to the colonies. In Ireland she helped to promote the fishing industry by starting schools and providing boats. She sought to relieve distress in congested districts of western Ireland by establishing peasant industries. She helped to form the Society for the Prevention of Cruelty to Children, and was a keen supporter of the ragged school union. She was also associated with Louisa Twining and Florence Nightingale; and in 1877–78 raised the Turkish compassionate fund for the starving peasantry and fugitives in the Russo-Turkish War (for which she obtained the order of the Medjidieh, a solitary case of its conferment on a woman). She was the friend of many famous men and women of her time, in art, literature, and science, of Charles Dickens and of Faraday, among many others. Dickens often acted as her almoner. In short, her position in England for half a century may well be summed up in words attributed to King Edward VII., "after my mother (Queen Victoria) the most remarkable woman in the kingdom." She was indeed a "British institution," and became a legend during her lifetime.

See *Baroness Burdett-Coutts: a sketch of her public life and work,* with a preface by Princess Mary Adelaide, Duchess of Teck (Chicago, 1893). There are many references to her in the memoirs of her contemporaries.

BURDON-SANDERSON, SIR JOHN SCOTT, BART. (1828–1905), Regius Professor of Medicine at Oxford, was born at West Jesmond, near Newcastle, on Dec. 21, 1828. Educated at the University of Edinburgh and at Paris, he became in 1860 medical inspector under the privy council, in which capacity he carried out important inquiries which foreshadowed the direct relation between specific micro-organisms and certain diseases. In 1874 he was appointed Jodrell professor of physiology at University college, London, retaining that post till 1882, when he took the Waynflete chair of physiology at Oxford. In 1882 the Royal Society awarded him a royal medal in recognition of his researches into the electrical phenomena exhibited by plants and the relations of minute organisms to disease, and of the services he had rendered to physiology and pathology. In 1895 Sanderson was appointed regius professor of medicine at Oxford. He served on three royal commissions—Hospitals (1883), Tuberculosis, Meat and Milk (1890), and University for London (1892). He died at Oxford on Nov. 23, 1905.

Sanderson may be regarded as the founder of the modern medical school at Oxford. He introduced new methods of teaching

See *Memoir of Sir J. Burdon-Sanderson,* with a selection from his papers and addresses, by Lady Burdon-Sanderson, J. S. Haldane and E. S. Haldane (1911).

BURDWAN, a town of British India, in Bengal, which gives its name to a district and to a division. Pop. (1941) 62,910. The town includes numerous villages scattered over an area of 9sq.m., and is mainly rural in character. The principal objects of interest are the Burdwan Raj palace and gardens; and several interesting ancient tombs; at Nawab Hat, some 2m distant, is a group of 108 Siva *lingam* temples built in 1788. The place was formerly very unhealthy and suffered after 1862 from a virulent type of fever called "Burdwan fever," but its health improved after the establishment of water works, in 1884.

The town is the headquarters of the Maharajadhiraj Bahadur of Burdwan, who ranks first in wealth and importance among the Zamindars of Bengal. The *raj* was founded in 1657 by Abu Rai Kapur, who migrated to Burdwan from the Punjab. One of the most distinguished of his descendants was Maharaja Mahtab Chand, whose loyalty to the government was rewarded with the grant of a coat of arms in 1868 and the right to a personal salute of 13 guns in 1877. The head of the house from 1903 to 1941 was Sir Bijay Chand Mahtab Maharajadhiraj Bahadur of Burdwan, G.C.I.E., K.C.S.I., I.O.M. (1881–1941), who was made a member of the Indian Order of Merit five years after his installation in recognition of the courage with which he risked his life to save that of Sir Andrew Fraser, the lieutenant governor of Bengal, on the occasion of an attempt to assassinate him made by a Bengali. He was a member of the Bengal Executive Council from 1919 to 1924, and was one of the representatives of India at the Imperial Conference in 1926.

The District of Burdwan lies along the right bank of the river Bhagirathi or Hooghly. It has an area of 2,705 sq.mi. and a pop. (1941) of 1,890,732. The east is a low-lying alluvial plain, subject to inundation from the river Damodar. The west of the district comprising the Asansol subdivision, consists of rolling uplands with a dry lateritic soil. The former tract is entirely agricultural, the latter largely industrial. It contains the greater part of the Raniganj coal-field, with an output of more than four million tons, and the Bengal Iron company and the Indian Iron and Steel company ironworks. The subdivisional town of Asansol (pop. 31,286) is an important railway junction and the centre of the Raniganj coal-field. Raniganj (pop. 16,373), which contains large pottery works, was the headquarters of the subdivision till 1906.

The Division of Burdwan comprises the six districts of Burdwan, Birbhum, Bankura, Midnapore, Hooghly and Howrah, with a total area of 14,135 sq.mi., and a population in 1941 of 10,287,369.

BUREAU, a writing-table or desk (from Fr. *burel* or *bureau*, a coarse cloth). From the meaning of "desk," the word is applied to an office or place of business, and particularly a government department; in the United States the term is used of certain subdivisions of the executive departments; *e.g.*, the bureau of statistics, a division of the treasury department. The term "bureaucracy" signifies the concentration of administrative power in bureaus or departments, and the undue interference by officials in matters outside the scope of state interference.

BUREAU VERITAS: *see* SHIPPING: REGISTRATION, CLASSIFICATION AND STATE REGULATION.

BURFORD, market town, Oxfordshire, England, 18 mi. W.N.W. of Oxford. Pop. of civil parish (1931) 907. The town was granted a guild merchant *c.* 1087–1107 by Robert Fitz Hamon, and was a borough from early times until 1863. A synod at Burford in 705 is chronicled, as is the defeat of the Mercians there by the West Saxons under Cuthred in 752. Fairs in April and September, granted in 1497, are still held. William Lenthall, speaker of the Long Parliament, lived at Burford.

The church of St. John the Baptist has a massive Norman tower with a delicate Perpendicular spire. The nave and aisles are mainly Perpendicular in appearance but are of earlier construction. There are many interesting monuments. Among notable old buildings in the High street is the Tolsey or old town hall.

BURG, a town of Germany, in Prussian Saxony, 14 mi. N.E. of Magdeburg. Pop. (1939) 29,657. It belonged originally to the lordship of Querfurt, passed with this to the archbishops of Magdeburg in 1496, and was ceded in 1635 with other portions of the Magdeburg territories to Saxony; in 1687 it was ceded to Brandenburg. It profited by the large influx of industrious French, Palatinate and Walloon refugees at the end of the 17th century. Its cloth and boot manufactures are noteworthy and it also produces asphalt, starch, soap and cardboard.

BURGAGE, a form of tenure, both in England and Scotland, applicable to the property connected with the old municipal corporations and their privileges. In England, it was a tenure whereby houses or tenements in an ancient borough were held of the king or other person as lord at a certain rent. The term is of less practical importance in the English than in the Scottish system, where it held an important place in the practice of conveyancing, real property having been generally divided into feudal-holding and burgage-holding. Since the Conveyancing (Scotland) Act 1874, there is, however, not much distinction between burgage-tenure and free holding. It is usual to speak of the English burgage-tenure as a relic of Saxon freedom resisting the shock of the Norman conquest and its feudalism, but it is perhaps more correct to consider it a local feature of that general exemption from feudality enjoyed by the *municipia* as a relic of their ancient Roman constitution. It persisted as a distinct form in Scottish conveyancing because burgage-holding was an exception to the system of subinfeudation which remained prevalent in Scotland when it was suppressed in England. While other vassals might hold of a graduated hierarchy of overlords up to the crown, the burgess always held directly of the sovereign. It is curious that while in England the burgage-tenure was deemed a species of socage (*q.v.*), to distinguish it from the military holdings, in Scotland it was strictly a military holding, by the service of watching and warding for the defence of the burgh. In England the franchises enjoyed by burgesses, freemen and other consuetudinary constituencies in burghs, were dependent on the character of the burgage–tenure. Tenure by burgage was subject to a variety of customs, the principal of which was Borough English (*q.v.*).

See Pollock and Maitland, *History of English Law* (1898); W. S. Holdsworth, *History of English Law* (1922–26).

BURGAS, the mediaeval Pyrgos, a seaport and the capital of Burgas department, S.E. Bulgaria. Pop. (1934), 36,230. Burgas lies on an inlet of the Black Sea, on a low fore-land, between the lagoons of Ludzha on the north and Kara-Yunus on the west. It faces open sea on the east, its own harbour on the south. It is connected by rail with Philippopolis and the main European network, and by light railway with Anhialo. The harbour, formally opened in 1904, has an average depth of five fathoms; large vessels can load at its quays, and the outer waters of the gulf are well lighted by lighthouses on the islets of Hagios Anastasios and Megalo-Nisi. After World War I it began to rival Varna as the chief port of Bulgaria, surpassing it in the grain trade. There is an important trade in grain, wool, tallow, cheese, butter, textiles, eggs and tobacco. In and near the town are flour mills, a sugar factory, soap factories, etc. There is a chamber of commerce, numerous foreign consulates, a commercial school, a boys' and a girls' high school.

Through this harbour passes 40% of the Black sea trade of Bulgaria. The modern town has few picturesque buildings.

BURGDORF, an industrial town in the Swiss canton of Berne, on the left bank of the Emme, 14 mi. N.E. of Berne (Fr. Berthoud). The lower (or modern) town is connected by a spiral street with the old town, picturesquely perched on a hill (1,942ft above sea-level or 167ft. above the river), crowned by the 15th century parish church and by the ancient castle in which Pestalozzi set up his educational establishment between 1799 and 1804. Cheese of the Emmenthal is an article of trade, and there are railway works, and factories of cloth, white lead and tinfoil. Burgdorf has a cantonal technical institute. Population (1941) was 10,156, practically all Protestants and German-speaking. A fine view of the Bernese Alps is obtained from the castle, which dates from the days of the dukes of Zäringen (11th–12th centuries), the last of whom (Berchtold V.) built walls round the town, and granted it a charter of liberties. Castle and town were sold, together with Thun, in 1384, to the town of Berne, whose bailiffs ruled in the castle till 1798.

See Aeschlimann, *Geschichte v. Burgdorf* (1847); Türler, *Das Schloss B.* (in N. Bern. Taschenbuch, 1922)

BURGENLAND, a province of Austria (*q.v.*) that by reason of its situation experienced a very disturbed history, reflected in the speech of its modern population (German, 241,326; Croat, 40,500; Magyar, 10,442; others, 7,179). The foundations of its settlement are embedded in the early culture of the Danube (*q.v.*), and upon these was built a composite structure in which German, Magyar and Slav influences were mingled. From 1491–1647 it was under direct control of Austria but was mortgaged in the latter year to Hungary, which returned it with the exception of the old capital, Sopron, in 1921.

Physically it comprises detached outliers and low promontories of the dying Alpine ranges. Inliers of primary strata and volcanic rocks appear but in general a thick covering of soft tertiary deposits with occasional stretches of loess hides the older formations. The northern half of the region (the "Seegau") falls quickly from the Leitha mountains (1,560ft.) and Rosalien mountains through a fertile, vine-clad, terraced landscape to the reed flats of the western shore of Lake Neusiedl, beyond which stretches a marshy gravel plain with extensive *puszta* pastures that support large numbers of cattle, pigs and poultry. By contrast, the southern half (the "Raabgau") is more undulating and is cut into a series of strips oriented north-west to south-east by the Raab and its tributaries. In both regions agriculture and forestry are the foundations of human prosperity; Burgenland exceeded all other Austrian provinces in its proportion of productive land, 89·8% of its area, and of this 50·0% is arable, 8·2% is meadowland and 28·3% is forest. Almost every settlement has its strip of pasture along the valley-floor, cultivated strips on the lower terraces and slopes, vineyards and orchards on the steeper sides, and above these the forest. In the north and east, low relief and climatic conditions that include a short, cold winter, a long, hot summer (mean annual temperature, 48°F to 50°F) and a rainfall less than 16in. per annum, are specially favourable to agriculture. Wheat, rye, barley, oats, maize, buckwheat and millet are the important cereals, while sugarbeet, potatoes and leguminous plants are produced in excess of local needs. Hemp in the lowlands and flax in the hilly districts vie with wood and reeds as raw materials for widespread but declining home industries. Lignite, antimony, sulphur and limestone are worked in small quantities but no important development of manufacture has arisen. Minor industries, *e.g.*, the weaving of coarse woollens at Pinkafeld (pop. 2,580) and the preparation of safety-matches at Neudörfel, are scattered along the western frontier particularly near the Wiener-Neustadt valley, but, with the exception of housecrafts mentioned above and the preparation of beet-sugar in two local factories, raw materials are exported to other parts of Austria for treatment; thus a large proportion of the fruit and timber moves to the distilleries and factories respectively of Vienna and Lower Austria.

This rich and fertile land is well-peopled and settlement is evenly distributed upon small-holdings, with minor concentrations in tiny market towns, *e.g.*, Eisenstadt, the capital (pop. *c.* 5,000), Neusiedl-am-See (2,760), Deutschkreut (3,320) and Oberwart (3,850), each of which serves its immediate surroundings. In some cases, notably Sauerbrunn (1,360) and Neusiedl-am-See, local circumstances such as the presence of thermal springs or other attractions give extra-regional importance to a town, but such health and pleasure resorts do not yet enjoy wide popularity. Both north and south have lost their larger markets, Sopron and Szombathely respectively, upon which the rather inadequate rail services of each converge, and Austria, prior to its absorption by Germany in 1938, had the task of reorganizing the outlets and outlook of the area. (W. S. L.)

HISTORY OF THE TRANSFER

The Treaties of Saint-Germain and Trianon envisaged the cession by Hungary to Austria of the German-speaking districts of West Hungary, with their centre Sopron (Oedenburg). Hungary should have handed the districts over on Aug. 9, 1921; instead she organized a violent propaganda against the transfer, and semi-irregular armed bands attacked the Austrian gendarmerie when it tried to take possession. The Inter-Allied Commission in charge appealed to the Council of Ambassadors; Italy offered her mediation, and on Oct. 13 Italy, Austria and Hungary signed a protocol at Venice, agreeing to a plebiscite being held in Sopron and the surrounding districts. Held on Dec. 14 and 19, this gave a Hungarian majority. Austria protested that the voters had been terrorized and the lists manipulated, but the Council of Ambassadors recognized the decision (Dec. 23) and persuaded Austria to do likewise (Feb. 28, 1922). Sopron remained with Hungary, and Austria entered into her new province in a mutilated form and lacking a natural centre.

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BÜRGER, GOTTFRIED AUGUST (1747–1794), German poet of the Romantic school, was born at Molmerswende, near Halberstadt, on Dec. 31, 1747, the son of a pastor. His maternal grandfather sent him to the University of Halle and then to Göttingen to study law, but withdrew his support at Göttingen on account of the young man's irregular life. He became attached to, though not actually a member of, the group of young romanticists known as the Göttinger Hain, which included Voss, the counts Stolberg, Höltz and others, and his first poems were published in the *Musenalmanach*, edited at Göttingen by Boie and Gotter. In 1772, through Boie's influence, Bürger obtained the post of "*Amtmann*" or district magistrate at Altengleichen near Göttingen. His grandfather now paid his debts. In 1773 the ballad *Lenore* was published in the *Musenalmanach*. This vivid and dramatic poem made his name a household word in Germany. In 1774 Bürger married Dorette Leonhart, daughter of a Hanoverian official. In 1778 Bürger became editor of the *Musenalmanach* and in the same year published the first collection of his poems. Pecuniary troubles oppressed him, and being accused of neglecting his official duties, and feeling his honour attacked, he gave up his position and in 1784 went to Göttingen, where he established himself as *Privatdocent*. Shortly before, his wife died on July 30, 1784, and on June 29, 1785, he married his sister-in-law "Molly." Her death on Jan. 9, 1786, affected him very deeply. He still continued to teach in Göttingen; at the jubilee of the foundation of the university in 1787 he was made an honorary doctor of philosophy, and in 1789 was appointed extraordinary professor in that faculty, though without a stipend. In the following year he married Elise Hahn. Only a few weeks of married life with his "Schwabenmädchen" sufficed to prove his mistake, and after two and a half years he divorced her. Deeply wounded by Schiller's criticism, in the 14th and 15th part of the *Allgemeine Literaturzeitung* of 1791, of the 2nd edition of his poems, disappointed, wrecked in fortune and health, Bürger eked out a precarious existence as a teacher in Göttingen until his death there on June 8, 1794.

Bürger was honest in purpose, generous to a fault, tender-hearted and modest. His lyric gift was very great, and in the romantic ballad he created a new genre, and found imitators both in Germany and in England. *Lenore*, *Das Lied vom braven Manne*, *Die Kuh*, *Der Kaiser und der Abt* and *Der wilde Jäger* are the classical examples. Among his purely lyrical poems, *Das Blümchen Wunderhold* and *Lied an den lieben Mond* found a place in many anthologies.

Editions of Bürger's *Sämtliche Schriften* appeared at Göttingen, 1817 (incomplete); 1829–33 (8 vols.), and 1835 (1 vol.); later editions by E. Griesebach (5th ed., 1894); W. von Wurzbach (4 vols. 1902). The *Gedichte* have been published in innumerable editions, by A. Sauer (2 vols. 1884), Consentius (1914) and others. *Briefe von und an Bürger* were edited by A. Strodtmann in 4 vols. (1874). On Bürger's life *see* the introduction to Sauer's edition of the poems, and W. von Wurzbach, *G. A. Bürger* (1900).

BURGERS, THOMAS FRANÇOIS (1834–1881), president of the Transvaal Republic, was born in Cape Colony on April 15, 1834, and was educated at Utrecht, Holland, where he graduated doctor in theology. On his return to South Africa he was ordained minister of the Dutch Reformed Church, and stationed at Hanover in Cape Colony. In 1864 an ecclesiastical tribunal suspended him for heretical opinions. He appealed to the colonial government, which had appointed him, and obtained judgment in his favour, which was confirmed by the privy council of England on appeal in 1865. On the resignation of M. W. Pretorius and the refusal of President Brand of the Orange Free State to accept the office, Burgers was elected president of the Transvaal, taking the oath on July 1, 1872. In 1873 he endeavoured to persuade Montsioa to agree to an alteration in the boundary of the Barolong territory as fixed by the Keate award, but failed (*see* Bechuanaland). In 1875 Burgers, leaving the Transvaal in charge of Acting-President Joubert, went to Europe mainly to promote a scheme for linking the Transvaal to the coast by a railway from Delagoa bay, which was that year definitely assigned to Portugal by the MacMahon award. With the Portuguese Burgers concluded a treaty, in Dec. 1875, providing for the construction of the railway. In June 1876 he induced the raad to declare war against Sikukuni (Secocoeni), a powerful native chief in the eastern Transvaal. The campaign was unsuccessful, and with its failure the republic fell into a condition of lawlessness and insolvency, while a Zulu host threatened invasion. Sir Theophilus Shepstone, who had been sent to investigate the condition of affairs in the Transvaal, issued April 12 a proclamation annexing the Transvaal to Great Britain. Burgers fully acquiesced in the necessity for annexation. He accepted a pension from the British government, and settled down to farming in Hanover, Cape Colony. He died at Richmond in that colony on Dec. 6, 1881 (*see* Transvaal: *History*).

BURGES, GEORGE (1786–1864), English classical scholar, was born in India. He had a great reputation as a Greek scholar, and was a somewhat acrimonious critic of rival scholars, especially Bishop Blomfield. He was a man of great learning and industry, but too fond of introducing arbitrary emendations into the text of classical authors. His chief works are: Euripides' *Troades* (1807) and *Phoenissae* (1800); Aeschylus' *Supplices* (1821), *Eumenides* (1822) and *Prometheus* (1831); Sophocles' *Philoctetes* (1833); E. F. Poppo's *Prolegomena to Thucydides* (1837), an abridged translation with critical remarks; *Hermesianactis Fragmenta* (1839). He also edited some of the dialogues of Plato with English notes, and translated nearly the whole of that author and the Greek anthology for Bohn's Classical library. He was a frequent contributor to the *Classical Journal* and other periodicals, and dedicated to Byron a play called *The Son of Erin* or *The Cause of the Greeks* (1823).

BURGESS, a term, in its earliest sense, meaning an inhabitant of a borough, one who occupied a tenement therein, such tenement, unlike the county freeholds, being devisable by will and constituting "burgage-tenure," but now applied solely to a registered parliamentary, or more strictly, municipal voter. In some of the American colonies (*e.g.*, Virginia), a "burgess" was a member of the legislative body, which was termed the "House of Burgesses." The *Burgess-roll* is the register or official list of burgesses in a borough. In English local government law, all the burgesses, and not merely the mayor and town council, are members of the municipal corporation.

BURGH (Bourke, Burke), the name of an historic Irish house, associated with Connaught for more than seven centuries. It was founded by William de Burgh, brother of Hubert de Burgh (*q.v.*). Before the death of Henry II. (1189) he received a grant of lands from John as lord of Ireland. At John's accession (1199) he was installed in Thomond and was governor of Limerick. In 1199–1201 he was supporting in turn Cathal Carrach and Cathal Crovderg for the native throne, but he was expelled from Limerick in 1203, and, losing his Connaught, though not his Munster, estates, died in 1205. His son Richard, in 1227, received the land of "Connok" (Connaught), as forfeited by its king, whom he helped to fight. From 1228 to 1232 he held the high office of justiciar of Ireland. In 1234 he sided with the crown against Richard, earl marshal, who fell in battle against him. Dying in 1243, he was succeeded as lord of Connaught by his son Richard, and then (1248) by his younger son Walter, who carried on the family warfare against the native chieftains, and added greatly to his vast domains by obtaining (*c.* 1255) from Prince Edward a grant of "the county of Ulster," in consequence of which he was styled later earl of Ulster. At his death in 1271, he was succeeded by his son Richard as 2nd earl. In 1286 Richard ravaged and subdued Connaught, and deposed Bryan O'Neill as chief native king, substituting a nominee of his own. He also attacked the native king of Connaught in favour of that branch of the O'Conors whom his own family supported. He led his forces from Ireland to support Edward I. in his Scottish campaigns, and on Edward Bruce's invasion of Ulster in 1315 Richard marched against him, but he had given his daughter Elizabeth in marriage to Robert Bruce, afterwards king of Scotland, about 1304. Occasionally summoned to English parliaments, he spent most of his 40 years of activity in Ireland, where he was the greatest noble of his day, usually fighting the natives or his Anglo-Norman rivals, the Geraldines. The patent roll of 1200 shows that in addition to his lands in Ulster, Connaught and Munster, he had held the Isle of Man, but had surrendered it to the king

His grandson and successor William, the 3rd earl (1326–1333), was the son of John de Burgh by Elizabeth, lady of Clare, sister and co-heir of the last Clare, earl of Hertford (d. 1314). He married a daughter of Henry, earl of Lancaster, and was appointed lieutenant of Ireland in 1331, but was murdered in his 21st year, leaving a daughter, the sole heiress, not only of the de Burgh possessions but of vast Clare estates. She was married in childhood to Lionel, son of Edward III., who was recognized in her right as earl of Ulster, and their direct representative, the duke of York, ascended the throne in 1461 as Edward IV., since when the earldom of Ulster has been held by members of the royal family only.

On the murder of the third earl in 1333, however, his male kinsmen succeeded in holding the bulk of the Burgh territories, and adopting Irish names became virtually native chieftains. Their two main branches were those of "MacWilliam Eighter" in southern Connaught, later given the title of earls of Clanricarde (1543); and "MacWilliam Oughter" who from 1603 held their territory as the viscountcy of Mayo. (*See* Clanricarde, Earls of; Mayo, Earls of.)

The lords Burgh (or Borough) of Gainsborough (1487–1599) were a Lincolnshire family believed to be descended from a younger son of Hubert de Burgh. The 5th baron was lord deputy of Ireland in 1597, and his younger brother, Sir John (d 1594), a distinguished soldier and sailor.

BURGH, HUBERT DE (d. 1243), chief justiciar of England in the reign of John and Henry III., entered the royal service in the reign of Richard I. Already in 1201 he was chamberlain to King John, the sheriff of three shires, the constable of Dover and Windsor Castles, the warden of the Cinque Ports and of the Welsh Marches. He served with John in the Continental wars which led up to the loss of Normandy. It was to his keeping that the king first entrusted the captive Arthur of Brittany. Coggeshall is our authority for the tale of Hubert's refusal to permit the mutilation of his prisoner; but his loyalty was not shaken by the subsequent murder of Arthur. In 1204 Hubert persisted in a long and obstinate defence of Chinon, at a time when nearly the whole of Poitou had passed into French hands. In 1213 he was appointed seneschal of Poitou.

Both before and after the issue of the Great Charter Hubert adhered loyally to the king; he was rewarded, in June 1215 with the office of chief justiciar, which he retained after the death of John and the election of William, the earl marshal, as regent. But, until the expulsion of the French from England, Hubert was entirely engaged with military affairs. He held Dover successfully through the darkest hour of John's fortunes; and his naval victory gained over Eustace the Monk, the noted privateer and admiral of Louis, in the Straits of Dover (Aug. 1217), compelled Louis to accept the treaty of Lambeth, under which he renounced his claims to the crown and evacuated England. The justiciar naturally assumed, after the death of William Marshal (1219), the leadership of the English loyalists. He was opposed by the legate Pandulf (1218–21), who claimed the guardianship of the kingdom for the Holy See; by the Poitevin Peter des Roches, bishop of Winchester, who was the young king's tutor; by the foreign mercenaries of John, among whom Falkes de Breauté took the lead; and by the feudal party under the earls of Chester and Albemarle. On Pandulf's departure the pope was induced to promise that no other legate should be appointed in the lifetime of Archbishop Stephen Langton. In 1223 the justiciar suddenly announced the resumption of all the castles, sheriffdoms, and other grants which had been made since the king's accession. A plausible excuse was found in the next year for issuing a sentence of confiscation and banishment against Falkes de Breauté. Finally, in 1227, Hubert, having proclaimed the king of age, dismissed the bishop of Winchester from his tutorship.

Hubert now stood at the height of his power. His possessions had been enlarged by four successive marriages, particularly by that which he contracted in 1221 with Margaret, the sister of Alexander II. of Scotland; in 1227 he received the earldom of Kent which had been dormant since the disgrace of Odo of Bayeux. But Henry III. chafed against Hubert's objections to wild plans of foreign conquest and inconsiderate concessions to the papacy. They quarrelled violently in 1229 at Portsmouth, when a sufficient supply of ships was not forthcoming for an expedition to France. In 1231 Henry lent an ear to those who asserted that the justiciar had secretly encouraged armed attacks upon the aliens to whom the pope had given English benefices. Hubert was suddenly disgraced and required to render an account of his long administration. Some colour was given to the attacks of Peter des Roches and his nephew Peter des Rievaux by Hubert's injudicious plea that he held a charter from King John which exempted him from any liability to produce accounts. He was dragged from the sanctuary at Bury St. Edmunds, in which he had taken refuge, and was kept in strait confinement until Richard of Cornwall, the king's brother, and three other earls offered to be his sureties. On the outbreak of Richard Marshal's rebellion (1233), he was carried off by the rebels to the Marshal stronghold of Striguil, in the hope that his name would add popularity to their cause. In 1234 he was admitted, along with the other supporters of the fallen Marshal, to the benefit of a full pardon. He regained his earldom and held it till his death, although he was once in serious danger from the avarice of the king (1239), who was tempted by Hubert's enormous wealth to revive the charge of treason which had formerly been brought against him.

Hubert's ambition of founding a great family was not realized. His earldom died with him, though he left two sons. In constitutional history he is remembered as the last of the great justiciars. The office was now shorn of its most important powers and became politically insignificant.

See The *Histoire des ducs de Normandie*, edited by F. Michel for the Soc. de l'Hist. de France (1840); Roger of Wendover's *Flores Historiarum*, edited for the English Historical Society by H. O. Coxe (1841–44); the *Chronica Majora* of Matthew Paris, edited by H. R. Luard for the Rolls Series (1872–83); the *Histoire de Guillaume le Marechal*, edited by Paul Meyer for the Soc. de l'Hist. de France (1891, etc.); J. E. Doyle's *Official Baronage of England*, ii. pp. 271–274; R. Pauli's *Geschichte von England*, vol. iii.; W. Stubbs's *Constitutional History of England*, vol. ii.

BURGH: *see* BOROUGH.

BURGHERSH, HENRY (1292–1340), English bishop and chancellor, was appointed bishop of Lincoln by Pope John XXII. in 1320, in spite of the fact that the chapter had already made an election. In 1322 his lands were seized by Edward II. and restored only in 1326. Burghersh took part in the movement which led to the deposition and murder of King Edward II., but became chancellor of England in 1328 under the new king, owing to the influence of Queen Isabella. On Isabella's disgrace in 1330 he lost his influence for a time, but was treasurer from 1334 to 1337, and was entrusted with many important commissions by the king.

His brother, Bartholomew, baron Burghersh (d. 1355), also enjoyed the confidence of Edward III., and fought at Crécy. His son, Bartholomew, was one of the original knights of the Garter, and fought at Poitiers in 1356.

BURGHLEY, WILLIAM CECIL, BARON (1520–1598), was born, according to his own statement, on Sept. 13, 1520, at Bourne, Lincolnshire, son of Richard Cecil (*see* CECIL). William was put to school first at Grantham and then at Stamford. In May 1535, at the age of 14, he went up to St. John's college, Cambridge, where he was brought into contact with the foremost educationists of the time, Roger Ascham and John Cheke. There he fell deeply in love with Cheke's sister, Mary, and was in 1541 removed by his father to Gray's Inn, without, after six years' residence at Cambridge, having taken a degree. The precaution proved useless, and four months later Cecil committed one of the rare rash acts of his life in marrying Mary Cheke. The only child of this marriage, Thomas, the future earl of Exeter, was born in May 1542, and in February 1543 Cecil's first wife died. Three years later he married (Dec. 21, 1546) Mildred, daughter of Sir Anthony Cooke, who was ranked by Ascham with Lady Jane Grey as one of the two most learned ladies in the kingdom, and whose sister, Anne, became the wife of Sir Nicholas, and the mother of Sir Francis Bacon.

Cecil, meanwhile, had obtained the reversion to the office of *custos rotulorum brevium*, and, according to his autobiographical notes, sat in parliament in 1543; but his name does not occur in the imperfect parliamentary returns until 1547, when he was elected for the family borough of Stamford. Earlier in that year he had accompanied Protector Somerset on his Pinkie campaign, being one of the two "judges of the Marshalsea," *i.e.*, in the courts-martial.

In 1548 he is described as the protector's master of requests, and was involved in the latter's fall (Oct. 1549). In November he was in the Tower, and on Jan. 25, 1550, he was bound over in recognizances to the value of a thousand marks. However, he soon ingratiated himself with Warwick, and on Sept. 15, 1550, he was sworn one of the king's two secretaries, and was knighted on Oct. 11, 1551. But service under Northumberland was no bed of roses. His responsibility for Edward's illegal "devise" of the Crown has been studiously minimized by Cecil himself and by his biographers. Years afterwards, he pretended that he had only signed the "devise" as a witness. There is no doubt that he saw which way the wind was blowing, and disliked Northumberland's scheme; but he had not the courage to resist the duke to his face. As soon, however, as the duke had set out to meet Mary, Cecil became the most active intriguer against him, and to these efforts, of which he laid a full account before Queen Mary, he mainly owed his immunity. He had, moreover, had no part in the divorce of Catherine or in the humiliation of Mary in Henry's reign, and he made no scruple about conforming to the religious reaction. It was rumoured in Dec. 1554 that Cecil would succeed Sir William Petre as secretary, an office which, with his chancellorship of the Garter, he had lost on Mary's accession. Probably the queen had more to do with the falsification of this rumour than Cecil, though he is said to have opposed in the parliament of 1555—in which he represented Lincolnshire—a bill for the confiscation of the estates of the Protestant refugees.

Cecil was in secret communication with Elizabeth before Mary died, and from the first the new queen relied on Cecil as she relied on no one else. Cecil was exactly the kind of minister England then required. A *via media* had to be found in Church and State, at home and abroad. Cecil was eminently a safe man, not an original thinker, but a counsellor of unrivalled wisdom. Caution was his supreme characteristic; he saw that above all things England required time. Like Fabius, he restored the fortunes of his country by deliberation. He averted open rupture until England was strong enough to stand the shock. There was nothing heroic about Cecil or his policy; it involved a callous attitude towards struggling Protestants abroad. But Cecil never developed that passionate aversion from decided measures which became a second nature to his mistress. His intervention in Scotland in 1559–60 showed that he could strike on occasion; and his action over the execution of Mary, queen of Scots, proved that he was willing to take responsibility from which Elizabeth shrank. Generally he was in favour of more decided intervention on behalf of Continental Protestants than Elizabeth would admit.

His share in the Anglican settlement of 1559 was considerable, and it coincided fairly with his own somewhat indeterminate religious views. Like the mass of the nation, he grew more Protestant as time wore on; he was readier to persecute Papists than Puritans; he had no love for ecclesiastical jurisdiction, and he warmly remonstrated with Whitgift over his persecuting Articles of 1583. The finest encomium was passed on him by the queen herself when she said, "This judgment I have of you, that you will not be corrupted with any manner of gifts, and that you will be faithful to the State."

Of personal incident, apart from his mission to Scotland in 1560, there is little during the long reign of Elizabeth. He represented Lincolnshire in the parliament of 1550, and Northamptonshire in that of 1563, and he took an active part in the House of Commons until his elevation to the peerage; but there seems no good evidence for the story that he was proposed as speaker in 1563. In Feb. 1559 he was elected chancellor of Cambridge university in succession to Cardinal Pole. In 1571 he was raised to the peerage as Baron Burghley of Burghley (or Burleigh); the fact that he continued to act as secretary after his elevation illustrates the growing importance of that office, which under his son became a secretaryship of state. In 1572, however, the marquess of Winchester, who had been lord high treasurer under Edward, Mary and Elizabeth, died, and Burghley succeeded to his post. It was a signal triumph over Leicester; and, although Burghley had still to reckon with cabals in the council and at court, his hold over the queen strengthened with the lapse of years. Before he died, Robert, his only surviving son by his second wife, was ready to step into his shoes as the queen's principal adviser. Having survived all his rivals, and all his children except Robert and Thomas, Burghley died at his London house on Aug. 4, 1598, and was buried in St. Martin's, Stamford.

Burghley's private life was singularly virtuous; he was a faithful husband, a careful father and a considerate master. A booklover and antiquary, he made a special hobby of heraldry and genealogy. It was the conscious and unconscious aim of the age to reconstruct a new landed aristocracy on the ruins of the old, and Burghley was a great builder and planter. All the arts of architecture and horticulture were lavished on Burghley House and Theobalds, which his son exchanged for Hatfield.

The most important collection of documents connected with Burghley is at Hatfield, where there are some ten thousand papers covering the period down to Burghley's death; these have been calendared in eight volumes by the Hist. mss. Comm. At least as many others are in the Record Office and British Museum, the Lansdowne mss. especially containing a vast mass of his correspondence; *see* the catalogues of Cotton, Harleian, Royal, Sloane, Egerton and Additional mss. in the British Museum, and the Calendars of Domestic, Foreign, Spanish, Venetian, Scottish and Irish State Papers.

Other official sources are the *Acts of the Privy Council* (vol. i.–xxix.); Lords' and Commons' Journals, D'Ewes' Journals; Rymer's *Foedera;* Collins' *Sydney Papers;* Nichols' *Progresses of Elizabeth.* Some valuable anonymous notes, probably by Burghley's servant Francis Alford, were printed in Peck's *Desiderata Curiosa* (1732), i. 1–66; other notes are in Naunton's *Fragmenta Regalia.* Lives by Collins (1732), Charlton and Melvil (1738), were followed by Nares's biography (3 vol., 1828–31); this provoked Macaulay's brilliant but misleading essay. M. A. S. Hume's *Great Lord Burghley* (1898) is largely a piecing together of the references to Burghley in the same author's *Calendar of Simancas mss.* The life by Dr. Jessopp (1904) is an expansion of his article in the *Dict. Nat. Biog.*

BURGKMAIR, HANS or **JOHN** (1473–*c.* 1531), German painter and engraver on wood, believed to have been a pupil of Albrecht Dürer, born at Augsburg. He certainly studied under his father, Thoman Burgkmair, and under Martin Schongauer. He was a member of the painters' guild in Strasbourg in 1490, and in Augsburg in 1498. Prof. Christ ascribes to him about 700 woodcuts, most of them distinguished by that spirit and freedom which we admire in the works of his supposed master. His principal work is the series of 135 prints representing the triumphs of the emperor Maximilian I. In his *Turnierbuch* of 52 illustrations he had the assistance of his son Hans Burgkmair (*c.*1500–59). Burgkmair was also an excellent painter in fresco, specimens of which are in the galleries of Munich and Vienna.

See the edition (1854–56) of his *Turnierbuch* by J. van Hefner; Muther, "H. Burgkmair" in vol. xix. of *Zeitsch. für Bildende Kunst.*

BURGLARY, at common law, the offence of breaking and entering the dwelling-house of another in the night-time with intent to commit a felony. The offence and its punishment are regulated in England by the Larceny Act 1916. That statute by s. 25 provides that: "Every person who in the night (1) breaks and enters the dwelling-house of another with intent to commit any felony therein; or (2) breaks out of the dwelling-house of another, having (a) entered the said dwelling-house with intent to commit any felony therein; or (b) committed any felony in the said dwelling-house" is guilty of the felony called burglary and is liable to penal servitude for life. The four important points to be considered in connection with the offence of burglary are (1) the time, (2) the place, (3) the manner and (4) the intent. The *time* is the essence of the offence; night is defined by the act of 1916 to mean "the interval between nine o'clock in the evening and six o'clock in the morning of the next succeeding day."

The *place* must be a dwelling-house or private residence, *i.e.*, the permanent building in which the occupier dwells. No building, although within the same curtilage as the dwelling-house and occupied therewith, is part of the dwelling-house for the purposes of burglary, unless there is a communication between such building and dwelling-house either immediate or by means of a covered and enclosed passage leading from the one to the other (s. 46 of the Act of 1916).

As to the *manner*, there must be both a breaking and an entry. Both must be at night, but not necessarily on the same night, provided that in the breaking and in the entry there is an intent to commit a felony. The breaking may be either an actual breaking of any external part of a building; or opening or lifting any closed door, window, shutter or lock; or entry by means of a threat, artifice or collusion with persons inside.

Breaking and entry must be with the *intent* to commit a felony, otherwise it is only trespass. The felony need not be a larceny; it may be either murder or rape.

Housebreaking in English law is to be distinguished from burglary, in that it is not essential that it should be committed at night, nor in a dwelling-house, save in the case of mere entry with intent to commit a felony. The offence and the punishment are now regulated by ss. 26 & 27 of the Larceny Act, 1916, and a distinction is made between housebreaking and committing felony, and housebreaking with intent to commit felony. Under s. 26: "Every person who (1) breaks and enters any dwelling-house, or any building within the curtilage thereof and occupied therewith, or any schoolhouse, shop, warehouse, counting-house, office, store, garage, pavilion, factory, or workshop, or any building belonging to His Majesty, or to any government department or to any municipal or other public authority, and commits any felony therein; or (2) breaks out of the same, having committed any felony therein" is guilty of felony and liable to penal servitude not exceeding 14 years. By s. 27: "Every person who, with intent to commit any felony therein, (1) enters any dwelling-house in the night; or (2) breaks and enters any dwelling-house, place of divine worship, or any building within the curtilage, or any school-house" or any of the other premises mentioned in s. 26 is guilty of felony and liable to penal servitude not exceeding seven years. Every burglary involves housebreaking, but every housebreaking does not amount to burglary.

In the United States state legislation has generally extended the common law offense of burglary. The breaking and entry of warehouses, shops, and similar premises is considered burglary in addition to the breaking and entry of dwelling-houses. Some statutes eliminate the necessity at common law for the offense being committed in the night-time, but such conduct is usually punishable as house-breaking rather than burglary. Many States have also made criminal the possession of burglarious tools with the intent to use them to commit burglary.

BURGLARY INSURANCE: *see* INSURANCE: MISCELLANEOUS.

BURGONET or **BURGANET** (from Fr. *bourguignote*, Burgundian helmet), a form of light helmet or head-piece, which was in vogue in the 16th and 17th centuries. (*See* HELMET.)

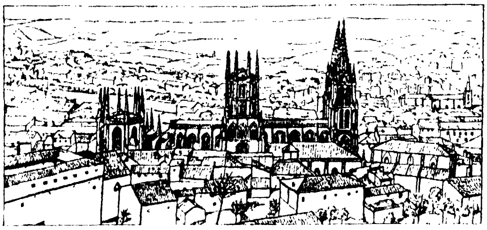
BURGOS, a province of northern Spain which includes the enclave of Treviño in the province of Álava. Pop. (1940) 378,580; area 5,481 sq.mi. The province extends from the main Cantabrian watershed, beyond the Ebro, in the north, to south of the river Douro. In the east it marches with Logroño and Soria in the heart of the Demanda and Urbión massifs which separate Old Castile from the middle Ebro. From these massifs it descends westwards and southwards to the wide stretches of flat ground occupying the centre of the northern part of the central plateau. The Pancorbo gorge, cut across the Montes Obarenes in the north-east, gives a line of communication between the basin of Miranda de Ebro and the rest of the province, and at the same time between Álava and Old Castile. The Ebro runs eastwards through the northern half of the province, but is not navigable. The Douro, or Duero, crosses the southern half, running west-north-west; it also is unnavigable in its upper valley. The other important streams are the Pisuerga, flowing south towards Palencia and Valladolid, and the Arlanzón, which flows through Burgos for over 75 mi.

Burgos is one of the great forest provinces of Spain, with more than 300,000 ac. of pine, oak, beech and other species under state management, while vast ranges of almost uninhabited upland serve as pasture for the flocks, which in most years exceed a million head of sheep. Lambs are exported to Bilbao and Madrid. Goats, horned cattle, horses, mules and swine are very numerous, but little interest is taken in the improvement of breeds. Cereal cultivation—with wheat ordinarily occupying about two-fifths of the cultivated area—is the basis of the agriculture of this province, of which the centre and south form part of the cereal zone *par excellence* of Spain; equipment is, on the whole, primitive. Before the civil war of 1936–39, farmers' co-operative societies were set up to provide agricultural credit and facilitate the purchase of implements and fertilizers; and an increased yield per acre, together with a fall in the wheat acreage after 1922, suggested improvement in methods and a check to the wasteful process of breaking up natural pasture for ploughland. The valleys of the Duero and Arlanzón produce good wine and are agriculturally important for their more equable climate, their good communications and their irrigation works, actual and projected. Soft coal (used for briquettes), mica, china-clay and salt are obtained in small quantities, and oil-bearing lands north of the capital have been under investigation. The industries of the province are on a small scale, the ancient woollen, linen and hemp manufactures surviving in small factories and as cottage industries. Hydroelectric power and light are available throughout the province. The northern railways from Madrid to the French frontier cross the province in the central districts: the Valladolid-Bilbao line in the north; and the Valladolid-Saragossa line in the south. The Burgos-Soria-Calatayud railway provides direct communication with the Mediterranean at Sagunto and Valencia. The only important town in the province is Burgos (51,177). The country towns and villages are inhabited by a notably intelligent and independent peasantry—petty farmers, shepherds and foresters—whose physical type is northern rather than Mediterranean; and Burgos stands fourth or fifth in Spain in respect of elementary education, above the rich provinces of Biscay and Barcelona. But the extreme subdivision of the peasants' holdings forces numbers of men to migrate to the Basque provinces, Barcelona and the Argentine republic, and consequently population declined after the beginning of the 20th century, despite the excess of births over deaths. The province of Burgos was under nationalist control almost from the start of the civil war of 1936–39.

See M. Anibarro and M. Rives, *Intento de un diccionario biográfico y bibliográfico de autores de la provincia de Burgos* (Madrid, 1890); *Burgos y su provincia*, anon. (Vitoria, 1898).

BURGOS, the capital formerly of Old Castile, and after 1833 of the Spanish province of Burgos. Pop. (1940) 51,177 (mun., 60,425). Burgos occupies a strategical site, commanding both the natural route from the Ebro to the plateau of Old Castile by the Pancorbo defile, now followed by the main road and railway line from France, and also the road from Pamplona, formerly part of the Pilgrims' Way leading to Santiago, which runs closer to the foothills of the Sierra de la Demanda (25 mi. east). Its site on the lower slopes of a castle-crowned hill, overlooking narrows of the river Arlanzón, is also one of tactical strength. Side valleys which enter the main valley here, from the north with the road from Bívar, the home of the Cid Campeador, and from the south, with the main road from Madrid, contribute further to the importance of Burgos as a nodal point.

The oldest quarter of the town, with the older churches, stands on the eastern slope of the Castle Hill; a broad alley, cobbled and terraced, descends steeply to the cathedral, which presses closely to the hillside at the foot, its great mass dominating the entire town. Eastwards along the flat ground extends the rest of the old town, whose life centres in the arcaded Plaza Mayor, the Plaza de Prim, a busy market-place, and the Plaza de la Libertad, with the late 15th century Casa del Cordón. Beyond these, along the road to France, and on the eastern outskirts, are the military headquarters, barracks, parade and exercise grounds. Across the river, and separated from the old town by long lines of avenues fringing the two banks, a new suburb, with the railway station and some modern factories, has been built on no very regular plan, round an older manufacturing quarter, and absorbing a number of convents and ex-convents and the Casa de Miranda, the last a building representative of the best domestic architecture of 16th century Spain. Six bridges connect the two sides of the river, the most important, the Puente de Santa María, leading to the Arco de Santa María, the finest of the four gates left to the old town. This gate, with its sculptures illustrating the history of Burgos, was built to commemorate the return of the citizens to their allegiance to the emperor Charles V. after the suppression in 1522 of the rising of the *comuneros*.


THE WHITE LIMESTONE CATHEDRAL OF BURGOS. FOUNDED IN A.D. 1221
The erection of this cathedral was not completed till 1567. It is an excellent example of florid Gothic. Its original cruciform design is obscured by its 15 additional chapels

Burgos is the see of an archbishop, whose province comprises the dioceses of León, Palencia, Osma, Calahorra and Santo Domingo, Vitoria and Santander. The cathedral, founded in 1221 by Ferdinand III. of Castile and the English bishop Maurice of Burgos, is a fine example of florid Gothic, built of white limestone. It was not completed until 1567, and the architects principally responsible for its construction were a Frenchman in the 13th century and a German in the 15th. Its cruciform design is almost hidden by the 15 chapels added at all angles to the aisles and transepts, by the beautiful 14th-century cloister on the north-west and the archiepiscopal palace on the south-west. Over the three central doorways of the main or western façade rise two lofty and graceful towers. Many of the monuments within the cathedral are of considerable artistic and historical interest. The chapel of Corpus Christi contains the chest which the Cid is said to have filled with sand and subsequently pawned for a large sum to the credulous Jews of Burgos. The legend adds that he redeemed his pledge. In the aisleless Gothic church of Santa Agueda, or Santa Gadéa, tradition relates that the Cid compelled Alphonso VI. of León, before his accession to the throne of Castile in 1072, to swear that he was innocent of the murder of Sancho, his brother and predecessor on the throne. San Esteban, completed between 1280 and 1350, and San Nicholás, dating from 1505, are small Gothic churches, each with a fine sculptured doorway. Many of the convents of Burgos have been destroyed, and those which survive lie chiefly outside the city. At the end of the Paseo de la Isla stands the nunnery of Santa María la Real de las Huelgas, originally a summer palace (*huelga*, "pleasure-ground") of the kings of Castile. In 1187 it was transformed into a Cistercian convent by Alphonso VIII., who invested the abbess with almost royal prerogatives, including the power of life and death, and absolute rule over more than 50 villages. Alphonso and his wife Eleanor, daughter of Henry II. of England, are buried here. The Cartuja de Miraflores, a Carthusian convent, founded by John II. of Castile (1406–54), lies 2m. south-east of Burgos. Its church contains a monument of exceptional beauty, carved by Gil de Siloë in the 15th century, for the tomb of John and his second wife, Isabella of Portugal. The convent of San Pedro de Cardeña, 7m. south-east of Burgos, was the original burial-place of the Cid, *in 1099, and of* Ximena, *in 1104*. About 50m. from the city is the abbey of Silos, which appears to have been founded under the Visigothic kings, as early as the 6th century. It was restored in 919 by Fernán González, and in the 11th century became celebrated throughout Europe, under the rule of St. Dominic or Domingo. It was reoccupied in 1880 by French Benedictine monks.

After its foundation in 884 as an outpost in the east of the Asturian kingdom, Burgos became rapidly the capital of the countship, and, later, the kingdom of Castile declared independent in 1035. The traditions of its earliest period are preserved in the statues, occupying niches on the face of the Arco de Santa Maria (vide supra), representing the founder Porcellos, the two first popularly elected "Judges of Castile," the 10th century hero Fernán González and the 11th century hero, the Cid Campeador, whose bones (since 1919) rest in the cathedral. The rival at first of León, and later—after the final absorption of the Leónese kingdom by Castile—of Toledo and Valladolid, Burgos, as the recognized "head of Castile," enjoyed the prestige of a capital city until the reign of Philip II. Like its rivals it sank to political insignificance after 1560, when Madrid was declared the *única corte*. There remained, however, to Burgos the commercial supremacy in Castile which resulted from the powers with which its merchant guild was invested by the Catholic sovereigns in 1494. In that year all foreign trade of Castile, particularly that in fine wool, and the charge of ships sailing from ports of the north coast were put under the jurisdiction of the Burgos guild; the shipping department of this organization became the model for the famous Casa de Contratación at Seville. With the decline of Castilian trade, Burgos languished until its revival in the 18th century under Charles III. It is an agricultural centre, with manufactures of woollen and leather goods, chemical manures, chocolate and paper. In July 1936, conservative Burgos became the official seat of General Franco's government and was a base for campaigns toward Madrid and the Basque states.

A general description of the city and its monuments is given by A. Llacayo y Santa María in *Burgos, etc.* (Burgos, 1889). *See* also *Architectural, Sculptural and Picturesque Studies in Burgos and its Neighbourhood*, a valuable series of architectural drawings in folio, by J. B. Waring (London, 1852). The following are monographs on particular buildings:—*Historia de la Catedral de Burgos, etc.*, by P. Orcajo (Burgos, 1856); *El Castillo de Burgos*, by E. de Oliver-Copons (Barcelona, 1893); *La Real Cartuja de Miraflores*, by F. Tarin y Juaneda (Burgos, 1896); Luis de Pablo Ibáñez, *Catedral de Burgos* (Burgos, 1921). For the history of the city see *En Burgos*, by V. Balaguér (Burgos, 1895); Eloy García de Quevedo y Concellón, *Ordenanzas del Consulado de Burgos de 1538* (Burgos, 1905); O. Jürgens, *Spanische Städte* (Hamburg, 1926). For the history of Silos *see* M. Férotin, *Histoire de l'Abbaye de Silos* (Paris, 1897).

BURGOYNE, JOHN (1722–1792), English general and dramatist, entered the army at an early age. In 1743 he made a runaway marriage with a daughter of the earl of Derby, but soon had to sell his commission to meet his debts, after which he lived abroad for seven years. By Lord Derby's interest Burgoyne was then reinstated at the outbreak of the Seven Years' War. He sat in parliament for Midhurst (1761), and for Preston (1768). At the same time he devoted much attention to art and drama (his first play, *The Maid of the Oaks*, being produced by Garrick in 1775), and gambled recklessly. In the army he had by this time become a major-general, and in 1777 he was at the head of the British reinforcements designed for the invasion of the American colonies from Canada. He gained possession of Ticonderoga (for which he was made a lieutenant-general) and Fort Edward. He pushed on, intending to effect a junction with Sir William Howe, who should have been advancing to meet him from New York. But owing to a delay in receiving his instructions Howe was not there. Skilful American operations had cut his communications with Canada and Burgoyne yielded to a superior force at Saratoga (Oct. 17). English indignation at his severe defeat was great; on May 26, 1778 Burgoyne, whom the Americans had permitted to return, unsuccessfully defended himself in parliament against attacks from nearly every party in the House: the Government denouncing him for his failure, Wilkes and his supporters for his allegedly brutal use of savage Indian troops. The immediate followers of Fox alone supported him at the time, but it is now generally admitted that the responsibility for the defeat at Saratoga did not lie with Burgoyne. He was deprived of his offices except that of general, and after temporary rehabilitation by Rockingham in 1782 he withdrew more and more into private life, his last public service being his participation in the impeachment of Warren Hastings. His comedy, *The Heiress*, which appeared in 1786, ran through ten editions within a year, and was translated into several foreign languages. He died suddenly on June 4, 1792. General Burgoyne, whose wife died in June 1776 during his absence in Canada, had several natural children (born between 1782 and 1788) by Susan Caulfield, an opera singer, one of whom became Field Marshal Sir J. F. Burgoyne. His *Dramatic and Poetical Works* appeared in two vols., 1808.

See E. B. de Fonblanque, *Political and Military Episodes from the Life and Correspondence of Right Hon. J. Burgoyne* (1876), W. L. Stone, *Campaign of Lieut.-Gen. J. Burgoyne*, etc. (Albany, N.Y., 1877); Philip Guedala, *Fathers of the Revolution* (1926); S. F. Batchelder, *Burgoyne and His Officers in Cambridge, 1777–1778* (Cambridge, Mass., 1926); and F. J. Hudleston, *Gentleman Johnny Burgoyne* (Indianapolis, 1927).

BURGOYNE, SIR JOHN FOX, Bart. (1782–1871), British field-marshal, was an illegitimate son of General John Burgoyne (*q.v.*). He was educated at Eton and Woolwich, obtained his commission in 1798, and served in 1800 in the Mediterranean. He took part in the Egyptian expedition of 1807, and was with Sir John Moore in Sweden in 1808 and in Portugal in 1808–9. In the Corunna campaign Burgoyne held the very responsible position of chief of engineers with the rear guard of the British army. He served with great distinction throughout the Peninsular War and after the battle of Vittoria, in 1813, he became commanding engineer on Lord Wellington's staff. At the end of the war he received the C.B. In the campaign of 1814–15 he served at New Orleans and Mobile. Burgoyne was largely employed, during the long peace which followed Waterloo, in other public duties as well as military work. In 1851 he was promoted lieutenant-general, and in the following year received the G.C.B.

When the Crimean War broke out Burgoyne accompanied Lord Raglan's headquarters to the East, superintended the disembarkation at Old Fort, and was in effect the principal engineer adviser to the English commander during the first part of the siege of Sevastopol. In 1868 on resigning his post as inspector-general of fortifications, which he had held for over 20 years, he was made a field-marshal; Parliament granted him, at the same time, a pension of £1,500. He died Oct. 7, 1871, a year after the tragic death of his only son, Captain Hugh Talbot Burgoyne, V.C. (1833–1870), who was in command of H.M.S. "Captain" when that vessel went down in the Bay of Biscay (Sept. 7, 1870).

See *Life and Correspondence of F.M. Sir John Burgoyne* (edited by Lt.-Col. Hon. G. Wrottesley, R.E. 1873); Sir Francis Head, *A Sketch of the Life and Death of F.M. Sir John Burgoyne* (1872); *Military Opinions of General Sir John Burgoyne* (ed. Wrottesley, 1859), a collection of the most important of Burgoyne's contributions to military literature.

BURGRAVE, the Eng. form, derived through French, of the Ger. *Burggraf* and Flem. *burg* or *burch-graeve*, *i.e.*, count of a castle or fortified town. The title corresponds generally to that of castellan or *châtelain* (*q.v.*).

BURGSTÄDT, a town in the south of the district of Leipzig in the *Land* of Saxony, 8m. N.W. of Chemnitz. Pop. (1933) 9,728. Manufactures include gloves, hosiery, knitted goods, cardboard and embroidery.

BURGUNDIO, sometimes erroneously styled Burgundius, an Italian jurist of the 12th century. He was a professor at the

University of Paris, and assisted at the Lateran Council in 1179, dying at a very advanced age in 1194. He was a distinguished Greek scholar, and is believed on the authority of Odofredus to have translated into Latin, soon after the Pandects were brought to Bologna, the various Greek fragments which occur in them, with the exception of those in the 27th book, the translation of which has been attributed to Modestinus. The Latin translations ascribed to Burgundio were received at Bologna as an integral part of the text of the Pandects, and form part of that known as *The Vulgate* in distinction from the Florentine text.

BURGUNDY. The name of Burgundy has denoted very diverse political and geographical areas at different periods of history and as used by different writers. The name is derived from the Burgundians, a people of Germanic origin, who at first settled between the Oder and the Vistula. In consequence of wars against the Alamanni, in which the latter had the advantage, the Burgundians, after having taken part in the great invasion of Radagaisus in 407, were obliged in 411 to take refuge in Gaul, under the leadership of their chief Gundicar. As allies of the Romans, they established themselves in certain cantons of the Sequani and of upper Germany, receiving a part of the lands, houses and serfs that belonged to the inhabitants. Thus was founded the first kingdom of Burgundy, the boundaries of which were widened at different times by Gundicar and his son Gunderic; its chief towns being Vienne, Lyons, Besançon, Geneva, Autun and Mâcon. Gundibald (d. 516), grandson of Gunderic, is famous for his codification of the Burgundian law, known consequently as *Lex Gundobada*, in French *Loi Gombette*. His son Sigismund, who was canonized by the Church, founded the abbey of St. Maurice at Agaunum. But, incited thereto by Clotilda, the daughter of Chilperic (a brother of Gundibald, and assassinated by him), the Merovingian kings attacked Burgundy. An attempt made in 524 by Clodomer was unsuccessful; but in 534 Clotaire (Chlothachar) and his brothers possessed themselves of the lands of Gundimar, brother and successor of Sigismund, and divided them between them. In 561 the kingdom of Burgundy was reconstructed by Guntram, son of Clotaire I., and until 613 it formed a separate State under the government of a prince of the Merovingian family.

After 613 Burgundy was one of the provinces of the Frankish kingdom, but in the redistributions that followed the reign of Charlemagne the various parts of the ancient kingdom had different fortunes. In 843, by the treaty of Verdun, Autun, Chalon, Mâcon, Langres, etc., were apportioned to Charles the Bald, and Lyons with the country beyond the Saône to Lothair I. On the death of the latter the duchy of Lyons (Lyonnais and Viennois) was given to Charles of Provence, and the diocese of Besançon with the country beyond the Jura to Lothair, king of Lorraine. In 879 Boso founded the kingdom of Provence, wrongly called the kingdom of Cisjuran Burgundy, which extended to Lyons, and for a short time as far as Mâcon (*see* PROVENCE).

In 888 the kingdom of Jurane Burgundy was founded by Rudolph I., son of Conrad, count of Auxerre, and the German king Arnulf could not succeed in expelling the usurper, whose authority was recognized in the diocese of Besançon, Basle, Lausanne, Geneva and Sion. For a short time his son and successor Rudolph II. (912–37) disputed the crown of Italy with Hugh of Provence, but finally abandoned his claims in exchange for the ancient kingdom of Provence, *i.e.*, the country bounded by the Rhône, the Alps and the Mediterranean. His successor, Conrad the Peaceful (937–93), whose sister Adelaide married Otto the Great, was hardly more than a vassal of the German kings. The last king of Burgundy, Rudolph III. (993–1032), being deprived of all but a shadow of power by the development of the secular and ecclesiastical aristocracy (especially by that of the powerful feudal houses of the counts of Burgundy [*see* FRANCHE-COMTÉ], SAVOY and PROVENCE) died without issue, bequeathing his lands to the emperor Conrad II. Such was the origin of the imperial rights over the kingdom designated after the 13th century as the kingdom of Arles (*q.v.*).

The name of Burgundy now gradually became restricted to the countship of that name, which excluded the district between the Jura and the Saône, in later times called Franche-Comté, and to the *duchy* which had been created by the Carolingian kings in the portion of Burgundy that had remained French, with the object of resisting Boso. This duchy had been granted to Boso's brother, Richard the Justiciary, count of Autun. It comprised at first the countships of Autun, Mâcon, Chalon-sur-Saône, Langres, Nevers, Auxerre and Sens, but its boundaries and designations changed many times in the course of the 10th century. Duke Henry died in 1002; and in 1015, after a war which lasted 13 years, the French king Robert II. reunited the duchy to his kingdom, despite the opposition of Otto William, count of Burgundy, and gave it to his son Henry, afterwards King Henry I. As king of France, the latter in 1032 bestowed the duchy upon his brother Robert, from whom sprang that first ducal house of Burgundy, which flourished until 1361. A grandson of this Robert, who went to Spain to fight the Arabs, became the founder of the kingdom of Portugal; but in general the first Capet dukes of Burgundy were pacific princes who took little part in the political events of their time, or in that religious movement which was so marked in Burgundy, at Cluny to begin with, afterwards among the disciples of William of St. Bénigne of Dijon, and later still among the monks of Cîteaux. In the 12th and 13th centuries we may mention Duke Hugh III. (1162–93), who played an active part in the wars that marked the beginning of Philip Augustus's reign; Odo (Eudes) III. (1193–1218), one of Philip Augustus's principal supporters in his struggle with King John of England; Hugh IV. (1218–72), who acquired the countships of Chalon and Auxonne; Robert II. (1272–1309), one of whose daughters, Margaret, married Louis X. of France, and another, Jeanne, Philip of Valois; Odo (Eudes) IV. (1315–50) who gained the countship of Artois in right of his wife, Jeanne of France, daughter of Philip V. the Tall and of Jeanne, countess of Burgundy.

In 1361, on the death of Duke Philip de Rouvres, son of Jeanne of Auvergne and Boulogne, who had married the second time John II. of France, surnamed the Good, the duchy of Burgundy returned to the crown of France. In 1363 John gave it, with hereditary rights, to his son Philip, surnamed the Bold, thus founding that second Capet house of Burgundy which filled such an important place in the history of France during the 14th and 15th centuries, acquiring as it did a territorial power which proved formidable to the kingship itself. By his marriage with Margaret of Flanders Philip added to his duchy, on the death of his father-in-law, Louis of Male, in 1384, the countships of Burgundy and Flanders; and in the same year he purchased the countship of Charolais from John, count of Armagnac. On the death of Charles V. in 1380 Philip and his brothers, the dukes of Anjou and Berry, had possessed themselves of the regency, and it was he who led Charles VI. against the rebellious Flemings, over whom the young king gained the victory of Roosebeke in 1382. Momentarily deprived of power during the period of the "Marmousets'" government, he devoted himself to the administration of his own dominions, establishing in 1386 an audit-office (*chambre des comptes*) at Dijon and another at Lille. In 1396 he refused to take part personally in the expedition against the Turks which ended in the disaster of Nicopolis, and would only send his son John, then count of Nevers. In 1392 the king's madness caused Philip's recall to power along with the other princes of the blood, and from this time dates that hostility between the party of Burgundy and the party of Orleans which became so intense when in May 1404 Duke Philip had been succeeded by his son, John the Fearless.

The victory of Hasbain which John achieved on Sept. 23, 1408 over the Liégeois, who had attacked his brother-in-law, John of Bavaria, bishop of Liége, still further strengthened his power and reputation, and during the following years the struggle between the Burgundians and the partisans of the duke of Orleans went on with varying results. In 1419, just when he was thinking of making advances towards the party of the dauphin (Charles VII.), he was assassinated by members of that party. This event inclined the new duke of Burgundy, Philip the Good, towards an alliance with England. In 1420 he signed the treaty of Troyes, which recognized Henry V. as the legitimate successor of Charles VI.; in 1423 he gave his sister Anne in marriage to John, duke of

Bedford; and during the following years the Burgundian troops supported the English pretender. But a dispute between him and the English concerning the succession in Hainaut, their refusal to permit the town of Orleans to place itself under his rule, and the defeats sustained by them, all combined to embroil him with his allies, and in 1435 he concluded the treaty of Arras with Charles VII. The king relieved the duke of all homage for his estates during his lifetime and gave up to him the countships of Mâcon, Auxerre, Bar-sur-Seine and Ponthieu; and, reserving the right of redemption, the towns of the Somme (Roye, Montdidier, Péronne, etc.). Besides this Philip had acquired Brabant and Holland in 1433 as the inheritance of his mother. He gave an asylum to the dauphin Louis when exiled from Charles VII.'s court, but refused to assist him against his father, and henceforth rarely intervened in French affairs. He busied himself particularly with the administration of his State, founding the university of Dôle, having records made of Burgundian customs, and seeking to develop the commerce and industries of Flanders. A friend to letters and the arts, he was the protector of writers like Olivier de la Marche, and of sculptors of the school of Dijon. He also desired to revive ancient chivalry as he conceived it, and in 1429 founded the order of the Golden Fleece; while during the last years of his life he devoted himself to the preparation of a crusade against the Turks. Neither these plans, however, nor his liberality, prevented his leaving a well-filled treasury and enlarged dominions, when he died in 1467.

Philip's successor was his son by his third wife, Isabel of Portugal, Charles, surnamed the Bold, count of Charolais, born in 1433. To him his father had practically abandoned his authority during his last years. Charles had taken an active part in the so-called wars "for the public weal," and in the coalitions of nobles against the king which were so frequent during the first years of Louis XI.'s reign. His struggle against the king is especially marked by the interview at Péronne in 1468, when the king had to confirm the duke in his possession of the towns of the Somme, and by a fruitless attempt which Charles the Bold made on Beauvais in 1472. Charles sought above all to realize a scheme already planned by his father. This was to annex territory which would reunite Burgundy with the northern group of her possessions (Flanders, Brabant, etc.) and to obtain the emperor's recognition of the kingdom of "Belgian Gaul." In 1469 he bought the landgraviate of Alsace and the countship of Ferrette from the archduke Sigismund of Austria, and in 1473 the aged duke Arnold ceded the duchy of Gelderland to him. In the same year he had an interview at Trier with the emperor Frederick III., when he offered to give his daughter and heiress, Mary of Burgundy, in marriage to the emperor's son Maximilian in exchange for the concession of the royal title. But the emperor, uneasy at the ambition of the "grand-duke of the West," did not pursue the negotiations.

Meanwhile the tyranny of the duke's lieutenant Peter von Hagenbach, who was established at Ferrette as governor (*grand bailli* or *Landvogt*) of Upper Alsace, had brought about an insurrection. The Swiss supported the cause of their allies, the inhabitants of the free towns of Alsace, and Duke René II. of Lorraine also declared war against Charles. In 1474 the Swiss invaded Franche-Comté and achieved the victory of Héricourt. In 1475 Charles succeeded in conquering Lorraine, but an expedition against the Swiss ended in the defeat of Grandson (Feb. 1476). In the same year the duke was again beaten at Morat, and the Burgundian nobles had to abandon to the victors a considerable amount of booty. Finally the duke of Lorraine returned to his dominions; Charles advanced against him, but on Jan. 6, 1477 he was defeated and killed before Nancy.

By his wife, Isabella of Bourbon, he only left a daughter, Mary, and Louis XI. claimed possession of her inheritance as guardian to the young princess. He succeeded in getting himself acknowledged in the duchy and countship of Burgundy, which were occupied by French garrisons. But Mary, alarmed by this annexation, and by the insurrection at Ghent (secretly fomented by Louis), decided to marry the archduke Maximilian of Austria, to whom she had already been promised (Aug. 1477), and hostilities soon broke out between the two princes. Mary died through a fall from her horse in March 1482, and in the same year the treaty of Arras confirmed Louis XI. in possession of the duchy. Franche-Comté and Artois were to form the dowry of the little Margaret of Burgundy, daughter of Mary and Maximilian, who was promised in marriage to the dauphin. As to the lands proceeding from the succession of Charles the Bold, which had returned to the Empire (Brabant, Hainaut, Limburg, Namur, Gelderland, etc.), they constituted the "Circle of Burgundy" from 1512 onward.

We know that the title of duke of Burgundy was revived in 1682 for a short time by Louis XIV. in favour of his grandson Louis, the pupil of Fénelon. But from the 16th to the 18th century Burgundy constituted a military government bounded on the north by Champagne, on the south by Lyonnais, on the east by Franche-Comté, on the west by Bourbonnais and Nivernais. It comprised Dijonnais, Autunois, Auxois, and the *pays de la montagne* or Country of the Mountain (Châtillon-sur-Seine), with the "counties" of Chalonnais, Mâconnais, Auxerrois and Bar-sur-Seine, and, so far as administration went, the annexes of Breese, Bugey, Valromey and the country of Gex. Burgundy was a *pays d'États*. The estates, whose privileges the dukes at first and later Louis XI., had to swear to maintain, had their assembly at Dijon, usually under the presidency of the governor of the province, the bishop of Autun as representing the clergy, and the mayor of Dijon representing the third estate. From the judiciary point of view the greater part of Burgundy depended on the parlement of Dijon; but Auxerrois and Mâconnais were amenable to the parlement of Paris.

See U. Plancher, *Histoire générale et particulière de Bourgogne* (1739–81); Courtépée, *Description générale et particulière du duche de Bourgogne* (1774–85); O. Jahn, *Geschichte der Burgundionen* (1874); E. Petit de Vausse, *Histoire des ducs de Bourgogne de la race capétienne* (1885–1905); B. de Barante, *Histoire des ducs de Bourgogne de la maison de Valois* (1833–36); the marquis Léon E. S. J. de Laborde, *Les Ducs de Bourgogne: Études sur les lettres, les arts et l'industrie pendant le XVe siècle* (1849–51). (R. P.)

BURGUNDY WINES. *Burgundy*, as known throughout the world, is a generous, full-bodied, dry red table wine, stronger in flavour, body, bouquet and of deeper colour than claret. In France, by law, the term *Burgundy* can be applied to wines, both red and white, produced within the departments of the Côte d'Or, the Saône et Loire and Yonne, in the eastern part of the country, which were up to 1789 in the province of Burgundy. In most other wine-growing countries any red wines of Burgundy type may be labelled Burgundy if the labels state also their place of origin.

Wines entered Burgundy's history with the planting of Italian vines during Caesar's conquest of Gaul and developed for centuries under monks, but not till the 16th century did the term Burgundy wine become generally accepted. By that time the province of Burgundy had spread to include several viticultural districts, each with its own Burgundy wines.

The most celebrated of the French Burgundies come from a narrow series of hills known as the Côte d'Or, running south-by-east for about 36 mi. from Dijon. On these slopes, where the soil glistens like gold when exposed by autumn leaf-fall, the grapes are carefully tended in small vineyards divided into many individually owned plots. For red wines the Pinot noir, and for white wines the Pinot blanc and Chardonnay, are the most-favoured grape varieties; while on lower ground the Gamay is prevalent.

The vineyards in the northern portion of the Côte d'Or, called the Côte de Nuits, produce perhaps the finest of all red Burgundy wines. Some of those in the southern portion, called the Côte de Beaune, are famous for their white Burgundies as well as for some of their reds.

Further south, on the hills of the Côte Chalonnaise, the Côte Maconnaise and the Beaujolais, large quantities of both red and white wines are produced.

Chablis.—Further north, about midway between Dijon and Paris, in the department of Yonne, the town of Chablis gives its name to one of the best-known white wines in the world. *Chablis*, while entitled under French law to be called a Burgundy wine, is quite different from the wines of the Côte d'Or. Produced on only a few thousand acres around the town of its naming, it reaches the market as a wine of the palest amber with a slightly greenish cast; it is delicate and less tart than Rhine wines, to which it is often compared, and flinty-flavoured.

In most countries other than France wines from any other areas of the world may be labelled Chablis if they possess the characteristics generally attributed to Chablis and carry on their labels the true places of origin. Such wines may have as their base the Pinot blanc and Chardonnay grapes traditional for white wines in the Chablis district, but many other grape varieties also are used. (*See* WINE.) (H. A. Cw.)

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BURHANPUR, a town of British India on the G.I.P. railway, in the Nimar district of the Central Provinces, situated on the north bank of the river Tapti, 310 m. N.E. of Bombay. It was founded in A.D. 1400 by a Mohammedan prince of the Farukhi dynasty of Khandesh. His successors held it for 200 years, after which it was annexed to the empire of Akbar. It formed the chief seat of the Government of the Deccan Provinces of the Mogul empire till Shah Jahan removed the capital to Aurangabad in 1635. Burhanpur was plundered in 1685 by the Mahrattas, and became for 100 years the centre of many conflicts between the Mahrattas and Moguls. In 1803 it was captured by General Wellesley, afterwards duke of Wellington, but restored by treaty to Sindhia, by whom it was finally ceded to the British in 1861. In its fort, old palace, mosques and tombs, it resembles the old Mogul capitals of the north, and is referred to in the *Ain-i-Akbari*, by Sir Thomas Roe, and Tavernier, as a city with very flourishing industries and trades. Like all Mogul cities, it was famous for luxury articles—brocades, flowered silks, gold and silver embroideries. It is now an ancient walled city which, after many years of decay from its old-time status, and the decline almost to vanishing point of the old industries, is showing an upward tendency under more modern conditions. There are a few old families who still produce gold and silver thread and brocades, and it still has a large body of weavers of silk bordered cloths, while the establishment of cotton mills, ginning factories and presses has restored some of its lost wealth.

Its population, after many intercensal fluctuations, has now risen to 53,987 (1941), comprising the largest proportion of Mohammedans to be found in any town in the Central Provinces. Its old Mogul water supply has been modernized, and the insanitary conditions considerably improved.

BURI or **BURE,** in Norse mythology, was born from the rocks, licked by the cow Andhumla (darkness). He was the father of Bor, who became the father of Odin.

BURIAL, depositing (a body) in the earth. Every one in England, whether a parishioner or not, has the right to be buried in the burial ground of the parish where he dies, except executed felons, who must be buried in the prison or in a place appointed by the Home Office. At common law the person under whose roof a death takes place has a duty to provide for the body being carried to the grave decently covered; and the executors or legal representatives of the deceased are bound to bury or dispose of the body in a manner becoming the estate of the deceased according to their discretion, and they are not bound to fulfil the wishes he may have expressed in this respect. The disposal must be such as will not expose the body to violation, or offend the feelings or endanger the health of the living; and cremation under proper restrictions is allowable. In the case of paupers dying in a workhouse, or shipwrecked persons whose bodies are cast ashore, the overseers or guardians are responsible for their burial. In the case of persons found *felo de se*, the coroner must give directions for the burial of the remains in the churchyard or burial ground of the parish in which the remains might be interred had a verdict of *felo de se* not been found. The expenses of burial are payable out of the deceased's estate in priority to all other debts. A husband is liable for the funeral expenses of his wife, even though she has been living separate from him, and though she was buried without his knowledge or request. A parent is liable for the funeral expenses of his children, if he has the means of paying. Legislation has principally affected (1) places of burial, (2) mode of burial, (3) fees for burial and (4) disinterment.

1. The overcrowded state of churchyards and burial grounds led to the passing of a group of statutes known as the Burial Acts, extending from 1852 up to 1900. By these acts a general system was set up, the aim of which was to remedy the existing deficiencies of accommodation by providing new burial grounds and closing old ones which should be dangerous to health, and to establish a central authority (now for most purposes the Ministry of Health) to superintend all burial grounds with a view to the protection of the public health and the maintenance of public decency in burials. The Ministry of Health thus has the power to obtain by order in council the closing of any burial ground it thinks fit, while its consent is necessary to the opening of any new burial ground; and it also has power to direct inspection of any burial ground or cemetery, and to regulate burials in common graves in statutory cemeteries and to compel persons in charge of vaults or places of burial to take steps necessary for preventing their becoming dangerous or injurious to health. The vestry of any parish was thus authorized to provide itself with a new burial ground, if its existing one was no longer available; such ground might be wholly or partly consecrated, and chapels might be provided for the performance of burial service. The ground was put under the management of a burial board, consisting of ratepayers elected by the vestry, and the consecrated portion of it took the place of the churchyard in all respects. Disused churchyards and burial grounds in London may be used as open spaces for recreation, and only buildings for religious purposes can be built on them (1881, 1884, 1887). The Local Government Act 1894 introduced a change into the government of burial grounds (consequent on the general change made in parochial government) by transferring, or allowing to be transferred, the powers, duties, property and liabilities of the burial boards in urban districts to the district councils, and in rural parishes to the parish councils and parish meetings; and by allowing rural parishes to adopt the Burial Acts, and provide and manage new burial grounds by the parish council, or a burial board elected by the parish meeting.

2. The mode of burial is a matter of ecclesiastical cognizance; in the case of churchyards and elsewhere it is in the discretion of the owners of the burial ground. The Ministry of Health now makes the regulations for burials in burial grounds provided under the Burial Acts; for cemeteries provided under the Public Health Act 1879. Private cemeteries and burial grounds make their own regulations. Before 1880 no body could be buried in consecrated ground except with the service of the church, which the incumbent of the parish or a person authorized by him was bound to perform; but the canons and prayer-book refused the use of the office for excommunicated or unbaptized persons, and persons against whom a verdict of *felo de se* had been found. But by the Burial Laws Amendment Act 1880, the bodies of persons entitled to be buried in parochial burial grounds, whether churchyards or graveyards, may be buried there, on proper notice being given to the minister, without the performance of the service of the Church of England, and either without any religious service or with a Christian and orderly religious service at the grave, which may be conducted by any person invited to do so by the person in charge of the funeral. Clergymen of the Church of England are also by the act allowed, but are not obliged, to use the burial service in any unconsecrated burial ground or cemetery, or building thereon, in any case in which it could be used in consecrated ground. In cases where it may not be so used, and where such is the wish of those in charge of the service, the clergy may use a form of service approved by the bishop without being liable to any ecclesiastical or temporal penalty. The proper performance of the burial office is provided for by the Public Worship

Regulation Act 1874. Statutory provision is made by the criminal law in this act for the preservation of order in burial grounds and protection of funeral services.

3. Fees are now payable by custom or under statutory powers on all burials. In a churchyard the parson must perform the office of burial for parishioners, even if the customary fee is denied, and it is doubtful who is liable to pay it. The custom must be immemorial and invariable. If not disputed, its payment can be enforced in the ecclesiastical court; if disputed, its validity must be tried by a temporal court. A special contract for the payment of an annual fee in the case of a non-parishioner can be enforced in the latter court. In the case of paupers and shipwrecked persons the fees are payable by the parish. In other parochial burial grounds and cemeteries the duties and rights to fees of the incumbents, clerks and sextons of the parishes for which the ground has been provided are the same as in burials in the churchyard. Burial authorities may fix the fees payable in such grounds, subject to the approval of the Home Secretary; but the fees for services rendered by ministers of religion and sextons must be the same in the consecrated as in the unconsecrated part of the burial ground, and no incumbent of a parish or a clerk may receive any fee upon burials except for services rendered by them (Act of 1900). On burials under the act of 1880 the same fees are payable as if the burial had taken place with the service of the church.

4. A corpse is not the subject of property, nor capable of holding property. If interred in consecrated ground, it is under the protection of the ecclesiastical court; if in unconsecrated, it is under that of the temporal court. In the former case it is an ecclesiastical offence, and in either case it is a misdemeanour, to disinter or remove it without proper authority, whatever the motive for such an act may be. Such proper authority is (1) a faculty from the ordinary, where it is to be removed from one consecrated place of burial to another, and this is often done on sanitary grounds or to meet the wishes of relatives, and has been done for secular purposes, *e.g.*, widening a thoroughfare, by allowing part of the burial ground (disused) to be thrown into it; (2) a licence from the Home Secretary, where it is desired to transfer remains from one unconsecrated place of burial to another; (3) by order of the coroner, in cases of suspected crime. *See* also CEMETERY; CREMATION, and DEAD, DISPOSAL OF THE.

See Sir R. J. Phillimore, *Ecclesiastical Law* (2nd ed., 1895); J. B. Little, *The Law of Burial* (1901); E. Austin, *Burial Grounds and Cemeteries* (1907). Lord Parmoor, *Law of Church and Clergy* (7th ed., 1921). (G. G. P.)

United States.—Burial in the United States is carried out in three ways—earth burial, reposal in crypts in mausolea and cremation. Cremation accounts for only about 15,000 "burials" annually in this country. By far the greatest number of burials is in the earth, although it is true that the mausoleum idea is fast growing, due to the fact that land in metropolitan areas is becoming too valuable to be devoted to cemetery purposes. It is growing, too, because many people find the large marble and granite edifices, beautiful architecturally, and free from the contaminating influences of earth and water, have a strong psychological appeal as compared with the seemingly colder idea of earth burial.

Earth burials in the United States, compared with burials of half a century ago, have become a matter of gradually increasing refinement. Bodies are now encased in caskets of fine wood or metals; some of them made on special order are works of art costing, at times, many thousands of dollars. There is a growing custom of encasing the casket in a water-tight vermin-proof steel vault, affording greater protection to the body and casket in the ground. No longer does one see the hideous shaped coffins of pine, painted black or brown that were formerly in use; nor does one see the coffin lowered into the grave by straps, but upon an automatic lowering device which slowly conveys the casket beyond the sight of those standing about. Clods of earth are not thrown into the grave on the casket, a bouquet of flowers serving the purpose of "dust to dust." Artificial grass covers the soil from the grave while the brief service is being pronounced, and a large special tent breaks the rays of the sun or protects from inclement weather. Motor driven equipment has replaced the old horse-drawn hearse and hacks. The dingy "funeral parlours" have given way to the tasteful modern funeral home or mortuary. Gradually an increasing number of funerals are being held from these places instead of from the private home or the church. It is now almost a fixed custom to take the dead body from the place of death to the mortuary where it is made ready for burial. Very rarely now is the body removed from the mortuary until it is conveyed to the cemetery.

In the United States, as in most countries, every person has an inherent right of burial. The Jewish rites among the orthodox must take place within 24 hours of death, and the funeral and burial are most simple. Embalming is not done with this class; burial is only in a Jewish cemetery. Many Catholics still make use of the "wake," and burial takes place only in consecrated grounds; that is, in a Catholic cemetery. None outside the pale of the Roman Catholic church may be interred in a Catholic cemetery. Protestants make use of all three forms of burial, and, with the Catholics, usually wait the customary three days after death before interment.

While all men are entitled to a Christian burial, there are those who do not receive it: Those who are executed by the State for crimes committed, and whose bodies are not claimed by relatives or friends; those who meet death by violence and whose bodies cannot be identified after a stated period of time; and those who will their bodies to science. Many of these find their way to the dissecting tables. The bars are raised against the burial of no man in a Protestant cemetery if family or friends can meet the expense of a burial plot. Even the potter's field is usually attached to the cemetery proper, wherein are buried by the city or town those who cannot provide funds for a family plot or a single grave.

For the most part common law obtains in the United States in most matters pertaining to burials, although in various States the common law has been changed and extended by legislative acts. This is particularly true regarding rights of burial. In all States a burial cannot be made until the last physician attending a case has made a certificate as to the cause of death. With this in hand the funeral director secures from the city or town clerk, or other legal registrar, a burial permit. The sexton of the cemetery will not prepare a grave without the burial permit, nor allow a funeral party to enter the grounds of the cemetery. A disinterment for reinterment in the same cemetery, or in a distant cemetery, cannot be made without a special permit, usually at the hands of the local board of health.

Funerals and burials of bodies dead of a contagious or communicable disease must be private, and in some cases within 12 hours. No funeral is permitted for those dying from certain causes. Shipment of such cases must be in metal-lined containers, and in case of certain diseases may not be shipped beyond the confines of the town or city. While embalming as a general proposition is not required by law, it is in almost universal practice in the U.S.A. The transportation of bodies dead of smallpox, Asiatic cholera, yellow fever, typhus fever or bubonic plague is absolutely forbidden. The bodies of those who have died from diphtheria (membraneous croup), scarlet fever (scarlatina, scarlet rash), glanders, anthrax or leprosy, are not accepted for transportation unless prepared for shipment by being thoroughly disinfected by an arterial and cavity injection with an approved disinfectant fluid and washed with a disinfectant, all of the work being done by a licensed embalmer. The body must then be enclosed in an air-tight, hermetically sealed metal container. In case of typhoid fever, puerperal fever, erysipelas, tuberculosis and measles and other dangerous communicable diseases, not mentioned above, the body may be prepared by cavity embalming if it can reach its destination within 48 hours; otherwise both arterial and cavity embalming must be employed. A body dying from non-contagious or noncommunicable diseases may be shipped without the above precautions in a sound metal or wooden container if destination can be reached in 30 hours; otherwise sanitary precautions must be taken. An attendant may not accompany a body dead of contagious or communicable diseases unless he shall have taken proper sanitary precautions.

In determining who shall have the right to bury a dead human body, and upon whom falls the duty, the courts have brought out the commonly accepted ruling that a body has no value in a commercial sense; it cannot be attached, conveyed or taken on execution. In the case of *Bogart* v. *The City of Indianapolis* it was laid down "that the bodies of the dead belong to the surviving relations, in the order of inheritance as property, and that they have the right to dispose of them as such, within restrictions analogous to those by which the disposition of other property is regulated." That is, the husband or wife have first word as to the disposition of the remains of the other; children come second, and other relatives in the order of blood succession. Coroners for the purpose of an inquest possess priority over all others but only for that purpose, and during the time of an inquest. In case of a person meeting death by violence, or in some hidden manner, and identification of the victim cannot be established, then the coroner may order burial in the potter's field or the body may be sent to a definite institution for scientific uses. Captains of ocean-going vessels by common consent through the ages have had the right personally to attend to the burial of persons dying on their ships. They are also given that right by an Arizona statute. However, sea burials possess a great horror for those not living on the high seas, and most liners now possess facilities for embalming bodies, and they are delivered to the authorities at the home port. Surviving relations have the right to call for a *post mortem* examination, to select the kind of casket for burial, to determine the plans for the funeral and interment, and incidentally are held responsible for the cost. In the United States a man may by will determine the final disposition of his own remains, and to a limited extent this wish is usually respected.

Generally speaking the right to bury does not extend to a second burial; however, disinterments may be made upon the proper showing to a local board of health. If there be any contention among members of a family over removal of a body from one cemetery to another, it is a matter for court decision. Precedents have been established on this point in the courts of New Jersey, Massachusetts, Rhode Island and Missouri.

It has been established that a pauper parent is not obliged to bury his deceased child if he is not financially able; he need not even incur future financial obligation by borrowing money to take care of the expense, but may call upon the proper civic authorities to bear the burden. Neglect on the part of financially able parents or other relatives, properly to dispose of a dead body is a criminal offence in some States, punishable by a fine three times the cost of the burial. The expenses of any funeral constitute a priority charge against an estate whether specifically so stated in a will or not. Many probate courts have established a custom of allowing only a "reasonable charge" as the proper cost of a funeral, in case of a court contention, although no statute has ever been set up to govern the matter of the amount of charges for a funeral and the consequent burial. (H. J. D.)

BURIAL SOCIETY, a form of friendly society, existing mainly in England, and constituted for the purpose of providing by voluntary subscriptions, for insuring money to be paid on the death of a member, or for the funeral expenses of the husband, wife or child of a member, or of the widow of a deceased member. (*See* FRIENDLY SOCIETIES.)

BURIAN VON RAJECZ, STEPHEN, COUNT (1851–1922), Austro-Hungarian statesman, was born at Stampfen, near Presburg (Bratislava), Jan. 16, 1851, of a Hungarian noble family. He entered the diplomatic service, spending many years in Moscow and in Sofia. From 1903 to 1912 he was finance minister and as such administered the provinces of Bosnia and Hercegovina. In June 1913 he was appointed Hungarian minister to the court of Vienna, and on Jan. 13, 1915 he succeeded Count Berchtold at the Foreign Office. Burian was unable to prevent the secession of Italy into the ranks of the Entente, but he succeeded in arranging the alliances with Bulgaria and Turkey. With regard to Poland he advocated the creation of an independent state coequal with Austria-Hungary. In general, he maintained that in military, political and economic matters Austria-Hungary must be treated as an equal partner with Germany, her ally.

On the question of peace, too, there was a sharp antithesis between the views of Burian and those of German statesmen. He proposed, as early as Nov. 1915, that Germany should make a public declaration of her willingness to guarantee the national independence of Belgium, and during 1916 repeatedly urged that the way should be paved for negotiation with the enemy on the basis of the renouncing of conquests in the west. The peace note of Dec. 12, 1916, which put an end to this quarrel, was the last important official act of Burian as foreign minister. A few days later he laid down his office, but was recalled after the resignation of his successor, Count Czernin, on April 15, 1918. Burian now worked energetically for peace. On Sept. 14, 1918, he addressed to all the belligerent nations an invitation to end the war by diplomatic negotiations. The invitation had no success: he therefore resigned, and from this time onwards ceased to take an active part in politics. He died at Vienna Oct. 20, 1922.

See S. Burian von Rajecz, *Drei Jahre aus der Zeit meiner Amtsführung im Kriege* (1923), Eng. tran. *Austria in Dissolution* (1925).

BURIAT MONGOL REPUBLIC, an autonomous Soviet Socialist Republic in Asiatic Russia, created as a region in Jan. 1922, and as a republic in Sept. 1923. Area 161,776 sq.mi. Pop. (1939) 542,170; urban 163,425, rural 378,745. The republic consists of detached parts related to the life of the Buriat herdsmen and cultivators. On the southeast there is a detached Buriat area, south of Chita, surrounded by the Chita province, near the Mongolian frontier, between the Yablonoi and Nerchinsk ranges; this is an area of sub-alpine meadows and sluggish streams. The main part of the republic consists primarily of part of the Vitim plateau, east of Lake Baikal, but the high west border of the lake is also included. From this main area the republic projects westwards along two highland lines, one following the Sayan mountains south and west of Baikal as far as the source of the River Iya, the other following the western tongue of hills north of the Angara valley, having a small detached highland piece at its western end. The Angara valley and the coast of Baikal north and south of it are in the Irkutsk province of the Siberian area (*q.v.*). The Buriats are a Mongol people, broad shouldered, stout, small, with slanting eyes, high cheekbones and broad, flat noses. They are skilful horse and cattle breeders, hunters and fishers. Many are still nomadic herdsmen, going in summer to the more exposed and higher Alpine meadows, in autumn to the mown meadows (thus providing manure for the cultivators), in winter to places sheltered from the biting winds and in spring to those places where the snow melts earliest. Sometimes spring snowstorms cause much damage to the flocks and herds. The hunters trap squirrel and other fur-bearing animals, and also the maral deer, valued for its horns. Fishing is extensively carried on, and has much developed with improved steamer traffic. Many Buriats, however, have given up the nomadic life and become settled cultivators. The areas where crops are raised show an interesting relation to orography, since they are all in the river valleys, chiefly in the south-east of the main area, *i.e.*, the valleys of the Selenga, Khilky, Chikoyu and Uda rivers: the areas bordering these rivers, Ulan Ude, formerly Verkhne Udinsk, Selenga and Troitskosavsk, have 46% of the ploughed lands in the republic. Ulan Ude is most densely sown, with 158,200 hectares out of the total 498,000 ploughed in the republic. The crops grown are rye 48.8%, oats 19.3%, wheat 17.4%, buckwheat 6.9%, barley 3.5%, grasses 2.3%, potatoes 1.5% of the total harvest. In the north-east of the republic (the Vitim plateau) there is no agriculture except for a sparse sowing along the valley of the Barguzin river, 6,000 hectares (1.2% of the whole sown area).

The mountain area south-east of Lake Baikal fringes the high Asiatic plateaus. A little east of the lake the broad deep Uda valley from the north-east joins the Selenga valley which runs north from Kiakhta and affords routes to the Gobi desert. The Trans-Siberian railway cuts across between the Uda and Selenga valleys eastward to the Khilok valley and Chita. The Barguzin mountains (7,000–8,000ft.) to the north-east of the lake and the Khamar Daban mountains (6,900ft.), south of the Selenga river, make communication difficult. Thick forests of larch, fir and cedar clothe these ridges, whose dome-shaped summits rise above the vegetation, but not the snow-line. The high plateau region is intersected by the picturesque valleys of the Barguzin river (to Lake Baikal) and the Zyra and Muga (to Vitim river). It is undulating, with ridges (1,500–2,000ft.) crossing it, and has broad, flat, marshy valleys, with sluggish, meandering streams, the better drained valleys having fine meadows for pasture. Glaciers existed and in post-glacial times numerous lakes (around whose shores are remains of Neolithic settlements): the lakes are drying and some have completely disappeared. The climate of the republic is on the whole exceedingly dry, with cold winters and hot summers. The rivers are frozen 160 days in the south and 180 in the north. Lake Baikal modifies the climate and the winter isotherms curve strikingly north, especially during freezing, when open water and the liberation of latent heat combine to warm the air and fogs develop. Conversely the summer isotherms bend south, and the range of temperature varies with distance from the lake 14·0° F Jan. to 60·8° F July on the Selenga delta, but −4·0° F Jan. to 71·6° F July farther east. Deep snow covers the mountains round the lake in winter. Earthquakes are frequent in the Selenga delta area and extend to Irkutsk, Barguzin and Selenginsk, and mineral springs are numerous, hot alkaline springs (130° F) at Turka, near the mouth of the Barguzin and at Pogromna on the Uda (similar to the Seltzer springs).

The province has mineral wealth, much of it not yet exploited: iron is mined on the south-east of Lake Baikal, on the Khamardaban slopes, manganese near the left bank of the mouth of the Upper Angara, and gold on the slopes of the north-east plateau. The Trans-Siberian railway passes round the south of the lake and through Ulan Ude up the Khilok valley, and has helped to develop the resources of the area. Trains are also ferried from Listvinichnoe on the Irkutsk coast of the lake to Misovaya (Misovsk) south of the Selenga river, and an ice-breaker is now in use. Steamers ply weekly between these two ports and ascend the Selenga river to the Mongolian frontier, importing brick tea via Kiakhta. Grain, cedar nuts, salt, soda, wool and timber are shipped on rafts down the Khilok, Chikoyu and Uda rivers (tributaries of the Selenga) and manufactured goods are taken up the river for export to China. Furs are exported in quantity, especially squirrel, and fish export has developed with improved steamer traffic. The chief towns are Ulan Ude (*q.v.*), pop. (1939) 129,417, Troitsokosavsk with Kyakhta, population 8,903, an important trading centre on the Mongolian frontier and Barguzin, population 2,217, at the mouth of the Barguzin. A railroad built in 1939 runs from Ulan Ude to Kyakhta.

The Buriats were conquered by the Russians at the end of the 17th century. Many are literate and possess books of their own translated from Tibetan to Mongolian, and the cultivators are progressive and keen to increase education, but among the nomad herdsmen education presents great difficulties and many children, especially girls, receive no school education.

BURIATS. The Buriats are a Mongol tribe, and are said to be an offshoot of the Khalkha Mongols. Their centre of dispersion to-day is Transbaikalia, but they are confirmed wanderers and are to be found from the Amur river to Lhasa. Some of the Buriats practise agriculture, but their chief occupation is the rearing of horses and cattle, and large numbers are steppe dwellers, with a culture similar to the other Mongol tribes (*see* MONGOLS). Physically they are very much mixed and it is not possible to speak of a Buriat physical type; in religion they are Buddhists, but Shamanism still survives among them.

BURIDAN, JEAN (JOANNES BURIDANUS) (*c.* 1297–*c.* 1358), French philosopher, was born at Béthune in Artois. He studied under William of Occam in Paris where he became professor of philosophy, and, in 1327, rector. The tradition that he was forced to flee from France along with other Nominalists, and founded the University of Vienna in 1356, is unsupported and in contradiction to the fact that the university was founded by Frederick II. in 1237. An ordinance of Louis XI., in 1473, directed against the Nominalists, prohibited the reading of his works. In philosophy Buridan followed Occam in denying all objective reality to universals. The aim of his logic is represented as having been the devising of rules for the discovery of syllogistic middle terms; this system for aiding slow-witted persons became known as the *pons asinorum*. The parts of logic which he treated with most minuteness are modal propositions and modal syllogisms. In commenting on Aristotle's *Ethics*, Buridan asserts that liberty is only a certain power of suspending the deliberative process and determining the direction of the intellect. Otherwise the will is entirely dependent on the intellect. The comparison of the will unable to act between two equally balanced motives to an ass dying of hunger between two equal and equidistant bundles of hay is not found in his works, and may have been invented by his opponents to ridicule his determinism. Buridan is also conspicuous for his departure from Aristotelian physics in his impetus theory of movement.

His works are:—*Summula de dialectica* (1487); *Compendium logicae* (1489); *Quaestiones in viii. libros physicorum* (1516); *In Aristotelis Metaphysica* (1518); *Quaestiones in x. libros ethicorum Aristotelis* (1489; 1637); *Quaestiones in viii. libros politicorum Aristotelis* (1500). *See* K. Prantl's *Geschichte der Logik*, bk. iv. 14–38; Stockl's *Geschichte der Philosophie des Mittelalters*, ii. 1023–28; J. Verweyen, *Das Problem d. Willensfreiheit in der Scholastik* (1909); P. Duhem, *Études sur Léonard de Vinci 2e et 3e série* (1000).

BURIN. The term "burin" or graving tool (Fr.) is applied to a flint tool of the Upper Palaeolithic—Aurignacian—period. It is marked by a facet produced by a blow from the working point lengthwise as is proved in genuine cases by small negative bulbs of percussion. In one variety of the two main forms the working edge is straight like a screwdriver, in the other, curved like a gouge. These types are further subdivided into classes distinguishable by the methods of formation and the faceting produced thereby in relation to the edge which may be straight, concave or convex. A beaked graver notable in Middle Aurignacian periods has a convex edge and has two typical forms, one with, the other without, a notch, the purpose of which is to retain the convex facets.

See M. C. Burkitt, *Prehistory* (1925).

BURKBURNETT, a city of Wichita county (Texas), U.S.A., in the fertile valley of the Red river, within two m. of the Oklahoma border. It is served by the Missouri-Kansas-Texas railway. Two m. east is a free highway bridge of concrete and steel, built jointly (1927) by the two States and the counties immediately served. The townsite of Burkburnett was laid out in 1907.

In 1914, when the city was incorporated, the population was about 1,200; in 1930 it was 3,281; in 1940, 2,814 by the federal census. It is the centre of a large oil field, which became important in 1917. During the boom period (1919–21) the townsite was drilled with from one to five wells per block. About 100 wells within the city are producing, and the output of the Burkburnett field in 1941 was about 5,000 bbl. per day. The city has one refinery, and numerous casing-head gas plants. A commission-manager form of government was adopted in 1923.

BURKE, SIR JOHN BERNARD (1814–1892), British genealogist, was born in London, Jan. 5, 1814, and was educated in London and in France. His father, John Burke (1787–1848), was also a genealogist, and in 1826 issued a *Genealogical and Heraldic Dictionary of the Peerage and Baronetage of the United Kingdom*. This work, generally known as *Burke's Peerage*, has been issued annually since 1847. While practising as a barrister Bernard Burke assisted his father in his genealogical work, and in 1848 took control of his publications. In 1853 he was appointed Ulster king-at-arms; in 1854 he was knighted, and in 1855 he became keeper of the state papers in Ireland. Burke also brought out several editions of a companion volume to the *Peerage*, *Burke's Landed Gentry*, which was first published between 1833 and 1838. In 1866 and 1883 he edited his father's *Dictionary of the Peerages of England, Scotland and Ireland, extinct, dormant and in abeyance* (earlier editions, 1831, 1840, 1846); in 1855 and 1876 editions of his *Royal Families of England, Scotland and Wales* (1st ed. 1847–51); and in 1878 and 1883 enlarged editions of his *Encyclopaedia of Heraldry, or General Armoury of England, Scotland and Ireland.*

Burke's own works include *The Roll of Battle Abbey* (1848); *The Romance of the Aristocracy* (1855); *Vicissitudes of Families* (1883, and several earlier editions); and *The Rise of Great Families* (1882). He was succeeded as editor of *Burke's Peerage* and *Landed Gentry* by his fourth son, Ashworth Peter Burke.

BURKE, EDMUND (1720–1797), British statesman and political writer. His is one of the greatest names in the history of political literature. There have been many more important statesmen, for he was never tried in a position of supreme responsibility. There have been many more effective orators, for lack of imaginative suppleness prevented him from penetrating to the inner mind of his hearers; defects in delivery weakened the intrinsic persuasiveness of his reasoning; and he had not that commanding authority of character and personality which has so often been the secret of triumphant eloquence. There have been many subtler, more original and more systematic thinkers about the conditions of the social union. But no one that ever lived used the general ideas of the thinker more successfully to judge the particular problems of the statesman. No one has ever come so close to the details of practical politics, and at the same time remembered that these can only be understood and only dealt with by the aid of the broad conceptions of political philosophy. And what is more than all for perpetuity of fame, he was one of the great masters of the high and difficult art of elaborate composition.

A certain doubtfulness hangs over the circumstances of Burke's life previous to the opening of his public career. The very date of his birth is variously stated. The most probable opinion is that he was born at Dublin on Jan. 12, 1729, new style. Of his family we know little more than that his father was a Protestant attorney, practising in Dublin, and that his mother was a Catholic, a member of the family of Nagle. He had at least one sister, from whom descended the only existing representatives of Burke's family; and he had at least two brothers, Garret Burke and Richard Burke, the one older and the other younger than Edmund. The sister, afterwards Mrs French, was brought up and remained throughout life in the religious faith of her mother; Edmund and his brothers followed that of their father. In 1741 the three brothers were sent to school at Ballitore in the county of Kildare, kept by Abraham Shackleton, an Englishman, and a member of the Society of Friends. He appears to have been an excellent teacher and a good and pious man. Burke always looked back on his own connection with the school at Ballitore as among the most fortunate circumstances of his life. Between himself and a son of his instructor there sprang up a close and affectionate friendship, and, unlike so many of the exquisite attachments of youth, this was not choked by the dust of life, nor parted by divergence of pursuit. Richard Shackleton was endowed with a grave, pure and tranquil nature, constant and austere, yet not without those gentle elements that often redeem the drier qualities of his religious persuasion. When Burke had become one of the most famous men in Europe, no visitor to his house was more welcome than the friend with whom long years before he had tried poetic flights, and exchanged all the sanguine confidences of boyhood. And we are touched to think of the simple-minded guest secretly praying, in the solitude of his room in the fine house at Beaconsfield, that the way of his anxious and overburdened host might be guided by a divine hand.

In 1743 Burke became a student at Trinity college, Dublin, where Oliver Goldsmith was also a student at the same time. But the serious pupil of Abraham Shackleton would not be likely to see much of the wild and squalid sizar. Henry Flood, who was two years younger than Burke, had gone to complete his education at Oxford. Burke, like Goldsmith, achieved no academic distinction. His character was never at any time of the academic cast. The minor accuracies, the limitation of range, the treading and retreading of the same small patch of ground, the concentration of interest in success before a board of examiners, were all uncongenial to a nature of exuberant intellectual curiosity and of strenuous and self-reliant originality. His knowledge of Greek and Latin was never thorough, nor had he any turn for critical niceties. He could quote Homer and Pindar, and he had read Aristotle. Like others who have gone through the conventional course of instruction, he kept a place in his memory for the various charms of Virgil and Horace, of Tacitus and Ovid; but the master whose page by night and by day he turned with devout hand, was the copious, energetic, flexible, diversified and brilliant genius of the declamations for Archias, the poet, and for Milo, against Catiline and against Antony, the author of the disputations at Tusculum and the orations against Verres. Cicero was ever to him the mightiest of the ancient names. In English literature Milton seems to have been more familiar to him than Shakespeare, and Spenser was perhaps more of a favourite with him than either.

It is too often the case to be a mere accident that men who become eminent for wide compass of understanding and penetrating comprehension, are in their adolescence unsettled and desultory. Of this Burke is a signal illustration. He left Trinity in 1748, with no great stock of well-ordered knowledge. He neither derived the benefits nor suffered the drawbacks of systematic intellectual discipline.

EARLY MANHOOD

After taking his degree at Dublin he went in the year 1750 to London to keep terms at the Temple. The ten years that followed were passed in obscure industry. Burke was always extremely reserved about his private affairs. All that we know of Burke exhibits him as inspired by a resolute pride, a certain stateliness and imperious elevation of mind. Such a character, while free from any weak shame about the shabby necessities of early struggles, yet is naturally unwilling to make them prominent in after life. There is nothing dishonourable in such an inclination. "I was not swaddled and rocked and dandled into a legislator," wrote Burke when very near the end of his days: "*Nitor in adversum* is the motto for a man like me. At every step of my progress in life (for in every step I was traversed and opposed), and at every turnpike I met, I was obliged to show my passport. Otherwise no rank, no toleration even, for me."

All sorts of whispers have been circulated by idle or malicious gossip about Burke's first manhood. He is said to have been one of the numerous lovers of his fascinating countrywoman, Margaret Woffington. It is hinted that he made a mysterious visit to the American colonies. He was for years accused of having gone over to the Church of Rome, and afterwards recanting. There is not a tittle of positive evidence for these or any of the other statements to Burke's discredit. The common story that he was a candidate for Adam Smith's chair of moral philosophy at Glasgow, when Hume was rejected in favour of an obscure nobody (1751), can be shown to be wholly false. Like a great many other youths with an eminent destiny before them, Burke conceived a strong distaste for the profession of the law. His father, who was an attorney of substance, had a distaste still stronger for so vagrant a profession as letters were in that day. He withdrew the annual allowance, and Burke set to work to win for himself by indefatigable industry and capability in the public interest that position of power or pre-eminence which his detractors acquired either by accident of birth and connections or else by the vile arts of political intrigue. He began at the bottom of the ladder, mixing with the Bohemian society that haunted the Temple, practising oratory in the free and easy debating societies of Covent Garden and the Strand, and writing for the booksellers.

In 1756 he made his first mark by a satire upon Bolingbroke entitled *A Vindication of Natural Society*. It purported to be a posthumous work from the pen of Bolingbroke, and to present a view of the miseries and evils arising to mankind from every species of artificial society. The imitation of the fine style of that magnificent writer but bad patriot is admirable. As a satire the piece is a failure, for the simple reason that the substance of it might well pass for a perfectly true, no less than a very eloquent statement of social blunders and calamities. Such acute critics as Chesterfield and Warburton thought the performance serious. Rousseau, whose famous discourse on the evils of civilization had appeared six years before, would have read Burke's ironical vindication of natural society without a suspicion of its irony. There have indeed been found persons who insist that the *Vindication* was a really serious expression of the writer's own opinions. This is absolutely incredible, for various reasons. Burke felt now, as he did thirty years later, that civil institutions cannot wisely or safely be measured by the tests of pure reason. His sagacity discerned that the rationalism by which Bolingbroke and the deistic school believed themselves to have overthrown revealed religion was equally calculated to undermine the structure of political government. This was precisely the actual course on which speculation was entering in France at that moment. His *Vindication* is meant to be a reduction to an absurdity. The rising revolutionary school in France, if they had read it, would have taken it for a demonstration of the theorem to be proved. The only interest of the piece for us lies in the proof which it furnishes, that at the opening of his life Burke had the same scornful antipathy to political rationalism which flamed out in such overwhelming passion at its close.

In the same year (1756) appeared the *Philosophical Inquiry into the Origin of our Ideas on the Sublime and Beautiful*, a crude and narrow performance in many respects, yet marked by an independent use of the writer's mind, and not without fertile suggestion. It attracted the attention of the rising aesthetic school in Germany. Lessing set about the translation and annotation of it, and Moses Mendelssohn borrowed from Burke's speculation at least one of the most fruitful and important ideas of his own influential theories on the sentiments. In England the *Inquiry* had considerable vogue, but it has left no permanent trace in the development of aesthetic thought.

Burke's literary industry in town was relieved by frequent excursions to the western parts of England, in company with William Burke. There was a lasting intimacy between the two namesakes, and they seem to have been involved together in some important passages of their lives; but we have Edmund Burke's authority for believing that they were probably not kinsmen. The seclusion of these rural sojourns, originally dictated by delicate health, was as wholesome to the mind as to the body. Few men, if any, have ever acquired a settled mental habit of surveying human affairs broadly, of watching the play of passion, interest, circumstance, in all its comprehensiveness, and of applying the instruments of general conceptions and wide principles to its interpretation with respectable constancy, unless they have at some early period of their manhood resolved the greater problems of society in independence and isolation. By 1750 the cast of Burke's opinions was decisively fixed, and they underwent no radical change.

He began a series of *Hints on the Drama*. He wrote a portion of an *Abridgment of the History of England*, and brought it down as far as the reign of John. It included, as was natural enough in a warm admirer of Montesquieu, a fragment on law, of which he justly said that it ought to be the leading science in every well-ordered commonwealth. Burke's early interest in America was shown by an *Account of the European Settlements* on that continent. Such works were evidently a sign that his mind was turning away from abstract speculation to the great political and economic fields, and to the more visible conditions of social stability and the growth of nations. This interest in the concrete phenomena of society inspired him with the idea of the *Annual Register* (1750), which he designed to present a broad grouping of the chief movements of each year. The execution was as excellent as the conception, and if we reflect that it was begun in the midst of that momentous war which raised England to her climax of territorial greatness in East and West, we may easily realize how the task of describing these portentous and far-reaching events would be likely to strengthen Burke's habits of wide and laborious observation, as well as to give him firmness and confidence in the exercise of his own judgment. Dodsley gave him £100 for each annual volume, and the sum was welcome enough, for towards the end of 1756 Burke had married. His wife was the daughter of a Dr. Nugent, a physician at Bath. She was always spoken of by his friends as a mild, reasonable and obliging person, whose amiability and gentle sense did much to soothe the too nervous and excitable temperament of her husband. She had been brought up, there is good reason to believe, as a Catholic, and she was probably a member of that communion at the time of her marriage. Dr. Nugent eventually took up his residence with his son-in-law in London, and became a popular member of that famous group of men of letters and artists whom Boswell has made so familiar and so dear to all later generations. Burke, however, had no intention of being dependent. His consciousness of his own powers animated him with a most justifiable ambition, if ever there was one, to play a part in the conduct of national affairs. Friends shared this ambition on his behalf, one of these was Lord Charlemont. He introduced Burke to William Gerard Hamilton (1750), now only remembered by the nickname "single-speech," derived from the circumstance of his having made a single brilliant speech in the House of Commons, which was followed by years of almost unbroken silence. Hamilton was by no means devoid of sense and acuteness, but in character he was one of the most despicable men then alive. There is not a word too many nor too strong in the description of him by one of Burke's friends, as "a sullen, vain, proud, selfish, cankered-hearted, envious reptile." The reptile's connection, however, was for a time of considerable use to Burke. When he was made Irish secretary, Burke accompanied him to Dublin, and there learnt Oxenstiern's eternal lesson, that awaits all who penetrate behind the scenes of government, *quam parva sapientia mundus regitur*.

BURKE THE PATRIOT

The penal laws against the Catholics, the iniquitous restrictions on Irish trade and industry, the selfish factiousness of the parliament, the jobbery and corruption of administration, the absenteeism of the landlords, and all the other too familiar elements of that mischievous and fatal system, were then in full force. As was shown afterwards, they made an impression upon Burke that was never effaced. So much iniquity and so much disorder may well have struck deep on one whose two chief political sentiments were a passion for order and a passion for justice. He may have anticipated with something of remorse the reflection of a modern historian, that the absenteeism of her landlords has been less of a curse to Ireland than the absenteeism of her men of genius. At least he was never an absentee in heart. He always took the interest of an ardent patriot in his unfortunate country; and, as we shall see, made more than one weighty sacrifice on behalf of the principles which he deemed to be bound up with her welfare.

When Hamilton retired from his post, Burke accompanied him back to London, with a pension of £300 a year on the Irish Establishment. This modest allowance he hardly enjoyed for more than a single year. His patron having discovered the value of so laborious and powerful a subaltern, wished to bind Burke permanently to his service. Burke declined to sell himself into final bondage of this kind. When Hamilton continued to press his odious pretensions they quarrelled (1705), and Burke threw up his pension. He soon received a more important piece of preferment than any which he could ever have procured through Hamilton.

The accession of George III. to the throne in 1700 had been followed by the disgrace of Pitt, the dismissal of Newcastle, and the rise of Bute. These events marked the resolution of the court to change the political system which had been created by the revolution of 1688. That system placed the government of the country in the hands of a territorial oligarchy, composed of a few families of large possessions, fairly enlightened principles, and shrewd political sense. It had been preserved by the existence of a Pretender. The first two kings of the house of Hanover could keep the crown on their own heads only by conciliating the Revolution families and accepting Revolution principles. By 1700 all peril to the dynasty was at an end. George III., or those about him, insisted on substituting for the aristocratic division of political power a substantial concentration of it in the hands of the sovereign. The ministers were no longer to be the members of a great party, acting together in pursuance of a common policy accepted by them all as a united body; they were to become nominees of the court, each holding himself answerable not to his colleagues but to the king, separately, individually, and by department. George III. had before his eyes the government of his cousin, the great Frederick; but not every one can bend the bow of Ulysses, and, apart from difference of personal capacity and historic tradition, he forgot that a territorial and commercial aristocracy cannot be dealt with in the spirit of the barrack and the drill-ground. But he made the attempt, and resistance to that attempt supplies the keynote to the first 25 years of Burke's political life.

Along with the change in system went high-handed and absolutist tendencies in policy. The first stage of the new experiment was very short. Bute, in a panic at the storm of unpopularity that *menaced him, resigned in 1763.* George Grenville and the less enlightened section of the Whigs took his place. They proceeded to tax the American colonists, to interpose vexatiously against their trade, to threaten the liberty of the subject at home by general warrants, and to stifle the liberty of public discussion by prosecutions of the press. Their arbitrary methods disgusted the nation, and the personal arrogance of the ministers at last disgusted the king. The system received a temporary check. Grenville fell, and the king was forced to deliver himself into the hands of the orthodox section of the Whigs. The marquess of Rockingham (July 10, 1765) became prime minister, and he was induced to make Burke his private secretary. Before Burke had begun his duties, an incident occurred which illustrates the character of the two men. The old duke of Newcastle, probably desiring a post for some nominee of his own, conveyed to the ear of the new minister various absurd rumours prejudicial to Burke—that he was an Irish papist, that his real name was O'Bourke, that he had been a Jesuit, that he was an emissary from St. Omer's. Lord Rockingham repeated these tales to Burke, who of course denied them with indignation. His chief declared himself satisfied, but Burke, from a feeling that the indispensable confidence between them was impaired, at once expressed a strong desire to resign his post. Lord Rockingham prevailed upon him to reconsider his resolve, and from that day until Lord Rockingham's death in 1782, their relations were those of the closest friendship and confidence.

The first Rockingham administration lasted only a year and a few days, ending in July 1766. The uprightness and good sense of its leaders did not compensate for the weakness of their political connections. They were unable to stand against the coldness of the king, against the hostility of the powerful and selfish faction of Bedford Whigs, and, above all, against the towering predominance of William Pitt. That Pitt did not join them is one of the many fatal miscarriages of history, as it is one of the many serious reproaches to be made against that extraordinary man's chequered and uneven course. An alliance between Pitt and the Rockingham party was the surest guarantee of a wise and liberal policy towards the colonies. He went farther than they did, in holding, like Lord Camden, the doctrine that taxation went with representation, and that therefore parliament had no right to tax the unrepresented colonists. The ministry asserted, what no competent jurist would now think of denying, that parliament is sovereign; but they went heartily with Pitt in pronouncing the exercise of-the right of taxation in the case of the American colonists to be thoroughly impolitic and inexpedient. No practical difference, therefore, existed upon the important question of the hour. But Pitt's prodigious egoism, stimulated by the mischievous counsels of men of the stamp of Lord Shelburne, prevented the fusion of the only two sections of the Whig party that were at once able, enlightened and disinterested enough to carry on the government efficiently, to check the arbitrary temper of the king, and to command the confidence of the nation. Such an opportunity did not return.

WHIG PARTY'S INSPIRATION

The ministerial policy towards the colonies was defended by Burke with splendid and unanswerable eloquence. He had been returned to the House of Commons for the pocket borough of Wendover, and his first speech (Jan. 27, 1766) was felt to be the rising of a new light. For the space of a quarter of a century, from this time down to 1790, Burke was one of the chief guides and inspirers of a revived Whig party. The "age of small factions" was now succeeded by an age of great principles, and selfish ties of mere families and persons were transformed into a union resting on common conviction and patriotic aims. It was Burke who did more than any one else to give to the Opposition, under the first half of the reign of George III., this stamp of elevation and grandeur. Before leaving office the Rockingham government repealed the Stamp act; confirmed the personal liberty of the subject by forcing on the House of Commons one resolution against general warrants, and another against the seizure of papers; and relieved private houses from the intrusion of officers of excise, by repealing the cider tax. Nothing so good was done in an English parliament for nearly twenty years to come. George Grenville, whom the Rockinghams had displaced, and who was bitterly incensed at their formal reversal of his policy, printed a pamphlet to demonstrate his own wisdom and statesmanship. Burke replied in his *Observations on a Late Publication on the Present State of the Nation* (1769), in which he showed for the first time that he had not only as much knowledge of commerce and finance, and as firm a hand, in dealing with figures as Grenville himself, but also a broad, general and luminous way of conceiving and treating politics in which neither then nor since has he had any rival among English publicists.

It is one of the perplexing points in Burke's private history to know how he lived during these long years of parliamentary opposition. It is certainly not altogether mere impertinence to ask of a public man how he gets what he lives upon, for independence of spirit, which is so hard to the man who lays his head on the debtor's pillow, is the prime virtue in such men. Probity in money is assuredly one of the keys to character, though we must be very careful in ascertaining and proportioning all the circumstances. Now, in 1768, Burke bought an estate at Beaconsfield, in the county of Buckingham. It was about 600 acres in extent, was worth some £500 a year, and cost £22,000. People have been asking ever since how the penniless man of letters was able to raise so large a sum in the first instance, and how he was able to keep up a respectable establishment afterwards. The suspicions of those who are never sorry to disparage the great have been of various kinds. Burke was a gambler, they hint, in Indian stock, like his kinsmen Richard and William, and like Lord Verney, his political patron at Wendover. Perhaps again, his activity on behalf of Indian princes, like the raja of Tanjore, was not disinterested and did not go unrewarded. The answer to all these calumnious innuendoes is to be found in documents and title-deeds of decisive authority, and is simple enough. It is, in short, this. Burke inherited a small property from his elder brother, which he realized. Lord Rockingham advanced him a certain sum (£6,000). The remainder, amounting to no less than two-thirds of the purchase-money, was raised on mortgage, and was never paid off during Burke's life. The rest of the story is equally simple, but more painful. Burke made some sort of income out of his 600 acres; he was for a short time agent for New York, with a salary of £700; he continued to work at the *Annual Register* down to 1788. But, when all is told, he never made as much as he spent; and in spite of considerable assistance from Lord Rockingham, amounting it is sometimes said to as much as £30,000, Burke, like the younger Pitt, got every year deeper into debt. Pitt's debts were the result of a wasteful indifference to his private affairs. Burke, on the contrary, was assiduous and orderly, and had none of the vices of profusion. But he had that quality which Aristotle places high among the virtues—the noble mean of magnificence, standing midway between the two extremes of vulgar ostentation and narrow pettiness. He was indifferent to luxury, and sought to make life, not commodious nor soft, but high and dignified in a refined way. He loved art, filled his house with statues and pictures, and extended a generous patronage to the painters. He was a collector of books, and, as Crabbe and less conspicuous men discovered, a helpful friend to their writers. Guests were ever welcome at his board; the opulence of his mind and the fervid copiousness of his talk naturally made the guests of such a man very numerous. *Non invideo equidem, miror magis,* was Johnson's good-natured remark, when he was taken over his friend's fine house and pleasant gardens. Johnson was of a very different type. There was something in this external dignity which went with Burke's imperious spirit, his spacious imagination, his turn for all things stately and imposing. We may say, if we please, that Johnson had the far truer and loftier dignity of the two; but we have to take such men as Burke with the defects that belong to their qualities. And there was no corruption in Burke's outlay. When the Pitt administration was formed in 1766, he might have had office, and Lord Rockingham wished him to accept it, but he honourably took his fate with the party. He may have spent £3,000 a year, where he would have been more prudent to spend only £2,000. But nobody was wronged; his creditors were all paid in time, and his hands were at least clean of traffic in reversions, clerkships, tellerships and all the rest of the rich sinecures which it was thought no shame in those days for the aristocracy of the land and the robe to wrangle for, and gorge themselves upon, with the fierce voracity of famishing wolves. The most we can say is that Burke, like Pitt, was too deeply absorbed in beneficent service in the affairs of his country, to have for his own affairs the solicitude that would have been prudent.

In the midst of intense political preoccupations, Burke always found time to keep up his intimacy with the brilliant group of his earlier friends. He was one of the commanding figures at the club at the Turk's Head, with Reynolds and Garrick, Goldsmith and Johnson. The old sage who held that the first Whig was the Devil, was yet compelled to forgive Burke's politics for the sake of his magnificent gifts. "I would not talk to him of the Rockingham party," he used to say; "but I love his knowledge, his genius, his diffusion and affluence of conversation." And everybody knows Johnson's vivid account of him: "Burke, sir, is such a man that if you met him for the first time in the street, where you were stopped by a drove of oxen, and you and he stepped aside to take shelter but for five minutes, he'd talk to you in such a manner that when you parted you would say, 'This is an extraordinary man.' " They all grieved that public business should draw to party what was meant for mankind. They deplored that the nice and difficult test of answering Berkeley had not been undertaken, as was once intended, by Burke, and sighed to think what an admirable display of subtlety and brilliance such a contention would have afforded them, had not politics "turned him from active philosophy aside." There was no jealousy in this. They did not grudge Burke being the first man in the House of Commons, for they admitted that he would have been the first man anywhere.

With all his hatred for the book-man in politics, Burke owed much of his own distinction to that generous richness and breadth of judgment which had been ripened in him by literature and his practice in it. He showed that books are a better preparation for statesmanship than early training in the subordinate posts and among the permanent officials of a public department. There is no copiousness of literary reference in his work, such as overabounded in the civil and ecclesiastical publicists of the 17th century. Nor can we truly say that there is much, though there is certainly some, of that tact which literature is alleged to confer on those who approach it in a just spirit and with the true gift. The influence of literature on Burke lay partly in the direction of emancipation from the mechanical formulae of practical politics; partly in the association which it engendered, in a powerful understanding like his, between politics and the moral forces of the world, and between political maxims and the old and great sentences of morals; partly in drawing him, even when resting his case on prudence and expediency, to appeal to the widest and highest sympathies; partly, and more than all, in opening his thoughts to the many conditions, possibilities and "varieties of untried being," in human character and situation, and so giving an incomparable flexibility to his methods of political approach.

This flexibility is not to be found in his manner of composition. That derives its immense power from other sources; from passion, intensity, imagination, size, truth, cogency of logical reason. Those who insist on charm, on winningness in style, on subtle harmonies and fine exquisiteness of suggestion, are disappointed in Burke: they even find him stiff and over-coloured. And there are blemishes of this kind. His banter is nearly always ungainly, his wit blunt, as Johnson said, and often unseasonable. As is usual with a man who has not true humour, Burke is also without true pathos. The thought of wrong or misery moved him less to pity for the victim than to anger against the cause. Again, there are some gratuitous and unredeemed vulgarities; some images that make us shudder. But only a literary fop can be detained by specks like these.

LITERARY STYLE

The varieties of Burke's literary or rhetorical method are very striking. It is almost incredible that the superb imaginative amplification of the description of Hyder Ali's descent upon the Carnatic should be from the same pen as the grave, simple, unadorned *Address to the King* (1777), where each sentence falls on the ear with the accent of some golden-tongued oracle of the wise gods. His stride is the stride of a giant, from the sentimental beauty of the picture of Marie Antoinette at Versailles, or the red horror of the tale of Debi Sing in Rungpore, to the learning, positiveness and cool judicial mastery of the *Report on the Lords' Journals* (1704), which Philip Francis, no mean judge, declared on the whole to be the "most eminent and extraordinary" of all his productions. But even in the coolest and driest of his pieces there is the mark of greatness, of grasp, of comprehension. In all its varieties Burke's style is noble, earnest, deep-flowing, because his sentiment was lofty and fervid, and went with sincerity and ardent disciplined travail of judgment. He had the style of his subjects; the amplitude, the weightiness, the laboriousness, the sense, the high flight, the grandeur, proper to a man dealing with imperial themes, with the fortunes of great societies, with the sacredness of law, the freedom of nations, the justice of rulers. Burke will always be read with delight and edification, because in the midst of discussions on the local and the accidental, he scatters apophthegms that take us into the regions of lasting wisdom. In the midst of the torrent of his most strenuous and passionate deliverances, he suddenly rises aloof from his immediate subject, and in all tranquillity reminds us of some permanent relation of things, some enduring truth of human life or human society. We do not hear the organ tones of Milton, for faith and freedom had other notes in the 18th century. There is none of the complacent and wise-browed sagacity of Bacon, for Burke's were days of personal strife and fire and civil division. We are not exhilarated by the cheerfulness, the polish, the fine manners of Bolingbroke, for Burke had an anxious conscience, and was earnest and intent that the good should triumph. And yet Burke is among the greatest of those who have wrought marvels in the prose of the English tongue.

Not all the transactions in which Burke was a combatant could furnish an imperial theme. We need not tell over again the story of Wilkes and the Middlesex election. The Rockingham ministry had been succeeded by a composite government, of which it was intended that Pitt, now made Lord Chatham and privy seal, should be the real chief. Chatham's health and mind fell into disorder almost immediately after the ministry had been formed. The duke of Grafton was its nominal head, but party ties had been broken, the political connections of the ministers were dissolved, and, in truth, the king was now at last a king indeed, who not only reigned but governed. The revival of high doctrines of prerogative in the crown was accompanied by a revival of high doctrines of privilege in the House of Commons, and the ministry was so smitten with weakness and confusion as to be unable to resist the current of arbitrary policy, and not many of them were even willing to resist it. The unconstitutional persecution of Wilkes was followed by the fatal recourse to new plans for raising taxes in the American colonies. These two points made the rallying ground of the new Whig opposition. Burke helped to smooth matters for a practical union between the Rockingham party and the powerful triumvirate, composed of Chatham, whose understanding had recovered from its late disorder, and of his brothers-in-law, Lord Temple and George Grenville. He was active in urging petitions from the freeholders of the counties, protesting against the unconstitutional invasion of the right of election. And he added a durable masterpiece to political literature in a pamphlet which he called *Thoughts on the Cause of the Present Discontents* (1770). The immediate object of this excellent piece was to hold up the court scheme of weak, divided and dependent administrations in the light of its real purpose and design; to describe the distempers which had been engendered in parliament by the growth of royal influence and the faction of the king's friends; to show that the newly formed Whig party had combined for truly public ends, and was no mere family knot like the Grenvilles and the Bedfords; and, finally, to press for the hearty concurrence both of public men and of the nation at large in combining against "a faction ruling by the private instructions of a court against the general sense of the people." The pamphlet was disliked by Chatham on the one hand, on no reasonable grounds that we can discover; it was denounced by the extreme popular party of the Bill of Rights, on the other hand, for its moderation and conservatism. In truth, there is as strong a vein of conservative feeling in the pamphlet of 1770 as in the more resplendent pamphlet of 1790. "Our constitution," he said, "stands on a nice equipoise, with steep precipices and deep waters upon all sides of it. In removing it from a dangerous leaning towards one side, there may be a risk of oversetting it on the other. Every project of a material change in a government so complicated as ours is a matter full of difficulties; in which a considerate man will not be too ready to decide, a prudent man too ready to undertake, or an honest man too ready to promise." Neither now nor ever had Burke any other real conception of a polity for England than government by the territorial aristocracy in the interests of the nation at large, and especially in the interest of commerce, to the vital importance of which in our economy he was always keenly and wisely alive. The policy of George III., and the support which it found among men who were weary of Whig factions, disturbed this scheme, and therefore Burke denounced both the court policy and the court party with all his heart and all his strength.

Eloquence and good sense, however, were impotent in the face of such forces as were at this time arrayed against a government at once strong and liberal. The court was confident that a union between Chatham and the Rockinghams was impossible. The union was in fact hindered by the waywardness and the absurd pretences of Chatham, and the want of force in Lord Rockingham. In the nation at large, the late violent ferment had been followed by as remarkable a deadness and vapidity, and Burke himself had to admit a year or two later that any remarkable robbery at Hounslow Heath would make more conversation than all the disturbances of America. The duke of Grafton went out, and Lord North became the head of a government, which lasted twelve years (1770-82), and brought about more than all the disasters that Burke had foretold as the inevitable issue of the royal policy. For the first six years of this lamentable period Burke was actively employed in stimulating, informing and guiding the patrician chiefs of his party. "Indeed, Burke," said the duke of Richmond, "you have more merit than any man in keeping us together." They were well-meaning and patriotic men, but it was not always easy to get them to prefer politics to fox-hunting. When he reached his lodgings at night after a day in the city or a skirmish in the House of Commons, Burke used to find a note from the duke of Richmond or the marquess of Rockingham, praying him to draw a protest to be entered on the journals of the Lords, and in fact he drew all the principal protests of his party between 1767 and 1782. The accession of Charles James Fox to the Whig party, which took place at this time, and was so important an event in its history, was mainly due to the teaching and influence of Burke. In the House of Commons his industry was almost excessive. He was taxed with speaking too often, and with being too forward. And he was mortified by a more serious charge than murmurs about superfluity of zeal. Men said and said again that he was Junius. His very proper unwillingness to stoop to deny an accusation, that would have been so disgraceful if it had been true, made ill-natured and silly people the more convinced that it was not wholly false But whatever the London world may have thought of him, Burke's energy and devotion of character impressed the better minds in the country. In 1774 he received the great distinction of being chosen as one of its representatives by Bristol, then the second town in the kingdom.

POLITICAL GENIUS

In the events which ended in the emancipation of the American colonies from the monarchy, Burke's political genius shone with an effulgence that was worthy of the great affairs over which it shed so magnificent an illumination. His speeches are almost the one monument of the struggle on which a lover of English greatness can look back with pride and a sense of worthiness, such as a churchman feels when he reads Bossuet, or an Anglican when he turns over the pages of Taylor or of Hooker. Burke's attitude in these high transactions is really more impressive than Chatham's, because he was far less theatrical than Chatham; and while he was no less nobly passionate for freedom and justice, in his passion was fused the most strenuous political argumentation and sterling reason of state. On the other hand he was wholly free from that quality which he ascribed to Lord George Sackville, a man "apt to take a sort of undecided, equivocal, narrow ground, that evades the substantial merits of the question, and puts the whole upon some temporary, local, accidental or personal consideration." He rose to the full height of that great argument. Burke here and everywhere else displayed the rare art of filling his subject with generalities, and yet never intruding commonplaces. No publicist who deals as largely in general propositions has ever been as free from truisms; no one has ever treated great themes with so much elevation, and yet been so wholly secured against the pitfalls of emptiness and the vague. And it is instructive to compare the foundation of all his pleas for the colonists with that on which they erected their own theoretic declaration of independence. The American leaders were impregnated with the metaphysical ideas of rights which had come to them from the rising revolutionary school in France. Burke no more adopted the doctrines of Jefferson in 1776 than he adopted the doctrines of Robespierre in 1793. He says nothing about men being born free and equal, and on the other hand he never denies the position of the court and the country at large, that the home legislature, being sovereign, had the right to tax the colonies. What he does say is that the exercise of such a right was not practicable; that if it were practicable, it was inexpedient; and that, even if this had not been inexpedient, yet, after the colonies had taken to arms, to crush their resistance by military force would not be more disastrous to them than it would be unfortunate for the ancient liberties of Great Britain. Into abstract discussion he would not enter. "Show the thing you contend for to be reason; show it to be common sense; show it to be the means of attaining some useful end." "The question with me is not whether you have a right to render your people miserable, but whether it is not your interest to make them happy." There is no difference in social spirit and doctrine between his protests against the maxims of the English common people as to the colonists, and his protests against the maxims of the French common people as to the court and the nobles; and it is impossible to find a single principle either asserted or implied in the speeches on the American revolution which was afterwards repudiated in the writings on the revolution in France.

It is one of the signs of Burke's singular and varied eminence that hardly any two people agree precisely which of his works to mark as the masterpiece. Every speech or tract that he composed on a great subject becomes, as we read it, the rival of every other. But the *Speech on Conciliation* (1775) has, perhaps, been more universally admired than any of his other productions, partly because its maxims are of a simpler and less disputable kind than those which adorn the pieces on France, and partly because it is most strongly characterized by that deep ethical quality which is the prime secret of Burke's great style and literary mastery. In this speech, moreover, and in the only less powerful one of the preceding year upon American taxation, as well as in the *Letter to the Sheriffs of Bristol*, in 1777, we see the all-important truth conspicuously illustrated that half of his eloquence always comes of the thoroughness with which he gets up his case. No eminent man has ever done more than Burke to justify the definition of genius as the consummation of the faculty of taking pains. Labour incessant and intense, if it was not the source, was at least an inseparable condition of his power. And magnificent rhetorician though he was his labour was given less to his diction than to the facts; his heart was less in the form than the matter. It is true that his manuscripts were blotted and smeared, and that he made so many alterations in the proofs that the printer found it worth while to have the whole set up in type afresh. But there is no polish in his style, as in that of Junius for example, though there is something a thousand times better than polish. "Why will you not allow yourself to be persuaded," said Francis after reading the *Reflections,* "that polish is material to preservation?" Burke always accepted the rebuke, and flung himself into vindication of the sense, substance and veracity of what he had written. His writing is magnificent, because he knew so much, thought so comprehensively, and felt so strongly.

The succession of failures in America, culminating in Cornwallis's surrender at Yorktown in Oct., 1781, wearied the nation, and at length the persistent and powerful attacks of the opposition began to tell. "At this time," wrote Burke, in words of manly self-assertion, 13 years afterwards, "having a momentary lead (1780–82), so aided and so encouraged, and as a feeble instrument in a mighty hand—I do not say I saved my country—I am sure I did my country important service. There were few indeed at that time that did not acknowledge it. It was but one voice, that no man in the kingdom better deserved an honourable provision should be made for him." In the spring of 1782 Lord North resigned. It seemed as if the court system which Burke had been denouncing for a dozen years was now finally broken, and as if the party which he had been the chief instrument in instructing, directing and keeping together must now inevitably possess power for many years to come. Yet in a few months the whole fabric had fallen, and the Whigs were thrown into opposition for the rest of the century. The story cannot be omitted in the most summary account of Burke's life. Lord Rockingham came into office on the fall of North. Burke was rewarded for services beyond price by being made paymaster of the forces, with the rank of a privy councillor. He had lost his seat for Bristol two years before, in consequence of his courageous advocacy of a measure of tolerance for the Catholics, and his still more courageous exposure of the enormities of the commercial policy of England towards Ireland. He sat during the rest of his parliamentary life (to 1704) for Malton, a pocket borough first of Lord Rockingham's, then of Lord Fitzwilliam's. Burke's first tenure of office was very brief. He had brought forward in 1780 a comprehensive scheme of economical reform, with the design of limiting the resources of jobbery and 'corruption which the crown was able to use to strengthen its own sinister influence in parliament. Administrative reform was, next to peace with the colonies, the part of the scheme of the new ministry to which the king most warmly objected. It was carried out with greater moderation than had been foreshadowed in opposition. But at any rate Burke's own office was not spared. While Charles Fox's father was at the pay-office (1765–78) he realized, as the interest of the cash balances which he was allowed to retain in his hands, nearly a quarter of a million of money. When Burke came to this post the salary was settled at £4,000 a year. He did not long enjoy the income. In July 1782 Lord Rockingham died; Lord Shelburne took his place; Fox, who inherited from his father a belief in Lord Shelburne's duplicity, which his own experience of him as a colleague during the last three months had made stronger, declined to serve under him. Burke, though he had not encouraged Fox to take this step, still, with his usual loyalty, followed him from office. This may have been the thing to do if their distrust of Shelburne was incurable, but the next step, coalition with Lord North against *him,* was not only a political blunder, but a shock to party morality, which brought speedy retribution. Either they had been wrong, and violently wrong, for a dozen years, or else Lord North was the guiltiest political instrument since Strafford. Burke attempted to defend the alliance on the ground of the substantial agreement between Fox and North in public aims. The defence is wholly untenable. The Rockingham Whigs were as substantially in agreement on public affairs with the Shelburne Whigs as they were with Lord North. The movement was one of the worst in the history of English party. It served its immediate purpose, however, for Lord Shelburne found himself (Feb. 24, 1783) too weak to carry on the government, and was succeeded by the members of the coalition, with the duke of Portland for prime minister (April 2, 1783). Burke went back to his old post at the pay-office and was soon engaged in framing and drawing the famous India Bill. This was long supposed to be the work of Fox, who was politically responsible for it. We may be sure that neither he nor Burke would have devised any government for India which they did not honestly believe to be for the advantage both of that country and of England. But it cannot be disguised that Burke had thoroughly persuaded himself that it was indispensable in the interests of English freedom to strengthen the party hostile to the court. As we have already said, dread of the peril to the constitution from the new aims of George III. was the main inspiration of Burke's political action in home affairs for the best part of his political life. The India Bill strengthened the anti-court party by transferring the government of India to seven persons named in the bill, and neither appointed nor removable by the crown. In other words, the bill gave the government to a board chosen directly by the House of Commons; and it had the incidental advantage of conferring on the ministerial party patronage valued at £300,000 a year, which would remain for a fixed term of years out of reach of the king. In a word, judging the India Bill from a party point of view, we see that Burke was now completing the aim of his project of economic reform. That measure had weakened the influence of the crown by limiting its patronage. The measure for India weakened the influence of the crown by giving a mass of patronage to the party which the king hated. But this was not to be. The India Bill was thrown out by means of a royal intrigue in the Lords, and the ministers were instantly dismissed (Dec. 18, 1783). Young William Pitt, then only in his 25th year, had been chancellor of the exchequer in Lord Shelburne's short ministry, and had refused to enter the coalition government from an honourable repugnance to join Lord North. He was now made prime minister. The country in the election of the next year ratified the king's judgment against the Portland combination; and the hopes which Burke had cherished for a political lifetime were irretrievably ruined.

THE IMPEACHMENT OF HASTINGS

The six years that followed the great rout of the orthodox Whigs were years of repose for the country, but it was now that Burke engaged in the most laborious and formidable enterprise of his life, the impeachment of Warren Hastings for high crimes and misdemeanours in his government of India. His interest in that country was of old date. It arose partly from the fact of William Burke's residence there, partly from his friendship with Philip Francis, but most of all, we suspect, from the effect which he observed Indian influence to have in demoralizing the House of Commons. "Take my advice for once in your life," Francis wrote to Shee; "lay aside 40,000 rupees for a seat in parliament: in this country that alone makes all the difference between somebody and nobody." The relations, moreover, between the East India Company and the government were of the most important kind, and occupied Burke's closest attention from the beginning of the American war down to his own India Bill and that of Pitt and Dundas. In Feb. 1785 he delivered one of the most famous of all his speeches, that on the nabob of Arcot's debts. The real point of this superb declamation was Burke's conviction that ministers supported the claims of the fraudulent creditors in order to secure the corrupt advantages of a sinister parliamentary interest. His proceedings against Hastings had a deeper spring. The story of Hastings's crimes, as Macaulay says, made the blood of Burke boil in his veins. He had a native abhorrence of cruelty, of injustice, of disorder, of oppression, of tyranny, and all these things in all their degrees marked Hastings's course in India. They were, moreover, concentrated in individual cases, which exercised Burke's passionate imagination to its profoundest depths, and raised it to such a glow of fiery intensity as has never been rivalled in our history. For it endured for 14 years, and was just as burning and as terrible when Hastings was acquitted in 1795, as in the select committee of 1781 when Hastings's enormities were first revealed. "If I were to call for a reward," wrote Burke, "it would be for the services in which for 14 years, without intermission, I showed the most industry and had the least success, I mean in the affairs of India; they are those on which I value myself the most; most for the importance, most for the labour; most for the judgment; most for constancy and perseverance in the pursuit." Sheridan's speech in the House of Commons upon the charge relative to the begums of Oude probably excelled anything that Burke achieved, as a dazzling performance abounding in the most surprising literary and rhetorical effects. But neither Sheridan nor Fox was capable of that sustained and overflowing indignation at outraged justice and oppressed humanity, that consuming moral fire, which burst forth again and again from the chief manager of the impeachment, with such scorching might as drove even the cool and intrepid Hastings beyond all self-control, and made him cry out with protests and exclamations like a criminal writhing under the scourge. Burke, no doubt, in the course of that unparalleled trial showed some prejudice; made some minor overstatements of his case; used many intemperances; and suffered himself to be provoked into expressions of heat and impatience by the cabals of the defendant and his party, and the intolerable incompetence of the tribunal. It is one of the inscrutable perplexities of human affairs, that in the logic of practical life, in order to reach conclusions that cover enough for truth, we are constantly driven to premises that cover too much, and that in order to secure their right weight to justice and reason good men are forced to fling the two-edged sword of passion into the same scale. But these excuses were mere trifles, and well deserve to be forgiven, when we think that though the offender was in form acquitted, yet Burke succeeded in these 14 years of laborious effort in laying the foundations once for all of a moral, just, philanthropic and responsible public opinion in England with reference to India, and in doing so performed perhaps the most magnificent service that any statesman has ever had it in his power to render to humanity.

Burke's first decisive step against Hastings was a motion for papers in the spring of 1786; the thanks of the House of Commons to the managers of the impeachment were voted in the summer of 1794. But in those eight years some of the most astonishing events in history had changed the political face of Europe. Burke was more than 60 years old when the states-general met at Versailles in the spring of 1789. He had taken a prominent part on the side of freedom in the revolution which stripped England of her empire in the West. He had taken a prominent part on the side of justice, humanity and order in dealing with the revolution which had brought to England new empire in the East. The same vehement passion for freedom, justice, humanity and order was roused in him at a very early stage of the third great revolution in his history—the revolution which overthrew the old monarchy in France. From the first Burke looked on the events of 1789 with doubt and misgiving. He had been in France in 1773, where he had not only the famous vision of Marie Antoinette at Versailles, "glittering like the morning star, full of life, and splendour and joy," but had also supped and discussed with some of the destroyers, the encyclopaedists, "the sophisters, economists and calculators." His first speech on his return to England was a warning (March 17, 1773) that the props of good government were beginning to fail under the systematic attacks of unbelievers, and that principles were being propagated that would not leave to civil society any stability. The apprehension never died out in his mind; and when he knew that the principles and abstractions, the un-English dialect and destructive dialectic, of his former acquaintances were predominant in the National Assembly, his suspicion that the movement would end in disastrous miscarriage waxed into certainty.

ATTITUDE TO FRENCH REVOLUTION

The scene grew still more sinister in his eyes after the march of the mob from Paris to Versailles in October, and the violent transport of the king and queen from Versailles to Paris. The same hatred of lawlessness and violence which fired him with a divine rage against the Indian malefactors was aroused by the violence and lawlessness of the Parisian insurgents. The same disgust for abstractions and naked doctrines of right that had stirred him against the pretensions of the British parliament in 1774 and 1776, was revived in as lively a degree by political conceptions which he judged to be identical in the French assembly of 1789. And this anger and disgust were exasperated by the dread with which certain proceedings in England had inspired him, that the aims, principles, methods and language which he so misdoubted or abhorred in France were likely to infect the people of Great Britain.

In November 1790 the town, which had long been eagerly expecting a manifesto from Burke's pen, was electrified by the *Reflections on the Revolution in France, and on the proceedings in certain societies in London relative to that event.* The generous Windham made an entry in his diary of his reception of the new book. "What shall be said," he added, "of the state of things, when it is remembered that the writer is a man decried, persecuted and proscribed; not being much valued even by his own party, and by half the nation considered as little better than an ingenious madman?" But the writer now ceased to be decried, persecuted and proscribed, and his book was seized as the expression of that new current of opinion in Europe which the more recent events of the Revolution had slowly set flowing. Its vogue was instant and enormous. Eleven editions were exhausted in little more than a year, and there is probably not much exaggeration in the estimate that 30.000 copies were sold before Burke's death seven years afterwards. George III. was extravagantly delighted; Stanislaus of Poland sent Burke words of thanks and high glorification and a gold medal. Catherine of Russia, the friend of Voltaire and the benefactress of Diderot, sent her congratulations to the man who denounced French philosophers as miscreants and wretches. "One wonders," Romilly said, by and by, "that Burke is not ashamed at such success." Mackintosh replied to him temperately in the *Vindiciae Gallicae*, and Thomas Paine replied to him less temperately but far more trenchantly and more shrewdly in the *Rights of Man.* Arthur Young, with whom he had corresponded years before on the mysteries of deep ploughing and fattening hogs, added a cogent polemical chapter to that ever admirable work, in which he showed that he knew as much more than Burke about the old system of France as he knew more than Burke about soils and roots. Philip Francis, to whom he had shown the proof-sheets, had tried to dissuade Burke from publishing his performance. The passage about Marie Antoinette, which has since become a stock piece in books of recitation, seemed to Francis a mere piece of foppery; for was she not a Messalina and a jade? "I know nothing of your story of Messalina," answered Burke; "am I obliged to prove judicially the virtues of all those I shall see suffering every kind of wrong and contumely and risk of life, before I endeavour to interest others in their sufferings? . . . Are not high rank, great splendour of descent, great personal elegance and outward accomplishments ingredients of moment in forming the interest we take in the misfortunes of men? . . . I tell you again that the recollection of the manner in which I saw the queen of France in 1774, and the contrast between that brilliancy, splendour and beauty, with the prostrate homage of a nation to her, and the abominable scene of 1789 which I was describing, *did* draw tears from me and wetted my paper. These tears came again into my eyes almost as often as I looked at the description,—they may again. You do not believe this fact, nor that these are my real feelings; but that the whole is affected, or as you express it, downright foppery. My friend, I tell you it is truth; and that it is true and will be truth when you and I are no more; and will exist as long as men with their natural feelings shall exist" (*Corr.* iii. 139).

Burke's conservatism was, as such a passage as this may illustrate, the result partly of strong imaginative associations clustering round the more imposing symbols of social continuity, partly of a sort of corresponding conviction in his reason that there are certain permanent elements of human nature out of which the European order had risen and which that order satisfied, and of whose immense merits, as of its mighty strength, the revolutionary party in France were most fatally ignorant. When Romilly saw Diderot in 1783, the great encyclopaedic chief assured him that submission to kings and belief in God would be at an end all over the world in a very few years. When Condorcet described the Tenth Epoch in the long development of human progress, he was sure not only that fulness of light and perfection of happiness would come to the sons of men, but that they were coming with all speed. Only those who know the incredible rashness of the revolutionary doctrine in the mouths of its most powerful professors at that time; only those who know their absorption in ends and their inconsiderateness about means, can feel how profoundly right Burke was in all this part of his contention. Napoleon, who had begun life as a disciple of Rousseau, confirmed the wisdom of the philosophy of Burke when he came to make the Concordat. That measure was in one sense the outcome of a mere sinister expediency, but that such a measure was expedient at all sufficed to prove that Burke's view of the present possibilities of social change was right, and the view of the Rousseauites and too sanguine Perfectibilitarians wrong. As we have seen, Burke's very first piece, the satire on Bolingbroke, sprang from his conviction that merely rationalistic or destructive criticism, applied to the vast complexities of man in the social union, is either mischievous or futile, and mischievous exactly in proportion as it is not futile.

To discuss Burke's writings on the Revolution would be to write first a volume upon the abstract theory of society, and then a second volume on the history of France. But we may make one or two further remarks. One of the most common charges against Burke was that he allowed his imagination and pity to be touched only by the sorrows of kings and queens, and forgot the thousands of oppressed and famine-stricken toilers of the land. "No tears are shed for nations," cried Francis, whose sympathy for the Revolution was as passionate as Burke's execration of it. "When the provinces are scourged to the bone by a mercenary and merciless military power, and every drop of its blood and substance extorted from it by the edicts of a royal council, the case seems very tolerable to those who are not involved in it. When thousands after thousands are dragooned out of their country for the sake of their religion, or sent to row in the galleys for selling salt against law—when the liberty of every individual is at the mercy of every prostitute, pimp or parasite that has access to power or any of its basest substitutes—my mind, I own, is not at once prepared to be satisfied with gentle palliatives for such disorders" (*Francis to Burke*, Nov. 3, 1790). This is a very terse way of putting a crucial objection to Burke's whole view of French affairs in 1789. His answer was tolerably simple. The Revolution, though it had made an end of the Bastille, did not bring the only real practical liberty; that is to say, the liberty which comes with settled courts of justice, administering settled laws, undisturbed by popular fury, independent of everything but law, and with a clear law for their direction. The people, he contended, were no worse off under the old monarchy than they will be in the long run under assemblies that are bound by the necessity of feeding one part of the community at the grievous charge of other parts, as necessitous as those who are so fed; that are obliged to flatter those who have their lives at their disposal by tolerating acts of doubtful influence on commerce and agriculture, and for the sake of precarious relief to sow the seeds of lasting want; that will be driven to be the instruments of the violence of others from a sense of their own weakness, and, by want of authority to assess equal and proportional charges upon all, will be compelled to lay a strong hand upon the possessions of a part. As against the moderate section of the Constituent Assembly this was just.

One secret of Burke's views of the Revolution was the contempt which he had conceived for the popular leaders in the earlier stages of the movement. In spite of much excellence of intention, much heroism, much energy, it is hardly to be denied that the leaders whom that movement brought to the surface were almost without exception men of the poorest political capacity. Danton, no doubt, was abler than most of the others, yet the timidity or temerity with which he allowed himself to be vanquished by Robespierre showed that even he was not a man of commanding quality. The spectacle of men so rash, and so incapable of controlling the forces which they seemed to have presumptuously summoned, excited in Burke both indignation and contempt. And the leaders of the Constituent who came first on the stage, and hoped to make a revolution with rose-water, and hardly realized any more than Burke did how rotten was the structure which they had undertaken to build up, almost deserved his contempt, even if, as is certainly true, they did not deserve his indignation. It was only by revolutionary methods, which are in their essence and for a time as arbitrary as despotic methods, that the knot could be cut. Burke's vital error was his inability to see that a root and branch revolution was, under the conditions, inevitable. His cardinal position, from which he deduced so many important conclusions, namely, that the parts and organs of the old constitution of France were sound, and only needed moderate invigoration, is absolutely mistaken and untenable. There was not a single chamber in the old fabric that was not crumbling and tottering. The court was frivolous, vacillating, stone deaf and stone blind; the gentry were amiable, but distinctly bent to the very last on holding to their privileges, and they were wholly devoid both of the political experience that only comes of practical responsibility for public affairs, and of the political sagacity that only comes of political experience. The parliaments or tribunals were nests of faction and of the deepest social incompetence. The very sword of the state broke short in the king's hand. If the king or queen could either have had the political genius of Frederick the Great, or could have had the good fortune to find a minister with that genius, and the good sense and good faith to trust and stand by him against mobs of aristocrats and mobs of democrats; if the army had been sound and the states-general had been convoked at Bourges or Tours instead of at Paris, then the type of French monarchy and French society might have been modernized without convulsion. But none of these conditions existed.

When he dealt with the affairs of India, Burke passed over the circumstances of British acquisition of power in that continent. "There is a sacred veil to be drawn over the beginnings of all government," he said. "The first step to empire is revolution, by which power is conferred; the next is good laws, good order, good institutions, to give that power stability." Exactly on this broad principle of political force, revolution was the first step to the assumption by the French people of their own government. Granted that the Revolution was inevitable and indispensable, how was the nation to make the best of it? And how were surrounding nations to make the best of it? This was the true point of view. But Burke never placed himself at such a point. He never conceded the postulate, because, though he knew France better than anybody in England except Arthur Young, he did not know her condition well enough. "Alas!" he said, "they little know how many a weary step is to be taken before they can form themselves into a mass which has a true political personality."

THE BREAK WITH FOX

Burke's view of French affairs, however consistent with all his former political conceptions, put an end to more than one of his old political friendships. He had never been popular in the House of Commons, and the vehemence, sometimes amounting to fury, which he had shown in the debates on the India Bill, on the regency, on the impeachment of Hastings, had made him unpopular even among men on his own side. In May 1789—that memorable month of May in which the states-general marched in impressive array to hear a sermon at the church of Nôtre Dame at Versailles—a vote of censure had actually been passed on him in the House of Commons for a too severe expression used against Hastings. Fox, who led the party, and Sheridan, who led Fox, were the intimates of the prince of Wales; and Burke would have been as much out of place in that circle of gamblers and profligates as Milton would have been out of place in the court of the Restoration. The prince, as somebody said, was like his father in having closets within cabinets and cupboards within closets. When the debates on the regency were at their height we have Burke's word that he was not admitted to the private counsels of the party. Though Fox and he were on friendly terms in society, yet Burke admits that for a considerable period before 1790 there had been between them "distance, coolness and want of confidence, if not total alienation on his part." The younger Whigs had begun to press for shorter parliaments, for the ballot, for redistribution of political power. Burke had never looked with any favour on these projects. His experience of the sentiment of the populace in the two greatest concerns of his life—American affairs and Indian affairs—had not been likely to prepossess him in favour of the popular voice as the voice of superior political wisdom. He did not absolutely object to some remedy in the state of representation (*Corr.* ii. 387), still he vigorously resisted such proposals as the duke of Richmond's in 1780 for manhood suffrage. The general ground was this:—"The machine itself is well enough to answer any good purpose, provided the materials were sound. But what signifies the arrangement of rottenness?"

Bad as the parliaments of George III. were, they contained their full share of eminent and capable men, and, what is more, their very defects were the exact counterparts of what we now look back upon as the prevailing stupidity in the country. What Burke valued was good government. His *Report on the Causes of the Duration of Mr. Hastings's Trial* shows how wide and sound were his views of law reform. His *Thoughts on Scarcity* attest his enlightenment on the central necessities of trade and manufacture, and even furnished arguments to Cobden 50 years afterwards. Pitt's parliaments were competent to discuss and willing to pass, all measures for which the average political intelligence of the country was ripe. Burke did not believe that altered machinery was at that time needed to improve the quality of legislation. If wiser legislation followed the great reform of 1832, Burke would have said that this was because the political intelligence of the country had improved.

Though averse at all times to taking up parliamentary reform, he thought all such projects downright crimes in the agitation of 1791–92. This was the view taken by Burke, but it was not the view of Fox, nor of Sheridan, nor of Francis, nor of many others of his party, and difference of opinion here was naturally followed by difference of opinion upon affairs in France. Fox, Grey, Windham, Sheridan, Francis, Lord Fitzwilliam, and most of the other Whig leaders, welcomed the Revolution in France. And so did Pitt, too, for some time. "How much the greatest event it is that ever happened in the world," cried Fox, with the exaggeration of a man ready to dance the carmagnole, "and how much the best." The dissension between a man who felt so passionately as Burke, and a man who spoke so impulsively as Charles Fox, lay in the very nature of things. Between Sheridan and Burke there was an open breach in the House of Commons upon the Revolution so early as February 1790, and Sheridan's influence with Fox was strong. This divergence of opinion destroyed all the elation that Burke might well have felt at his compliments from kings, his gold medals, his twelve editions. But he was too fiercely in earnest in his horror of Jacobinism to allow mere party associations to guide him. In May 1791 the thundercloud burst, and a public rupture between Burke and Fox took place in the House of Commons.

The scene is famous in English parliamentary annals. The minister had introduced a measure for the division of the province of Canada and for the establishment of a local legislature in each division. Fox in the course of debate went out of his way to laud the Revolution, and to sneer at some of the most effective passages in the *Reflections*. Burke was not present, but he announced his determination to reply. On the day when the Quebec Bill was to come on again, Fox called upon Burke, and the pair walked together from Burke's house in Duke Street down to Westminster. The Quebec Bill was recommitted, and Burke at once rose and soon began to talk his usual language against the Revolution, the rights of man, and Jacobinism whether English or French. There was a call to order. Fox, who was as sharp and intolerant in the House as he was amiable out of it, interposed with some words of contemptuous irony. Pitt, Grey, Lord Sheffield, all plunged into confused and angry debate as to whether the French Revolution was a good thing, and whether the French Revolution, good or bad, had anything to do with the Quebec Bill. At length Fox, in seconding a motion for confining the debate to its proper subject, burst into the fatal question beyond the subject, taxing Burke with inconsistency, and taunting him with having forgotten that ever-admirable saying of his own about the insurgent colonists, that he did not know how to draw an indictment against a whole nation. Burke replied in tones of firm self-repression; complained of the attack that had been made upon him; reviewed Fox's charges of inconsistency; enumerated the points on which they had disagreed, and remarked that such disagreements had never broken their friendship. But whatever the risk of enmity, and however bitter the loss of friendship, he would never cease from the warning to flee from the French constitution. "But there is no loss of friends," said Fox in an eager undertone. "Yes," said Burke, "there *is* a loss of friends. I know the penalty of my conduct. I have done my duty at the price of my friend—our friendship is at an end." Fox rose, but was so overcome that for some moments he could not speak. At length, his eyes streaming with tears, and in a broken voice, he deplored the breach of a 20 years' friendship on a political question. Burke was inexorable. To him the political question was so vivid, so real, so intense, as to make all personal sentiment no more than dust in the balance. Burke confronted Jacobinism with the relentlessness of a Jacobin. The rupture was never healed, and Fox and he had no relations with one another henceforth beyond such formal interviews as took place in the manager's box in Westminster Hall in connection with the impeachment.

A few months afterwards Burke published the *Appeal from the New to the Old Whigs*, a grave, calm and most cogent vindication of the perfect consistency of his criticisms upon the English Revolution in 1688 and upon the French Revolution of 1789, with the doctrines of the great Whigs who conducted and afterwards defended in Anne's reign the transfer of the crown from James to William and Mary. The *Appeal* was justly accepted as a satisfactory performance for the purpose with which it was written. Events, however, were doing more than words could do to confirm the public opinion of Burke's sagacity and foresight. He had always divined by the instinct of hatred that the French moderates must gradually be swept away by the Jacobins, and now it was all coming true. The humiliation of the king and queen after their capture at Varennes; the compulsory acceptance of the constitution; the plain incompetence of the new Legislative Assembly; the growing violence of the Parisian mob, and the ascendency of the Jacobins at the Common Hall; the fierce day of June 20, 1792, when the mob flooded the Tuileries, and the bloodier day of Aug. 10, when the Swiss Guard was massacred and the royal family flung into prison; the murders in the prisons in September; the trial and execution of the king in Jan. 1793; the proscription of the Girondins in June, the execution of the queen in October—if we realize the impression likely to be made upon the sober and homely English imagination by such a heightening of horror by horror, we may easily understand how people came to listen to Burke's voice as the voice of inspiration, and to look on his burning anger as the holy fervour of a prophet of the Lord.

BURKE AND PITT

Fox still held to his old opinions as stoutly as he could, and condemned and opposed the war which England had declared against the French republic. Burke, who was profoundly incapable of the meanness of letting personal estrangement blind his eyes to what was best for the commonwealth, kept hoping against hope that each new trait of excess in France would at length bring the great Whig leader to a better mind. He used to declaim by the hour in the conclaves at Burlington House upon the necessity of securing Fox; upon the strength which his genius would lend to the administration in its task of grappling with the sanguinary giant; upon the impossibility, at least, of doing either with him or without him. Fox's most important political friends who had long wavered, at length, to Burke's great satisfaction, went over to the side of the government. In July 1794 the duke of Portland, Lord Fitzwilliam, Windham and Grenville took office under Pitt. Fox was left with a minority which was satirically said not to have been more than enough to fill a hackney coach. "That is a calumny," said one of the party; "we should have filled two." The war was prosecuted with the aid of both the great parliamentary parties of the country, and with the approval of the great bulk of the nation. Perhaps the one man in England who in his heart approved of it less than any other was William Pitt. The difference between Pitt and Burke was nearly as great as that between Burke and Fox. Burke would be content with nothing short of a crusade against France, and war to the death with her rulers. "I cannot persuade myself," he said, "that this war bears any the least resemblance to any that has ever existed in the world. I cannot persuade myself that any examples or any reasonings drawn from other wars and other politics are at all applicable to it" (*Corr.* iv. 219). Pitt, on the other hand, as Lord Russell truly says, treated Robespierre and Carnot as he would have treated other French rulers, whose ambition was to be resisted, and whose interference in the affairs of other nations was to be checked. And he entered upon the matter in the spirit of a man of business, by sending ships to seize some islands belonging to France in the West Indies, so as to make certain of repayment of the expenses of the war.

In the summer of 1794 Burke was struck to the ground by a blow to his deepest affection in life, and he never recovered from it. His whole soul was wrapped up in his only son, of whose abilities he had the most extravagant estimate and hope. All the evidence goes to show that Richard Burke was one of the most presumptuous and empty-headed of human beings. "He is the most impudent and opiniative fellow I ever knew," said Wolfe Tone. Gilbert Elliot, a very different man, gives the same account. "Burke," he says, describing a dinner party at Lord Fitzwilliam's in 1793, "has now got such a train after him as would sink anybody but himself: his son who is quite *nauseated* by all mankind; his brother, who is liked better than his son, but is rather oppressive with animal spirits and brogue; and his cousin, William Burke, who is just returned unexpectedly from India, as much ruined as when he went years ago, and who is a fresh charge on any prospects of power Burke may ever have. Mrs. Burke has in her train Miss French [Burke's niece], the most perfect *she Paddy* that ever was caught. Notwithstanding these disadvantages Burke is in himself a sort of power in the state. It is not too much to say that he is a sort of power in Europe, though totally without any of those means or the smallest share in them which give or maintain power in other men." Burke accepted the position of a power in Europe seriously. Though no man was ever more free from anything like the egoism of the intellectual coxcomb, yet he abounded in that active self-confidence and self-assertion which is natural in men who are conscious of great powers, and strenuous in promoting great causes. In the summer of 1791 he despatched his son to Coblenz to give advice to the royalist exiles, then under the direction of Calonne, and to report to him at Beaconsfield their disposition and prospects. Richard Burke was received with many compliments, but of course nothing came of his mission, and the only impression that remains with the reader of his prolix story is his tale of the two royal brothers, who afterwards became Louis XVIII. and Charles X., meeting after some parting, and embracing one another with many tears on board a boat in the middle of the Rhine, while some of the courtiers raised a cry of "Long live the king!"—the king who had a few weeks before been carried back in triumph to his capital with Mayor Pêtion in his coach. When we think of the pass to which things had come in Paris by this time, and of the unappeasable ferment that boiled round the court, there is a certain touch of the ludicrous in the notion of poor Richard Burke writing to Louis XVI. a letter of wise advice how to comport himself.

At the end of the same year, with the approval of his father he started for Ireland as the adviser of the Catholic Association. He made a wretched emissary, and there was no limit to his arrogance, noisiness and indiscretion. The Irish agitators were glad to give him 2,000 guineas and to send him home. The mission is associated with a more important thing, his father's *Letters to Sir Hercules Langrishe*, advocating the admission of the Irish Catholics to the franchise. This short piece abounds richly in maxims of moral and political prudence. And Burke exhibited considerable courage in writing it; for many of its maxims seem to involve a contradiction, first, to the principles on which he withstood the movement in France, and second, to his attitude upon the subject of parliamentary reform. The contradiction is in fact only superficial. Burke was not the man to fall unawares into a trap of this kind. His defence of Catholic relief—and it had been the conviction of a lifetime—was very properly founded on propositions which were true of Ireland, and were true neither of France nor of the quality of parliamentary representation in England. Yet Burke threw such breadth and generality over all he wrote that even these propositions, relative as they were, form a short manual of statesmanship.

END OF PARLIAMENTARY LIFE

At the close of the session of 1794 the impeachment of Hastings had come to an end, and Burke bade farewell to parliament. Richard Burke was elected in his father's place at Malton. The king was bent on making the champion of the old order of Europe a peer. His title was to be Lord Beaconsfield, and it was designed to annex to the title an income for three lives. The patent was being made ready, when all was arrested by the sudden death of the son who was to Burke more than life. The old man's grief was agonizing and inconsolable. "The storm has gone over me," he wrote in words which are well known, but which can hardly be repeated too often for any who have an ear for the cadences of noble and pathetic speech "The storm has gone over me, and I lie like one of those old oaks which the late hurricane has scattered about me. I am stripped of all my honours; I am torn up by the roots and lie prostrate on the earth . . . I am alone. I have none to meet my enemies in the gate, . . . I live in an inverted order. They who ought to have succeeded me have gone before me. They who should have been to me as posterity are in the place of ancestors."

A pension of £2,500 was all that Burke could now be persuaded to accept. The duke of Bedford and Lord Lauderdale made some remarks in parliament upon this paltry reward to a man who, in conducting a great trial on the public behalf, had worked harder for nearly ten years than any minister in any cabinet of the reign. But it was not yet safe to kick up heels in face of the dying lion. The vileness of such criticism was punished, as it deserved to be, in the *Letter to a Noble Lord* (1796), in which Burke showed the usual art of all his compositions in shaking aside the insignificances of a subject. He turned mere personal defence and retaliation into an occasion for a lofty enforcement of constitutional principles, and this, too, with a relevancy and pertinence of consummate skilfulness. There was to be one more great effort before the end.

In the spring of 1796 Pitt's constant anxiety for peace had become more earnest than ever. He had found out the instability of the coalition and the power of France. Like the thrifty steward he was, he saw with growing concern the waste of the national resources and the strain upon commerce, with a public debt swollen to what then seemed the desperate sum of £400,000,000. Burke at the notion of negotiation flamed out in the *Letters on a Regicide Peace*, in some respects the most splendid of all his compositions. They glow with passion, and yet with all their rapidity is such steadfastness, the fervour of imagination is so skilfully tempered by close and plausible reasoning, and the whole is wrought with such strength and fire, that we hardly know where else to look either in Burke's own writings or elsewhere for such an exhibition of the rhetorical resources of our language. We cannot wonder that the whole nation was stirred to the very depths, or that they strengthened the aversion of the king, of Windham and other important personages in the government against the plans of Pitt. The prudence of their drift must be settled by external considerations. Those who think that the

French were likely to show a moderation and practical reasonableness in success, such as they had never shown in the hour of imminent ruin, will find Burke's judgment full of error and mischief. Those, on the contrary, who think that the nation which was on the very eve of surrendering itself to the Napoleonic absolutism was not in a hopeful humour for peace and the European order, will believe that Burke's protests were as perspicacious as they were powerful, and that anything which chilled the energy of the war was as fatal as he declared it to be.

When the third and most impressive of these astonishing productions came into the hands of the public, the writer was no more. Burke died on July 8, 1797. Fox, who with all his faults was never wanting in a fine and generous sensibility, proposed that there should be a public funeral, and that the body should lie among the illustrious dead in Westminster Abbey. Burke, however, had left strict injunctions that his burial should be private; and he was laid in the little church at Beaconsfield. It was the year of Campo Formio. So a black whirl and torment of rapine, violence and fraud was encircling the Western world, as a life went out which, notwithstanding some eccentricities and some aberrations, had made great tides in human destiny very luminous.

(J. Mo.)

BIBLIOGRAPHY Of the *Collected Works*, there are two main editions—the quarto and the octavo. (1) Quarto, in eight vols., begun in 1792, under the editorship of Dr. F. Lawrence; vols. i–iii. were published in 1792; vols. iv.–viii., edited by Dr. Walter King, sometime bishop of Rochester, were completed in 1827. (2) Octavo in 16 vols. This was begun at Burke's death, also by Drs. Lawrence and King; vols. i.–viii. were published in 1803 and reissued in 1808, when Dr. Lawrence died; vols. ix.–xii. were published in 1813 and the remaining four vols. in 1827. A new edition of vols. i.–vii. was published in 1823 and the contents of vols. i.–xii. in 2 vols. octavo in 1834. An edition in nine vols. was published in Boston, Massachusetts, in 1839. This contains the whole of the English edition in 16 volumes, with a reprint of the *Account of the European Settlements in America* which is not in the English edition.

Among the numerous editions published later may be mentioned that in Bohn's *British Classics*, published in 1853. This contains the fifth edition of Sir James Prior's life; also an edition in 12 vols., octavo, published by J. C. Nimmo, 1808. There is an edition of the *Select Works* of Burke with introduction and notes by E. J. Payne in the Clarendon Press series, new edition, 3 vols., 1897. *The Correspondence of Edmund Burke*, edited by Earl Fitzwilliam and Sir R. Bourke, with appendix, detached papers and notes for speeches, was published in 4 vols., 1844. This *Correspondence*, however, is far from being complete. It is necessary to see: *The epistolary Correspondence of Edmund Burke and Dr. French Lawrence*, 1 vol., Rivington, 1827 (not included in the Fitzwilliam *Correspondence* of 1844); *Letters from Edmund Burke to Richard Shackleton* (in *The Leadbeater Papers*, vol 2.), 1862; *Correspondence of Edmund Burke and William Windham*, edited by J. P. Gilson, 1910 (Roxburghe Club). *The Speeches of Edmund Burke, in the House of Commons and Westminster Hall*, were published in 4 vols., 1816. Other editions of the speeches are those *On Irish Affairs*, collected and arranged by Matthew Arnold, with a preface (1881), *On American Taxation, On Conciliation with America*, together with the *Letter to the Sheriffs of Bristol*, edited with introduction and notes by F. G. Selby (1895).

The standard life of Burke is that by Sir James Prior, *Memoir of the Life and Character of Edmund Burke with Specimens of his Poetry and Letters* (1824). The Lives by C. MacCormick (1798) and by R. Bisset (1798, 1800) are of little value. Other lives are those by T. MacKnight (1808) and by Bertram Newman (1827). A. P. I. Samuel's *The early life, correspondence and writings of Edmund Burke* (1923), throws new light on this part of Burke's life. Of critical estimates of Burke's life the *Edmund Burke* of John Morley, "English Men of Letters" series (1879), is an elaboration of the above article, *see* also his *Burke, a Historical Study* (1867) lately reprinted (New York, Knapp, 1924); "Three Essays on Burke," by Sir James Fitzjames Stephen in *Horae Sabbaticae*, series iii. (1892); and *Peptographia Dublinensis, Memorial Discourses preached in the Chapel of Trinity College, Dublin, 1895–1902; Edmund Burke*, by G. Chadwick, bishop of Derry (1902). The best account of Burke's philosophy is John MacCunn's *The political philosophy of Edmund Burke* (1913). *See* also: Richmond Lennox, *Edmund Burke und sein politisches Arbeitsfeld* (Munich, 1923); Charles Edwyn Vaughan, "Burke," in his *Studies in the history of political philosophy* (Manchester, 1925).

BURKE, ROBERT O'HARA (1820–1861), Australian explorer, was born at St. Cleram, Co. Galway, Ireland, in 1820, entered the Austrian army, left it in 1848, and joined the Royal Irish Constabulary. Five years later he emigrated to Tasmania, and shortly afterwards crossed to Melbourne, where he became an inspector of police. At the end of 1857 the Philosophical Institute of Victoria appointed a committee to inquire into and report upon the exploration of the Australian interior, and an expedition was organized under the leadership of Burke, with W. J. Wills as surveyor and astronomical observer. This expedition, which left Melbourne on Aug. 21, 1860, forms a painful episode in Australian annals. Ten Europeans and three Sepoys accompanied the expedition, which was soon torn by internal dissensions. Near Menindie on the Darling, Landells, Burke's second in command, became insubordinate and resigned, his example being followed by the doctor—a German. On Nov. 11 Burke, with Wills and five assistants, 15 horses and 16 camels, reached Cooper's Creek in Queensland, where a depot was formed near good grass and abundance of water. Here Burke proposed waiting the arrival of his third officer, Wright, whom he had sent back from Torowoto to Menindie to fetch some camels and supplies. Wright, however, delayed his departure until Jan. 26, 1861. Meantime, weary of waiting, Burke, with Wills, King and Gray as companions, determined on Dec. 16 to push on across the continent, leaving an assistant named Brahe to take care of the depot until Wright's arrival. On Feb. 4, 1861, Burke and his party, worn down by famine, reached the estuary of the Flinders river, not far from the present site of Normantown on the Gulf of Carpentaria. On Feb. 26 began their return journey. The party suffered greatly from famine and exposure. In vain they looked for the relief which Wright was to bring them. On April 16 Gray died, and the emaciated survivors halted a day to bury his body. That day's delay, as it turned out, cost Burke and Wills their lives; they arrived at Cooper's Creek to find the depot deserted. But a few hours before, Brahe, unrelieved by Wright, and thinking that Burke had died or changed his plans, had taken his departure for the Darling. Burke and his companions struggled on, until death overtook Burke and Wills at the end of June. King sought the natives, who cared for him until his relief by a search party in September.

BURKE, WILLIAM (1792–1829), Irish criminal, was born in Ireland in 1792. After trying his hand at a variety of trades there, he went to Scotland about 1817 as a navvy, and in 1827 was living in a lodging-house in Edinburgh kept by William Hare, another Irish labourer. Towards the end of that year one of Hare's lodgers, an old army pensioner, died. This was the period of the body-snatchers or Resurrectionists, and Hare and Burke, aware that money could always be obtained for a corpse, sold the body to Dr. Robert Knox, a leading Edinburgh anatomist, for £7 10s. The price obtained and the simplicity of the transaction suggested to Hare an easy method of making a profitable livelihood, and Burke at once fell in with the plan. The two men inveigled obscure travellers to Hare's or some other lodging-house, made them drunk and then suffocated them, taking care to leave no marks of violence. The bodies were sold to Dr. Knox for prices averaging from £8 to £14. At least 15 victims had been disposed of in this way when the suspicions of the police were aroused, and Burke and Hare were arrested. The latter turned king's evidence, and Burke was found guilty and hanged at Edinburgh on Jan. 28, 1829. Hare is believed to have died in England under an assumed name. From Burke's method of killing his victims has come the verb "to burke," meaning originally to suffocate, or suppress secretly, or to kill with the object of selling the body for the purposes of dissection; later to evade or suppress an inconvenient fact or question. R. L. Stevenson's story, *The Body Snatcher*, may have been suggested in part by Burke's exploits.

See George Macgregor, *History of Burke and Hare and of the Resurrectionist Times* (Glasgow, 1884); and Messrs. Hodge's series of *Notable Trials* (1917 *sqq.*).

BURLAMAQUI, JEAN JACQUES (1694–1748), Swiss publicist, was born at Geneva, where he was honorary professor of ethics and the law of nature for 15 years. As a member of the council of state, he gained a high reputation for his practical sagacity. His *Principes du droit naturel* (1747) and *Principes du droit politique* (1751) passed through many editions, and were extensively used as text-books. His fundamental principle may be described as rational utilitarianism, and in many ways it resembles that of Cumberland.

BURLEIGH, HENRY THACKER (1866–), Negro baritone, composer and arranger, was born at Erie, Pa., Dec. 2, 1866. The grandson of a slave, he supported himself at various jobs until he succeeded in obtaining admittance to the National Conservatory of Music, New York, singing before a committee that included Joseffy. Here he studied for four years. The mother of Edward MacDowell took interest in him as also did Anton Dvořák, for whom he copied manuscripts. In 1894 he was appointed soloist at St. George's Episcopal church, New York, the only Negro out of sixty applicants, retaining the position ever since. He is the composer of over fifty songs, including fine settings of Whitman's "Ethiopia Saluting the Colours" and Rupert Brooke's sonnet "The Soldier," festival anthems, and violin pieces, and has achieved an international reputation by his arrangements of negro spirituals, notably "Deep River." The Spingarn Medal was conferred on him in 1917.

BURLESQUE, a form of the comic in art, consisting broadly in an imitation of a work of art with the object of exciting laughter, by distortion or exaggeration, by turning, for example, the highly rhetorical into bombast, the pathetic into the mock-sentimental, and especially by a ludicrous contrast between the subject and the style, making gods speak like common men and common men like gods. While parody (*q.v.*), also based on imitation, relies for its effect more on the close following of the style of its counterpart, burlesque depends on broader and coarser effects. Its particular sphere is in literature, and especially in drama. The *Batrachomyomachia*, or Battle of the Frogs and Mice, is the earliest example in classical literature, being a travesty of the Homeric epic. The Italian word first appears in the *Opere Burlesche* of Francesco Berni (1407–1535). In France, during part of the reign of Louis XIV., the burlesque attained great popularity; burlesque Aeneids, Iliads and Odysseys were composed, and even the most sacred subjects were not left untravestied. Of the numerous writers of these, P. Scarron is most prominent, and his *Virgile Travesti* (1648–53) was followed by numerous imitators. In English literature Chaucer's *Rime of Sir Thopas* is a burlesque of the long-winded mediaeval romances. Among the best-known true burlesques in English dramatic literature may be mentioned the 2nd duke of Buckingham's *The Rehearsal,* a burlesque of the heroic drama, and Sheridan's *The Critic.* In the later 19th century the name "burlesque" was given to a form of musical dramatic composition with which the Gaiety theatre, London, and the names of Edward Terry, Fred Leslie, and Nellie Farren are particularly connected. The Gaiety type of burlesque gave place to the "musical comedy," and in more recent years to the "revue."

The name burlesque (*burlesca* or *burla*), is also given sometimes to instrumental compositions of an appropriately light-hearted character.

BURLEY, hub city of Minidoka irrigation project in Idaho, U.S.A. It has 120,000 ac. of irrigated land on the great Snake river, 84 mi. S.W. from Pocatello, in the heart of the Idaho potato section. It is served by the Union Pacific railroad system. It has an airport. Its population in 1940 by federal census was 5,329. Principal industries: beet sugar refinery, cheese factory, flour mill and creamery. It was settled in 1905 and incorporated in 1918.

BURLINGAME, ANSON (1820–1870), American legislator and diplomat, was born in New Berlin, N.Y., on Nov. 14, 1820. In 1823 his parents took him to Ohio, and about ten years afterwards to Michigan. In 1838–41 he studied in one of the "branches" of the university of Michigan, and in 1846 graduated at the Harvard law school. He practised law in Boston, and won a wide reputation by his speeches for the Free Soil party in 1848. He was a member of the Massachusetts senate in 1853–54, and of the national House of Representatives 1855–61, being elected for the first term as a "Know Nothing" and afterwards as a member of the new Republican Party. He was an effective debater in the House, and for his impassioned denunciation (June 21, 1856) of Preston S. Brooks (1819–57), for his assault upon Senator Charles Sumner, was challenged by Brooks. Burlingame accepted the challenge and specified rifles as the weapons to be used, his second chose Navy island, above the Niagara Falls, and in Canada, as the place for the meeting. Brooks, however, refused these conditions. In 1861 President Lincoln appointed him (June 14, 1861) minister to China. This office he held until Nov. 1867, when he resigned and was immediately appointed minister plenipotentiary to head a Chinese diplomatic mission to the United States and the principal European nations. The embassy arrived in the United States in March, 1868, and concluded at Washington (July 28, 1868) a series of articles, supplementary to the Reed Treaty of 1858, and later known as "The Burlingame Treaty." The "Burlingame Treaty" recognizes China's right of eminent domain over all her territory, gives China the right to appoint at ports in the United States consuls, "who shall enjoy the same privileges and immunities as those enjoyed by the consuls of Great Britain and Russia"; provides that "citizens of the United States in China of every religious persuasion and Chinese subjects in the United States shall enjoy entire liberty of conscience and shall be exempt from all disability or persecution on account of their religious faith or worship in either country," and grants certain privileges to citizens of either country residing in the other, the privilege of naturalization, however, being specifically withheld. Burlingame's speeches did much to awaken a more intelligent appreciation of China's attitude toward the outside world. He died suddenly at St. Petersburg on Feb 23, 1870.

His son EDWARD LIVERMORE BURLINGAME (1848–1922) was educated at Harvard and at Heidelberg, was a member of the editorial staff of the New York *Tribune* in 1871–72 and of the *American Cyclopaedia* in 1872–76, and in 1886–1914 was the editor of *Scribner's Magazine.*

See Frederick Wells Williams, *Anson Burlingame and the First Chinese Mission to Foreign Powers* (1912); also Robert Grant, "Edward Livermore Burlingame," *Harvard Graduates' Magazine,* vol. xxxi. p. 368–370 (1923).

BURLINGAME, a beautiful and rapidly-growing residential town of San Mateo county, California, U.S.A., 15 mi. S. of San Francisco, on the bay. The population in 1920 was 4,107; in 1930, 13,270; in 1940, 15,940 by the federal census. The town was incorporated in 1908.

BURLINGTON, a city of Iowa, U.S.A., situated on the bluffs of the Mississippi river, near the southeast corner of the state; the county seat of Des Moines county. It is on federal highways 34 and 61, and is a railroad centre, served by the Burlington and the Rock Island railways. Pop. (1940) 25,832. It has a jobbing business, notably in furniture; railway repair and construction shops; and other manufactures, including baskets, engines, agricultural implements, coffins, monuments, barrels, leather goods, buttons, soaps, clothing and gloves, brooms, paints and varnishes, crackers, candy and mattresses. The factory output in 1939 was valued at $12,793,060. In 1941 the United States government constructed the Iowa ordnance plant 4 mi. W. of Burlington. It comprises 22,000 ac. with 800 buildings and about 90 mi. of railroad sidetrack. The cost exceeded $50,000,000. The plant employs 7,500.

Lieutenant Z. M. Pike visited the site of Burlington in 1805, and recommended the erection of a fort. A fur-trading post was established in 1829, and permanent settlers began to come in 1833, after the Black Hawk war. A town was laid out in 1834. At first it was called Flint Hills, a translation of the Indian name, but was renamed for Burlington, Vermont. The town was incorporated in 1837, and received a city charter in 1838 from the territory of Wisconsin. The territorial legislature of Wisconsin met here from 1836 to 1838, and that of Iowa from 1838 to 1840. The city adopted a commission form of government in 1917. The *Daily Hawk-Eye Gazette,* Iowa's oldest daily newspaper, was consolidated in 1933. The *Gazette* was established in 1837; and the *Hawk-Eye* in 1839.

BURLINGTON, a city of Burlington county, New Jersey, U.S.A., on the east bank of the Delaware river and the Pennsylvania railroad, 18 mi. N.E. of Philadelphia. The population was 10,844 in 1930, and was 10,905 in 1940 by the federal census. It is in the heart of a famous peach-growing region. The principal manufactures are cast-iron pipe, pipe fittings, silk, typewriter ribbons and carbon paper. The State Masonic Home is here. Burlington is noted for its historic associations, and interesting old buildings, some of which date from early in the 18th century. One of the oldest is now the headquarters of the Daughters of the American Revolution. St. Mary's Church was built in 1703. The birthplace of James Fenimore Cooper is the home of the Historical Society, and the birthplace of Captain James Lawrence (1781–1813) still stands. Ivy-mantled St. Mary's Hall, a school for girls, was founded in 1837. The Burlington Society Library, established in 1757, and still conducted under its original charter from George II., is one of the oldest public libraries in the country. A trust fund established in 1682, when the assembly of West Jersey gave to Burlington "Matinicunk Island," opposite the town, "for the maintaining of a school for the education of youth," still yields revenue, which is used for the public schools.

Burlington was settled in 1677 by a colony of English Quakers, and was at first called New Beverly, but was soon renamed after Bridlington, the Yorkshire home of many of the settlers. It was incorporated as a town in 1693, and became the seat of Government of West Jersey. After the union of East and West Jersey (1702) it was one of the two capitals of the new royal province, and until 1790 the meetings of the legislature alternated between Burlington and Perth Amboy. The city was chartered in 1784. The first newspaper in the state, the *New Jersey Gazette*, established here in 1777, was influential during the Revolution.

BURLINGTON, an industrial city of Alamance county, North Carolina, U.S.A., on the southern railway, about 55 mi. N.W. of Raleigh. The population in 1940 was 12,198. It has cotton mills making 1,000,000 yards of cloth per week; hosiery mills with a weekly output of over 125,000 dozen pairs; dyeing plants, furniture factories and several other industries. The jobbing business in hosiery amounts to from $10,000,000 to $12,000,000 a year. The assessed valuation of property in 1940 was $12,575,810. Burlington was founded in 1866, to be the headquarters of the North Carolina railroad, and was called Company Shops until in 1887 it was incorporated as Burlington. Elon college, a coeducational institution of the Southern Christian church, chartered in 1889, is three miles west.

BURLINGTON, the largest city of Vermont, U.S.A., is situated in a beautiful spot on the east shore of Lake Champlain, just below the mouth of the Winooski river, 100 mi. S.E. of Montreal; it is a port of entry and the county seat of Chittenden county. It is on federal highways 2 and 7; is served by the Central Vermont and the Rutland railways, and by Canadian Colonial and Northeast air lines and by ferry to New York state; and has a municipal airport.

The area is 10 sq.mi. The population was 27,686 in 1940 by the federal census; in 1880 the population was 11,365, and in 1900, 18,640.

The city is built on a slope which rises to a height of 400 ft., commanding views of the Green mountains 20 mi. E. and the Adirondacks across the lake. It is a touring centre in summer, and also attracts many visitors for the winter sports. Large quantities of lumber were imported formerly from Canada, but the total commerce of the harbour has fallen. Burlington has a large wholesale and retail trade and numerous manufactures, including lumber, brush fibres, venetian blinds, window shade rollers, ovens, dyes, butter colour, spools and bobbins, maple sugar utensils, woollen goods, candy and printing. The total factory output in 1937 was valued at $4,768,294. It is in the sugar maple region, and there are many co-operative creameries in the vicinity. The assessed valuation of property in 1940 was $27,060,207.

The University of Vermont and state agricultural college, with an annual enrolment of about 1,500, occupies a hilltop overlooking the city. The original constitution of the republic of Vermont, drafted in 1777, provided for a university. It was chartered, largely through the efforts of Ira Allen, in 1791, by the first general assembly after the state became a member of the union; and the agricultural college was incorporated with it in 1865. Its college of medicine, dating back to the appointment of a lecturer in chirurgery and anatomy in 1804, is one of the oldest in the country. Ft. Ethan Allen, an artillery post of the United States army, is 4 mi. east of the city. It was the base of the relief operations by troops and by aeroplane and seaplane after the disastrous floods of November 1927.

Burlington was chartered by Governor Benning Wentworth of New Hampshire in 1763. Settlement began in 1774, and the city was incorporated in 1865.

It was the home of Ethan Allen from 1787 until his death in 1789.

BURMA, an overseas territory of the British empire which, though formerly a province of the Indian empire, is geographically a part of Indo-China and is frequently called by the French "Indo-Chine anglaise." The territory of Burma as constituted since the annexation of Upper Burma in 1886 comprises the British territory of Upper and Lower Burma, the native states known as the Federated Shan States, Karenni, and tracts of lightly administered territory in the more remote parts. Lower Burma corresponds to the area acquired by the British Indian government in the two wars of 1826 and 1852, while Upper Burma is the former independent kingdom of Burma, annexed on Jan. 1, 1886. The territory stretches from 9° 55′ to about 28° 30′ N. and from long. 92° 10′ to 101° 9′ E. The extreme length from north to south is almost 1,200 mi. and the broadest part, which is in about lat. 21° N., is 575 mi. from east to west. The total area is estimated at 261,600 sq.mi.

Burma proper, inclusive of the Chin hills and the administered Kachin hill tracts, occupies about 180,000 sq.mi., the Shan States, which comprise the whole of the eastern portion of the territory, about 65,000 sq.mi. and the unadministered territory about 16,000 sq.mi.

Roughly half of Burma lies outside the tropics, but the configuration of the country is such that the whole may be regarded as a tropical country. In the north the boundary between Burma, Tibet and China has not yet been precisely determined. The northwestern frontier touches Assam, the dependent state of Manipur, and those portions of Bengal included in the Lushai hills and Chittagong. On the west the boundary is formed by the Bay of Bengal, in the southwest by the Gulf of Martaban. On the east the frontier touches the Chinese province of Yunnan, the Chinese Shan and Lao States, French Indo-China and Siam. In the south the boundary is formed by the Pakchan river.

TESY OF THE NORTHERN

A "RED KAREN" GIRL
Reddish brown in colour the Karens form one of the chief hill tribes of Burma. The women weave the material for clothing.

Geomorphology.—Burma falls naturally into three great geomorphological units: (*a*) The Arakan Yoma, a great series of fold ranges of Alpine age, which forms the barrier between Burma and India. The foothills of the Arakan Yoma stretch as far as the shores of the Bay of Bengal. (*b*) The Shan plateau massif, occupying the whole of the east of the country and extending southward into Tenasserim. The massif forms part of what has been called the Indo-Malayan mountain system and has existed as a geomorphological unit since the close of the Mesozoic. (*c*) The Central basin, lying between the Arakan Yoma and the Shan plateau. Formerly a gulf of the early Tertiary sea, open to the south, it is now occupied by a great spread of Tertiary rocks.

The great mountain range of the Arakan Yoma and its continuation northward has a core of old crystalline rocks. On either side are hard, tightly-folded sedimentary rocks, mainly Tertiary in age. Rocks of Jurassic and Cretaceous age are also known to occur, but the geology of the ranges is still very imperfectly known. Extensive strike faulting occurs along the eastern flanks of the Arakan Yoma and large serpentine intrusions, probably of Cretaceous age, are associated with the faults. Chromite and other useful minerals are known to occur, especially in association with the serpentine, but are not at present exploited. The western edge of the Shan plateau massif is well marked both physically and geologically. It rises abruptly from the valley, and for 400 or 500 mi. the edge is formed by a long strip of granitic or gneissose rocks. The predominant rocks in the Shan plateau are gneisses—which yield the rubies and other gems for which Burma has so long been famous—and a massive limestone of Devono-carboniferous age. Rocks of all ages from pre-Cambrian to Jurassic occur in the massif, whilst deposits of late Tertiary and Pleistocene age occupy old lake basins. In pre-Cambrian rocks at Mogok occur the principal ruby mines, —but the industry is now of minor importance. At Bawdwin, associated with a group of ancient volcanic rocks, are very extensive deposits of silver-lead ore, mainly argentiferous galena, which are worked by the Burma Corporation, Ltd., and smelted at the nearby works of Namtu. The refined silver and lead are sent by rail to Rangoon for export. Other silver-lead deposits are known in other parts of the Shan States, and have been worked in the past by the Chinese. Tenasserim forms a continuation of the tin-bearing belt of Malaya, and large quantities of tin and tungsten are obtained. Geologically this portion of the Indo-Malayan mountains consists of large granitic intrusions, elongated in the north-south direction and intruded into a series of ancient rocks of unknown age. The basin of the Irrawaddy between the Arakan Yoma and the Shan plateau, consists almost entirely of Tertiary rocks. The beds are remarkable for their enormous thickness; the Eocene beds reach upwards of 15,000 ft.; the Peguan (Oligo-Miocene) upwards of 16,000 ft., and the Irrawaddian (Mid-Pliocene) upwards of 5,000 ft. Forming a line down the centre of the basin are the well-known oil fields of Burma. The oil occurs mainly in rocks of Peguan age. From north to south are the fields of Indaw, Yenangyat, Singu, Yenangyaung, Minbu and several minor fields. The most important fields are Yenangyaung and Singu. Brown coal also occurs in considerable quantities in the valley of the Chindwin and elsewhere in the Tertiary rocks, but as yet has been little used. Along a line running, roughly, along the centre of the ancient Tertiary trough are numerous extinct volcanoes; some form small tuff cones with small crater lakes; others are plugs of rhyolitic matter, but the largest is the complex cone of Mt. Popa.

Physical Features.—The three physical units into which Burma is naturally divided have already been mentioned as geomorphological units. Burma is separated from the neighbouring Indian empire by a long fold range, uplifted at the same time as the Himalayas in India. In the north the range is narrow, and known as the Patkai hills. Farther south the direction changes from southwest to south and the ranges broaden out, enclosing the Manipur plateau. The individual parts have received different names, and include the Naga hills, Chin hills and Lushai hills, but from Manipur southward the whole range is known as the Arakan Yoma. As such it becomes narrower, curves round to south-southeast and terminates in Cape Negrais, though geologically the same series of folds is continued in the Andaman and Nicobar islands. A small part of Burma—the division of Arakan (*q.v.*)—lies between the Arakan Yoma and the Bay of Bengal. Some of the peaks of the Arakan Yoma rise to over 10,000 ft., and the highest is believed to be Mt. Victoria. The whole range forms an effective barrier between Burma and India proper. The east of Burma, including the whole of the Shan States (*q.v.*), is occupied by a plateau, which forms part of the great Yunnan plateau of China. The plateau averages 3,000 ft. in height, but its surface has been much dissected, and running through the centre from north to south is the deep trough occupied by the Salween river. Southwards, the plateau passes through Karenni into that part of Burma known as Tenasserim, and gradually loses its plateau character.

Between the Arakan Yoma on the west and the Shan plateau on the east, lie the basin of the Irrawaddy and its great tributary, the Chindwin, and the basin of the smaller Sittang. This is for the most part a lowland area, with ranges of hills—of which the Pegu Yoma is the most important—running from north to south. Almost in the centre the extinct volcano of Mt. Popa reaches nearly 5,000 ft. above sea level. The Arakan coast of Burma is Pacific in type; it is rocky and dangerous, backed by high mountains and fringed by islands. Of the islands, Ramree and Cheduba are the largest. The Tenasserim coast is similar; in the south is the Mergui archipelago. Between the Arakan and Tenasserim coasts lies the low delta of the Irrawaddy and Sittang rivers.

Most of the hilly and mountainous regions were formerly forest covered, and over large areas have good, fertile forest soils. Where clearings have been made, temporary cultivation has destroyed the virgin richness of the soil. In the wetter regions the heavy rains often entirely wash away the soil from cleared hill sides and expose the bare rock. The limestone rocks of the Shan plateau are usually covered by a thin red soil from which the lime has been entirely leached out. The richest soils in the province are the alluvial soils of the flat Irrawaddy delta and the broad river valleys. Excellent loamy soil is also afforded by the mixed clays and sands of the Peguan rocks, but the Irrawaddian and other sandy series give rise to extensive tracts of very light soil, almost pure sand. In the wetter parts of Burma, owing to the well marked dry season, a thick mantle of lateritic soil stretches over most of the lowland tracts.

Climate.—Burma forms part of the great monsoon region of Asia, but its climate is profoundly modified by the relief of the country. There are really three seasons; the cool season, which is also rainless, sets in towards the end of October and lasts till February, the hot season (rainless) from March to the end of May or early June and the rainy season from June to October. October is an unpleasant month; the rains have almost ceased, but the temperature and humidity are high. Along the coast, and especially in the south (Tenasserim), both the daily and annual range of temperature are small. In Moulmein the annual range is 8°; in Rangoon it is 10°. Away from the moderating influence of the sea, the range of temperature increases greatly, and is especially large in the dry belt. The annual range in Mandalay is 20°. The average temperature in the south of Burma is 80°.

From October to May Burma is under the influence of the north-east trade wind or the north-east monsoon as it is more often called. The north and south alignment of the mountains causes this wind to blow almost directly from the north. It is a cool wind, but decreases in intensity towards the end of the dry season. The change to the south-west monsoon is heralded by thunderstorms toward the end of May, but the rains do not usually break until early in June. The south-west monsoon, blowing as it does from the Indian ocean, is the rain-bearing wind. A glance at a physical map will show that the coastal districts receive the full force of the wind, and a heavy rainfall in consequence. Most of Arakan has nearly 200 in. (5,120 mm.) of rain. Rangoon enjoys an annual fall of 99.1 in. (2,537 mm.). The heart of Burma lies in the lee of the lofty Arakan Yoma and the rainfall is scanty—as little as 20 in. in the heart of the dry belt. Mandalay lies in this dry region and receives an average of 33.4 in. (855 mm.). Owing to its elevation, the Shan plateau has a moderately good rainfall.

Rivers and Lakes.—The rivers of Burma fall into three groups. There are numerous short, rapid streams, such as the Naaf, Kaladan, Lemru and An, which flow down from the Arakan Yoma into the Bay of Bengal. The centre of Burma is drained by the Irrawaddy (*q.v.*) and its tributaries, and by the Sittang. The Shan plateau is drained mainly by the Salween (*q.v.*) and its tributaries; in Tenasserim there are again a number of short, rapid rivers flowing from the hills into the Gulf of Martaban. The longest is the Tenasserim river.

The largest lake in Burma is a shallow stretch of water in the Federated Shan States, known as Inlé lake. It is the remnant of a much larger lake, is rapidly becoming smaller and occupies a hollow in the surface of the plateau. A large lake known as Indawgyi, is found in the north of Burma near Mogaung. It has an area of nearly 100 sq.mi. and, with the decreasing size of Inlé lake, should perhaps be given pride of place. It is surrounded on three sides by ranges of hills, but is open to the north where it has an outlet in the Indaw river. In all the lowland tracts there are numerous small lakes occupying deserted river meanders. In the heart of the delta numerous large lakes or marshes, abounding in fish, are formed by the overflow of the Irrawaddy river during the rainy season, but decrease in the dry season.

Vegetation.—The wide range of rainfall in Burma is responsible for great variations in the natural vegetation. Frost never occurs in the lowlands, but roughly above 3 000 ft. the occasional frosts have caused a great change in vegetation. Above that level, which may conveniently be called the frost line, evergreen oak forests, sporadic pine forests and wide areas of open land, with bracken and grass, are the rule. Rhododendron forests occur at high levels. Below the frost line the natural vegetation depends mainly upon the rainfall: *(a)* With more than 80 in. of rain, evergreen tropical rain forests occur. The trees of the forests are of many species, but more than one-half belong to the Dipterocarpaceae. The timbers are hard and little used. *(b)* With between 40 and 80 in. of rain are the monsoon forests which lose their leaves during the hot season. These forests are the home of the valuable teak tree, as well as the pyingado and other useful timber trees. *(c)* With less than 40 in. the forest becomes very poor and passes into scrubland and semi-desert. There is little or no true grassland. *(d)* Extensive areas of the Irrawaddy delta are clothed with tidal forests, in which some of the trees reach a height of over 100 ft , and are of considerable value.

The wasteful methods of the native cultivator have, in the past, resulted in the destruction of vast areas of valuable forest. The practice was to cut down and burn a tract of virgin forest, cultivate the field (taung-ya) so formed for two or three years while the pristine freshness of the soil lasted and then to desert it for a fresh tract. It is but rarely that the forest established itself again over the deserted taung-ya; more often the area became covered with a tangled mass of bamboo, bracken or grass. For more than half a century, however, the Forest Department has been at work, and all the valuable forests are constituted into government reserves. Reserves covered 31,637 sq mi. in 1939–40. Various privileges are accorded to the natives who live within the reserved area. The timber (mainly teak for constructional work and pyingado—*Xylia dolabriformis*—for railway sleepers) is worked either by the government or by lessees—public and private companies—under careful supervision. Extraction is so controlled that it shall not exceed regeneration. The output of teak in 1939–40 was about 400,000 tons.

Timber is fourth in importance among the exports of Burma, and for some years the annual exports have been more than 270,000 tons annually; worth more than £2,500,000. More than half Burma is forested.

Fauna.—The anthropoid apes are represented by two gibbons, and there are about a dozen species of monkeys. Tigers are still common throughout the province; leopards and several species of wildcat also occur. The Himalayan black bear and the Malayan bear are found in the hills. Bats are numerous and the huge flying fox is particularly common in several of the large towns. Amongst the hoofed quadrupeds, the elephant is still numerous in many of the denser forests, and numbers are caught annually in keddahs and trained for forest work. Two species of rhinoceros occur, but are now far from common. Among wild animals the *pyaung* or bison and *saing* or wild cattle are common. The small barking deer *(gyi)* is the commonest of the larger animals and is still abundant almost everywhere. The thamin, sambar and hog deer are also common. A licence is required for hunting most of the larger animals, and many of them enjoy a "close season." The half-wild pariah or "pi" dogs swarm in every village Among the numerous birds, the bright hued small parrots may be specially noted, and the ubiquitous paddy bird. Crows are exceedingly abundant and very bold. A characteristic lizard is the house gecko or *tauktè* (so called because it makes a loud croaking noise like "tauktè," repeated four to ten times). Snakes, including the python, are numerous.

Natural Regions.—For an adequate study of this large and varied territory, a division into at least seven natural regions is desirable: (1) The Arakan coastal strip is hilly or mountainous, has a very heavy rainfall and is covered with the remnants of a dense evergreen forest which has, however, been largely replaced by dense bamboo thickets This region is sparsely inhabited, and the population is concentrated round the principal town and port of Akyab. Communication with the rest of Burma is difficult, except by sea. The region coincides roughly with the districts of Akyab, Kyaukpyu, Sandoway and the western strip of Bassein. (*See* ARAKAN and AKYAB.) (2) The Tenasserim coastal strip is similar, but is of importance as the tin and wolfram producing region. Rubber plantations are increasing in importance. Moulmein is the chief town. The region coincides roughly with the districts of Mergui, Tavoy, Amherst, Thaton and Salween. (*See* TENASSERIM and MOULMEIN [MAULMEIN].) (3) The Western hills region consists of the mountainous, almost uninhabited, tracts of the Arakan Yoma and its hill ranges. Such districts as the hill district of Arakan, Pakokku hill tracts, Chin hills and Somra tract, lie wholly within this region. (4) The Northern hills region occupies the north of the country and includes the sources of the Irrawaddy and its principal tributary, the Chindwin. The region is as yet little developed. It includes the districts of Upper Chindwin, Myitkyina, Katha and most of Bhamo. (5) The dry belt occupies the heart of Burma. It is a flat and fairly thickly populated region, extensively cultivated and having some irrigated areas. The oil fields, with one exception, lie in this region. It coincides, roughly, with the districts of Lower Chindwin, Shwebo, Sagaing, Mandalay, Pakokku, Myingyan, Meiktila, Minbu, Magwe, Thayetmyo and Yamethin. (6) The deltas region, including the deltas of the Irrawaddy and Sittang rivers and the intervening forested ridge of the Pegu Yoma, is the most important and the most thickly populated part of Burma. It includes the districts of Hanthawaddy, Pyapon, Maubin, Myaungmya, most of Bassein, Henzada, most of Prome, Tharrawaddy, Insein, Pegu and Toungoo. (7) The Shan plateau was, until fairly recently, cut off in a remarkable way from the rest of Burma, and still preserves many distinctive features. The region coincides, roughly, with the Federated Shan States.

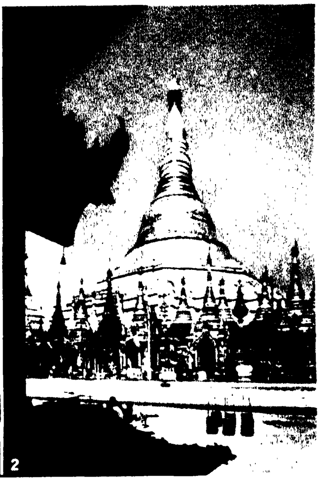
Burma is essentially a rural country. Only two towns have more than 100,000 inhabitants—Rangoon with 501,291 (1941), and Mandalay with 163,537 (1941). The smaller towns are river ports, collecting and distributing centres, or have achieved some importance from having been chosen as the headquarters of a district. The dry belt is the natural geographical centre of Burma and therein lie the old Burmese capitals—Pagan, Shwebo, Ava, Amarapura and Mandalay, with Prome on the southern borders of the dry belt.

Population.—Burma's population (1941 census) was 16,823,798.

Total Population of Burma over Comparable Area

Census year	Number	Increase %
1901	10,490,624	
1911	12,115,217	10.5
1921	13,312,192	9.1
1931	14,667,146	9.0
1941	16,823,798	13.1

The inhabitants of Burma belong to many races and speak many languages. In general, the native races are all Mongolians; the Burmese are the most advanced, and occupy the fertile low lands; some of the other races are restricted to the hills. Every year large numbers of Indians are attracted to Burma by the higher rates of wages, and the opportunities for trading and cultivation. A decreasing proportion of the Indian immigrants settle permanently. Burma is in the interesting position of being an underpopulated country, capable of considerable development, lying between two of the most densely populated countries in the world—India and China. It is believed that Burma has been populated by successive waves of migration from the north; indeed the advance of the Kachin races was still in progress when Burma was annexed to the British empire. The Burmese, including the closely allied Arakanese of the Arakan coast, the Talaings of the country around Moulmein, and the Tavoyans around Tavoy, number more than 11,000,000. The national dress is a cylindrical skirt, called a *longyi*, worn folded over in a simple fold in the front and reaching to the ankles. All Burmese, of both sexes, prefer silks of bright but delicate shades, and even the poorest possesses at least one silk *longyi*. The distinctive silk, woven in



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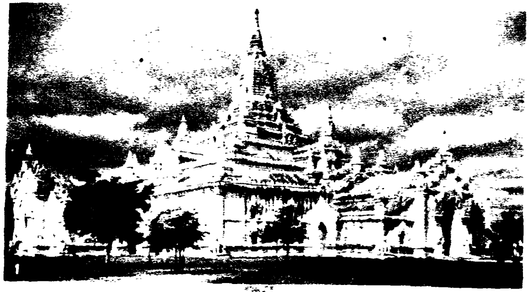
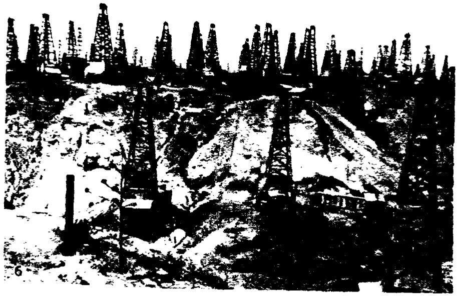
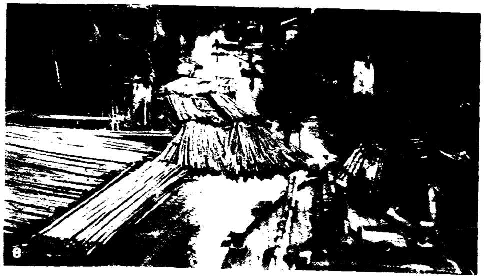
SCENES OF BURMESE LIFE

1. Rice from the mills being handled by labourers for distribution throughout Burma
2. Shwe Dagon pagoda, of Rangoon, the finest in Indo-China and a mecca for pilgrims from all parts of the country
3. Burmese hpongyi or priest, with the prescribed shaven head and yellow robe
4. Elephants stacking logs in the timber yards of Rangoon
5. Hindu women drawing water from a primitive well near Rangoon
6. Burmese women with pottery for sale at Mandalay
7. Threshing grain in Burma; water buffalo or oxen are used to trample the grain

BURMA







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BURMESE LIFE AND INDUSTRY

1. The Ananda Pagoda, in Pagan, a town on the Irrawaddy river
2. Bullock cart, customary means of travel on a country road
3. A market in Rangoon. Most of the retail trade of the city is carried on in these markets, which are social centres also
4. Women drawing buckets of oil from open well at Yenangyaung
5. Burmese well, Yenangyaung, showing crude windlass run by hand
6. Oil field, Yenangyaung. Law compels commercial companies to drill in circular spaces. Natives dig between circles
7. Burmese girls of Rangoon smoking native cigars or cheroots
8. Bamboo rafts on a tidal creek in the Irrawaddy delta
9. Women working ropes to lower diggers into native wells. Others are operating a fan mill which supplies the well with air

the district round Mandalay, is still in general use. The *longyi* is worn by both sexes, the men wear also a single breasted short jacket of sombre hue, called an *aingyi;* the women's garment is similar but double breasted and usually white. The older generation of Burmese men wear their straight black hair long, tied in a knot on one side of the head. It is now not uncommon to cut the hair in European style. The men's headdress is a *gaungbaung*—a strip of brightly-coloured thin silk wound round the head. The women oil their long tresses with coco-nut oil and coil them in a cylindrical coil on the top of the head.

The Burmese are Buddhists, and their religion occupies a large place in their life. The spiritual head of every village is the yellow-robed *hpongyi,* or monk. The monastery, or *hpongyi-kyaung* just outside the village walls—most Burmese villages are surrounded by a fence against wild animals and robbers—is also the village school. Every village has its pagoda, a silent reminder of the precepts of Buddha, and the whitewashed pagodas crown almost every hill, but there are no temples in the ordinary sense of the word. As a result of the numerous village schools, the percentage of wholly illiterate men is small. The women are more industrious and businesslike than the men, but their school education has been neglected. The Burmese women enjoy an amount of freedom unusual in non-European races. As a whole the Burmese are characterized by cleanliness, a sense of humour and a love of sport, but fond of a life of ease and good living. The various hill tribes are, in general, less advanced than the Burmese. The most advanced are the Karens, who inhabit the Irrawaddy delta, the Pegu Yoma and the native states of Karenni and the eastern Toungoo hills. The Shans occupy most of the Shan plateau and are also found in the upper part of the Chindwin valley. The Kachins belong mainly to the north and northeast, the Chins to the western mountains, while on the Chinese borders are found the Palaungs, Was, etc. Some of the latter are still addicted to the barbarous practice of head hunting. All the hill tribes of Burma are non-Buddhists, being for the most part Animists. Christianity has made rapid strides among them, especially among the Karens.

Burmese woman in ordinary dress of bright silk skirt and white jacket

The Indians have settled mainly in the delta regions, in Arakan and along the rivers and railway lines. Except in the remoter districts, Indians supply nearly all the coolie labour, while the easy-going habits of the Burmese often result in his falling into the clutches of the Indian moneylender. There are now roughly 1,000,000 Indians in Burma, drawn mainly from Madras, Bihar, Orissa and Bengal. The Chinese form an important community. Except on the border in the northeast, where the Yunnanese and Chinese Shans are found, the Chinese belong essentially to the artisan and merchant classes, and make excellent law-abiding citizens.

Europeans, mainly English and Scotch, number about 10,000; very few can be regarded as permanent residents. Eurasians (now officially termed Anglo-Indians) number about 19,000. The Anglo-Indians find employment as clerks, in minor administrative capacities, and on the railways.

Religion.—The chief religious principle of the Burmese is to acquire merit toward *Neikban* (Nirvana) by good works done in this life. The bestowal of alms, offerings of rice to priests, the founding of a monastery, the erection of a pagoda or the building of a rest house (*zayat*) for travellers, are all works of religious merit. An analysis shows that less than two in every thousand Burmese profess Christianity, and there are one per thousand of Mohammedans among them. It is admitted by the missionaries themselves that Christianity has progressed very slowly among the Burmese in comparison with the rapid progress made among the Karens. It is among the Sgaw Karens that the greatest progress in Christianity has been made, and the number of Animists among them is very much smaller. The number of Burmese Christians is considerably increased by the inclusion among them of the Christian descendants of the Portuguese settlers of Syriam deported to the old Burmese Tabayin, a village now included in the Ye-u subdivision of Shwebo. These Christians returned themselves as Burmese. The forms of Christianity which make most converts in Burma are the Baptist and Roman Catholic faiths.

Education.—Government schools are of two kinds: English schools, mainly for Anglo-Indians; and Anglo-vernacular schools, in which the medium of instruction is English in the upper standards, and the vernacular in the lower. Recognized colleges and schools numbered 7,639 in 1938, with 568,037 pupils. There were also 18,436 nonrecognized monastic schools, with 212,975 pupils. The University of Rangoon comprising two arts colleges, and an engineering college, a medical college and teachers' training school were added in 1929 and 1931. There are, in addition, a technical institute and veterinary college at Insein, a forest school at Pyinmana, and an agricultural college at Mandalay.

The Burmese language is a monosyllabic, agglutinative language, more closely allied to Chinese than to the Indian languages. A single syllable may have several meanings, according to the tone used or to the way in which the syllable is stressed. Many dialects and languages belonging to the Burmese group are distinguished, quite apart from the entirely distinct languages spoken by the Shans, Kachins, Karens and other hill tribes. Burmese and English are the official languages. Hindustani is widely spoken wherever Indian labour is employed.

Languages Spoken in Burma, 1931
(Distribution of total population by race groups, classified by language)

	No. of persons	No. per 10,000 of population
Tibeto Chinese Family:		
A. Burma group	9,862,604	6,733
Burmese	8,841,760	6,036
Arakanese, etc.	844,407	578
Danu, Intha, etc.	140,735	96
Atsi, Lashi, Maru, etc.	35,702	25
B. Lolo-Muso group	93,052	64
C. Kuki-Chin group	343,854	235
D. Naga group	4,201	3
E. Kachin group	153,897	105
F. Sak group	35,237	24
G. Mishmi group	..	..
H. Mro group	14,094	10
I. Tai group	1,021,017	698
J. Chinese group	17,831	122
Austric Family:		
K. Malay group	6,368	4
L. Mon group	305,204	208
M. Palaung *Wa* group	176,024	120
N. Khasi group	..	..
Karen Family:		
O. Karen group	1,341,066	916
Man Family:		
P. Man group	947	1
Total of indigenous languages (including Chinese)	13,536,961	9,242
Total of non-indigenous languages (Indian, European and other languages)	1,110,536	758
	14,647,497	10,000

Note: There is an increasing tendency for Burmese to become the language of people belonging racially to such groups as Kuki-Chin, Kachin and Tai.

The Burmese adopted alphabets borrowed from the old, rock-cut Pali of India. Thus their alphabet, their religion and a considerable number of words, are of Indian origin. Burmese music is distinctive; their melodies are mainly composed of the five notes, C, D, E, G, A; they do not use semitones, so the chromatic scale is unknown. Music is essentially associated with the drama. Characteristic instruments include the *kyi-waing*, a series of gongs cast out of bell metal, arranged in a circular frame of stout cane and the *saing-waing*, composed of 18 cylindrical drums hung from a circular frame.

Government.—The divisions of Arakan and Tenasserim were annexed to the British empire after the First Burmese War in 1826; Pegu after the Second Burmese War in 1853. These three divisions constitute Lower Burma. Upper Burma was annexed in 1886 after the Third Burmese War. As a province of India, Burma came under the Central Government of India, and so under the secretary of State for India in London. At the head of the Provincial Government of Burma was the governor. In accordance with the policy of the British government in giving a large measure of self-government to the native races of India, native ministers, since Jan. 1923, played an important part in government. An excellent summary of the former form of administration is given in the *Report on the Administration of Burma for the Year 1921–22.* With effect from Jan. 2, 1923, the province of Burma was constituted a governor's province under the Government of India Act, 1919. The executive authority of the government vested in a governor in council in respect of a small number of subjects known as reserved subjects, and in the governor acting with ministers in respect of subjects known as transferred subjects. The governor and the two members of his executive council (one of whom must have been for at least 12 years in the service of the Crown in India) were appointed by the King by warrant under the royal sign manual. The ministers also numbered two, and were appointed by the governor from among the non-official elected members of the Legislative Council. The principal transferred subjects dealt with by the ministers (normally natives of Burma) included local self-government, medical administration, public health, education, public works, agriculture, forests, etc. The Legislative Council consisted of 103 members, of whom two were members of the Executive Council, 79 were elected by the popular franchise, and 22 were nominated by the governor. Of the 22 nominated members not more than 14 might be officials. In order to secure adequate representation of Indian and other minorities out of the 79 constituencies there were eight of Indian urban communities, five of rural Karen communities, eight of European and Anglo-Indian (Eurasian) communities, and six special constituencies, such as the university. The remainder were ordinary rural or urban constituencies. The legislative authority of the council extended over the province of Burma, with the exception of the "backward tracts," later styled "excluded areas." The council might not impose any new taxes or deal with matters which were the concern of India as a whole, but otherwise might repeal or alter, as to the province of Burma, any law made by any authority in British India. The annual estimates of provincial revenue and expenditure were laid before the council and, subject to certain safeguards in respect of reserved subjects, funds for proposed expenditures were voted by it. In addition to his authority over the province of Burma, the governor also exercised political control over Karenni, a tract consisting of several petty states between Burma and Siam.

The province was divided into eight divisions, each in charge of a commissioner: Arakan, Pegu, Irrawaddy, Tenasserim, Magwe, Mandalay, Sagaing and the Federated Shan States. The commissioners were responsible to the governor in council, or to the governor in the case of the Shan States, for the working of every department of the public service except the military department and part of the judicial department. The divisions were further divided into about 40 districts each in charge of a deputy commissioner. Deputy commissioners performed the functions of district magistrates, collectors, registrars and sometimes of district judges. Subordinate to the deputy commissioners were assistant commissioners, extra assistant commissioners and *myoôks*. The *myoôks* or township officers were drawn from the ranks of the subordinate civil service and were the ultimate salaried representatives of government who came into most direct contact with the people. The extra assistant commissioners were members of the Burma civil service (class II); higher officials were mostly members of the Indian civil service or Burma civil service (class I). Finally there were the village headmen or *thugyis*, chosen by the villagers and approved by government, who had limited magisterial powers and collected the land, capitation and house taxes.

On April 1, 1937, Burma was separated from India and placed directly under the crown, with a governor (Sir Archibald Cochrane) and a legislature of its own. Its constitution is incorporated in the Government of India Act of 1935. The legislature consists of a senate of 36 members (18 elected by the house of representatives and 18 nominated by the governor), and a house of representatives of 132 elected members; and the administration is in the hands of a premier and ministers not exceeding 10 in number. To aid him in the administration of subjects outside the purview of the legislature, *i.e.*, defense, external affairs, excluded areas, etc., the governor could appoint three counsellors.

The governor is assisted also in matters affecting the financial stability of the country, finance and monetary policy by a financial adviser. An advocate-general assists the government in dealing with points of law.

Two financial commissioners exercise control over various departments, such as land revenue, settlements and land records, excise (including opium and salt), customs, agriculture, co-operation, veterinary and the Rangoon Development Trust.

The Shan States (62,000 sq.mi.) are within the administrative area of Burma, but are managed by their own chiefs under the supervision of a commissioner.

The same official also advises the chiefs of the feudatory Karenni States.

The high court of judicature at Rangoon was established in 1922. It consists of a chief justice and nine other judges. The Public Works Department is under the control of chief engineers for buildings, roads and irrigation. The police department is under the control of an inspector general; the frontier force (used in frontier tracts) under an inspector general. The forest department is administered by a chief conservator of forests and the territory is divided into a number of "circles," each under a conservator, assisted by officers of the Burma, provincial and subordinate forest services. (*See* SHAN STATES.) For Burmese law *see* INDIAN LAW.

Agriculture and Industries.—Burma is essentially an agricultural country. According to the 1931 census 30% of the total population declared cultivation to be their principal occupation and only 15.20% of the people were classed as urban, this figure including a large proportion of non-Burmese. Agriculture is concentrated on the alluvial lands of the delta, and the valleys of the Irrawaddy, Chindwin, and Sittang. Two-thirds of the cropped area is occupied by rice, the production of which averages more than 6,000,000 tons per annum, or just under half a ton per inhabitant. There is therefore a considerable export surplus. Where the rainfall is less than 40 in., rice cannot be grown without irrigation, and in the dry areas sesamum, millet, cotton and groundnuts are the chief crops. Over 1,500,000 acres are irrigated, chiefly by canals. At the time of the British annexation of Burma there were some old irrigation systems in the Kyaukse and Minbu districts, which had been allowed to fall into disrepair, and these have now been renewed and extended. In addition, the Mandalay canal, 40 mi. in length, with 14 distributaries, was opened in 1902; the Shwebo canal, 27 mi. long, was opened in 1906, and later two branches 29 mi. and 20 mi. in length; and the Mon canal, 53 mi. long, was started in 1904. Nearly 1,500,000 acres are devoted to fruit, vegetable and tobacco growing, and 500,000 acres are under cotton. Some 20,000,000 acres of land are classed as cultivable waste, as against 21,500,000 acres of "occupied" land. Out of about 17,500,000 acres cultivated (exclusive of the Shan States) the areas sown with the principal crops and matured are:

	1921–22	1940–41
	Acres	Acres
Rice	10,702,000	12,518,500
Sesamum	1,034,000	1,353,000
Millet	840,000	450,000
Groundnuts	306,000	780,600
Cotton	310,000	418,250

During the last few years, the number of rubber plantations has increased in spite of restrictions on output. Burmese production of crude rubber has reached an annual average of 9,000 tons, the main producing areas being Mergui and Tavoy.

Small humped oxen are kept everywhere as beasts of burden and for use in plowing. They are replaced to a considerable extent in the delta and wetter areas by the heavier water buffalo. Herds of small goats are numerous in the dry belt, and small numbers of very poor sheep are reared.

Fisheries and fish-curing exist both along the seacoast of Burma and in inland tracts, and afforded employment to 65,000 persons in 1931. Salted fish forms, along with boiled rice, one of the chief articles of food among the Burmese. A little mother-of-pearl is gathered in the Mergui archipelago.

The mineral wealth of Burma is considerable, but in many cases little developed, and owing to recent price fluctuations output has tended to decline. Petroleum is the most important mineral, and production during the last few years has been as follows:

1909–13 average	236,500,000 gal.
1916–20 average	282,600,000 gal.
1921–25 average	270,500,000 gal.
1931–36 average	260,500,000 gal.
1939	275,673,000 gal.

(240 gal.—one metric ton)

Extensive deposits of brown coal (lignite) occur, chiefly in the Chindwin valley and in old lake basins in the Shan plateau, but production has been negligible, and ceased entirely in 1926. Oil shale is also found in the latter region. Silver-lead ores occur at Bawdwin, in the northern Shan States, and the exploiting company, the Burma corporation, produced 6,175,000 oz. of silver and 76,000 tons of lead in 1939. There are deposits of tin and tungsten at Tenasserim and Yamethin, and 5,441 tons of tin and 4,342 tons of wolfram (tungsten ore) were produced in 1939; also 5,564 tons of mixed tin and wolfram concentrates from Karenni. The Burma ruby mines, after many vicissitudes, went into liquidation in 1925–26. The famous jade of China is found in the north of Burma, and exported overland to China via Mogaung and Bhamo. The mines are situated beyond Kamaing, north of Mogaung, in the Myitkyina district. The miners are all Kachins, and the right to collect the jade duty of 33⅓% is farmed out by the government to a lessee, who has hitherto always been a Chinese. The amount obtained has varied considerably. The value of the jade varies enormously according to colour, which should be a particular shade of dark-green; but semitransparency, brilliancy and hardness are, however, essentials. About 100 tons per annum were produced between 1931 and 1937, the best quality jade coming from the old river mines. Large quantities are produced by the open cuts on the top of the hill near Tawmaw, but the quality is inferior.

Other minerals found in Burma are: copper matte (avge. ann. prod. 1935–39, 7,600 tons); iron ore (avge. ann. prod. 24,000 tons); nickel (avge. ann. prod. 3,800 tons); and zinc (avge. ann. prod. 70,000 tons). Gold is found in many rivers of Upper Burma, but exploitation is spasmodic, and after 1930 the annual production averaged 50 oz. Amber is found in the Hukawng valley, but is of poor quality. Salt is manufactured at various places on the coast, also a little in Upper Burma.

Communications.—From time immemorial the principal highway of Burma has been the Irrawaddy (*q.v.*) and its tributaries. Even at the present day the railways tend to supplement rather than replace the rivers as highways of trade. The railways, all of metre gauge and 2,059 miles in length (1940), were taken over by the government in 1929 and since separation belong to the Burma government. The main line runs from Rangoon to Mandalay, crosses the Irrawaddy by the Ava bridge (1934) and continues to Myitkyina. There is no railway connection with India, nor with any other country, and Yenangyaung, the centre of the oil fields, is still only accessible by river. There are only 6,811 miles of metalled roads and 5,661 miles unmetalled and motorable in Burma, so that the country is in great need of more roads, which are scanty over much of the country. Outside Rangoon, Mandalay and Kalaw, there are no hotels; but there are houses, built primarily for the use of government officials on tour, where the traveller may obtain shelter for a nominal payment. Most of the smaller villages of Burma consist of a collection of from a dozen to 100 or more huts built of timber uprights and bamboo. The villages are surrounded by a bamboo or wooded stockade—mainly as a protection against wild animals. While the civil head of the village is the *thugyi,* or headman, chosen by the villagers and recognized by the government, the spiritual head of the village is the senior *hpongyi* of the neighbouring *hpongyi kyaung.* Larger villages or towns arise as collecting or distributing centres, or have important bazaars. In many cases their importance has been enhanced by their having been made the administrative headquarters of a district or a division. A large number of the more important towns are river ports.

The staple industry of Burma is agriculture, but many cultivators are also artisans in the by-season. In addition to rice growing, the felling of timber, and the fisheries, the chief occupations are rice husking, silk weaving and dyeing. The most important of the nonagricultural manufacturing industries is that connected with the working and refining of oil. The principal refineries are at Syriam, near Rangoon. The introduction of cheap cottons and silk fabrics has dealt a blow to hand weaving, while aniline dyes are driving out the native vegetable product; but both industries still linger in the rural tracts. The best silk weavers are to be found at Amarapura. The total number of persons engaged in the production of textile fabrics in Burma, according to the census of 1931, was 233,208, against 419,007 in 1901. The chief dye product of Burma is cutch, a yellow dye obtained from the wood of the *sha* tree. Cutch boiling forms the chief means of livelihood of a number of the poorer classes in the Prome and Thayetmyo districts of Lower Burma, and a subsidiary means of subsistence elsewhere. Cheroot making and smoking is universal with both sexes. The chief arts of Burma are lacquer working (centred at Pagan), wood carving and silverwork. The floral wood carving is remarkable for its freedom and spontaneity. The carving is done in teakwood when it is meant for fixtures, but teak has a coarse grain, and otherwise *yamane* clogwood, said to be a species of *Gmelina,* is preferred. The tools employed are chisel, gouge and mallet. The design is traced on the wood with charcoal, gouged out in the rough, and finished with sharp fine tools, using the mallet for every stroke. The great bulk of the silverwork is in the form of bowls of different sizes, in shape something like the lower half of a barrel, only more convex, of betel boxes, cups and small boxes for lime. Both in the wood carving and silverwork the Burmese character displays itself, giving boldness, breadth and freedom of design, but a general want of careful finish.

The following table shows the progressive value of the trade of Burma since 1871–72 in lakhs of rupees (one lakh = Rs. 100,000).

Year	Imports	Exports
1871–72	316	378
1881–82	638	806
1891–02	1,050	1,267
1901–02	1,278	1,874
1909–14	2,499	3,619
1914–19	2,205	3,788
1919–24	3,795	6,027
1937–38	2,381	5,044
1940–41	2,955	5,537

Approximately 86% of the foreign trade of Burma passes through Rangoon (*q.v.*). Other leading ports are Bassein, a rice port on the west of the delta; Akyab, the outlet of Arakan; and Moulmein, Tavoy and Mergui, which serve the Tenasserim division. Of the export trade, well over one-half is with India, about one-third with other parts of the British empire, especially the home country and less than one-sixth with foreign countries. Of the import trade about two-thirds is with India and only one-fifth with foreign countries outside the British empire. The principal exports are rice, petroleum products, timber, cotton, hides and skins, metals and ores, beans, rubber and lac. The export of rice varies between 3,000,000 and 3,500,000 tons, and in 1940–41 represented about half of the total exports. The principal imports are cotton goods, machinery and hardware, coal, silk and sugar. The currency in Burma is that in use throughout India, but the common unit of weight is the Burmese viss (3-6 lb.).

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The most important papers dealing with the geology of Burma will be found in the *Records* and *Memoirs* of the Geological Survey of India and in the *Transactions* of the Mining and Geological Institute of India. Climate: *The Rainfall of India* (annual); *Season and Crop Report* (annual). Vegetation: L. D. Stamp, *The Vegetation of Burma* (Calcutta, 1925). Population: *Census of India*, vol. xi. (1931), report and tables; Fielding Hall, *The Soul of a People;* Jesse Tennyson, *The Lacquer Lady*. Statistics, etc.: *Annual Reports* issued by the Provincial Government on Administration (general information), Season and Crops, Sea-borne Trade, Overland Trade, Shan States, Public Instruction and Forest Administration. *See* also annual publications of the government of India. Maps: Carte internationale au millioneme. The Survey of India publishes maps on the scale of 1 mi. to 1 in., old and new series, 2 mi. to 1 in., 4 mi. to 1 in, 16 mi. to 1 in., and 32 mi. to 1 inch.

HISTORY

The earliest history of Burma is mainly conjectural. It is believed that the aborigines were a Negrito race of which the only survivals are to be found in the Andaman islands, once part of the mainland. The present inhabitants of Burma are descendants of different Mongolian tribes, which migrated at a remote period from western China and Tibet, by the Irrawaddy and Salween rivers and penetrated into Arakan. The Tais or Shans spread over the Shan States and Siam, on both sides of the Chinese frontier, and encroached into Burma proper. The Krans went off into Arakan, the Pyus established a kingdom at Prome, and the Mons or Talaings in Pegu. Immigrants came from Chittagong, into Arakan, from Manipur into Upper Burma, and from Madras and Malaya into Pegu and Tenasserim. The Hindu mythology ousted Mongolian traditions, but Buddhism, subdued by Brahminism in India, in its turn overcame Brahminism in Burma, and through its wonderful monastic system has directed the religious lives of the people for some 2,000 years. Legend and fable, in which innumerable tribal chiefs figured as mighty kings, only gave way to authenticable history when King Anawrata (a contemporary of William the Conqueror) founded the Pagan dynasty in A.D. 1054. He and his ten successors were the first real rulers of Burma. He expelled the debased Ari priesthood and forcibly imported the purest form of Buddhism, monks and scriptures from its seat at Thaton. The Ananda, the gem of the Pagan pagodas, was built in the reign of Kyanzittha (1084–1112). The Pagan dynasty included pious sovereigns like Htilominlo (1210–34), and his son, Kyaswa (1234–50), but the later sovereigns degenerated, and the last of them—Narathihapate—earned the vengeance of Kublai Khan and lost his kingdom in 1287 by the execution of three distinguished ambassadors with their retinues sent by the emperor of China.

The Shan Dominion (1287–1531).—Under the Shan irruption chaos supervened, and for two and a half centuries Burmese history is a confused record of princes and upstarts, Talaings, Shans and Burmese constantly contending for the mastery, petty kingdoms rising and falling at Ava, in Pegu, at Toungoo, and in Arakan. Among the more famous of the Pegu kings was Razadarit (1385–1423), a man of blood and treachery. A daughter of his, Shinsawbu (1453–72) and Dammazedi, a monk who turned layman and married her daughter, ushered in a period of comparative peace, recorded as the Golden Age of Pegu. It was during this epoch that the famous Shwe Dagon pagoda of Dagon (Rangoon) was twice heightened and enriched, but still barbarous practices continued. The dynasty was overthrown by the house of Toungoo in 1531, which re-established a Burmese kingdom.

The Toungoo Dynasty.—Toungoo began as a stronghold for Burmese refugees against Shans and Talaings alike in 1280, and was ruled by 28 chiefs in all, of whom 15 perished by assassination. The last of the house, Tabinshwehti (1531–50), with the aid of his brother-in-law, the famous general, Bayinnaung, captured Prome and Martaban, invaded Arakan, captured Pegu, attacked Siam, and was finally crowned at Ava, the Shan chiefs being ousted from Upper Burma. Bayinnaung (1551–81), who succeeded, had first to fight for his kingdom, then carry on a career of conquest. He captured the old Siamese capital of Ayuthia, subdued the Shan States and half Siam, and reigned over the whole of Burma, except Arakan. He exchanged missions with Bengal and Colombo, from whom he obtained a daughter and a sacred Tooth, but his enormous conscriptions of men and constant warfare reduced his own province almost to desolation. His son, Nandabayin, who followed in his footsteps, completed the ruin. The Siamese invaded Burma, and the Arakanese raided and burned Pegu. The king was deposed and murdered, and for 16 years the kingdom was again split into petty States, some of which, including Ava, were retained by sons of Bayinnaung. A grandson of that monarch, Anaukpetlun (1605–28) reconquered the depopulated south, sacked the port of Syriam, and impaled its Portuguese governor, de Brito. He restored the monarchy and set up his court at Pegu. He commanded both the terror and the admiration of his subjects. The successors of Anaukpetlun retired to Ava, and the monarchy became increasingly effete, though Thalun (1629–48) was a patron of learning. For about a century a series of weaklings nominally reigned at Ava. During this period Upper Burma was twice over-run by the Ming and Manchu Chinese, and five times by the Manipuris. Ava's authority over Pegu constantly diminished until in 1740 the Talaings set up a king of their own, and in the course of ten years had over-run the country round Ava. Against this unnatural Talaing supremacy a leader was found in a headman of Shwebo, Alaungpaya, who founded the last dynasty of Burmese kings.

The Alaungpaya Dynasty.—Alaungpaya (Alompra), beginning with the defeat of small bodies of troops sent to capture him was eventually able to establish himself as king. His energy was marvellous, for, though he reigned for eight years only (1752–60), in that period he had reconquered the whole country, captured Syriam, seized and sacked Pegu, defeated the Manipuris, completely subjugated the Talaings, established himself in Rangoon, and invaded Siam. The Talaings who survived fled to Siam, and the Delta was again depopulated. While investing the Siamese capital, Ayuthia, for the fifth time in its history, he was stricken with illness, and, retiring by forced marches, died on the way.

Early European Contact with Burma.—In the century that ended with Alaungpaya the earliest European contact with Burma was that of the Portuguese, many of whom settled in the country and married Burmese wives. The Portuguese adventurer, de Brito, was left as governor of Syriam by the invading Arakanese, and Portuguese half-breeds formed contingents in some of the contending armies, these and Armenians being found in considerable numbers in the sea-ports. The British and Dutch East India Companies had branches in Burma under junior representatives from about 1627, but both of them withdrew some 50 years later. In 1709 the British re-established a factory at Syriam, which lasted till 1743, when the Talaings burned it down, suspecting that the English were aiding the Burmese. The English factory was then moved to Negrais and it was there that the settlement and garrison were treacherously massacred in Alaungpaya's reign in 1759, on the pretext that they had helped the Talaings. The company unsuccessfully sent Captain Alves as an envoy to demand redress. When Dupleix sent two ships to save Syriam, besieged by Alaungpaya, all the French officers were executed. The guns and the crews of the ships were a valuable accession to Alaungpaya's military strength, and these European gunners were given a place of honour in his armies. There were many instances in which ships were seized and their crews enslaved. But in all these years the European governments concerned were much too occupied with other commitments to exact serious retribution for outrages against their subjects.

Alaungpaya's Successors.—Alaungpaya was succeeded by his eldest son, Naungdawgyi, who, after three years, was succeeded by his brother, Hsinbyushin (1763–76), who again made Ava the capital. He raided Manipur in person, carrying away thousands of its population into captivity, attacked Siam and eventually captured Ayuthia. This campaign was followed by a Chinese invasion, which the Burmese armies took four years to repel. A Siamese rising resulted in the Burmese being driven across the frontier. On the death of Hsinbyushin his son, Singu, reigned for six years only and was then murdered. The throne was seized by Bodawpaya (1782–1819), a son of the great Alaungpaya, who shifted his capital to Amarapura, and annexed Arakan. He carried off 20,000 Arakanese into captivity, with the famous Mahamuni Buddha, which is now the Arakan pagoda at Mandalay. This subjugation was a contributory cause to the first Burmese war. The tyranny exercised over the defeated Arakanese, who were constantly dragged off in numbers to forced labour or military expeditions, provoked acts of rebellion entailing ruthless repression. Insurgent leaders took refuge in Chittagong and planned acts of war against the Burmese, leading to demands for their surrender as rebels. The indignities with which British envoys and missions to the Burma court were treated, merely served to increase the arrogance of the Burmese ruler. Manipur and Assam were once more over-run, and their inhabitants deported, enslaved or massacred. When Bodawpaya died, his dominion, except on the Siamese side, extended further than ever before. His grandson, Bagyidaw (1819–37) succeeded. The British government in India were incredibly patient until in 1824, Burmese troops moved across over the Cachar frontier. In March, the viceroy notified a state of war and the first British transports arrived at Rangoon. This first Burmese war of 1824 was terminated by the Treaty of Yandabo, 1826, the cession of Arakan and Tenasserim, the abandonment of all claims upon Assam and Manipur, and the payment by instalments of a crore of rupees. The two ceded territories were administered by commissioners as appanages of Bengal. The Yandabo Treaty provided for a resident at the court of Ava, but it was not till 1830 that Major Burney was sent there. Burney established some influence with the court, but was never properly received by the king. Bagyidaw became melancholy mad, and in 1837 was superseded by his brother, Tharawadi (1837–46). Although Tharawadi refrained from the usual massacre of kinsmen on his accession, in deference to Burney's exhortations, Burney's successors were treated ignominiously, and in 1840 the mission was withdrawn. A rebellion of the Shan States, mercilessly repressed, and a final uprising by the Talaings in Pegu, gave Tharawadi an excuse to return to the old atrocities. Before long he became so mad and outrageous in his doings that in 1845 his eldest son, Pagan Min, put him under restraint, and on his death succeeded to the throne (1846–53). Pagan Min was avaricious and immoral. The governor of Rangoon, Maung Ok, was notorious for his extortions. British ships having suffered greatly a small squadron was sent to Rangoon to demand redress and the removal of the governor. Pagan was defiant, and sent new governors with armies of several thousand men to Rangoon, Bassein and Martaban. British ships were fired upon, and Lord Dalhousie sent a stern ultimatum, expiring on April 1, 1852. No reply arriving, the second Burmese war began. The Burmese resistance was feeble, and on Dec. 20, 1852, Lord Dalhousie proclaimed the annexation of the Pegu province. In the meantime a revolution had taken place and Pagan had been deposed by his brother, Mindon Min (1853–78). The First Commissioner of Pegu, Captain, afterwards Sir Arthur Phayre, took a mission to Amarapura to negotiate a commercial treaty. He was received politely, but the treaty was not secured. In 1857 Mindon shifted his capital to Mandalay, and occupied himself with civil reforms, substituting salaries to officials for the periodical levies which were hitherto the custom. The salaries were seldom paid. In 1862 the several British territories were constituted the Province of British Burma, Phayre being the first chief commissioner. He succeeded in negotiating a commercial treaty, but the royal monopolies in which Mindon specialized stood in the way and evasions became so notorious that Phayre's successor, Colonel Fytche, negotiated a second treaty, but without much practical effect. Mindon had two minor rebellions of princes to suppress, but in the absence of foreign wars devoted himself to pious works. He also sent a mission to Rome, Paris and London; treaties were concluded with Italy and France, the former being purely diplomatic, but the latter gave too many rights to France and Mindon refused to ratify it. Mindon, a humane king, died in 1878, genuinely mourned by his people.

Thibaw (1878–1885):—The End of the Burmese Monarchy.—The last of the kings of Burma owed his selection to the ambition of the Alenandaw queen, a masterful and ferocious lady, whose daughter, the notorious Supayalat, he married. While Mindon was dying the rival princes had been treacherously arrested, and they were kept imprisoned for over two years. On Feb. 15, 1879, the usual massacre of princes began. Mandalay had by this time become an Alsatia for all sorts of foreign riff-raff, strongly anti-British in their ideas, who misled the court into thinking that the affair would blow over. For the time being action was not taken, but the cup was filling up, and in 1879, after various incidents of Burmese truculence against British subjects had occurred, the resident and his whole staff withdrew from Mandalay. Thibaw sent envoys to Thayetmyo in 1879, and another one to Simla in 1882, whom he recalled. In the meantime Thibaw was intriguing with the French Consul, M. Haas, and contracts for a French Railway to Mandalay, and a French flotilla on the Irrawaddy, were actually signed. Disturbances broke out in various parts of Upper Burma, and a fresh massacre of political prisoners under cover of a bogus jail outbreak added to the excitement. The Bombay-Burma Trading Corporation was arbitrarily fined Rs. 230,000 for alleged breaches of contract. It was not until Oct. 1885, that an ultimatum was sent, to which Thibaw gave an evasive and defiant reply, issuing a Proclamation calling upon his subjects to unite and annihilate the English barbarians and conquer and annex their country. The British Expeditionary Force, under Sir Harry Prendergast, crossed the frontier on Nov. 4, proceeding up the Irrawaddy, and by the end of that month Thibaw and his family had been deported to India, and the kingdom of Burma had ceased to exist, annexation being proclaimed by Lord Dufferin on Jan. 1, 1886.

Burma Under British Rule.—Burma remained a chief commissionership under Sir Charles Bernard, Sir Charles Crosthwaite, Sir Alexander Mackenzie, and Sir Frederick Fryer, the last becoming the first lieutenant-governor, in 1897. He was followed by Sir Hugh Barnes, Sir Herbert Thirkell-White, and Sir Harvey Adamson. In 1915, Sir Harcourt Butler succeeded for two years, when he was translated to the United Provinces. When Sir Reginald Craddock, the last lieutenant-governor, ended his term in 1922, Sir H. Butler returned as first governor under the new Constitution.

These successive changes in the status of the head of the province corresponded roughly with stages in the development of Burma, when Arakan and Tenasserim had been under British rule for 103 years, Pegu for 74 and Upper Burma for 42. Arakan and Tenasserim had been so reduced and depopulated that they gave but little trouble, Pegu took several years to pacify, and the pacification of Upper Burma was not completed until after five years, at first engaging the energies of 32,000 Regular troops. A force of military police (frontier force) 16,000 strong, half of whom were recruited from India, was formed soon after the annexation, and the Chins on the northwest, and the Kachins on the northeast occasionally gave trouble by risings, the last during World War I. Perhaps never in the history of any country has the contrast between its past and present been so great and rapid.

Financial stringency first retarded progress, and the administrators of Burma long chafed against restrictions which Finance Ministers in India felt bound to impose. The civilizing influences of the impartial administration of justice, of communications by rail, river and road, of the wonderful development of trade, and the direct humanizing effects of education, medical relief, and the labours of the great Christian missions could not but produce a change in the outlook of the great majority of the Burmese people.

Burma was separated from India on April 1, 1937, and was placed directly under the crown of England, with a British governor and a legislature of its own. There have been boycotts of British goods, of the new Rangoon university and government schools, echoes of Gandhi's Non-Co-operation movement, and agitations against payment of taxes, but such movements did not last long. More serious were the rebellion, which began in Tharrawaddy, and the Rangoon anti-Indian labour riots in 1930. Serious rioting also took place in 1938 in many parts of the country because of an alleged insult to Buddhism by a Muslim. The nationalist spirit which developed toward the end of World War I grew strongly under the new constitution and was much influenced in the '30s by the economic depression, the expanding Burmese population, the decision of the British government to separate Burma from India, and the wider outlook of Burmese leaders.

Agrarian problems arising from indebtedness and alienation of land became acute from 1930. But under the 1937 constitution the Burmese ministry set itself resolutely to tackle these problems and much valuable legislation was enacted. An agreement to restrict Indian immigration had been reached. A trade agreement had also been negotiated, and far-reaching educational, health and social measures were in train. In fact the constitution seemed to be working well toward the goal of full self-government which had been declared to be the objective of Burma's constitutional progress. These activities were interrupted by the Japanese invasion of Burma in Dec. 1941. Rangoon fell in March 1942 and the Japanese had by June 1942 occupied all Burma except parts of Arakan and some hill tracts in the northwest and north. By the end of World War II in Sept. 1945, however, the Japanese had been driven from most of the country.

See Dautremer, *Burma under British Rule* (trans. 1913); Sir C. Crosthwaite, *The Pacification of Burma* (1913); Sir H. T. White, *Burma* (1923).

BURMAH OIL COMPANY LIMITED, THE. This, the largest British petroleum company—in the sense that its capital is entirely British and its production and market within the Empire—had its origin in the oil refinery at Rangoon erected in 1871 by a Glasgow syndicate and subsequently acquired by the late David Sime Cargill.

From these very small beginnings the undertaking grew until in 1939 its issued capital amounted to £17,736,513, standing at a heavy premium in the stock markets, while its own net crude oil production in Burma amounted to some 800,000 tons per annum.

In addition it has interests in other oil lands in India and large holdings in the Anglo-Iranian Oil Co. Ltd. (which it formed) and in the Shell Transport & Trading Co. Ltd.

The Burmese oil deposits have long been known, and were worked in a primitive way for possibly two centuries prior to 1871. The late Lord Curzon's saying that the Allies floated to victory on a sea of oil was by no means the earliest reference to the military uses of petroleum.

In the Burmese War of 1825 the native oil was used as a military weapon; the fire rafts then employed by the Burmese in their attack on British vessels in Rangoon harbour were "made of bamboos firmly fixed together, between every two or three of which lines of earthenware jars filled with petroleum and cotton were secured." It was by the same method of jars and rafts that, in the early days of Mr. Cargill's enterprise, his refinery at Rangoon received its crude oil down the river Irrawaddy from Yenangyaung.

The first machine-drilled oil well in Burma was completed in 1889, and the growth of Rangoon refineries alone since then may be gauged by the fact that in 1939 in one month alone eight times as much crude oil was handled by the company as during the whole year 1889.

It is notable that the company, in association with the Tata Iron and Steel Company Ltd., founded in India after the War of 1914–18 a successful native tin-plate industry. Risks were enormous, but technical success has been achieved, and by 1939 production had reached over 1,000,000 boxes per annum. The company's operations in Burma and India give direct and indirect employment to over 45,000 people, the bulk of whom it houses and provides with medical and other services. Hospitals and schools are run by the company in all its large centres of operation, and it has provident funds for its employees. (L. C. M.; X.)

BURMANN, PIETER (1668–1741), Dutch classical scholar, known as "the Elder," was born at Utrecht. He studied at Utrecht and Leyden, and went to the bar, without, however, abandoning his classical studies. In 1696 he was nominated to the professorship of eloquence and history at Utrecht, and to this chair was soon added that of Greek and politics. In 1714 he visited Paris and ransacked the libraries. In the following year he was appointed to the chair of history, Greek language and eloquence at Leyden. He was subsequently appointed professor of history for the United Provinces and chief librarian. Burmann was rather a compiler than a critic; his commentaries show immense learning and accuracy, but are wanting in taste and judgment.

Burmann edited the following classical authors:—Phaedrus (1698), Horace (1699), Valerius Flaccus (1702), Petronius Arbiter (1709), Velleius Paterculus (1719), Quintilian (1720), Justin (1722), Ovid (1727), *Poetae Latini minores* (1731), Suetonius (1736), Lucan (1740). He also published an edition of Buchanan's works, continued Graevius's great work, *Thesaurus Antiquitatum et Historiarum Italiae*, and wrote a treatise *De Vectigalibus populi Romani* (1694), and a short manual of Roman antiquities, *Antiquitatum Romanarum Brevis Descriptio* (1711). His *Sylloge epistolarum a viris illustribus scriptarum* (1725) is of importance for the history of learned men. The list of his works occupies five pages in Saxe's *Onomasticon*. His poems and orations were published after his death. There is an account of his life in the *Gentleman's Magazine for April* (1742) by Dr. Johnson.

BURMANN, PIETER (1714–1778), called by himself "the Younger" (Secundus), Dutch philologist, nephew of Pieter Burmann (1668–1741) (*q.v.*), was born at Amsterdam on Oct. 13, 1714. In 1735 he was appointed professor of eloquence and history at Franeker, and the chair of poetry was combined with the professorship in 1741. In the year 1742 he became professor of history and philology at the Athenaeum in Amsterdam. He was subsequently professor of poetry (1744), general librarian (1752), nd inspector of the gymnasium (1753). He died on June 24, 1778, at Sandhorst, near Amsterdam. He was a man of extensive learning. His violent disposition involved him in quarrels with contemporaries, notably Saxe and Klotz. His most valuable works are: *Anthologia Veterum Latinorum Epigrammatum et Poematum* 1759–73); *Aristophanis Comoediae Novem* (1760); *Rhetorica ad Herennium* (1761). He completed the editions of Virgil (1746) and Claudian (1760), which had been left unfinished by his uncle, and commenced an edition of Propertius, one of his best works, of which only half was printed at the time of his death. It was completed by L. van Santen and published in 1780.

BURMESE BUDDHIST LAW: *see* INDIAN LAW.

BURMESE WARS. Three wars were fought between Burma and the British during the 19th century (*see* BURMA: *History*), which resulted in the gradual extinction of Burmese independence.

First Burmese War, 1823–26.—On Sept. 23, 1823, an armed party of Burmese attacked a British guard on Shapura, an island close to the Chittagong side, killing and wounding six of the guard. Two Burmese armies, one from Manipur and another from Assam, also entered Cachar, which was under British protection, in Jan. 1824. War with Burma was formally declared on March , 1824. On May 17 a Burmese force invaded Chittagong and drove a mixed sepoy and police detachment from its position at Ramu, but did not follow up its success. The British rulers in India, however, had resolved to carry the war into the enemy's country; an armament, under Comm. Charles Grant and Sir Archibald Campbell, entered the Rangoon river, and anchored off the own on May 10, 1824. After a feeble resistance the place was surrendered, troops were landed, and the inhabitants fled. On May 8, Sir A. Campbell ordered an attack on some of the nearest posts, which were all carried after a steadily weakening defence. Another attack was made on June 10 on the stockades at the village of Kemmendine. Some of these were battered by artillery from the war vessels in the river, and the shot and shells had such effect on the Burmese that they evacuated them. The devastation of the country, which was part of the defensive system of the Burmese, was carried out with unrelenting rigour, and the invaders were soon reduced to great difficulties. The health of the men declined, and their ranks were fearfully thinned. The monarch of Ava sent large reinforcements to his dispirited and beaten army; and early in June an attack was commenced on the British lines but proved unsuccessful. On the 8th the British assaulted. The enemy were beaten at all points; and their strongest stockaded works, battered to pieces by a powerful artillery, were in general abandoned. With the exception of an attack by the prince of Tharrawaddy in the end of August, the enemy allowed the British to remain unmolested during the months of July and August. This interval was employed by Sir A. Campbell in subduing the Burmese provinces of Tavoy and Mergui, and the whole coast of Tennasserim. This was an important conquest, as the country was salubrious and afforded convalescent stations to the sick, who were now so numerous in the British army that there were scarcely 3,000 soldiers fit for duty.

The rainy season terminated about the end of October; and the court of Ava, alarmed by the discomfiture of its armies, recalled the veteran legions which were employed in Arakan, under their renowned leader Maha Bandula. Bandula hastened by forced marches to the defence of his country; and by the end of November an army of 60,000 men had surrounded the British position at Rangoon and Kemmendine, for the defence of which Sir Archibald Campbell had only 5,000 efficient troops. The enemy in great force made repeated attacks on Kemmendine without success, and on Dec. 7 Bandula was defeated in a counter attack by Sir A. Campbell. The fugitives retired to a strong position on the river, but on the 15th were driven in confusion from the field.

Sir Archibald Campbell now resolved to advance on Prome, about 100m. higher up the Irrawaddy river. He moved with his force on Feb. 13, 1825, in two divisions, one proceeding by land, and the other, under Gen. Willoughby Cotton, destined for the reduction of Danubyu, being embarked on the flotilla. Taking the command of the land force, he continued his advance till March 11, when intelligence reached him of the failure of the attack upon Danubyu. He instantly commenced a retrograde march; on the 27th he effected a junction with Gen. Cotton's force, and on April 2 entered the entrenchments at Danubyu without resistance, Bandula having been killed by the explosion of a bomb. The English general entered Prome on the 25th and remained there during the rainy season. On Sept. 17 an armistice was concluded for one month. In the course of the summer Gen. Joseph Morrison had conquered the province of Arakan; in the north the Burmese were expelled from Assam; and the British had made some progress in Cachar.

The armistice having expired on Nov. 3, the army of Ava, amounting to 60,000 men, advanced in three divisions against the British position at Prome, which was defended by 3,000 Europeans and 2,000 native troops. Sir A. Campbell on Dec. 1 attacked the different divisions of the Burmese and successively drove them from all their positions. The Burmese retired on Malun, along the course of the Irrawaddy, where they occupied, with 10,000 or 12,000 men, a series of strongly fortified heights and a formidable stockade. On the 26th they sent a flag of truce to the British camp and negotiations having commenced, peace was proposed to them on the following conditions: (1) The cession of Arakan, together with the provinces of Mergui, Tavoy, and Ye; (2) the renunciation by the Burmese sovereign of all claims upon Assam and the contiguous petty states; (3) the Company to be paid a crore of rupees as an indemnification for the expenses of the war; (4) residents from each court to be allowed, with an escort of 50 men; while it was also stipulated that British ships should no longer be obliged to unship their rudders and land their guns as formerly in the Burmese ports. This treaty was agreed to and signed, but the ratification of the king was still wanting; and it was soon apparent that the Burmese had no intention to sign it, but were preparing to renew the contest. On Jan. 19, accordingly, Sir A. Campbell attacked and carried the enemy's position at Malum. Another offer of peace was here made by the Burmese, but it was found to be insincere; and the fugitive army made at the ancient city of Pagan a final stand in defence of the capital. They were attacked and overthrown on Feb. 9, 1826; and the invading force being now within four days' march of Ava, Dr. Price, an American missionary, who with other Europeans had been thrown into prison when the war commenced, was sent to the British camp with the treaty (known as the treaty of Yandaboo) ratified, the prisoners of war released, and an instalment of 25 lakhs of rupees. The British army then evacuated the country.

Second Burmese War, 1852.—On March 15, 1852, Lord Dalhousie sent an ultimatum to King Pagan, announcing that hostile operations would be commenced if all his demands were not agreed to by April 1. Meanwhile a force consisting of 8,100 troops had been despatched to Rangoon under the command of Gen. H. T. Godwin, C.B., while Comm. Lambert commanded the naval contingent. No reply being given to this letter, the first blow of the second Burmese War was struck by the British on April 5, 1852, when Martaban was taken. Rangoon town was occupied on the 12th, and the Shwe Dagôn pagoda on the 14th, after heavy fighting, when the Burmese army retired northwards. Bassein was seized on May 19 and Pegu was taken on June 3 after some sharp fighting round the Shwe-maw-daw pagoda. During the rainy season the approval of the East India Company's court of directors and of the British government was obtained to the annexation of the lower portion of the Irrawaddy valley, including Prome. Lord Dalhousie visited Rangoon in July and August and discussed the whole situation with the civil, military, and naval authorities. In consequence, Gen. Godwin occupied Prome on Oct. 9 after but slight resistance. Early in December, Lord Dalhousie informed King Pagan that the province of Pegu would henceforth form part of the British dominions, and that if his troops resisted the measure his whole kingdom would be destroyed. The proclamation of annexation was issued on Jan. 20, 1853, and thus the Second Burmese War was brought to an end without any treaty being signed.

Third Burmese War, 1885–86.—The imposition of an impossible fine on the Bombay-Burma Trading Company, coupled with the threat of confiscation of all their rights and property in case of non-payment, led to the British ultimatum of Oct. 22, 1885; and by Nov. 9 a practical refusal of the terms having been received at Rangoon, the occupation of Mandalay and the dethronement of King Thibaw were determined upon. The British planned an advance by water direct on the capital, and Maj.-Gen. Prendergast had command of the expedition. As was only to be expected in an enterprise of this description, the navy as well as the army was called in requisition; and as usual the services rendered by the seamen and guns were most important. The total effective of the force was 9,034 fighting men, 2,810 native followers, and 67 guns, and for river service 24 machine guns.

Thayetmyo was the British post on the river nearest to the frontier, and here, by Nov. 14, five days after Thibaw's answer had been received, practically the whole expedition was assembled. On the same day Gen. Prendergast received instructions to commence operations. The Burmese king and his country were taken completely by surprise by the unexampled rapidity of the advance. There had been no time for them to collect and organize for the stubborn resistance of which the river and its defences were capable. They had not even been able to block the river by sinking steamers, etc., across it, for, on the very day of the receipt of orders to advance, the armed steamers "Irrawaddy" and "Kathleen" engaged the nearest Burmese batteries, and brought out from under their guns the king's steamer and some barges which were lying in readiness for this very purpose. On the 16th the batteries themselves on both banks were taken by a land attack, the enemy being evidently unprepared and making no resistance.

On Nov. 17, however, at Minhla, on the right bank of the river, the Burmans in considerable force held successively a barricade, a pagoda, and the redoubt of Minhla. The attack was pressed home by a brigade of native infantry on shore, covered by a bombardment from the river, and the enemy were defeated with a loss of 170 killed and 276 prisoners, besides many more drowned in the attempt to escape by the river. The advance was continued next day and the following days, the naval brigade and heavy artillery leading and silencing in succession the enemy's river defences at Nyaungu, Pakôkku, and Myingyan. On Nov. 26, when the flotilla was approaching the ancient capital of Ava, envoys from King Thibaw met Gen. Prendergast with offers o surrender; and on the 27th, when the ships were lying off tha city and ready to commence hostilities, the order of the king t his troops to lay down their arms was received. There were thre strong forts here, full at that moment with thousands of armed Burmans, and though a large number of these filed past and laid down their arms by the king's command, many more were allowed to disperse with their weapons; and these, in the time that followed, broke up into dacoit or guerrilla bands, which became the scourge of the country and prolonged the war for years Meanwhile, however, the surrender of the king of Burma was complete; and on Nov. 28, in less than a fortnight from the declaration of war, Mandalay had fallen, and the king himself was a prisoner, while every strong fort and town on the river, and all the king's ordnance (1,861 pieces) and thousands of rifles, muskets, and arms had been taken.

From Mandalay, Gen. Prendergast seized Bhamo on Dec. 28. This was a very important move, as it forestalled the Chinese, who were preparing to claim the place. But unfortunately, although the king was dethroned and deported, and the capital and the whole of the river in the hands of the British, the bands of armed soldiery, unaccustomed to conditions other than those of anarchy, rapine, and murder, took advantage of the impenetrable cover of their jungles to continue a desultory armed resistance. Reinforcements had to be poured into the country, and it was in this phase of the campaign, lasting several years, that the most arduous work fell to the lot of the troops. The final pacification of the country, under the direction of Sir Frederick (afterwards Earl) Roberts, was only brought about by an extensive system of small protective posts scattered all over the country, and small lightly equipped columns moving out to disperse the enemy.

No account of the third Burmese War would be complete without a reference to the first, and perhaps for this reason most notable, land advance into the enemy's country. This was carried out in Nov. 1885 from Toungoo, the British frontier post in the east of the country, by a small column of all arms under Col. W. P. Dicken, 3rd Madras Light Infantry, the first objective being Ningyan. The operations were completely successful, in spite of a good deal of scattered resistance, and the force afterwards moved forward to Yamethin and Hlaingdet. As inland operations developed, the want of mounted troops was badly felt, and several regiments of cavalry were brought over from India, while mounted infantry was raised locally.

BURMU: *see* Hameg.

BURN, RICHARD (1709–1785), English legal writer, was born at Winton, Westmorland, and died at Orton on Nov. 12, 1785. Educated at Queen's College, Oxford, he entered the Church, became (1736) vicar of Orton in Westmorland, and chancellor of the diocese of Carlisle (1765). Burn's *Justice of the Peace and Parish Officer* (1755) has passed through innumerable editions. His *Ecclesiastical Law* (1760), was the basis of many modern commentaries on ecclesiastical law. The best edition is that by R. Phillimore (1842). Burn also wrote *Digest of the Militia Laws* (1760) and *A New Law Dictionary* (1792).

BURNABY, FREDERICK GUSTAVUS (1842–1885), English traveller and soldier, was born on March 3, 1842, at Bedford, the son of a clergyman. Educated at Harrow and in Germany, he entered the Royal Horse Guards in 1859. In the summer of 1874 he accompanied the Carlist forces as correspondent of *The Times*, but before the end of the war he was transferred to Africa to report on Gordon's expedition to the Sudan. This took Burnaby as far as Khartum. Returning to England in March 1875, he matured his plans for a journey on horseback to Khiva through Russian Asia, which had just been closed to travellers. His accomplishment of this task, in the winter of 1875–76, described in his book *A Ride to Khiva*, brought him immediate fame. His next leave of absence was spent in another adventurous journey on horseback, through Asia Minor, from Scutari to Erzerum with the object of observing the Russian frontier, an account of which he afterwards published. In the Russo-Turkish War of 1877, Burnaby (who soon afterwards became lieut.-colonel) acted as travelling agent to the Stafford House (Red Cross) Committee, but had to return to England before the campaign was over. In 1882 he crossed the Channel in a balloon. Having been disappointed in his hope of seeing active service in the Egyptian campaign of 1882, he participated in the Suakin campaign of 1884 without official leave, and was wounded at El Teb when acting as an intelligence officer under General Valentine Baker. He was employed by Lord Wolseley in the Nile Expedition, and met his death in the hand-to-hand fighting of the battle of Abu Klea (Jan. 17 1885).

See R. K. Mann, *The Life of F. G. Burnaby* (1882); T. Wright, *The Life of Colonel Fred Burnaby* (1908).

BURNAND, SIR FRANCIS COWLEY (1836–1917), English humorist, was born in London. He was educated at Eton and Cambridge, and originally studied first for the Anglican, then for the Roman Catholic Church; but eventually took to the law and was called to the bar. He had founded the Amateur Dramatic club at Cambridge and finally he abandoned the church and the law, first for the stage and subsequently for dramatic authorship. His first great dramatic success was made with the burlesque *Black-Eyed Susan* (1866), and he wrote a large number of other burlesques, comedies and farces. Burnand became in 1862 a regular contributor to *Punch;* in 1880 he was appointed editor and only retired from that position in 1906. In 1902 he was knighted. His literary reputation as a humorist depends, apart from his long association with *Punch*, on his well-known book *Happy Thoughts*, originally published in *Punch* in 1863–64 and frequently reprinted.

See his *Records and Reminiscences* (1904).

BURNE-JONES, SIR EDWARD BURNE, Bart. (1833–808), English painter and designer, was born Aug. 28 1833, at Birmingham. He was educated at King Edward's school, Birmingham, and Exeter college, Oxford, where William Morris was his contemporary. With Morris he read *Modern Painters* and the *Morte d'Arthur*. He studied the Italian pictures in the university galleries and Dürer's engravings; but his keenest enthusiasm was kindled by the sight of two works by a living man, Rossetti. One of these was a woodcut in Allingham's poems, "The Maids of Elfinmere"; the other was the water-colour "Dante drawing an Angel," then belonging to Mr. Coombe, of the Clarendon Press, nd now in the university collection. At Easter 1856 he left college without taking a degree. This was his own decision, not due as often stated) to Rossetti's persuasion; but on settling in London, where Morris soon joined him at 17 Red Lion square, he began to work under Rossetti's friendly instruction.

In 1859 Burne-Jones made his first journey to Italy. He saw Florence, Pisa, Siena, Venice and other places, and appears to have found the gentle and romantic Sienese more attractive than any other school. Rossetti's influence still persisted; and its impress is visible, more strongly perhaps than ever before, in the wo water-colours "Sidonia von Bork" and "Clara von Bork," painted in 1860. These little masterpieces have a directness of execution rare with the artist. In powerful characterization, combined with a decorative motive, they rival Rossetti at his best. In June of this year Burne-Jones married Miss Georgiana Macdonald, two of whose sisters were the wives of Sir E. Poynter and Mr. J. L. Kipling. They lived first in Bloomsbury, then in Kensington square, then at the Grange, Fulham. In 1862 the artist and his wife accompanied Ruskin to Italy.

Burne-Jones exhibited from 1864 to 1887 at the Society of Painters in Water-Colours. Between 1870 and 1877 he showed only two water-colours (at the Dudley gallery), but he was workng hard on a number of large pictures in oils. At the first exhibiion of the Grosvenor gallery, he exhibited the "Days of Creation," "The Beguiling of Merlin," and "The Mirror of Venus." His reputation was now made. In 1878 he exhibited several canvases, and in 1879 the "Annunciation," quieter in colouring, in 1884 "Cophetua and the Beggar Maid," in 1886 "The Depths of the Sea," and in 1891 "The Star of Bethlehem," commissioned by the orporation of Birmingham. He had been elected A.R.A. in 1885, but resigned in 1893. He was occupied with various decorative eries, the most famous of which was perhaps "The Briar Rose," and in 1892–93 produced some portraits. He received a baronetcy n 1894. He died on June 17 1898. His son and successor in the baronetcy, Sir Philip Burne-Jones (d. June 21, 1926), also became an artist. His only daughter, Margaret, married Mr. J. W. Mackail.

Burne-Jones's influence has been exercised far less in painting than in the wide field of decorative design. Here it has been enormous. His first designs for stained glass, 1857–61, were made for Messrs. Powell, but after 1861 he worked exclusively for Morris & Co. Windows executed from his cartoons are to be found all over England; others exist in churches abroad. For the American Church in Rome he designed a number of mosaics. Reliefs in metal, tiles, gessowork, decorations for pianos and organs, and cartoons for tapestry represent his manifold activity. In works, however, which were only designed and not carried out by him, a decided loss of delicacy is to be noted. The colouring of the tapestries (of which the "Adoration of the Magi" at Exeter college is the best known) is more brilliant than successful. The range and fertility of Burne-Jones as a decorative inventor can be, perhaps, most conveniently studied in the sketch-book, 1885–95, which he bequeathed to the British Museum. The artist's influence on book-illustration must also be recorded. In early years he made a few drawings on wood for Dalziel's Bible and for *Good Words;* but his later work for the Kelmscott Press, founded by Morris in 1891, is that by which he is best remembered. Besides several illustrations to other Kelmscott books, he made 87 designs for the *Chaucer* of 1897.

BIBLIOGRAPHY.—In 1904 was published *Memorials of Edward Burne-Jones,* by his widow, two volumes of extreme interest and charm. The *Work of Burne-Jones,* a collection of 91 photogravures, appeared in 1900.

See also Julia Cartwright (Mrs. Ady), *Sir E. Burne-Jones, his Life and Work* (1894); Malcolm Bell, *Sir E. Burne-Jones: a Record and a Review* (1898); J. W. Mackail, *The Life of William Morris* (1899); *Catalogue to Burlington Club Exhibition of Drawings by Burne-Jones,* with introduction by Cosmo Monkhouse (1899).

BURNELL, ARTHUR COKE (1840–1882), English Sanskrit scholar, was born at St. Briavels, Gloucestershire, in 1840. In 1860 he went to Madras as a member of the Indian civil service. Here he utilized every opportunity to acquire or copy Sanskrit manuscripts. In 1870 he presented his collection of 350 mss. to the India library. In 1874 he published a *Handbook of South Indian Palaeography,* characterized by Max Müller as "indispensable to every student of Indian literature," and in 1880 issued for the Madras Government his greatest work, the *Classified Index to the Sanskrit mss. in the Palace at Tanjore.* He also translated and commented on many other Sanskrit manuscripts, being particularly successful in elucidating the essential principles of Hindu law. Burnell originated with Sir Henry Yule, the well-known dictionary of Anglo-Indian words and phrases, *Hobson-Jobson* (1886). He broke down under the strain of overwork and the Madras climate, and died at West Stratton, Hampshire, on Oct. 12, 1882. A further collection of Sanskrit manuscripts was purchased from his heirs by the India library after his death.

BURNELL, ROBERT (d. 1292), English bishop and chancellor, was born at Acton Burnell in Shropshire, and began his public life probably as a clerk in the royal chancery. He was soon in the service of Edward, the eldest son of King Henry III., and was constantly in attendance on the prince. Having received some ecclesiastical preferments, he acted as one of the regents of the kingdom from the death of Henry III. in Nov. 1272 until Aug. 1274, when the new king, Edward I., returned from Palestine and made him his chancellor. In 1275 Burnell was elected bishop of Bath and Wells. As the friend and chief adviser of Edward I., Burnell influenced the legislative and foreign policy of his master. In 1283 a council, or, as it is sometimes called, a parliament, met in his house at Acton Burnell, and he was responsible for the settlement of the court of chancery in London. Licentious and avaricious, he amassed great wealth; and when he died on Oct. 25, 1292, he left numerous estates in Shropshire, Worcestershire, Somerset, Kent, Surrey and elsewhere. He was, however, genial and kind-hearted, a great lawyer and a faithful minister.

See R. W. Eyton, *Antiquities of Shropshire* (1854–60); and E. Foss, *The Judges of England* (1848–64).

BURNES, SIR ALEXANDER (1805–1841), British traveller and explorer, was born at Montrose, Scotland, on May 16, 1805. He joined the army of the East India Company at 17, and in 1822 became interpreter at Surat. Transferred to Cutch in 1826 as assistant to the political agent, he turned his attention to the history and geography of north-western India and the adjacent countries. In 1831 he was sent to Lahore with a present of horses from King William IV. to Maharaja Ranjit Singh and made extensive investigations. Next year he started from Lahore, disguised as an Afghan, and made his way across Afghanistan to Balkh, from there to Bukhārā, Asterabad and Teheran, and across Persia to Bushire, where he embarked for England. His *Travels to Bokhara* (1834) brought him acknowledgment from the geographical societies of London and Paris, and were widely read. After his return to India he undertook (1836) a political mission to Dost Mohammed at Kabul. He advised Lord Auckland to support Dost Mohammed on the throne of Kabul, but the viceroy reinstated Shah Shuja. On the restoration of Shah Shuja in 1839, he became regular political agent at Kabul. He was assassinated on Nov. 2, 1841. In 1861 it was found that some Burnes' despatches from Kabul in 1839 had been altered, so as to convey opinions opposite to his, but Lord Palmerston refused after such a lapse of time to grant the inquiry demanded in the House of Commons. A narrative of his Afghan experiences is given in his posthumously published *Cabool* (1842).

See Sir J. W. Kaye, *Lives of Indian Officers* (1889).

BURNET, GILBERT (1643–1715), English bishop and historian, was born in Edinburgh on Sept. 15, 1643, the youngest son of Robert Burnet (1592–1661), afterwards Lord Crimond. Robert Burnet had been twice exiled on account of his refusal to sign the Covenant, but he was none the less a severe critic of the government of Charles I. and his attitude certainly influenced his son. Gilbert Burnet was educated at Marischal college, Aberdeen, and in 1661 became a probationer for the Scottish ministry. In that year his father died, and Gilbert was offered a benefice which he declined on account of the unsettled state of Church affairs. He now visited Oxford and Cambridge, and after six months' absence returned to Scotland. He again refused offers of preferment and went to Holland and France. In Amsterdam he studied Hebrew and met Protestant divines of all shades of opinion, and in Paris he also met the leading Protestant ministers.

On his return to England in 1664 he became intimate with Sir Robert Moray and with John Maitland, afterwards duke of Lauderdale, both of whom at that time favoured leniency towards the Scottish Covenanters. While he was in London Burnet also became a member of the newly established Royal Society. During his absence abroad the living of Saltoun, East Lothian, had been kept open for him, and he began his ministrations there in Oct. 1664. In 1669 he resigned his parish to become professor of divinity in the University of Glasgow. He had already begun to differ from Lauderdale, who was moving in the direction of repression, and became Leighton's right hand in the attempt to secure a compromise between episcopacy and presbyterianism. He had on his side Anne, duchess of Hamilton, on whose behalf he edited *Memoirs of the Lives and Actions of James and William, dukes of Hamilton and Castleherald . . .* (London, 1676). Meanwhile, he had married an heiress, Lady Margaret Kennedy, daughter of the 6th earl of Cassilis and a cousin of Lauderdale. He renounced all claim to his wife's fortune, and the marriage itself was kept secret for three years.

The ascendancy of Lauderdale in Scotland induced Burnet to settle in England. He went up to London in 1673 to arrange for the publication of the Hamilton *Memoirs* and on his return to Scotland found that Lauderdale would not see him and had denounced him to Charles II. as a centre of Scottish discontent. Burnet returned to London and resigned his professorship at Glasgow. He had been appointed one of the court chaplains, but Charles II. struck him off the roll. He became, however, chaplain to the Rolls Chapel, and was elected lecturer at St. Clement's. Up to April 1675 he had enjoyed the favour of the duke of York, who was, however, alienated when Burnet gave evidence before a committee of the House of Commons against Lauderdale.

He presently began the preparation of his *History of the Reformation in England.* This book was prepared from the original sources, but unfortunately Burnet was denied access to the Cotton library, possibly through Lauderdale's influence. The first volume was published in 1679, the second in 1681, and the third in 1715. During the agitation about the popish plot in 1678 he acted with moderation and tried to save at least one of the victims, William Staly. He proposed a compromise in place of the Exclusion bill, a course which led to a very brief reconciliation with the court. He was known to have received the confidence of Wilmot, earl of Rochester, before his death, and he attended Lord Russell on the scaffold; further, against his own wish, it is true, he preached the usual anti-Catholic sermon on Guy Fawkes day (1684). He was consequently deprived of his appointments by order of the court, and on the accession of James II. retired to Paris, and eventually to The Hague, where he took the precaution of naturalizing himself as a Dutch subject, by way of protection against a prosecution for high treason threatened in England. His first wife was now dead, and he married a Dutch heiress of Scottish descent, Mary Scott.

Burnet was able to render great service to William, prince of Orange, because of the confidence placed in him by Princess Mary. He persuaded the princess to offer to leave the whole political power in her husband's hands in the event of their joint succession to the English crown. At the revolution he returned to England with William and Mary, and the English text of their declaration was drawn up by him. On his own account he published an *Inquiry into the Measures of Submission to the Supreme Authority,* defending the revolution. For these services he was rewarded by the see of Salisbury, and was consecrated on March 31, 1689, by a commission of bishops, Archbishop Sancroft having declined personally to perform the office. Burnet commanded the confidence of Queen Mary, and after her death William III. appointed an ecclesiastical commission, of which Burnet was a prominent member, for the disposal of vacant benefices, which had been personally supervised by Mary during her lifetime. The provision for the poorer livings afterwards carried out by the measure known as Queen Anne's Bounty was originally a proposal made by Burnet. He became tutor (1699) to Princess Anne's son, the duke of Gloucester, but his influence at court declined after Queen Mary's death, and disappeared after the accession of Queen Anne.

From 1685 onwards Burnet had been employed on his *History of His Own Time,* but he had from time to time written pamphlets in defence of the Broad Church position. Of these, probably the most important was his *Exposition of the Thirty-nine Articles* (1699) which was intended to pave the way for the re-admission of Nonconformists to the Church of England, and which gave great offence to the High Church clergy. His *History of His Own Time* was, by his direction, not published until six years after his death. Even then, the work (2 vols. 1724–34) appeared with some omissions made by his sons, Gilbert and Thomas. Burnet has frequently been charged with misrepresentation, notably in his account of the birth of James, the old Pretender. The most valuable part of his work is naturally that relating to transactions of which he had personal knowledge, notably the Church history of Scotland and the events leading up to the revolution.

Burnet's second wife died in 1698, and in 1700 he married Elizabeth Berkeley, the author of *A Method of Devotion,* posthumously published in 1710. Of his children by his second wife, William (d. 1720) became a colonial governor in America; Gilbert (1690–1726) became prebendary of Salisbury in 1715, and chaplain to George I. in 1718; and Sir Thomas (1694–1753), his literary executor and biographer, became in 1741 judge in the court of common pleas.

BIBLIOGRAPHY.—The chief authorities for Bishop Burnet's life are the autobiography "Rough Draft of my own Life" (ed. H. C. Foxcroft, 1902, in the *Supplement to Burnet's History*), the life by Sir Thomas Burnet in the *History of His Own Time,* vol. vi. (1823), and the *History* itself. A rather severe but detailed and useful criticism is given in L. v. Ranke's *History of England,* vol. vi. pp. 45–101 (Eng. ed., 1875). Burnet's letters to his friend, George Savile, marquess of Halifax, were published by the Royal Historical Society (*Camden Miscellany,* vol. xi.). The *History of His Own Time* (fol., 1724–34) ran through many editions before it was reprinted at the Clarendon Press (1823), and supplementary volume (1833), with the suppressed passages of the first volume and notes by the earls of Dartmouth and Hardwicke, with the remarks of Swift. This edition, under the direction of M. J. Routh, was enlarged in a second Oxford edition of 1833. A new edition, based on this, but making use of the Bodleian ms., which differs very considerably from the printed version, was edited by Osmund Airy (1897, etc.). In 1902 (Clarendon Press) Miss H. C. Foxcroft edited *A Supplement to Burnet's History of His Own Time,* to which is prefixed an account of the relation between the different versions of the History—the Bodleian ms., the fragmentary Harleian ms. in the British Museum and Sir Thomas Burnet's edition; the book contains the remaining fragments of Burnet's original memoirs, his autobiography, his letters to Admiral Herbert and his private meditations. His *History of the Reformation of the Church of England* was edited (Clarendon Press, 1865) by N. Pocock.

See also *A Life of Gilbert Burnet, Bishop of Salisbury* (1907), by T. E. S. Clarke and H. C. Foxcroft, with an introduction by C. H. Firth, which contains a chronological list of Burnet's published works. Of Burnet's personal character there are well-known descriptions in chapter vii. of Macaulay's *History of England,* and in W. E. H. Lecky's *History of England in the Eighteenth Century.*

BURNET, JOHN (1863–1928), Scottish classical scholar, was born at Edinburgh Dec. 6, 1863. Educated at Balliol college, Oxford, he was successively assistant professor of Greek at St. Andrews (1887), assistant master at Harrow (1888–90), and low of Merton college, Oxford, until 1892, when he became professor of Greek at St. Andrews.

His *Early Greek Philosophy* (1892, 3rd. ed. 1920), is important as being the first historical treatment of the pre-Socratics and the first study of the relation between Greek science and early Greek philosophy. He next edited Aristotle's *Ethics* (1899) and the *Dialogues* of Plato (1900–07). In his edition of the *Phaedo* (1911) he set forth his theory, later developed in *Greek Philosophy: Thales to Plato* (1914), that Plato's own doctrines were not put into the mouth of Socrates but are discoverable in the later dialogues, where Socrates occupies a less important position, and in Aristotle's works. The companion volume to the *Phaedo* includes the *Euthyphro,* the *Apology* and the *Crito* (1924). Burnet's shorter publications include *Higher Education and the War* (1917). He died at St. Andrews on May 26, 1928.

BURNET, THOMAS (1635–1715), English divine, was born at Croft in Yorkshire about the year 1635. He was educated at Northallerton, and at Clare Hall, Cambridge, and became master of the Charterhouse in 1685. As master he made a noble stand against the illegal attempts to admit Andrew Popham as a pensioner of the house.

Burnet published his famous *Telluris Theoria Sacra,* or *Sacred Theory of the Earth,* in London in 1681. This work, containing a fanciful theory of the earth's structure, attracted much attention, and he was afterwards encouraged to issue an English translation, which was printed in folio, 1684–89. In 1692 he published *Archaeologiae Philosophicae: sive Doctrina antiqua de Rerum Originibus,* in which he treated the Mosaic account of the fall of man as an allegory. This excited a great clamour against him; and the king was obliged to remove him from the office of clerk of the closet which Archbishop Tillotson had procured for him. Of this book an English translation was published in 1729. Burnet died at the Charterhouse on Sept. 27, 1715.

Two posthumous works appeared several years after his death—*De Fide et Officiis Christianorum* (1723), and *De Statu Mortuorum et Resurgentium Tractatus* (1723); in which he maintained the doctrine of a middle state, the millennium, and the limited duration of future punishment.

A *Life of Dr. Burnet,* by Heathcote, appeared in 1759.

BURNET, the name given to various species of *Poterium,* a genus of the rose family. The plants are perennial herbs with pinnate leaves and small flowers arranged in dense long-stalked heads. Great burnet (*Poterium officinale*) is found in damp meadows; salad burnet (*P. Sanguisorba*) is a smaller plant growing in dry pastures.

BURNETT, FRANCES ELIZA HODGSON (1849–1924), Anglo-American novelist, was born in Manchester, England, Nov. 24, 1849. With her family she moved to Knoxville, (Tenn.), in 1865, marrying in 1873 Dr. L. M. Burnett of Washington, whom she divorced in 1898. A prolific writer for children and adults from her girlhood, she first won recognition by her tale of Lancashire life, *That Lass o' Lowrie's* (1877). Other favourites by her were *Through One Administration* (1883), *A Lady of Quality* (1896), *The Dawn of a To-morrow* (1906), *The Shuttle* (1907), *T. Tembarom* (1913), and *The Head of the House of Coombe* (1922), pleasantly romantic stories. Perhaps her most popular creation was the title character of *Little Lord Fauntleroy* (1886), whose charming manners and picturesque garb provided an uncomfortable model for small boys for a generation. The dramatization of *Little Lord Fauntleroy* and of *Sara Crewe* (1888) as *The Little Princess* made her best known on the stage. She was the author of several plays in two of which she collaborated with her second husband, Stephen Townsend, an English surgeon. She died Oct. 29, 1924, at Plandome, Long Island.

One I Knew the Best of All (1904) is autobiographical. *See* also Vivian Burnett's, *The Romantick Lady* (1928).

BURNEY, CHARLES (1726–1814), English musical historian, was born in Shrewsbury on April 12, 1726. His first music-master was Edmund Baker, organist of Chester cathedral, and a pupil of Dr. John Blow, and later he went to London as a pupil of the celebrated Dr. Arne, with whom he remained three years. In 1749 he was appointed organist of St. Dionis-Backchurch, Fenchurch street, with a salary of £30 a year; and he was also engaged to take the harpsichord in the "New Concerts" then recently established at the King's Arms, Cornhill. In that year he married Miss Esther Sleepe, who died in 1761; in 1769 he married Mrs. Stephen Allen of Lynn. Threatened with consumption, he went in 1751 to Lynn in Norfolk, where he was elected organist, with an annual salary of £100, and there he resided for the next nine years. During that time he began to entertain the idea of writing a general history of music. His *Ode for St. Cecilia's Day* was performed at Ranelagh gardens in 1759, and in 1760 he returned to London.

Amidst his various professional avocations, Burney never lost sight of his favourite object, his *History of Music*, and therefore resolved to travel abroad for the purpose of collecting materials that could not be found in Great Britain. Accordingly he left London in June 1770, and proceeded to Paris, and thence to Geneva, Turin, Milan, Padua, Venice, Bologna, Florence, Rome and Naples to collect material for his projected history of music. The first results of his observations he published in *The Present State of Music in France and Italy* (1771). In July 1772 Burney visited the Continent, to collect further materials, and after his return to London the result appeared under the title of *The Present State of Music in Germany, the Netherlands and United Provinces* (1773). In 1773 he was chosen a fellow of the Royal Society and in 1776 appeared the first volume of his long-projected *History of Music*, the remaining three volumes following some years later. The least satisfactory volume is the fourth, the treatment of Handel and Bach being quite inadequate, and the whole work was severely criticized abroad, though it constituted a notable achievement for its day.

Other works by Dr. Burney are *A Plan for a Music School* (1774), *Memoirs and Letters of Metastasio* (1796) and *An Essay towards a History of Comets* (1769). He first published in England the music performed at the Vatican in Passion Week. In 1783 Edmund Burke's influence obtained for him the appointment of organist to Chelsea hospital, and Fox procured him a pension of £300 a year in 1806. He died at Chelsea on April 12, 1814.

Burney's portrait was painted by Reynolds, and his bust was cut by Nollekens in 1805.

Dr. Burney's eldest son, James, was a distinguished officer in the royal navy, who died a rear-admiral in 1821; his second son was the Rev. Charles Burney, D.D. (1757–1817), a well-known classical scholar, whose splendid collection of rare books and mss. was ultimately bought by the nation for the British Museum; and his second daughter was Frances (Madame d'Arblay, *q.v.*). The *Diary* and letters of Madame d'Arblay contain many minute and interesting particulars of her father's public and private life, and of his friends and contemporaries. A life of Burney by Madame d'Arblay appeared in 1832.

BURNEY, FANNY: *see* D'Arblay, Frances.

BURNHAM, DANIEL HUDSON (1846–1912), American architect, was born at Henderson (N.Y.) Sept. 4, 1846. He was educated at Chicago and at Waltham (Mass.). He worked as an architect in Chicago, and in 1871 formed a partnership with John W. Root. They were entrusted with the planning of the Chicago world's fair (1893). On the death of Root this work fell wholly upon Burnham. In 1894 he was elected president of the American institute of architects. His success with the Chicago world's fair buildings soon led to his being called upon to design other large structures, including the rookery and railway exchange in Chicago; the flatiron building and new Wanamaker's store in New York; the Pennsylvania railroad station in Pittsburgh; Filene's store in Boston; the Union station in Washington, and Selfridge's stores, London. He also was asked to propose plans for improving several cities, including Cleveland, San Francisco, Chicago, and Baltimore. In 1905 he was asked by the U.S. Government to design plans for cities in the Philippines, including Manila. He was made chairman of the national committee appointed for beautifying Washington (D.C.). He died in Heidelberg, Germany, on June 1, 1912.

BURNHAM, EDWARD LEVY LAWSON, 1st Baron (1833–1916), English newspaper proprietor, was born in London Dec. 28, 1833, and died on Jan. 9, 1916. He was educated at University College school. His father, Joseph Moses Levy (d. 1888), acquired *The Daily Telegraph and Courier* in 1855, a few months after it had been founded by Col. Sleigh, and, aided by his son, soon changed the current of its fortunes, raising it to a leading position among the London dailies, of which it was the pioneer penny paper. Edward Levy (he took the added name of Lawson under his uncle Lionel Lawson's will in 1875) acted as editor of *The Daily Telegraph* till his father's death and then became its managing proprietor and sole controller till 1903, when he was made a baron and passed over these duties to his son. He had received a baronetcy in 1892.

For many years Edward Lawson was one of the outstanding figures in English journalism. No one in Great Britain did more than he to brighten and humanize the daily newspaper and transform it from a plain, severe chronicle of the day's events (only mitigated by the occasional ferocity of its political judgments) into a readable and entertaining presentation of the world's news. The abolition of the last of the paper duties in 1861, in which Edward Lawson himself bore an active part, called into being a host of fresh newspaper readers among the middle classes, which welcomed the popular features of the new journalism. Edward Lawson's conception of a popular daily paper was that it should be a faithful mirror of the times and make a strong appeal to the sentiment and the emotion of its readers. Under his direction *The Daily Telegraph* raised many large funds for various national, patriotic and charitable objects, despatched missions of exploration and discovery to Central Africa and elsewhere, and started many novel features, such as popular correspondences on live topics of the day, which have since become the established commonplace of journalism. For many years *The Daily Telegraph* warmly supported the Liberal party, but it strongly dissented from Mr. Gladstone's anti-Turkish policy and the final severance came on his Irish policy of Home Rule. Edward Lawson was not by nature a strong political partisan; what interested him most was the social advancement of the people, and the development of the British Empire, to which causes he gave strong support, whatever the politics of the government of the day.

He was more than once president of the Institute of Journalists and the Newspaper Press Fund, and in 1900 presided over the first Imperial Press Conference in London. He married Henriette Georgiana (d. 1897), daughter of the actor-manager, Benjamin Webster. (J. B. F.)

BURNHAM, HARRY LAWSON WEBSTER LAWSON, 1st Viscount (1862–1933), eldest son of the 1st Baron Burnham, was born in London, Dec. 18, 1862, and educated at Eton and Balliol college, Oxford. He represented, as a Liberal, West St. Pancras from 1885 to 1892, East Gloucestershire from 1893 to 1895, and the Mile End division of the Tower Hamlets from 1905 to 1906, and again, but this time as a Unionist, from 1910 to 1916, when he succeeded to his father's title. He also served on the London County Council from 1889 to 1892, and from 1897 to 1904, and was mayor of Stepney in 1908 and 1909.

In 1903, when his father retired from the active duties of the managing proprietorship of *The Daily Telegraph,* the Hon. Harry Lawson, as he then was, became the sole director of the conduct and policy of that newspaper. These duties, however, did not prevent him from devoting a large share of his time to public work. Lord Burnham was a member of the committee which drafted the Reform act of 1918, and of Lord Bryce's committee on the problem of the reform of the powers and constitution of the second chamber. He was a chairman or a member of innumerable committees, commissions, conciliation boards, etc In the year 1921 he was unanimously elected president of the International Labour Conference of the League of Nations at Geneva and was re-elected to the same post in the following year. Lord Burnham presided over the standing joint committees on the salaries of teachers, and made an award on the proposed new scales of payment. The Burnham scales, as they were universally called, received the support of the teachers, the local authorities, and the Ministry of Education, and when they came up for revision in 1924, Lord Burnham was again asked to undertake the task.

During these years of parliamentary and public activity he gave the closest attention to the direction of *The Daily Telegraph* (which he sold at the end of 1927), and was prominent in the various organizations of the newspaper press He succeeded his father as president of the Newspaper Press Fund and the Newsvendors' Benevolent Institution. In 1910 he was president of the Institute of Journalists, chairman of the Newspaper Proprietors' Association from its foundation, during World War I he was chairman of the Press Conference, to which the government consigned the responsible duty of the regulation of news. Lord Burnham succeeded his father as president of the Empire Press Union and presided over the National Press conferences in Canada in 1920 and in Australia in 1925. In 1917 Lord Burnham was made a companion of honour and in 1919 a viscount. He married in 1884, Olive, daughter of Sir Henry de Bathe, bart., and had one daughter. His brother, Col. the Hon. William Arnold Webster Lawson (1864–1943), succeeded him at his death in 1933.

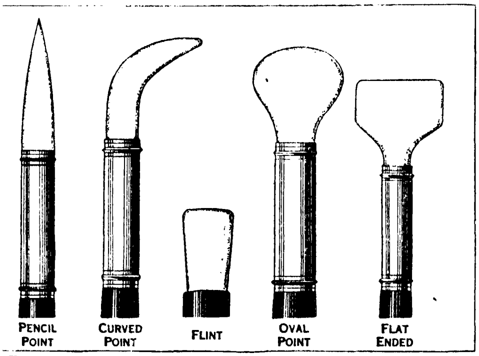
BURNHAM BEECHES, a wooded tract of 375 ac. in Buckinghamshire, England, acquired in 1879 by the corporation of the city of London, and preserved for public use. This tract, the remnant of an ancient forest, lies west of the road between Slough and Beaconsfield, and 2 miles north of Burnham Beeches station on the Great Western railway. Near the township of Burnham are slight Early English remains of an abbey founded in 1265. The district is developing as a residential centre. Population of civil parish of Burnham (1931) 4,416.

BURNHAM-ON-CROUCH, urban district, Essex, England, 43 mi. N.E. from London on a branch of the L.N.E. ry. Pop. (1938) 3,545. Area 8.6 sq.mi. Burnham lies 6 mi. from the North sea; below it the Crouch is joined on the south side by the Roch, which branches into numerous creeks and together with the main estuary forms Foulness, Wallasea, Potton and other low, flat islands, embanked and protected from incursions of the sea. The church of St. Mary is principally late Perpendicular, a good example; it has Decorated portions and a Norman font. There are extensive oyster beds in the Crouch estuary.

BURNING TO DEATH. As a legal punishment for various crimes burning alive was formerly very widespread. It was common among the Romans, being given in the XII. Tables as the special penalty for arson. Under the Gothic codes adulterers were so punished, and throughout the middle ages it was the civil penalty for certain heinous crimes. In England, under the common law, women condemned for high treason or petty treason (murder of husband, murder of master or mistress, certain offences against the coin, etc.) were burned, this being considered more "decent" than hanging and exposure on a gibbet. In practice the convict was strangled before being burnt. The last woman burnt in England suffered in 1789, the punishment being abolished in 1790.

Burning was not included among the penalties for heresy under the Roman imperial codes; but the burning of heretics by orthodox mobs had long been sanctioned by custom before the edicts of emperor Frederick II. (1222–23) made it the civil-law punishment for heresy. His example was followed in France by Louis IX. in the Establishments of 1270. In England, where the civil law was never recognized, the common law took no cognizance of ecclesiastical offences, and the church courts had no power to condemn to death. There were, indeed, in the 12th and 13th centuries isolated instances of the burning of heretics. William of Newburgh describes the burning of certain foreign sectaries in 1169, and early in the 13th century a deacon was burnt by order of the council of Oxford (Foxe ii. 374; *cf.* Bracton, *de Corona,* ii. 300), but by what legal sanction is not obvious. The right of the Crown to issue writs *de haeretico comburendo,* claimed for it by later jurists, was based on that issued by Henry IV. in 1400 for the burning of William Sawtrey; but Sir James Stephen (*Hist. Crim. Law*) points out that this was issued "with the assent of the lords temporal," which seems to prove that the Crown had no right under the common law to issue such writs. The burning of heretics was actually made legal in England by the statute *de haeretico comburendo* (1400), passed ten days after the issue of the above writ. This was repealed in 1533, but the Six Articles Act of 1539 revived burning as a penalty for denying transubstantiation. Under Queen Mary the acts of Henry IV. and Henry V. were revived; they were finally abolished in 1558 on the accession of Elizabeth. Edward VI., Elizabeth and James I., however, burned heretics (illegally as it would appear) under their supposed right of issuing writs for this purpose. The last heretics burnt in England were two Arians, Bartholomew Legate at Smithfield and Edward Wightman at Lichfield, both in 1610. As for witches, countless numbers were burned in most European countries, though not in England, where they were hanged. In Scotland in Charles II.'s day the law still was that witches were to be "worried at the stake and then burnt"; and a witch was burnt at Dornoch so late as 1708.

BURNISHER, a tool used principally in the arts, as the name implies, to give a high polish to a decorated surface. The tool differs in size, shape and material, according to the purpose for which it is intended. The burnisher used by the artist is generally about 10 to 12 in. in length. At one end is an agate, flint or blood stone, very smoothly polished, and cut in various shapes, ranging from a point to a round, square or oblong end, curved hook or spear shape, firmly set in a metal ferrule. The burnisher, as a finishing tool, is brought into the process of gilding after the surface has been carefully prepared—scraped, cleaned, polished, washed in an acid solution and thoroughly dried. The gold leaf is then applied and the colour brought out by means of rubbing with the burnisher.



TYPES OF FLINT AND AGATE BURNISHERS USED IN BOOKBINDING

We find on very early panel and mural paintings, and on illuminated manuscripts, a thinly beaten gold-leaf or finely powdered metallic gold, applied over a smooth priming or foundation, similar to what we to-day call burnish gold size. This was prepared by the early gilders from a very high grade of rabbit or hide glue, mixed together with natural red bolus, a variety of clay. After the gold size has dried smooth and hard, the gold-leaf or powder is carefully applied and then very gently rubbed with the burnisher until the desired high finish is obtained. It is necessary, that the gold to be burnished be laid on a very smooth and hard surface to obtain the most brilliant results. To-day, burnish gold-leaf, a variety differing only slightly from the ordinary gold-leaf—about one karat softer—is used extensively. Genuine metallic gold powder is but seldom employed owing to its high cost. As substitute, the imitation gold powder, or so-called burnishing bronze, is widely used commercially. The gilders of picture and mirror frames, book edges, greeting and playing card edges, illuminated manuscripts and other productions are the principal users of these burnishers.

Another style of burnisher made of a very high grade steel is used by the artist etcher and metal worker to remove rough burrs or to obtain a highly polished surface to parts of the copper or zinc plate, or to make corrections. The carver of leather also employs a burnisher to give a desired finish to the tooled leather. The burnisher used by the ceramic artist to finish gold decorations on china or porcelain, is made of spun glass. The gold on the china is quite dull after leaving the firing kiln. It is carefully burnished with the glass burnisher until the finish which is required is obtained.

There is no record of any definite date or period when burnishers were introduced in the arts. From earliest times there is evidence of their use. (*See* also POTTERY AND PORCELAIN; CHINAWARE; GILDING.) (F. W. WE.)

BURNLEY, municipal, county and parliamentary borough of Lancashire, England, at the junction of the rivers Brun and Calder, 29m. N. of Manchester, on the L.M.S. railway and the Leeds and Liverpool canal. Pop. (1938) 88,650. Area 7.3 sq.mi. The church of St. Peter has a Perpendicular tower, but is largely modernized. During the cotton famine consequent upon the American Civil War of 1861–65 Burnley suffered severely, and the operatives were employed on relief works embracing an extensive system of improvements. In 1902 Towneley hall and park were acquired by the corporation, the mansion being adapted to use as a museum and art gallery. There are a school of science, municipal technical school, a grammar school and girls' school, museum and art gallery, 5 public parks and 12 recreation grounds. The principal industries are cotton-weaving, worsted-making, iron-founding, coal-mining, brick-burning and the making of sanitary wares. The parliamentary borough (1867) returns one member. The town was incorporated in 1861 and the county borough was created in 1888. In 1890 Burnley was created a bishopric suffragan of the diocese of Manchester but later was included under the diocese of Blackburn, founded 1926.

BURNOUF, EUGENE (1801–1852), French orientalist, was born in Paris on April 8, 1801, and died May 28, 1852. He published in 1826 an *Essai sur le Pâli . . .*, written in collaboration with Christian Lassen; and in the following year *Observations grammaticales sur quelques passages de l'essai sur le Pâli.* His next great work was the deciphering of the Zend manuscripts brought to France by Anquetil-Duperron (*q.v.*). By his labours a knowledge of the Zend language was first brought into the scientific world of Europe. He caused the *Vendidad Sade,* part of one of the books bearing the name of Zoroaster, to be lithographed with the utmost care from the Zend ms. in the Bibliothèque Nationale, and published it in folio parts, 1829–43. From 1833 to 1835 he published his *Commentaire sur le Yaçna, l'un des livres liturgiques des Parses;* he also published the Sanskrit text and French translation of the *Bhâgavata Purâna ou histoire poétique de Krichna* in three folio volumes (1840–47). His last works were *Introduction à l'histoire du Bouddhisme indien* (1844), and a translation of *Le lotus de la bonne loi* (1852).

BIBLIOGRAPHY.—*See* a notice of Burnouf's works by Barthélemy Saint-Hilaire, prefixed to the second edition (1876) of the *Introd. à l'histoire du Bouddhisme indien;* also Naudet, "Notice historique sur MM. Burnouf, père et fils," in *Mém. de l'Acad. des Inscriptions,* xx. A list of his valuable contributions to the *Journal asiatique,* and of his ms. writings, is given in the appendix to the *Choix de lettres d'Eugène Burnouf* (1891).

BURNOUS, a long cloak of coarse woollen stuff with a hood, usually white in colour, worn by the Arabs and Berbers throughout North Africa.

BURNS, SIR GEORGE, BART. (1795–1890), British shipowner, was born in Glasgow on Dec. 10, 1795, the son of the Rev. John Burns. In partnership with a brother, James, he began as a Glasgow general merchant about 1818, and in 1824, in conjunction with a Liverpool partner, Hugh Matthie, started a line of small sailing ships which ran between Glasgow and Liverpool. As business increased the vessels were also sailed to Belfast, and steamers afterwards replaced the sailing ships. In 1830 a partnership was entered into with the McIvers of Liverpool, in which George Burns devoted himself specially to the management of the ships. In 1838 with Samuel Cunard, Robert Napier and other capitalists, the partners (McIver and Burns) started the "Cunard" Atlantic line of steamships. They secured the British Government's contract for the carrying of the mails of North America. The sailings were begun with four steamers of about 1,000 tons each, which made the passage in 15 days at some 8½ knots per hour. George Burns retired from the Glasgow management of the line in 1860. He was made a baronet in 1889. He died on June 2, 1890 at Castle Wemyss.

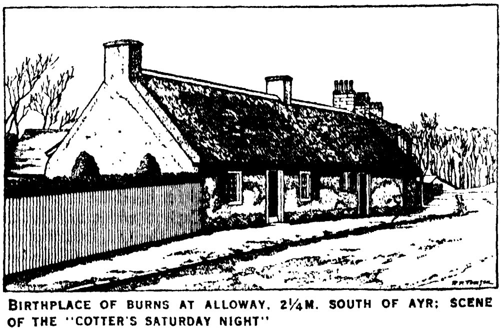
SIR JOHN BURNS (1829–1901), his eldest son, became head of the Cunard Company, and was created a peer, under the title of Baron Inverclyde, in 1897; he was the first to suggest to the Government the use of merchant vessels for war purposes.

GEORGE ARBUTHNOT BURNS (1861–1905), 2nd Baron Inverclyde, became chairman of the Cunard Company in 1902. He conducted the negotiations which resulted in the refusal of the Cunard Company to enter the shipping combination, the International Mercantile Marine Company, formed by Messrs. J. P. Morgan & Co., and took a leading part in the application of turbine engines to ocean liners.

BURNS, JOHN (1858–1943), English politician, was born at Vauxhall, London, in October 1858, the second son of Alexander Burns, an engineer, of Ayrshire extraction. He attended a national school in Battersea until he was ten years old, when he was sent to work in Price's candle factory. He worked for a short time as a page-boy, then in some engine works, and at fourteen was apprenticed for seven years to a Millbank engineer. He continued his education at the night-schools, and read extensively, especially the works of Robert Owen, J. S. Mill, Paine and Cobbett. He ascribed his conversion to the principles of Socialism to his sense of the insufficiency of the arguments advanced against it by J. S. Mill, but he had learnt Socialistic doctrine from a French fellow-workman, Victor Delahaye, who had witnessed the Commune. After working at his trade in various parts of England, and on board ship, he went for a year to the West African coast at the mouth of the Niger as a foreman engineer. His earnings from this undertaking were expended on a six months' tour in France, Germany and Austria for the study of political and economic conditions. He had early begun the practice of outdoor speaking, and his exceptional physical strength and strong voice were invaluable qualifications for a popular agitator. In 1878 he was arrested and locked up for the night for addressing an open-air demonstration on Clapham Common. He was again arrested in 1886 for his share in the West End riots when the windows of the Carlton and other London clubs were broken, but cleared himself at the Old Bailey of the charge of inciting the mob to violence. In November of the next year, however, he was again arrested for resisting the police in their attempt to break up the meeting in Trafalgar Square, and was condemned to six weeks' imprisonment. In 1884 he joined the Social Democratic Federation, which put him forward unsuccessfully in the next year as parliamentary candidate for West Nottingham. His connection with the Social Democratic Federation was short-lived; but he was an active member of the executive of the Amalgamated Society of Engineers, and was still working at his trade in Hoe's printing machine works when he became a Progressive member of the first London County Council, being supported by an allowance of £2 a week subscribed by his constituents, the Battersea working men. He introduced in 1892 a motion that all contracts for the County Council should be paid at trade union rates and carried out under trade union conditions, and devoted his efforts in general to a war against monopolies, except those of the state or the municipality. In the same year (1889) in which he became a member of the County Council he acted with Ben Tillett as the chief leader and organizer of the London dock strike. He entered the House of Commons as member for Battersea in 1892, and was re-elected in 1895, 1900 and 1906. In parliament he became well known as an Independent Radical, and he was included in the Liberal cabinet by Sir Henry Campbell-Bannerman in December 1905 as president of the Local Government Board, and retained the office in Mr. Asquith's government. His policy at the Local Government Board was thought to be too conservative even by some members of the Conservative Party, and early in 1914 he was promoted to the presidency of the Board of Trade. He left the Government in the following August, as he disagreed with the Cabinet's decision to join in World War I. He resigned without making any public statement of his reasons, and took no further active part in Parliament. At the 1918 election he desired to stand again, but received no local support as he refused to join the Labour party. He died in London, Jan. 24, 1943.

BURNS, ROBERT (1759–1796), greatest of Scottish poets, was born on Jan. 25, 1759, in a cottage about 2m. from Ayr. He was the eldest son of a small farmer, William Burness, of Kincardineshire stock. "The poet," said Thomas Carlyle, "was fortunate in his father—a man of thoughtful, intense character, as the best of our peasants are, valuing knowledge, possessing some and open-minded for more, of keen insight and devout heart, friendly and fearless: a fully unfolded man seldom found in any rank in society, and worth descending far in society to seek. . . . Had he been ever so little richer, the whole might have issued otherwise. But poverty sank the whole family even below the reach of our cheap school system, and Burns remained a hard-worked plough-boy."

Through a series of migrations from one unfortunate farm to another; from Alloway (where he was taught to read) to Mt. Oliphant, and then (1777) to Lochlea in Tarbolton (where he learnt the rudiments of geometry), the poet remained in the same condition of straitened circumstances. At the age of 13 he thrashed the corn with his own hands, at 15 he was the principal labourer. "This kind of life," he writes, "the cheerless gloom of a hermit and the unceasing toil of a galley-slave, brought me to my 16th year." His naturally robust frame was overtasked, and his nervous constitution received a fatal strain. His shoulders were bowed, he became liable to headaches, palpitations and fits of depressing melancholy. From these hard tasks and his fiery temperament, craving in vain for sympathy in a frigid air, grew a thirst for stimulants and revolt against restraint. Sent to school at Kirkoswald, he became, for his scant leisure, a great reader—eating at meal-times with a spoon in one hand and a book in the other—carrying a few small volumes in his pocket to study in spare moments in the fields. "The collection of songs," he tells us, "was my *vade mecum.* I pored over them driving my cart or walking to labour, song by song, verse by verse, carefully noting the true, tender, sublime or fustian." He lingered over the ballads in his cold room by night; by day, whilst whistling at the plough, he invented new forms and was inspired by fresh ideas, "gathering around him the memories and the traditions of his country till they became a mantle and a crown."



BIRTHPLACE OF BURNS AT ALLOWAY, 2¼M. SOUTH OF AYR; SCENE OF THE "COTTER'S SATURDAY NIGHT"

Burns had written his first verses of note, "Behind yon hills where Stinchar (afterwards Lugar) flows," when in 1782 he went to Irvine to learn the trade of a flax-dresser. "It was," he says, "an unlucky affair. As we were giving a welcome carousal to the New Year, the shop took fire and burned to ashes; and I was left, like a true poet, without a sixpence." His own heart, too, had unfortunately taken fire. He was poring over mathematics till, in his own phraseology—still affected in its prose by the classical pedantries caught from Pope by Ramsay—"the sun entered Virgo, when a charming *fillette,* who lived next door, overset my trigonometry, and set me off at a tangent from the scene of my studies." The poet was jilted, went through the usual despairs, and resorted to the not unusual sources of consolation.

He had found that he was "no enemy to social life," and his mates had discovered that he was the best of boon companions in the lyric feasts, where his eloquence shed a lustre over wild ways of life, and where he was beginning to be distinguished as a champion of the New Lights and a satirist of the Calvinism whose waters he found like those of Marah.

In Robert's 25th year his father died, full of sorrows and apprehensions for the gifted son.

For some time longer the poet, with his brother Gilbert, lingered at Lochlea, reading agricultural books, miscalculating crops, attending markets, and in a mood of reformation resolving, "in spite of the world, the flesh and the devil, to be a wise man." Affairs, however, went no better with the family; and in 1784 they migrated to Mossgiel, where he lived and wrought, during four years, for a return scarce equal to the wage of the commonest labourer in our day.

Meanwhile he had become intimate with his future wife, Jean Armour; but the father, a master mason, discountenanced the match, and the girl being disposed to "sigh as a lover," as a daughter to obey, Burns, in 1786, gave up his suit, resolved to seek refuge in exile, and having accepted a situation as book-keeper to a slave estate in Jamaica, had taken his passage in a ship for the West Indies.

His old associations seemed to be breaking up, men and fortune scowled, and "hungry ruin had him in the wind," when he wrote the lines ending—

> Adieu, my native banks of Ayr,

and addressed to the most famous of the loves, in which he was as prolific as Catullus or Tibullus, the proposal—

> Will ye go to the Indies, my Mary.

He was withheld from his project and the current of his life was turned by the success of his first volume, which was published at Kilmarnock in June, 1786. It contained some of his most justly celebrated poems, the results of his scanty leisure at Lochlea and Mossgiel; among others "The Twa Dogs"—a graphic idealization of Aesop—"The Author's Prayer," "The Address to the Deil," "The Vision," "The Dream," "Hallowe'en," "The Cotter's Saturday Night," the lines "To a Mouse" and "To a Daisy," "Scotch Drink," "Man was made to Mourn," the "Epistle to Davie," and some of his most popular songs. This epitome of a genius so marvellous and so varied took his audience by storm. "The country murmured of him from sea to sea." "With his poems," says Robert Heron, "old and young, grave and gay, learned and ignorant, were alike transported. I was at that time resident in Galloway, and I can well remember how even plough-boys and maid-servants would have gladly bestowed the wages they earned the most hardly, and which they wanted to purchase necessary clothing, if they might but procure the works of Burns." This first edition only brought the author £20 direct return, but it introduced him to the *literati* of Edinburgh, whither he was invited, and where he was welcomed, feasted, admired and patronized.

Sir Walter Scott bears testimony to the dignified simplicity, and almost exaggerated independence of the poet, during this *annus mirabilis* of his success. "As for Burns, *Virgilium vidi tantum,* I was a lad of 15 when he came to Edinburgh, but had sense enough to be interested in his poetry, and would have given the world to know him. I saw him one day with several gentlemen of literary reputation, among whom I remember the celebrated Dugald Stewart. Of course we youngsters sat silent, looked and listened . . . I remember . . . his shedding tears over a print representing a soldier lying dead in the snow, his dog sitting in misery on one side, on the other his widow with a child in her arms. His person was robust, his manners rustic, not clownish. . . . His countenance was more massive than it looks in any of the portraits. There was a strong expression of shrewdness in his lineaments; the eye alone indicated the poetic character and temperament. It was large and of a dark cast, and literally glowed when he spoke with feeling or interest. I never saw such another eye in a human head. His conversation expressed perfect self-confidence, without the least intrusive forwardness. . . . He was much caressed in Edinburgh, but the efforts made for his relief were extremely trifling." Burns went from those meetings, where he had been posing professors (no hard task), and turning the heads of duchesses, to share a bed in the garret of a writer's apprentice—they paid together 3s. a week for the room. It was in the house of Mr. Carfrae, Baxter's Close, Lawnmarket, "first scale stair on the left hand in going down, first door in the stair." During Burns's life it was reserved for William Pitt to recognize his place as a great poet; the more cautious critics of the north were satisfied to endorse him as a rustic prodigy, and brought upon themselves a share of his satire. Some of the friendships contracted during this period—as for Lord Glencairn and Mrs. Dunlop—are among the most pleasing and permanent in literature. But in the poet's city life there was an unnatural element. He stooped to beg for neither smiles nor favour, but the gnarled country oak is cut up into cabinets in artificial prose and verse. In the letters to Graham, the prologue to Wood, and the epistles to Clarinda, he is dancing minuets with hob-nailed shoes. When, in 1787, the second edition of the *Poems* came out, the proceeds of their sale realized for the author £400. On the strength of this sum he gave himself two long rambles, full of poetic material—one through border towns into England as far as Newcastle, returning by Dumfries to Mauchline, and another a grand tour through the East Highlands, as far as Inverness, returning by Edinburgh, and so home to Ayrshire.

In 1788 Burns took a new farm at Ellisland[1] on the Nith, settled there, married, lost his little money, and wrote, among other pieces, "Auld Lang Syne" and "Tam o' Shanter." In 1789 he obtained, through the good office of Mr. Graham, of Fintry, an appointment as excise-officer of the district, worth £50 per annum. In 1791 he removed to a similar post at Dumfries worth £70. In the course of the following year he was asked to contribute to George Thomson's *Select Collection of Original Scottish Airs with Symphonies and Accompaniments for the Pianoforte and Violin: the poetry by Robert Burns.* To this work he contributed about 100 songs, the best of which are now ringing in the ear of every Scotsman from New Zealand to San Francisco. For these, original and adapted, he received a shawl for his wife, a picture by David Allan representing the "Cotter's Saturday Night" and £5. The poet wrote an indignant letter and never afterwards composed for money. Unfortunately the "Rock of Independence" to which he proudly retired was but a castle of air, over which the meteors of French political enthusiasm cast a lurid gleam. In the last years of his life, exiled from polite society on account of his revolutionary opinions, he became sourer in temper and plunged more deeply into the dissipations of the lower ranks, among whom he found his only companionship and sole, though shallow, sympathy.

Burns began to feel himself prematurely old. Walking with a friend who proposed to him to join a county ball, he shook his head, saying "that's all over now," and adding a verse of Lady Grizel Baillie's ballad—

> O were we young as we ance hae been,
> We sud hae been galloping down on yon green,
> And linking it ower the lily-white lea,
> But were na my heart light I wad dee.

His hand shook; his pulse and appetite failed; his spirits sank into a uniform gloom. In April 1796 he wrote—"I fear it will be some time before I tune my lyre again. By Babel's streams I have sat and wept. I have only known existence by the pressure of sickness and counted time by the repercussions of pain. I close my eyes in misery and open them without hope. I look on the vernal day and say with poor Fergusson—

> Say wherefore has an all-indulgent heaven
> Life to the comfortless and wretched given."

On July 4 he was seen to be dying. On the 12th he wrote to his cousin for the loan of £10 to save him from passing his last days in jail. On the 21st he was no more. On the 25th, when his last son came into the world, he was buried with local honours, the volunteers of the company to which he belonged firing three volleys over his grave.

Burns's lyrics owe part of their popularity to the fact of their being an epitome of melodies, moods and memories that had belonged for centuries to the national life, the best inspirations of which have passed into them. But in gathering from his ancestors Burns has exalted their work by asserting a new dignity for their simplest themes. He is the pupil of Ramsay, but he leaves his master to make a social protest and to lead a literary revolt. The *Gentle Shepherd,* still largely a court pastoral, in which "a man's a man" if born a gentleman, may be contrasted with "The Jolly Beggars"—the one is like a minuet of the ladies of Versailles on the sward of the Swiss village near the Trianon, the other like the march of the maenads with Théroigne Méricourt. Ramsay adds to the rough tunes and words of the ballads the refinement of the wits who in the "Easy" and "Johnstone" clubs talked over their cups of Prior and Pope, Addison and Gay. Burns inspires them with a fervour that thrills the most wooden of his race. We may clench the contrast by a representative example. This is from Ramsay's version of perhaps the best-known of Scottish songs:—

> Methinks around us on each bough
>   A thousand Cupids play;
> Whilst through the groves I walk with you,
>   Each object makes me gay.
> Since your return—the sun and moon
>   With brighter beams do shine,
> Streams murmur soft notes while they run
>   As they did lang syne.

Compare the verses in Burns—

> We twa hae run about the braes
>   And pu'd the gowans fine;
> But we've wandered mony a weary foot
>   Sin auld lang syne.
> We twa hae paidl'd in the burn,
>   Frae morning sun till dine:
> But seas between us braid hae roar'd
>   Sin auld lang syne.

The affectations of Burns's style are insignificant and rare. His prevailing characteristic is an absolute sincerity. A love for the lower forms of social life was his besetting sin; Nature was his healing power. He compares himself to an Aeolian harp, strung to every wind of heaven. His genius flows over all living and lifeless things with a sympathy that finds nothing mean or insignificant. An uprooted daisy becomes in his pages an enduring emblem of the fate of artless maid and simple bard. He disturbs a mouse's nest and finds in the "tim'rous beastie" a fellow-mortal doomed like himself to "thole the winter's sleety dribble," and draws his oft-repeated moral. He walks abroad and, in a verse that glints with the light of its own rising sun before the fierce sarcasm of "The Holy Fair," describes the melodies of a "simmer

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[1] **In 1928 Ellisland was bequeathed to the British nation by John Williamson of Edinburgh.**

Sunday morn." He loiters by Afton Water and "murmurs by the running brook a music sweeter than its own." He stands by a roofless tower, where "the howlet mourns in her dewy bower," and "sets the wild echoes flying," and adds to a perfect picture of the scene his famous vision of "Libertie." In a single stanza he concentrates the sentiment of many night thoughts—

> The wan moon is setting beyond the white wave,
> And Time is setting wi' me, O.

For other examples of the same graphic power we may refer to the course of his stream—

> Whiles ow'r a linn the burnie plays
> As through the glen it wimpled,

or to "The Birks of Aberfeldy" or the "spate" in the dialogue of "The Brigs of Ayr." The poet is as much at home in the presence of this flood as by his "trottin' burn's meander." Familiar with all the seasons he represents the phases of a northern winter with a frequency characteristic of his clime and of his fortunes; her tempests become anthems in his verse, and the sounding woods "raise his thoughts to Him that walketh on the wings of the wind"; full of pity for the shelterless poor, the "ourie cattle," the "silly sheep," and the "helpless birds," he yet reflects that the bitter blast is not "so unkind as man's ingratitude." This constant tendency to ascend above the fair or wild features of outward things, or to penetrate beneath them, to make them symbols, to endow them with a voice to speak for humanity, distinguishes Burns as a descriptive poet from the rest of his countrymen.

Lovers of rustic festivity may hold that the poet's greatest performance is his narrative of "Hallowe'en," which for easy vigour, fullness of rollicking life, blended truth and fancy, is unsurpassed in its kind. Campbell, Wilson, Hazlitt, Montgomery, Burns himself, and the majority of his critics, have recorded their preference for "Tam o' Shanter," where the superstitious element that has played so great a part in the imaginative work of this part of Britain is brought more prominently forward. Few passages of description are finer than that of the roaring Doon and Alloway Kirk glimmering through the groaning trees; but the unique excellence of the piece consists in its variety, and a perfectly original combination of the terrible and the ludicrous. Like Goethe's *Walpurgis Nacht*, brought into closer contact with real life, it stretches from the drunken humours of Christopher Sly to a world of fantasies almost as brilliant as those of the *Midsummer Night's Dream*, half solemnized by the severer atmosphere of a sterner clime. The contrast between the lines "Kings may be blest," and those which follow, beginning "But pleasures are like poppies spread," is typical of the perpetual antithesis of the author's thought and life, in which, at the back of every revelry, he sees the shadow of a warning hand, and reads on the wall the writing, *Omnia mutantur*. With equal or greater confidence other judges have pronounced Burns's masterpiece to be "The Jolly Beggars." Certainly no other single production so illustrates his power of exalting what is insignificant, glorifying what is mean, and elevating the lowest details by the force of his genius. "The form of the piece," says Carlyle, "is a mere cantata, the theme the half-drunken snatches of a joyous band of vagabonds, while the grey leaves are floating on the gusts of the wind in the autumn of the year. But the whole is compacted, refined and poured forth in one flood of liquid harmony. It is light, airy and soft of movement, yet sharp and precise in its details; every face is a portrait, and the whole a group in clear photography. The blanket of the night is drawn aside; in full ruddy gleaming light these rough tatterdemalions are seen at their boisterous revel wringing from Fate another hour of wassail and good cheer." Over the whole is flung a half-humorous, half-savage satire—aimed, like a two-edged sword, at the laws, and the law-breakers, in the acme of which the graceless crew are raised above the level of ordinary gipsies, footpads and rogues, and are made to sit "on the hills like gods together, careless of mankind," and to launch their Titan thunders of rebellion against the world.

> A fig for those by law protected;
> Liberty's a glorious feast,
> Courts for cowards were erected,
> Churches built to please the priest.

The most scathing of his *Satires*, under which head fall many of his minor and frequent passages in his major pieces, are directed against the false pride of birth, and what he conceived to be the false pretences of religion. The apologue of "Death and Dr. Hornbook," "The Ordination," the song, "No churchman am I for to rail and to write," the "Address to the Unco Guid," "Holy Willie," and above all "The Holy Fair," with its savage caricature of an ignorant ranter of the time called Moodie, and others of like stamp, not unnaturally provoked offence. Burns had a firm faith in a Supreme Being, not as a vague mysterious Power, but as the Arbiter of human life. Amid the vicissitudes of his career he responds to the cotter's summons, "Let us worship God."

> An atheist's laugh's a poor exchange
> For Deity offended

is the moral of all his verse, which treats seriously of religious matters. His prayers in rhyme give him a high place among secular psalmists.

Like Chaucer, Burns was a great moralist, though a rough one. In the "Epistle to a Young Friend," the shrewdest advice is blended with exhortations appealing to the highest motive, that which transcends the calculation of consequences, and bids us walk in the straight path from the feeling of personal honour, and "for the glorious privilege of being independent." Burns, like Dante, "loved well because he hated, hated wickedness that hinders loving," and this feeling, as in the lines—"Dweller in yon dungeon dark," sometimes breaks bounds; but his calmer moods are better represented by the well-known passages in the "Epistle to Davie," in which he preaches acquiescence in our lot, and a cheerful acceptance of our duties in the sphere where we are placed. This *philosophic douce*, never better sung by Horace, is the prevailing refrain of our author's *Songs*. These have passed into the air we breathe; they are so real that they seem things rather than words, or, nearer still, living beings. They have taken all hearts, because they are the breath of his own; not polished cadences, but utterances as direct as laughter or tears. Between the first of war songs, composed in a storm on a moor, and the pathos of "Mary in Heaven," he has made every chord in our northern life to vibrate. The distance from "Duncan Gray" to "Auld Lang Syne" is nearly as great as that from Falstaff to Ariel. There is the vehemence of battle, the wail of woe, the march of veterans "red-wat-shod," the smiles of meeting, the tears of parting friends, the gurgle of brown burns, the roar of the wind through pines, the rustle of barley rigs, the thunder on the hill—all Scotland in his verse. Let who will make her laws, Burns has made the songs, which her emigrants recall "by the long wash of Australasian seas," in which maidens are wooed, by which mothers lull their infants, which return "through open casements unto dying ears"—they are the links, the watchwords, the masonic symbols of the Scots race. (J. N.)

The greater part of Burns's verse was posthumously published, and, as he himself took no care to collect the scattered pieces of occasional verse, different editors have from time to time printed, as his, verses that must be regarded as spurious. *Poems chiefly in the Scottish dialect*, by Robert Burns (Kilmarnock, 1786), was followed by an enlarged edition printed in Edinburgh in the next year. Other editions of this book were printed—in London (1787), an enlarged edition at Edinburgh (1793) and a reprint of this in 1794. A facsimile of the 1786 edition was published in 1927. Poems by Burns appeared originally in the *Caledonian Mercury*, the *Edinburgh Evening Courant*, the *Edinburgh Herald*, the *Edinburgh Advertiser;* the London papers, *Stuart's Star and Evening Advertiser* (subsequently known as the *Morning Star*), the *Morning Chronicle;* and in the *Edinburgh Magazine* and the *Scots Magazine*. Many poems, most of which had first appeared elsewhere, were printed in a series of penny chap-books, *Poetry Original and Select* (Brash and Reid, Glasgow), and some appeared separately as broadsides. A series of tracts issued by Stewart and Meikle (1796–99) includes some of Burns's numbers; *The Jolly Beggars, Holy Willie's Prayer* and other poems making their first appearance in this way. The seven numbers of this publication were reissued in Jan. 1800 as *The Poetical Miscellany*. This was followed by Thomas Stewart's *Poems ascribed to Robert Burns* (Glasgow, 1801). Burns's songs appeared chiefly in James Johnson's *Scots Musical Museum* (1787–1803), which he appears after the first volume to have virtually edited, though the two last volumes were published only after his death; and in George Thomson's *Select Collection of Original Scottish Airs* (1793–1841). Only five of the songs done for Thomson appeared during the poet's lifetime, and Thomson's text cannot be regarded with confidence. The Hastie mss. in the British museum (Addit. ms. 22,307) include 162 songs, many of them in Burns's handwriting; and the Dalhousie ms., at Brechin Castle, contains Burns's correspondence with Thomson. For a full account of the songs *see* James C. Dick, *The Songs of Robert Burns now first printed with the Melodies for which they were written* (1903); also D. Cook, *Annotations of Scottish Songs by Burns* (1922).

The items in W. Craibe Angus's *Printed Works of Robert Burns* (1899) number 930. Only the more important collected editions can be here noticed. Dr. Currie was the anonymous editor of the *Works of Robert Burns; with an Account of his Life, and a Criticism on his Writings* . . . (Liverpool, 1800). This was undertaken for the benefit of Burns's family at the desire of his friends, Alexander Cunningham and John Syme. A second and amended edition appeared in 1801, and was followed by others, but Currie's text is neither accurate nor complete. Additional matter appeared in *Reliques of Robert Burns* . . . by R. H. Cromek (London, 1808). In *The Works of Robert Burns, With his Life*, by Allan Cunningham (London, 1834) there are many additions and much biographical material. *The Works of Robert Burns,* edited by James Hogg and William Motherwell (1838–41), contains a life of the poet by Hogg, and some useful notes by Motherwell, attempting to trace the sources of Burns's songs. The *Correspondence between Burns and Clarinda* was edited by W. C. M'Lehose (1843). An improved text of the poems was provided in the second "Aldine Edition" of the *Poetical Works* (1839), for which Sir H. Nicolas, the editor, made use of many original mss. In the *Life and Works of Robert Burns*, ed. by Robert Chambers (1851–52; library edition, 1856–57; new edition, revised by William Wallace, 1896), the poet's works are given in chronological order, interwoven with letters and biography. Other well-known editions are those of George Gilfillan (1856); of Alexander Smith (Golden Treasury Series 1865); of P. Hately Waddell (Glasgow, 1867); an edition with Dr. Currie's memoir and an essay by Prof. Wilson (1843–44); of W. Scott Douglas (the Kilmarnock edition, 1876, and the "library" edition, 1877–79), and of Andrew Lang, assisted by W. A. Craigie (1896). The complete correspondence between Burns and Mrs. Dunlop was printed by W. Wallace (1898).

A critical edition of the *Poetry of Robert Burns,* which may be regarded as definitive, and is provided with full notes and variant readings, was prepared by W. E. Henley and T. F. Henderson (1896–97; reprinted 1901), and is generally known as the "Centenary Burns." In vol. iii. the extent of Burns's indebtedness to Scottish folk-song and his methods of adaptation are minutely discussed; vol. iv. contains an essay on "Robert Burns. Life, Genius, Achievement," by W. E. Henley.

The chief original authority for Burns's life is his own letters. The principal "lives" are to be found in the editions just mentioned. His biography has also been written by J. Gibson Lockhart (*Life of Burns*, 1828); for the "English Men of Letters" series in 1879 by Prof. J. Campbell Shairp; and by Sir Leslie Stephen in the *Dictionary of National Biography* (vol. viii., 1886). For the more important essays on Burns *see* Thomas Carlyle (*Edinburgh Review*, Dec. 1828); John Nichol (W. Scott Douglas's edition of Burns); R. L. Stevenson (*Familiar Studies of Men and Books*); Auguste Angellier (*Robert Burns: La vie et les oeuvres* 1893); Lord Rosebery (*Robert Burns: Two Addresses in Edinburgh*, 1896); J. Logie Robertson (in *In Scottish Fields*, 1890, and *Furth in Field*, 1894); T. F. Henderson, *Robert Burns* (1904); A. Dakers, *Robert Burns. His Life and Genius* (1923). There is a selected bibliography in chronological order in W. A. Craigie's *Primer of Burns* (1896).

BURNS AND SCALDS. A burn is the effect of dry heat of 140° F and over, a scald being the result of moist heat of over 120° F. Clinically there is no distinction between the two, and their classification and treatment are identical. In Dupuytren's classification, burns are divided into six classes according to the severest part of the lesion. Burns of the first degree are characterized by severe pain, redness, transient swelling, and later exfoliation of the skin. Burns of the second degree show vesicles (small blisters) over the inflamed area. Beneath the vesicle the highly sensitive papillae of the skin are exposed. They leave no scar, but often produce a permanent discoloration. In burns of the third degree, there is a partial destruction of the true skin, leaving sloughs of a yellowish or black colour. The pain is at first intense, but passes off on about the second day to return again at the end of a week, when the sloughs separate, exposing the sensitive nerve filaments of the underlying skin. This results in a slightly depressed cicatrix which shows but slight tendency to contraction. Burns of the fourth degree, which follow the prolonged application of any form of intense heat, involve the total destruction of the true skin. The pain is much less severe than in the preceding class, since the nerve endings have been totally destroyed. The results, however, are far more serious, and healing is slow. Deep puckered scars are formed, which show great tendency to contract, and the resulting loss of function may be extremely serious. In burns of the fifth degree the underlying muscles are more or less destroyed, and in those of the sixth the bones are also charred.

The clinical history of a severe burn can be divided into three periods. The first lasts from 30 to 48 hours, during which the patient lies in a condition of profound shock and feels little or no pain. If death results coma first supervenes. The second period begins when the effects of shock pass, and continues until the slough separates, which takes one to two weeks. Much fever is present, and the tendency to complications is great. Bronchitis, pneumonia, pleurisy, meningitis, intestinal catarrh, and ulceration of the duodenum, have been recorded. These complications are the result of septic infection and absorption, and antiseptic treatment reduces their frequency. The third period lasts until recovery. The prognosis depends chiefly on the extent of skin involved, death almost invariably resulting when one-third of the total area of the body is affected, however superficially. Of secondary but still grave importance is the position of the burn, one over a serous cavity being more serious than one on a limb. Also it must be remembered that children very easily succumb to shock.

Treatment.—The treatment is both general and local. The general treatment in severe burns consists in dealing promptly with shock before attempting to treat the burn itself. Stimulants should be avoided, and every effort made to soothe the patient, a useful aid being immersion in a hot bath. After the stage of shock has passed, the secondary effects, such as toxaemia and septicaemia, must be dealt with on general medical principles. The local treatment should aim at preventing sepsis, avoiding frequent dressings, favouring the removal of the eschar, and of obtaining a pliant scar and avoiding deformity.

Scars from burns may be reduced to some extent by radium and X-rays, provided the treatment is commenced within a few months of the injury.

Bibliography.—J. M. H. MacLeod, *Handbook of the Pathology of the Skin* (1903); *Burns and their Treatment* (1918); *The Diseases of the Skin* (1920).

BURNSIDE, AMBROSE EVERETT (1824–1881), American soldier, was born at Liberty, Ind., on May 23, 1824, of Scottish pedigree, his American ancestors settling in the north-west wilderness, where his parents lived in a rude log cabin. He was appointed to the U.S. military academy through casual favour, and graduated in 1847, when war with Mexico was nearly over. In 1853 he resigned his commission, and in 1853–58 was engaged in the manufacture of firearms at Bristol, R.I. In 1856 he invented a breech-loading rifle. When the Civil War broke out he took command of a Rhode Island regiment of three months' militia, on the summons of Governor Sprague, took part in the relief of the national capital and commanded a brigade in the first battle of Bull Run. On Aug. 6, 1861 he was commissioned brigadier-general of volunteers, and placed in charge of the expeditionary force which sailed in Jan. 1862, for the North Carolina coast. The victories of Roanoke Island, Newbern and Fort Macon (Feb.–April) were the chief incidents of the campaign. He was promoted major-general U.S.V. soon afterwards and was transferred to the Virginian theatre of war. Part of his forces fought in the last battles of Pope's campaign in Virginia, and Burnside himself was engaged in the battles of South Mountain and Antietam. At the latter he was in command of McClellan's left wing, but the want of vigour in his attack was unfavourably criticized. His patriotic spirit, modesty and amiable manners, made him highly popular, and upon McClellan's final removal (Nov. 7) from the Army of the Potomac, President Lincoln chose him as successor. The choice was unfortunate. He sustained a crushing defeat at the battle of Fredericksburg (Dec. 13, 1862), and on Jan. 27, 1863, gave way to Gen. Hooker. Transferred to Cincinnati in March, 1863, he caused the arrest and court-martial of Clement L. Vallandigham (*q.v.*), lately an opposition member of Congress, for an alleged disloyal speech, and later in the year his measures for the suppression of press criticism aroused much opposition; he helped to crush Morgan's Ohio raid in July; then, moving to relieve the loyalists in east Tennessee, in September entered Knoxville, to which the Confederate general James Longstreet unsuccessfully laid siege. In 1864 Burnside led his old corps under Grant in the Wilderness and Petersburg campaigns. After bearing his part well in the many bloody battles of that time, he was overtaken once more by disaster. The failure of the "Burnside mine" at Petersburg brought about his resignation. In 1866 he became governor of Rhode Island, serving for three terms (1866–69). From 1875 till his death he was a Republican member of the U.S. Congress. He was present with the German headquarters at the siege of Paris in 1870–71. He died at Bristol, R.I., on Sept. 13, 1881.

See B. P. Poore, *Life and Public Services of Ambrose E. Burnside* (Providence, 1882); A. Woodbury, *Major-General Burnside and the Ninth Army Corps* (Providence, 1867); Daniel Ross Ballou, *The Military Services of Major-General Ambrose Everett Burnside in the Civil War* (1914).

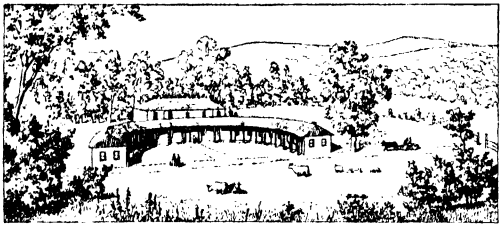
BURNSIDE, WILLIAM (1852–1927), British mathematician, was born in London on July 2, 1852. He was educated at Christ's Hospital and Cambridge. After teaching at Cambridge, Burnside was appointed, in 1885, professor of mathematics at the Royal Naval college, Greenwich, where he remained until he retired in 1919.

Burnside's earlier researches were in applied mathematics, but his later and more important work is in pure mathematics. He is the author of more than 150 papers. In his two papers on automorphic functions (1891–92) Burnside devised a new class of function simpler than that used by Henri Poincaré in his work on the periodicity of functions. This work led him to a study of the theory of groups; he wrote a number of papers on this subject and collected the material into an important book, *Theory of Groups of Finite Order* (1897; second, enlarged edition 1909). He was the author of papers on elliptic functions, non-Euclidean geometry, kinetic theory of gases and theory of waves in liquids. One paper on probability was published in 1918 and a draft of a work on this subject was found amongst his papers after his death, which occurred on Aug. 21, 1927.

Burnside received many academic honours, he was a Fellow of the Royal Society and was awarded the Royal Medal by that society in 1904.

BURNTISLAND, a royal and small burgh, Fifeshire, Scotland, on the shore of the Firth of Forth, 5¼ mi. S.W. of Kirkcaldy by the L.N.E.R. Pop. (est. 1938) 5,672. Its links and beach give it repute as a summer resort. The chief industries are railway locomotive works, the large aluminum manufacture, and shipbuilding. Coal is exported. Its harbour is the northern station of a ferry across the firth from Granton, 5 mi. south. On the rocks forming the western end of the harbour stands Rossend castle. The name Burntisland may refer to the time when the site, or part of it, formed an island, as sea-sand is the subsoil even of the oldest quarters. Another derivation is from Gaelic words meaning "the island beyond the bend." It returns one member to parliament with Kinghorn, Kirkcaldy and the united burgh of Buckhaven and Methil.

BURR, AARON (1756–1836), American political leader, was born at Newark, (N.J.). His father, the Rev. Aaron Burr (1715–57), was the second president of the College of New Jersey, now Princeton university; his mother was the daughter of Jonathan Edwards, the well-known Calvinist theologian. Both his parents died when Aaron Burr was a small child, and his uncle, Timothy Edwards, became his guardian. Aaron Burr graduated from the College of New Jersey, now Princeton, in 1772 and began studying law in the celebrated law school conducted by his brother-in-law, Tapping Reeve, at Litchfield, (Conn.). When the Revolution broke out the youth joined Washington's army at Cambridge. Impatient with its inaction he enlisted to accompany Arnold on the long and arduous march against Quebec and so distinguished himself that, on Arnold's recommendation, he was attached to Gen. Montgomery's staff. Upon his return he was given a place on Washington's staff, but differences between him and his general soon resulted in his being transferred to the staff of Gen. Putnam. Burr is given credit for saving, by his vigilance, a whole brigade from capture during the retreat from Long Island, though in doing it he defied the orders of his superiors. As lieutenant-colonel of a regiment, he passed the winter of 1777 at Valley Forge guarding a pass commanding the approach to the camp, and the next June he commanded a brigade and distinguished himself at the battle of Monmouth. In Jan. 1779 he assumed command of the American lines stretching from the Hudson to the Sound in Westchester county (N.Y.), a region in which there was much lawlessness and plundering by ill-disciplined troops from both armies. Burr established a thorough patrol system, rigorously enforced martial law and restored order.



FROM JAMES PARTON, "AARON BURR"

HARMON BLENNERHASSETT'S HOME ON THE ISLAND OF THE SAME NAME IN THE OHIO RIVER, WHERE THE AARON BURR CONSPIRACY WAS FORMED

Because of ill-health Burr resigned from the army in 1779, renewed the study of law, and in 1782 was admitted to the bar at Albany. That year also witnessed his marriage to Theodosia Prevost, the fascinating and cultured widow of a British officer. The next year, upon the evacuation of New York city by the British, Burr and his wife removed to that city and established themselves in a beautiful mansion at Richmond Hill, just outside the town. The following ten years, when Burr was a leader both in his profession and in the political world and his home the centre of brilliant social gatherings, were doubtless the happiest of his life. He was elected to the State assembly in 1784, and in 1789 his legal talents were recognized by his appointment as attorney-general of the State of New York. In 1791, at the age of 35, he was elected to the U.S. Senate, defeating Gen. Schuyler, father-in-law of Alexander Hamilton, the future leader of the Federalist party. After his service as U.S. Senator he was again for two terms in the State assembly. He had become a power among the Democratic-Republicans of the North, and in 1800 was placed on the presidential ticket with Thomas Jefferson. In New York, recognized as the pivotal State in the election, Burr's personal canvassing and admirable organization were responsible for a Democratic victory. Burr was, in this campaign, the first to organize and manipulate the Tammany society for political purposes, and is credited with starting that institution on its way to political influence. It had been intended that Burr should be vice-president, but through a blunder his name received as many electoral votes as Jefferson's, thus (according to the Constitution at that time) throwing the decision into the House of Representatives. Here a faction of Federalists, preferring Burr to Jefferson, attempted to secure his election and a deadlock for 35 ballots resulted. Hamilton's determined opposition to Burr finally resulted in Jefferson's election.

Burr during the time remained quietly away. He made no effort in his own behalf, but rumours that he had tried to wrest the presidency from his chief became so strong that the loyalty of his party was lost to him, and Jefferson distrusted him. As vice-president, however, he presided over the Senate with a fairness and dignity recognized even by his bitterest enemies. In 1804 he tried to retrieve his political fortunes by running for the governorship of New York. Many of the declining Federalist party wished to support Burr, the latter having become somewhat Federalist in his sympathies, but again Hamilton threw his influence against him as a "dangerous" man of whom he "could detail . . . a still more despicable opinion."

Burr, smarting under this final defeat, and under many assaults upon his character, demanded an explanation of these words from Hamilton. Hamilton quibbled. Burr challenged, and the two met at ten paces at Weehawken. Burr's shot was fatal. But the shot in a sense also killed Burr for it made him an outcast from his country's social and political life. Bereft of all moorings, the man disappeared for some time only to reappear as the instigator of a scheme so daring and exaggerated that it has become one of the legends of American history. Actually Burr had purchased a tract of land in Louisiana and intended to profit by leading a colony of settlers on to it and establishing, perhaps, a new State. Furthermore, in event of a war with Spain, which at that time seemed certain, Burr intended to lead an expedition of his colonists and others into Mexico to win that country for the United States, or for himself. No one was quite sure. Rumours were wildly exaggerated. General James Wilkenson, commander of the army in the west, but really a traitor who had long been in the pay of Spain, told Jefferson that Burr was raising an army to separate the western States from the Union. Jefferson, always suspicious of Burr, had him arrested for treason. A spectacular trial, with John Marshall presiding, was held at Richmond. When the evidence was sifted nothing to prove treasonable actions was found. Though the court in a fair trial found him "not guilty," public opinion would not believe him so, and Burr fled to Europe for four years. Here he lived in pathetic circumstances on borrowed funds, and his morals reached their lowest ebb. He returned to America in answer to the entreaties of his daughter, but the ship bearing her to meet him was lost in a storm and never heard from again. The lone man reopened his law office and for 22 more years gave himself to his profession. In 1833, at the age of 77, he married the wealthy widow Eliza B. Jumel, but the two soon separated. It was Burr's last adventure. He died at Port Richmond, Staten Island, (N.Y.) on Sept. 14, 1836.

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BURR, THEODOSIA (1783–1813), brilliant and accomplished daughter of Aaron Burr, was after Mrs. Burr's death the mistress of the Burr mansion, and, although very young, filled that station with grace and dignity. In 1801 she married Joseph Alston, wealthy planter and later governor of South Carolina. She was largely instrumental in paving the way for her father's return from Europe, and embarked from Charleston with her son and only child to meet him, but the vessel in which she sailed was never heard from and probably foundered in a storm off Cape Hatteras.

See M. Minnegerode, "Theodosia Burr, Prodigy," in his *Lives and Times* (1924); G. Bradford, "Theodosia Burr," in *Wives* (1925).

BURRIANA, a seaport of eastern Spain, in the province of Castellón de la Plana; on the estuary of the river Seco or Bechi. Pop. (1940), 15,725 (mun., 18,473). The open roadstead of Burriana has a considerable seasonal export trade in oranges grown in the surrounding fertile plain, which is irrigated from the river Mijares, on the north. Large quantities of grain, oil, wine and melons are also produced. Burriana is connected by a light railway with the neighbouring towns of Onda (6,483), Almazora (7,804), Villarreal (16,777) and Castellón de la Plana (42,324).

BURRITT, ELIHU (1810–1879), American philanthropist, known as "the learned blacksmith," was born in New Britain (Conn.), on Dec. 8, 1810. For the most part self-taught, by the age of 30 he could read nearly 50 languages, including Latin, Greek, French, Spanish, Italian and German. In 1848 he organized the Brussels Congress of "Friends of Peace," which was followed by annual congresses in Paris, Frankfort, London, Manchester and Edinburgh. He was U.S. consul at Birmingham from 1865 to 1870. He returned to America and died at New Britain on March 9, 1879.

See *Life*, by Charles Northend, in the memorial volume (1879); and an article by Ellen Strong Bartlett in the *New England Magazine* (June, 1897).

BURROUGHS, JOHN (1837–1921), American poet and writer on natural history, was born near Roxbury, in Delaware county (N.Y.), April 3, 1837. In his earlier years he engaged in various pursuits—teaching, journalism, farming, and fruit-raising, and for nine years was a clerk in the treasury department at Washington. After publishing in 1867 a volume of *Notes on Walt Whitman as poet and person* (a subject to which he returned in 1896 with his *Whitman: a Study*) he began in 1871, with *Wake-Robin,* a series of books on birds, flowers, and rural scenes which has made him the successor of Thoreau as a popular essayist on the plants and animals environing human life. His later writings showed a more philosophic mood and a greater disposition toward literary or meditative allusion than their predecessors, but the general theme and method remained the same. His chief books, in addition to *Wake-Robin,* are *Birds and Poets* (1877), *Locusts and Wild Honey* (1879), *Signs and Seasons* (1886), and *Ways of Nature* (1905); these are in prose, but he wrote much also in verse, a volume of poems, *Bird and Bough,* being published in 1906. *Winter Sunshine* (1875) and *Fresh Fields* (1884) are sketches of travel in England and France. Until his death, March 29, 1921, while returning from California to his country home in New York State, he continued to write frequent essays on out-of-door life, some of which were assembled in the following volumes: *Time and Change* (1912), *The Summit of the Years* (1913), *The Breath of Life* (1915), *Under the Apple Trees* (1916), and *Field and Study* (1919).

BIBLIOGRAPHY.—John Burroughs, *My Boyhood* (1922); *John Burroughs' Talks, His Reminiscences and Comments* as reported by Clifton Johnson (1922); Clara Barrus, *The Life and Letters of John Burroughs* (1925); Clara Barrus, *The Heart of Burroughs' Journals* (1928).

BURROUGHS ADDING MACHINE COMPANY, a United States company manufacturing office and business machines, situated in Detroit, Mich., and incorporated in 1905. It succeeded the American Arithmometer Company which was organized in St. Louis, Mo., in 1886, to manufacture adding machines under patents issued to William Seward Burroughs (1857–1898). Burroughs, who inherited his mechanical ingenuity from his father, started as clerk in a small bank, where he conceived the idea which he later developed into the first commercially successful adding machine. Through improvements and development of new models, the company now manufactures machines which add, subtract, multiply and divide, and also machines designed especially for accounting, billing, cash registering, statistical and other specific purposes.

At first it was thought that banks would be the only users and that when the then 8,000 banks in the United States had each purchased a machine the market would be saturated, but as the public realized the time to be saved and the reduction in clerical help to be made through the use of such equipment, the field broadened until Burroughs machines are now used by all types of business and in many homes throughout the world. Production has at times exceeded 10,000 machines per month. Up to 1940 approximately 2,000,000 Burroughs machines had been sold.

The adaptation of bank accounting methods to business machines has resulted in nearly all banks now using uniform methods of keeping accounts. The company has factories in Detroit and Plymouth, Mich.; Windsor, Ont.; and Nottingham, England, and its products are sold in all civilized countries, mainly through agents or subsidiary corporations. (S. B.)

BURROWS, RONALD MONTAGU (1867–1920), British scholar and archaeologist, was born at Rugby and educated at Charterhouse and Christ Church, Oxford. While assistant to Prof. Gilbert Murray in the Greek department at Glasgow university, 1891–97, he started his excavations at Pylos and Sphacteria (1895–96), which had the important result of vindicating Thucydides as an accurate historian. From 1898 to 1908 he was professor of Greek at University college, Cardiff, and from 1908 to 1913 at Manchester university. In 1905 and 1907 he excavated tombs at Mycalessus (Rhitsona) in Boeotia, thereby systematizing for the first time the study of Boeotian archaeology, and in 1907 published *The Discoveries in Crete.* From 1913 until his death he was principal of King's college, London, being the first layman to hold that post. From 1913 onwards he was the leading British philhellene, having "discovered" Venizelos in 1912, and being invited by Venizelos during the World War (1916) to be the semi-official diplomatic representative in London of the Greek Provisional Government. In 1915 the British cabinet adopted his plan for bringing Greece into the war by the offer of Cyprus. Confidant and adviser of Venizelos, he wrote and lectured extensively on Near Eastern political problems. At King's college, he founded the many chairs concerned with European history and literature, and the School of Slavonic Studies.

See George Glasgow, ***Ronald Burrows: A Memoir,*** with foreword by E. K. Venizelos.

BURRUS, SEXTUS AFRANIUS, Roman general, was appointed *praefectus praetorio* by Claudius in A.D. 52, on the recommendation of Agrippina, who thought one head of the praetorian cohorts would be more amenable than two. He was joint tutor to Nero with Seneca, and organized Nero's acclamation by the praetorians on the death of Claudius (55). He opposed the executions ordered by Agrippina at the opening of the reign, and so long as he and Seneca kept their influence the reign of Nero was brilliantly successful. But in A.D. 60 Burrus refused to assist in the murder of Agrippina, and again opposed the murder of Octavia, Nero's wife, and Nero began to find him irksome. He died in A.D. 63. Tacitus alone gives Nero the benefit of the doubt whether his death was really due to poison. After his death Seneca by himself was helpless, and Nero ran his course unchecked.

See Tac. Ann. XII.–XIV.; Dio., XLII., 13; C.I.L. XII., 5842.

BURSAR, literally a keeper of the *bursa* or purse (M.Lat. *bursarius*). The word is now chiefly used of the official, usually one of the fellows, who administers the finances of a college, or of the treasurer of a school or other institution. The term is also applied to the holder of "a bursary," an exhibition at Scottish schools or universities, and also in England to a scholarship or exhibition enabling a pupil of an elementary school to continue his education at a secondary school.

BURSCHENSCHAFT, an association of students at the German universities. It was formed as a result of the German national sentiment awakened by the War of Liberation, its object being to foster patriotism and Christian conduct, as opposed to the particularism and low moral standard of the old *Landsmannschaften.* It originated at Jena, under the patronage of the Grand Duke of Saxe-Weimar, and rapidly spread, the *Allgemeine deutsche Burschenschaft* being established in 1818. The loud political idealism of the *Burschen* excited the fears of the reactionary powers, which culminated after the murder of Kotzebue (*q.v.*) by Karl Sand in 1819, a crime inspired by a secret society among the *Burschen* known as the Blacks (*Schwarzen*). Nominally suppressed by the Carlsbad Decrees (*q.v.*) and again in 1833, it lived on until, in 1848, all laws against it were abrogated. The *Burschenschaften* henceforth became purely social and nonpolitical societies.

BURSERACEAE, a family of dicotyledonous plants, all trees with pinnate leaves, the bark more or less resinous. There are 16 genera and more than 500 species in the tropics of both hemispheres. Large genera are *Protium,* about 90 species and mostly American, *Bursera,* 100 species, all American, *Commiphora* with more than 140 species in Africa and Madagascar, and *Canarium* with about 150 species in the Indo-Malaysian region. The genus *Santiria,* also Indo-Malaysian, contains about 50 species. Certain species of *Canarium* produce important resins, such as Manila elemi (*C. luzonicum* and *C. ovatum*) (*see* ELEMI), while others produce important nuts, such as the Javan canari (*C. commune*), and the Philippine pili (*C. ovatum*).

For a consideration of the genera *see* A. Engler, *Nat. Pflanzenfam.,* ed. 2, 19a:405–456. f. 191–220 (1931).

BURSLEM, former town of Staffordshire, England, 150 mi. N.W. from London by the L.M.S. railway and the Grand Trunk canal. First incorporated in 1878, it was amalgamated in 1910 with Stoke-on-Trent (*q.v.*), of which the civil parish of Burslem formed five wards after 1922. The oldest of the pottery towns, it was already famous in the 17th century. Here Josiah Wedgwood was born in 1730, his family having practised the manufacture in this locality for several generations, while he himself began work independently at the Ivy House pottery in 1759. He is commemorated by the Wedgwood institute, founded in 1863, and at which Sir Oliver Lodge and Arnold Bennett studied. Burslem, anciently Burwardeslyn, is mentioned in Domesday. With Tunstall and Goldenhill, it forms the Burslem parliamentary division of the city of Stoke-on-Trent.

BURTON, JOHN HILL (1809–1881), Scottish historian, was born at Aberdeen on Aug. 22, 1809. He qualified for the Scottish bar and practised as an advocate. His *Manual of the Law of Scotland* (1839) brought him into notice; he joined Sir John Bowring in editing the works of Jeremy Bentham, and for a short time was editor of the *Scotsman,* which he committed to the cause of free trade. In 1846 he achieved high reputation by his *Life of David Hume,* based upon extensive and unused ms. material. In 1847 he wrote his biographies of Simon, Lord Lovat, and of Duncan Forbes, and in 1849 prepared for Chambers's Series manuals of political and social economy and of emigration. He contributed largely to the *Scotsman* and *Blackwood,* writing *Narratives from Criminal Trials in Scotland* (1852), *Treatise on the Law of Bankruptcy in Scotland* (1853), and publishing in 1853 the first volume of his *History of Scotland,* which was completed in 1870. Two volumes of the *National Scottish Registers* were published under his supervision. His last work, *The History of the Reign of Queen Anne* (1880), is inferior to his *History of Scotland.* He died on Aug. 10, 1881.

BURTON, SIR RICHARD FRANCIS (1821–90), British consul, explorer and orientalist, was born at Torquay, March 19, 1821, and baptized at Elstree, Herts. He came of the Westmorland Burtons of Shap, but his grandfather, the Rev. Edward Burton, settled in Ireland as rector of Tuam, and his father, Lieut.-Col. Joseph Netterville Burton, of the 36th Regiment, was an Irishman by birth and character. His mother was descended from the MacGregors, and he was proud of a remote drop of Bourbon blood piously believed to be derived from a morganatic union of the Grand Monarque. There were even those, including some of the Romany themselves, who saw gipsy written in his peculiar eyes as in his character, wild and resentful, essentially vagabond, intolerant of convention and restraint.

His irregular education strengthened the inherited bias. A childhood spent in France and Italy, under scarcely any control, fostered the love of untrammelled wandering and a marvellous fluency in continental vernaculars. Such an education so little prepared him for academic proprieties, that when he entered Trinity college, Oxford, in Oct. 1840, a criticism of his military moustache by a fellow undergraduate instigated a challenge to a duel, and Burton in various ways distinguished himself by such eccentric behaviour that rustication inevitably ensued. Nor was he much more in his element as a subaltern in the 18th Regiment of Bombay Native Infantry, which he joined at Baroda in Oct. 1842. Discipline of any sort he abhorred, and the one recommendation of the East India Company's service in his eyes was that it offered opportunities for studying oriental life and languages. He had begun Arabic without a master at Oxford, and worked in London at Hindustani under Forbes before he went out; in India he laboured indefatigably at the vernaculars, and his reward was an astonishingly rapid proficiency in Gujarati, Marathi and Hindustani, as well as Persian and Arabic.

His appointment as an assistant in the Sind survey enabled him to mix with the people, and he frequently passed as a native in the bazaars and deceived his own *munshi,* to say nothing of his colonel and messmates. His wanderings in Sind were the apprenticeship for the pilgrimage to Mecca, and his seven years in India laid the foundations of his unparalleled familiarity with eastern life and customs, especially among the lower classes. Besides Government reports and contributions to the Asiatic Society, his Indian period produced four books, published after his return home: *Scinde, or the Unhappy Valley* (1851), *Sindh and the Races that Inhabit the Valley of the Indus* (1851), *Goa and the Blue Mountains* (1851), and *Falconry in the Valley of the Indus* (1852). None of these achieved popularity, but the account of Sind is remarkably vivid and faithful.

The pilgrimage to Mecca in 1853 made Burton famous. He had planned it whilst mixing disguised among the Muslims of

Sind, and had laboriously prepared for the ordeal by study and practice. No doubt the primary motive was the love of adventure, which was his strongest passion; but along with the wanderer's restlessness marched the zest for exploration, and whilst wandering was in any case a necessity of his existence, he preferred to roam in untrodden ways where mere adventure might be dignified by geographical service. There was a "huge white blot" on the maps of central Arabia where no European had ever been, and Burton's scheme, approved by the Royal Geographical Society, was to extend his pilgrimage to this "empty abode," and remove a discreditable blank from the map. War among the tribes curtailed the design, and his journey went no farther than Medina and Mecca. The exploit of accompanying the Muslim hajj to the holy cities was not unique, nor so dangerous as has been imagined. Several Europeans have accomplished it before and since Burton's visit without serious mishap. Passing himself off as an Indian Pathan covered any peculiarities or defects of speech. The pilgrimage, however, demands an intimate proficiency in a complicated ritual, and a familiarity with the minutiae of eastern manners and etiquette; and in the case of a stumble, presence of mind and cool courage may be called into request.

There are legends that Burton had to defend his life by taking others'; but he carried no arms, and confessed, rather shamefacedly, that he had never killed anybody at any time. The actual journey was less remarkable than the book in which it was recorded, the *Pilgrimage to Al-Medinah and Meccah* (1855). Its vivid descriptions, pungent style, and intensely personal "note" distinguish it from books of its class; its insight into Semitic modes of thought and its picture of Arab manners give it the value of an historical document; its grim humour, keen observation and reckless insobriety of opinion, expressed in peculiar, uncouth but vigorous language make it a curiosity of literature.

Burton's next journey was more hazardous than the pilgrimage, but created no parallel sensation. In 1854 the Indian Government accepted his proposal to explore the interior of the Somali country, which formed a subject of official anxiety in its relation to the Red sea trade. He was assisted by Capt. J. H. Speke and two other young officers, but accomplished the most difficult part of the enterprise alone. This was the journey to Harrar, the Somali capital, which no white man had entered. Burton vanished into the desert, and was not heard of for four months. When he reappeared, he had not only been to Harrar, but had talked with the king, stayed ten days there in deadly peril, and ridden back across the desert, almost without food and water, running the gauntlet of the Somali spears all the way. Undeterred by this experience, he set out again, but was checked by a skirmish with the tribes, in which one of his young officers was killed, Captain Speke was wounded in 11 places, and Burton himself had a javelin thrust through his jaws. His *First Footsteps in East Africa* (1856), describing these adventures, is one of his most exciting and most characteristic books, full of learning, observation and humour.

After serving on the staff of Beatson's Bashi-bazouks at the Dardanelles, but never getting to the front in the Crimea, Burton returned to Africa in 1856. The Foreign Office, moved by the Royal Geographical Society, commissioned him to search for the sources of the Nile, and, again accompanied by Speke, he explored the lake regions of equatorial Africa. They discovered Lake Tanganyika in Feb. 1858, and Speke, pushing on during Burton's illness and acting on indications supplied by him, lighted upon Victoria Nyanza. The separate discovery led to a bitter dispute, but Burton's expedition, with its discovery of the two lakes, was the incentive to the later explorations of Speke and Grant, Baker, Livingstone and Stanley; and his report in volume xxxiii. of the *Proceedings of the Royal Geographical Society*, and his *Lake Regions of Equatorial Africa* (1860), are the true parents of the multitudinous literature of "darkest Africa."

Burton was the first Englishman to explore Somaliland, the first to discover the great lakes of central Africa, and one of the first to enter Mecca. His East African pioneering coincides with areas which have since become peculiarly interesting to the British empire; and three years later he was exploring on the opposite side of Africa, at Dahomey, Benin and the Gold coast, regions which have also entered among the imperial "questions" of the day. Before middle-age Burton had compressed into his life, as Lord Derby said, "more of study, more of hardship, and more of successful enterprise and adventure, than would have sufficed to fill up the existence of half a dozen ordinary men." *The City of the Saints* (1861) was the fruit of a flying visit to the United States in 1860.

Since 1849 his connection with the Indian army had been practically severed; in 1861 he definitely entered the service of the Foreign Office as consul at Fernando Po, whence he was shifted successively to Santos in Brazil (1865), Damascus (1869), and Trieste (1871), holding the last post till his death Oct. 20 1890. Each of these posts produced its corresponding books: Fernando Po led to the publishing of *Wanderings in West Africa* (1863), *Abeokuta and the Cameroons* (1863), *A Mission to Gelele, king of Dahomé* (1864), and *Wit and Wisdom from West Africa* (1865). *The Highlands of the Brazil* (1869) was the result of four years' residence and travelling; and *Letters from the Battle-fields of Paraguay* (1870) related to a journey across South America to Peru. Damascus suggested *Unexplored Syria* (1872), and might have led to much better work, since no consulate in either hemisphere was more congenial to Burton's taste and linguistic studies; but he mismanaged his opportunities, got into trouble with the Foreign Office, and was removed to Trieste, where his oriental prepossessions and prejudices could do no harm, but where, unfortunately, his oriental learning was thrown away.

He did not, however, abandon his eastern studies or his eastern travels. Various fresh journeys or revisitings of familiar scenes are recorded in his later books, such as *Zanzibar* (1872), *Ultima Thule* (1875), *Etruscan Bologna* (1876), *Sind Revisited* (1877), *The Land of Midian* (1879) and *To the Gold Coast for Gold* (1883). None of these had more than a passing interest. Burton had not the charm of style or imagination which gives immortality to a book of travel. He wrote too fast, and took too little pains about the form. His blunt, disconnected sentences and ill-constructed chapters were full of information and learning, and contained not a few thrusts for the benefit of government or other people, but they were not "readable." There was something ponderous about his very humour, and his criticism was personal and savage.

By far the most celebrated of all his books is the translation of the "Arabian Nights" (*The Thousand Nights and a Night,* 16 vols., privately printed, 1885–88), which occupied the greater part of his leisure at Trieste. As a monument of his Arabic learning and his encyclopaedic knowledge of eastern life, this translation was his greatest achievement. It is open to criticism in many ways; it is not so exact in scholarship, nor so faithful to its avowed text as might be expected from his reputation; but it reveals a profound acquaintance with the vocabulary and customs of the Muslims, with their classical idiom as well as their most vulgar "Billingsgate," with their philosophy and modes of thought as well as their most secret and most disgusting habits.

Burton's "anthropological notes," embracing a wide field of pornography, apart from questions of taste, abound in valuable observations based upon long study of the manners and the writings of the Arabs. The translation itself is often marked by extraordinary resource and felicity in the exact reproduction of the sense of the original; Burton's vocabulary was marvellously extensive, and he had a genius for hitting upon the right word; but his fancy for archaic words and phrases, his habit of coining words, and the harsh and rugged style he affected, detract from the literary quality of the work without in any degree enhancing its fidelity.

With various grave defects, but sometimes brilliant merits, the translation holds a mirror to its author. He was, as has been well said, an Elizabethan born out of time; in the days of Drake his very faults might have counted to his credit.

Of his other works, *Vikram and the Vampire, Hindu Tales* (1870), and a history of his favourite arm, *The Book of the Sword,* vol. i. (1884), unfinished, may be mentioned. His translation of *The Lusiads of Camoens* (1880) was followed (1881) by a sketch of the poet's life. Burton had a fellow-feeling for the poet adventurer, and his translation is an extraordinarily happy reproduction of its original. A manuscript translation of the "Scented Garden," from the Arabic, was burned by his widow, acting in what she believed to be the interests of her husband's reputation. Burton married Isabel Arundell in 1861, and owed much to her courage, sympathy and passionate devotion. Besides her *Life*, other monuments of her devotion to his memory are the Arab tent of stone and marble that she built for his mausoleum at Mortlake, and the "Burton Memorial Lecture Fund," which was inaugurated in 1921 and presents (through the Royal Asiatic Society) a triennial medal to a prominent explorer of the lands with which Burton was associated.

BIBLIOGRAPHY.—Besides Lady Burton's *Life* (1893; abridged edn. 1898) there are.—*A Sketch of the Career of R. F. B.*, by A. B. Richards, A. Wilson, and St. C. Baddeley (1886); *The True Life of Captain Sir R. F. B.*, by his niece, G. M. Stisted (1896); a *Life* by Thos Wright of Olney (1906), an industrious and rather critical work which casts doubt on Burton's originality as an Arabic translator and emphasizes his indebtedness to Payne's *Arabian Nights* (1881); *The Real Sir R. B.*, by W. P. Dodge (1907); and a brief sketch by S. Lane-Poole prefixed to the *Pilgrimage* (*Bohn*, 1898), from which some sentences are here, by permission, introduced. *See* also N. M. Penzer's *An Annotated Bibliography of Sir R. F. B.* (1923) and *Selected Papers on Anthropology, Travel, etc.* (1924). (S. L.-P.)

BURTON, ROBERT (1577–1640), English divine and author of *The Anatomy of Melancholy*, was born at Lindley, Leicestershire, on Feb. 8, 1577. He was educated at Sutton Coldfield and Nuneaton, became a commoner of Brasenose college, Oxford, in 1593, and six years later was elected a student at Christ Church, where he spent the rest of his days. In 1616 he was appointed vicar of St. Thomas's, Oxford, and about 1630 rector of Segrave, Leicestershire. He died on Jan. 25, 1640, having some years previously predicted the year of his death by the calculation of his nativity. His portrait in Brasenose shows the face of a scholar—shrewd, contemplative, humorous.

Burton's first writing, *Philosophaster* (1606), was a Latin comedy and vivacious exposure of charlatanism. It was acted at Christ Church in 1617, but was supposed to be lost, until edited by W. E. Buckley in 1862, together with a number of minor academical exercises. In 1621 appeared *The Anatomy of Melancholy* (by Democritus Junior), revised editions being published in 1624, 1628, 1632, 1638, the sixth edition posthumously printed in 1651 containing Burton's last revision. Sir William Osler has spoken of the *Anatomy* as a "great medical treatise, orderly in arrangement, serious in purpose." But it is much more; it is a mine of information on the life and the thought of the period, covering such diverse topics as the varieties of contemporary sports, current anecdotes, cosmological opinions, and religious theories; and again its abundant quotations from the patristics, the classics, and English authors put before us the gracious erudition of a scholar. In the very extensive preface, Burton declares that he wrote the treatise in order to escape melancholy, and gives his reasons for assuming the name, Democritus Junior. After remarking on the prevalence of madness, even in communities and states, he sketches a Utopia with many practical suggestions, including old-age pensions. The preface is followed by a tabular synopsis of part one. Then, after a brief description of diseases in general, the innumerable causes of melancholy, which differs from madness only in degree, are discussed. Among the natural, as opposed to the supernatural causes, Burton mentions the influence of the stars, heredity, education, bodily ills, accidental states of life, and kinds of food, exhibiting under the subdivision of particular causes a wealth of medical lore. The first part ends with a discussion of suicide. Part two is devoted to the cure of melancholy and sets forth the need of regulating the diet and organic processes, the value of pure air and exercise, the advantages of rectifying dreams, passions and mental perturbations, and the remedial powers of various drugs and of surgery. Part three is occupied firstly with love-melancholy, including an intricate treatise on love, interspersed with famous love-stories from the Bible and from history, and secondly with religious melancholy.

The *Anatomy*, widely read in the 17th century, lapsed for a time into obscurity, but Dr. Johnson greatly admired it, Sterne laid it heavily under contribution, and Charles Lamb found a kindred spirit reflected in it. Of the many editions following those cited above the best is that of A. R. Shilleto (1896), reissued in 1923 in Bohn's Library series. The 1651 edition was elaborately reprinted by the Nonesuch Press in 1925.

See *Robert Burton and the Anatomy of Melancholy*, being papers edit. by F. Madan for the Oxford Bibliographical Society (1926); and *Burton the Anatomist, Being Extracts from the Anatomy, etc.*, edit. by G. C. F. Mead and R. C. Clift (1925).

BURTON, WILLIAM EVANS (1804–60), English actor and playwright, born in London in Sept. 1804, was the son of William George Burton (1774–1825), a printer, and author of *Research into the religions of the Eastern nations as illustrative of the scriptures* (1805). He made his first appearance on the London stage in 1831. In 1834 he went to America, where he appeared in Philadelphia as Dr. Ollapod in *The Poor Gentleman*. He took a prominent place, both as actor and manager, in New York, Philadelphia and Baltimore, the theatre which he leased in New York being renamed Burton's theatre. He had much popular success as Captain Cuttle in John Brougham's dramatization of *Dombey and Son*, and in other low comedy parts in plays from Dickens's novels. Burton was the author of a large number of plays, one of which, *Ellen Wareham* (1833), was produced simultaneously at five London theatres. In Philadelphia he established the *Gentleman's Magazine*, of which Edgar Allan Poe was for some time the editor. He edited the *Cambridge Quarterly* and the *Souvenir*, and wrote several books, including a *Cyclopaedia of Wit and Humour* (1857). He collected a library of more than 100,000 volumes, especially rich in Shakespeariana, which was dispersed after his death at New York city on Feb. 9 1860.

BURTON-OPITZ, RUSSELL (1875–), American physiologist, was born in Ft. Wayne, Ind., on Oct. 25, 1875. He graduated in 1895 at the Rush medical college of the University of Chicago and in 1905 received the degree of doctor of philosophy from the same university, having done postgraduate work also at the universities of Vienna and Breslau, in the latter of which he was assistant in physiology from 1898 to 1901. In 1901 he also carried on research at the marine biological laboratory in Naples. He was assistant in physiology in Harvard university in 1901–02 and then joined the faculty of Columbia university in which he was associate professor of physiology from 1909 to 1923 when he became lecturer in physiology and associate professor of medicine in the New York post-graduate medical school.

His publications include a *Text Book of Physiology* and *Advance Lessons in Physiology* (both 1920) and an *Elementary Manual of Physiology* (1925).

BURTON-UPON-TRENT, county borough, Staffordshire, England; lying mainly on the left bank of the river Trent. Pop. (1891) 46,047; (1938) 46,800. It is 122½ mi. N.W. of London and is served by the L.M.S. and L.N.E. railways. The Trent is navigable from a point near the town downward. In the 9th century St. Modwen is said to have established a convent on the Isle of Andressey opposite Burton. In 1002 Wulfric, earl of Mercia, founded here a Benedictine abbey, and by charter of 1004 granted to it the town with other large endowments. Burton was evidently a mesne borough under the abbot, who held the court of the manor and received the profits of the borough according to the charter of Henry I. Later charters were given by Henry II., by John (who also granted an annual fair of three days' duration, and a weekly market on Thursday), by Henry III., by Henry VII., and by Henry VIII. At the dissolution Henry VIII. founded on the site of the abbey a collegiate church dissolved before 1545, when its lands, with all the privileges formerly vested in the abbot, were conferred on Sir William Paget, ancestor of the marquess of Anglesey, now holder of the manor. Brewing is an ancient industry of the town, but its modern development began about 1708. Forty years later it had a market at St. Petersburg and the Baltic ports, and in 1796 there were nine brewing firms in the town. The use of local well-water impregnated with sulphate of lime derived from gypsum deposits is one factor in the localization of brewing here. Burton is the home of such ales as those of Bass, Worthington, Allsopp and Ind, Coope, the premises of Bass alone covering 750 ac. Many people are employed in the subsidiary industries, especially cask making. Metal workers are also an important element in the population. The church of St. Mary and St. Modwen embodies some remains of an ancient Gothic building. Of the Benedictine abbey dedicated to the same saints there remain a gatehouse and lodge, and a fine doorway. The former abbot's house at Seyney Park is a half-timbered building of the 15th century. The free grammar school was founded in 1525. A fine bridge over the Trent, and the municipal buildings (extended 1939) were provided by Lord Burton. There are recreation grounds on the Derbyshire side of the river.

Burton was incorporated in 1878, is governed by a mayor, eight aldermen and 24 councillors, and is in the Burton Parliamentary Division of Staffordshire. Area 6.6 sq.mi.

BURU (Dutch, *Boeroe*), an island of the Moluccas, Netherlands Indies, between 3° 4′ and 3° 50′ S., and 125° 58′ and 127° 15′ E. It belongs to the residency of Amboina and stands on the outer wall of Archaean rocks which encloses the inner volcanic ring to which the Banda Islands and some of the southwestern islands belong. Oval in shape, it is 90 mi. long, 50 mi. wide; area 3,400 sq.miles. It has high mountains, especially in the N.W., where Mt. Tomahu (Kau palatmada) reaches 7,967 ft., while Kaku Siel is almost as high. In the centre of the island is the large Lake Waikolo (Rana lake) at an altitude of 2,000 ft., with some small affluents, and its outlet, the Wai Nibe, on the north. In the east the mountains are comparatively low, and surrounding Kayeli bay is a wide, circular, level plain. Crystalline slate occurs in the north, and mesozoic sandstone and chalk in the south, deposits which are rare in the archipelago. Most of the island is covered by forest with teak, ebony, and kanari, but the north is bare of trees and overgrown with coarse *kussu* grass, while in swampy parts sago palms are abundant. Ambelau Island (sago palms and coco-nuts) lies off the southeast coast. The mammals of Buru include two very interesting specimens—the *babi-rusa*, or pig-deer (first described by A. R. Wallace, whose hunters killed one during his residence in Buru), and the black, crested baboon (*Cynopithecus nigrescens*). Among birds it has kingfishers (*Ceyx cajeli*), flycatchers, honeysuckers, orioles, and a beautiful sunbird (*Nectarinea proserpina*), also a rare species of Megapodius, or mound-builder (*Megapodius wallacei*). The indigenous people of Buru are Alfur, resembling the Alfurs of Ceram. Agriculture is simple and for local use, but a few villages have coco-nut plantations. The coast has people from Buton, Amboina, the Sula Islands, and other neighbouring coasts, together with some Arabs and Chinese. Most are Mohammedans, but there are probably 2,000 or 3,000 Christians. The total population is estimated at 27,000. The Christians live mostly on the south and southwest coasts and the Mohammedans about Kayeli bay. The chief industry is the manufacture of cajeput oil, from distillation of the leaves of the wild *Melaleuca cajeputi* in Kayeli and other villages along the north coast by Chinese, Arabs, and Sulanese. Millet is grown, and coal is reported to exist. Namlea, on Kayeli bay, is the chief port, and vessels of the Royal Mail Packet Company call here and at Leksula, on the southwest coast. Ambelau Island has a Mohammedan population of 1,300; the people live by fishing and trading with neighbouring islands. In former times the sultan of Ternate claimed a suzerainty over Buru, but in 1683 the Dutch repudiated all their contracts with that monarch. Buru was occupied by the Japanese in World War II.

See A. R. Wallace, *The Malay Archipelago* (1890).

BURUJIRD, a province of Iran embracing a large part of Luristan (*q.v.*), bounded on the south by Khuzistan and extending to the frontier of 'Iraq on the west. It lies mostly in the upper reaches of the Kerkha and Diz rivers and has the distinction of being one of the most mountainous districts of Iran, consisting of a series of parallel ranges running northwest to southeast with fertile valleys intervening. It is inhabited almost exclusively by nomads, and to the southwest are to be found some of the finest grazing grounds in Iran. The revenue in 1926–27 amounted to 2½ million krans (about £60,000). The province is of particular importance as the shortest route from the head of the Persian gulf to the capital runs through it, while from Burujird itself Kermanshah, Hamadan and Isfahan are easily accessible. The road from Dizful to Khoramabad has been greatly improved and at present (1944) is carrying an immense load of lend lease material to Russia and the railway connects Mohammerah with Tehran, Dizful and Burujird.

Burujird town, the administrative headquarters of the province (33° 55′ N. and 48° 55′ E.) is on a tributary of the Ab-i-Diz, elevation 5,500 ft. Population (est.) 35,000.

The town has become a distributing centre of some importance since comparative security has been restored in Luristan. The chief industries of the district are the making of carpets of inferior quality and of various kinds of native cotton stuffs, which supply the simple needs of the villages and nomad tribes in the district. There are two monuments in the town, a mosque, possibly 12th century, and a mausoleum with a stupalike dome.

BURUN. The Burun, inhabiting the extreme southern portion of the Sudan and the hills north of the Khor Yabus, are a tall race whose men go naked and whose women wear a small apron. Knowledge of the Burun is limited to measurements and photographs taken by the late Dr. Pirrie. These people differ in habits and customs from the river negroids, live in small widely separated huts, have no cattle, use the bow and poisoned arrows and carry throwing sticks. Measurements and photographs suggest that the Burun nearly approach the Nuba of southern Kordofan.

BURUSHASKI LANGUAGE. Burushaski (Burošʌski) is the mother tongue of some 17,600 people inhabiting the central portion of the states of Hunza and Nagir which lie to the north of Kashmir where the Hindu Kush and Karakoram ranges meet.

A distinct dialect, known as Werchikwār (Wərčikwa·r) or Wershikwār, is spoken by the (some 7,000) people of Wershegūm, part of the Yasīn valley.

No affinity has yet been proved between Burushaski, and any other language.

The principal sounds of Burushaski are:

Vowels a ʌ ɔ æ ɛ e i ɪ o ʊ u ai (æi and əi)
and the longer a· ɛ· e· i· o· u·
Consonants k χ g γ q ŋ t d n p f (pf) b w m
č ǰ y s z š ž ʦ l r

There is also a series of sounds made with tip of the tongue retracted which may amount in some cases to "cerebrals" on the stricter definition of the term. So

č̣ ǰ̣ ṣ̌ ẓ̌

Natives recognize ḍ (passing into medial ṛ).

There is a curious sound which seems to be a cerebral or retracted ỵ.

Natives claim to recognize the aspirates: kh th ph čh ǰh. In a few words there appears to be a velar g̣ corresponding to q. Werchikwār has an additional l, probably cerebral.

Initial g d b γ and w are changed to
k t p q and p
after certain prefixes.

Among the many distinctive features of grammar and construction are the following: –

Nouns are divided into four categories according as they represent: male human beings (mh), female human beings (fh), animals of both sexes and some inanimate objects (x), the remaining inanimate objects (y).

The principles underlying the differentiation of the x and y categories cannot at present be fully stated but in general names of fruit and wood and articles made of wood are x. Names of liquids, plastic and finely divided substances, trees, metals, abstract ideas and "immaterial" objects are y.

The following vary to a greater or less extent, according to the category of the noun to which they refer:

1. Plural suffixes of nouns (and occasionally adjectives).
2. Demonstrative pronouns and adjectives.
3. Third person singular and plural of the finite tenses of verbs.

Case inflection is effected by the use of suffixes and postpositions.

Agglutinative Pronouns are used as pronominal prefixes with certain nouns and verbs. With nouns they indicate the possessor, with intransitive verbs the subject, and with transitive verbs sometimes the direct, sometimes the indirect object, and occasionally the subject. With a large series of verbs they are used as infixes after an initial d.

Verbs are conjugated by the use of terminal inflections added to two bases, present and past. The imperative is founded on the past base.

Transitive and causative verbs are formed from intransitive verbs by prefixing an element *—ᴀ— or *—ᴀs—(*— indicates the presence of a pronominal prefix).

Numerals.—The numeral system consists of a series of numbers from 1 to 10. The numbers from 20 to 99 are based on the numbers 20 and 40, to which are added the numbers 1 to 19, while 20 and 40 are themselves multiplied as required by a preceding number, *e.g.*, $95 = 2\times40+(10+5)$. The element of 2 is emphasized: 2, 4, 8, 20 and 40 being all obviously related. There is a special series of forms of the numerals used in counting, as multiplicators and with certain nouns of measure, etc.

The numbers 1 and 3 are also differentiated for h as opposed to x and y, and 2 has special forms for h, x and y.

Vocabulary.—Excluding obvious loan words taken chiefly from Persian, Ṣhiṇa and Khowār, the vocabulary of Burushaski and the whole of its inflectional system are, so far as is known peculiar to itself. It would probably be impossible to point out an alien among its pronouns, numerals (except sa's 1,000), verbs and nouns relating to the common objects of daily life.

Bibliography.—*The Linguistic Survey of India* (vol. viii., ii., Calcutta, 1919), has a bibliography of works relating to Burushaski and Werchikwar; D. L. R. Lorimer, "A Burushaski Text from Hunza" *Bulletin of the School of Oriental Studies*, iv. 3, 1927, pp. 505–531; I. Zarubin, "Vershikskoe Narechie Kandzhutskovo Yazika," *Zapiski Kollegii Vostokovedov, Akademii Nauk*, ii. 2. pp. 275–364 1927, an important work on Werchikwar, with a bibliography including Russian authorities and documents. (D. L. R. L.)

BURY, JOHN BAGNELL (1861–1927), British historian, was born Oct. 16, 1861, and was educated at Trinity college, Dublin, where he was elected to a fellowship in 1885. A fine Greek scholar, he edited Pindar's *Nemean* and *Isthmian Odes;* but he devoted himself chiefly to the study of history, and was chosen professor of modern history at Dublin in 1893, becoming regius professor of Greek in 1898. He resigned both positions in 1902, when he was elected regius professor of modern history in the university of Cambridge. His historical work was mainly concerned with the later Roman empire, and his edition of Gibbon's *Decline and Fall*, with a masterly introduction and valuable notes (1896–1900) is the standard text. He also wrote histories of *The Roman Empire, 27* B.C.–*180* A.D. (1893), *Greece to the Death of Alexander the Great* (1900), *The Eastern Roman Empire, 802–867* (1912), and *The Later Roman Empire, 395–565* (1923); a *Life of St. Patrick* (1905); *The Invasion of Europe by the Barbarians* (1928); etc. He died in Rome June 1, 1927. *See* the *Bibliography, with Memoir* by N. H. Baynes (1929).

BURY, RICHARD DE: *see* Aungervyle, Richard.

BURY, municipal county and parliamentary borough, Lancashire, England, on the River Irwell, 10½ mi. N.W. of Manchester, on the L.M.S.R. and the Manchester and Bolton canal. Pop. (1938) 59,380. Area 11.5 sq.mi. Bury, of which the name is derived from the Anglo-Saxon burhg, birig or byrig (town, castle or fortified place), was the site of a Saxon station, and an old English castle stood in Castle Croft close to the town. It was a member of the Honour of Clitheroe and a fee of the royal manor of Tottington, which soon after the Conquest was held by the Lacys. The church of St. Mary is an early foundation, mention of a church being made in Domesday. The present building dates from 1876.

Under a grant made by Edward IV to Sir Thomas Pilkington, fairs are still held on March 5, May 3 and Sept. 18, and a market, formerly held under the same grant on Thursday, is now held on Saturday.

The woollen trade was established here through the agency of Flemish immigrants in the reign of Edward III, and in Elizabeth's time this industry was of such importance that an *aulneger* was appointed to measure and stamp the woollen cloth. But although the woollen manufacture is still carried on, the cotton trade has been gradually superseding it since the early part of the 18th century. The family of the Kays, the inventors, belonged to this place, and Robert Peel's print-works were established here in 1770. The cognate industries of calico printing, dyeing and bleaching are carried on, and there are iron foundries and machinery works. Many light industries have been established. Kay's free grammar school was founded in 1726. An important business experiment established the well-known Bury Co-operative society in 1856. Bury has a technical college and an art gallery.

Until 1846 the town was governed by three constables chosen annually at the court leet. It was incorporated in 1876, and the county borough was created in 1888. The parliamentary borough returns one member.

BURY ST. EDMUNDS, municipal borough, and capital of West Suffolk, England, 87 mi. N.E. by N. of London by the L.N.E. railway. Pop. (1938) 16,890. It is on the River Lark, a tributary of the Great Ouse, in a richly cultivated district. The settlement (Beodricesworth) was one of the royal towns of the Saxons, and may have occupied the site of a Roman villa. Sigebert, king of the East Angles, founded a monastery here about 633, which in 903 became the burial place of King Edmund, who was slain by the Danes about 870. It owed its early celebrity to the reputed miracles performed at the shrine of the martyr king. By 925 the fame of St. Edmund had spread far and wide, and the name of the town was changed to St. Edmund's Bury. Sweyn, in 1020, having destroyed the older monastery and ejected the secular priests, built a Benedictine abbey on its site. King Edmund had granted to the abbot and convent jurisdiction over the whole town, free from all secular services; and Canute in 1020 freed it from episcopal control. By various grants from the abbots, the town gradually attained the rank of a borough. Henry III., in 1235, granted two annual fairs, one in the month of December (which still survives), the other, the great St. Matthew's fair, which was abolished by the Fairs act of 1871. Another fair was granted in 1405. In 1606–07 a charter of incorporation was granted, with an annual fair in Easter week and a market. Further charters date from the 17th century. Remains of the great abbey include the church gate, one of the finest specimens of early Norman architecture in England, the western gate (Decorated) and ruined walls. St. Mary's church has a beautifully carved roof and is of 15th century date, while St. James's is also Perpendicular. The free grammar school dates from the time of Edward VI. The old police station, in Cornhill, s a fine specimen of a Norman house, now used as the borough museum. Bury St. Edmunds formerly had a large woollen trade. The agricultural trade is important, cattle and corn markets being held; while there are agricultural implement works. The town s governed by a mayor, six aldermen and 18 councillors. Area 5.7 sq.mi. For purposes of parliamentary representation it is included in the Bury St. Edmunds division of the administrative county of West Suffolk.

THE MARTYRDOM OF ST. EDMUND
Slain by the Danes about A.D. 870, St. Edmund, the last king of the East Angles, was buried in the borough which now bears his name, in A.D. 903

BUSBECQ, OGIER GHISLAIN DE (1522–1592), Flemish author, ambassador of the emperor Ferdinand I. at Constantinople, was born at Comines, Flanders, natural son of the lord of Busbecq. After serving under Charles V. he entered the service of Ferdinand of Austria, king of the Romans, and was sent by him to the court of Suleiman the Magnificent in 1555 and again in 1556, where he suffered imprisonment and ill-treatment at the hands of the Sultan, whose mind had been poisoned against him by the French ambassadors. Finally, however, he succeeded in framing terms of peace, which were ratified on his return to Vienna in 1562. After this he held various posts at the imperial court, Ferdinand having succeeded his brother Charles V. as emperor. He collected Greek mss. (now in the national library at Vienna), coins, Greek inscriptions, and introduced various plants into Germany. He also discovered the Monumentum Ancyranum; in the Crimea he found a community of Goths still retaining the Gothic customs and languages.

Bibliography.—Busbecq's *Itinera Constantinopolitum et Amasianum* (Antwerp 1581 and 1582, Paris 1589 under the title *A. G. Busbequii Legationis Turcicae Epistolae IV.*) is an important source for the history of Turkey at this time; Eng. trans., by E. S. Forster (1927); his *Epistolae ad Rudolphum II., Imperatorem a Gallia scriptae* (Louvain, 1630) describe the French court.

BUSBY, RICHARD (1606–95), headmaster of Westminster school, was born at Lutton in Lincolnshire in 1606. He was educated at Westminster school and Christ Church, Oxford, where he graduated in 1628. He was rewarded in 1630 for his services to the Stuart cause with the prebend and rectory of Cudworth, with the chapel of Knowle annexed, in Somersetshire. Next year he became headmaster of Westminster, a post which he retained till his death, at the age of 90. He himself once boasted that 16 of the bishops who then occupied the bench had been birched with his "little rod." Among the more illustrious of his pupils may be mentioned South, Dryden, Locke, Prior and Bishop Atterbury. He wrote and edited many works for the use of his scholars, notably his Greek and Latin grammars. He died on April 6, 1695.

BUSBY, the fur cap, decorated with plume and busby-bag, which forms part of the full-dress uniform of Hussars and Royal Horse Artillery. (*See* also Uniforms.)

BUSCH, MORITZ (1821–1890), German publicist, was born at Dresden. After a visit to the United States (1851–52), described in *Wanderungen zwischen Hudson und Mississippi* (1853), he travelled extensively in the East and wrote books on Egypt, Greece and Palestine. From 1856 he was employed at Leipzig on the *Grenzboten*, which, under Gustav Freytag, had become the organ of the Nationalist Party. He was closely connected with the Augustenburg Party in Schleswig-Holstein, but after 1866 he transferred his services to the Prussian Government, and was employed in a semi-official capacity in Hanover. From 1870 onwards he was one of Bismarck's press agents, and accompanied him during the campaign of 1870–71. In 1878 he published the first of his works on Bismarck—*Graf Bismarck und seine Leute, während des Krieges mit Frankreich*, followed by *Neue Tagebuchblätter* (1879) and *Unser Reichskanzler* (1884), chiefly dealing with the work in the foreign office in Berlin. Immediately after Bismarck's death Busch published the chancellor's famous petition to the emperor William II., dated March 18, 1890, requesting to be relieved of office. This was followed by *Bismarck und sein Werk* (1898); and, in London and in English, by the famous memoirs entitled, *Bismarck: some Secret Pages of his History*, in which were reprinted the whole of the earlier works, with a considerable amount of new matter, passages from the earlier works which had been omitted because of the attacks they contained on people in high position, records of later conversations, and some important letters and documents which had been entrusted to him by Bismarck. Many passages were of such a nature that it could not be safely published in Germany; but in 1899 a far better and more complete German edition was published at Leipzig.

See Ernst Goetz, in *Biog. Jahrbuch* (1900).

BUSCH, WILHELM (1832–1908), German caricaturist, was born at Wiedensahl in Hanover on April 15, 1832, and died on Jan. 9, 1908. After studying at the academies of Düsseldorf, Antwerp and Munich, he joined in 1859 the staff of *Fliegende Blätter*, the leading German comic paper, and was, together with Oberländer, the founder of modern German caricature. His humorous drawings and caricatures are remarkable for the extreme simplicity and expressiveness of his pen-and-ink line, which record with a few rapid scrawls the most complicated contortions of the body and the most transitory movement. His humorous illustrated poems, such as *Max und Moritz*, *Der heilige Antonius von Padua*, *Die Fromme Helene*, *Hans Huckebein* and *Die Erlebnisse Knopps des Junggesellen*, play, in the German nursery, the same part that Edward Lear's nonsense verses do in England. He invented the series of comic sketches illustrating a story in scenes without words, which have inspired Caran d'Ache and his successors.

See monograph by K. W. Neumann (1919).

BÜSCHING, ANTON FRIEDRICH (1724–1793), German geographer, was born at Stadthagen, Schaumburg-Lippe, on Sept. 27, 1724; professor of philosophy at Göttingen (1754–57), pastor of the German congregation and director of a flourishing school at St. Petersburg (1761–65), and from 1766 onwards director of the *Gymnasium zum Grauen Kloster*, founded at Berlin by Frederick the Great. By his writings and by his work as a teacher he gave a great impulse to education in Germany. He died in Berlin on May 28, 1793. Büsching was a prolific writer. His *magnum opus* is the unfinished *Neue Erdesbeschreibung* (8th ed. 1787–88), continued by Ebeling. This book, which laid the foundation of modern statistical geography, was published in parts between 1754 and 1761 (Eng. trans. by Murdoch, 6 vols., 1762). Other important works by Büsching are *Grundriss zu einer Historie der Philosophie* (2 parts, 1772–74); and *Beiträge zur Lebensgeschichte denkwürdigen Personen* (6 vols., 1783–89). He also edited two important geographical periodicals.

BUSENBAUM (or Busembaum), **HERMANN** (1600–1668), Jesuit theologian, was born at Nottuln, Westphalia. Out of his lectures to students at Cologne grew his celebrated book *Medulla theologiae moralis, facili ac perspicua methodo resolvens casus conscientiae* (1645). The manual passed through over 200 editions before 1776. Pierre Lacroix added considerably to its bulk, and editions in two folio volumes appeared in both Germany (1710–14) and France (1729). In these sections on murder and especially on regicide were much amplified, and in connection with Damien's attempt on the life of Louis XV. the book was severely handled by the *parlement* of Paris. At Toulouse in 1757, though the offending sections were repudiated by the heads of the Jesuit colleges, the *Medulla* was publicly burned, and the episode undoubtedly led the way to the duc de Choiseul's attack on the Society of Jesus. Busenbaum also wrote a book on the ascetic life, *Lilium inter spinas*. He became rector of the Jesuit college at Hildesheim and then at Münster, where he died on Jan. 31 1668.

Bibliography.—Modern editions of the *Medulla theologiae* (Tournay, 1848 and 1876); another edition with commentary by Ballerini and Palmieri (1893–94).

BUSH. (1) A word common to many European languages, meaning (*cf.* the Ger. *Busch*, Fr. *bois*, Ital. *bosco*, and the mediaeval Lat. *boscus*) a shrub or group of shrubs, especially of those plants whose branches grow low and thick. Collectively "the bush" is used in British colonies, particularly in Australasia and South Africa, for the tract of country covered with brushwood not yet cleared for cultivation. From the custom of hanging a bush as a sign outside a tavern comes the proverb "Good wine needs no bush."

(2) From a Teutonic word meaning "a box" (*cf.* the Ger. *Rad-büchse*, a wheel box, and the termination of "blunderbuss" and "arquebus"; the derivation from the Fr. *bouche*, a mouth, is not correct); a lining frequently inserted in the bearings of machinery. When a shaft and the bearing in which it rotates are made of the same metal the two surfaces are in certain cases apt to "seize" and abrade each other. To prevent this, bushes of some dissimilar metal are employed, thus a shaft of mild steel or wrought iron may be made to run in hard cast steel, cast iron, bronze or Babbitt metal. The last, having a low melting point, may be cast about the shaft for which it is to form a bearing.

BUSHEL, a dry measure of capacity, containing 8 gallons or 4 pecks (from O.Fr. *boissiel, cf.* med. Lat. *bustellus, busellus*, a little box). It has been in use for measuring corn, potatoes, etc., from a very early date, the value varying locally and with the article measured. The "imperial bushel," legally established in Great Britain in 1826, contains 2,218·192 cu.in., or 80lb. of distilled water, determined at 62° F, with the barometer at 30in. Previously, the standard bushel used was known as the "Winchester bushel," so named from the standard being kept in the town hall at Winchester; it contained 2,150·42 cu.in. This standard is the basis of the bushel used in the United States and Canada; but other "bushels" for use in connection with certain commodities have been legalized in different states.

BUSHIDO, the unwritten code of laws governing the lives of the nobles of Japan, equivalent to the European chivalry. Its maxims have been orally handed down, together with a vast accumulation of traditional etiquette, the result of centuries of feudalism. Its inception is associated with the uprise of feudal institutions under Yoritomo, the first of the Shoguns, late in the 12th century, but bushido in an undeveloped form existed before them. The word is originally Chinese and was imported into Japan with the rudiments of the "military-knight-deportment" which it represents. *See* Inazo Nitobe, *Bushido: The Soul of Japan* (1905); also JAPAN: *Defense.*

BUSHIRE, the chief port of Iran, near the head of the Persian gulf (28° 59′ N. and 50° 49′ E.), is situated on the northern part of a peninsula which nowhere exceeds 40 ft. in elevation. Bushire is the headquarters of the Iranian administrative division known as "The Gulf Ports," forming part of the province of Fars and Southern Ports, and as such is the residence of the governor of the division and of a director of Iranian customs. It is likewise the headquarters of a British consul-general. The population of the town is about 40,000 and of the whole peninsula 60,000; the natives are more Arab in blood than Persian and are occupied mainly in seafaring, trade and, to a lesser extent, agriculture. The town is poorly built but the bazaars are fairly extensive. The ordinary water supply is not good, being slightly brackish, but a limited supply of drinking water is now obtainable from a condensing plant erected by the British authorities at Rishire. There is a quarantine station on the small island of Abbasek on the north side of the inner harbour, but apart from occasional outbreaks of plague the town is comparatively healthful although the extreme heat and humidity combined make the summer months almost unbearable.

Bushire has an outer and an inner anchorage; the former distant about 4½ mi. from the landing stage, is open to the winds; but the latter, or so-called harbour of Khor Deira, is a channel from 3½ to 5 cables wide and 3½ fathoms deep, extending for 1½ miles. Being the terminus of an important trade route to Shiraz, Isfahan and Tehran, Bushire is a busy place of direct trade with Basra, India, Great Britain, Egypt and various European ports. The articles of export are chiefly opium, woollen carpets, dates and nuts, hides, drugs, gum, raw cotton, wool and cereals. The total trade in 1941–42 amounted to 31,164 tons, of which 17,813 tons were imports, a more than 60% reduction of the figures of 1925–26 due largely to war conditions. Vessels of the British India Steam Navigation company's fast mail service between Bombay and Basra call weekly and the ships of other companies occasionally. There are cables to Fao, Hanjam and Jask and a wireless station. Tehran is easily reached in four days by motorcar.

Bushire has arisen only in comparatively modern times—at the expense of older sites. Its forerunner was Rishire, which had a very ancient history and, even until comparatively modern times, it was a busy maritime town, of 2,000 houses, in the 16th century. Portuguese maps of the 16th and 17th centuries show it as the chief emporium of the Persian coast. But Rishire gradually declined as Bushire arose and became the quarry which supplied the material for the greater part of Bushire. The foundations of the modern town were laid by Nadir Shah who in 1736 destined it to be the base for his Persian navy. Though his scheme came to naught, his interest in the town had the effect of concentrating the trade of the Persian gulf there, more and more, so that Bandar Abbas lost its commercial supremacy. The British East India company finally transferred their trading activities in Persia from Bandar Abbas to Bushire in 1759 and since then Bushire has become increasingly important.

During the war with Persia (1856–57) Bushire surrendered to a British force and remained in British occupation for some months. Again in Aug. 1915, during World War I, the peninsula was occupied for a short time by British troops.

See G. N. Curzon, *Persia and the Persian Question* (1892); A. T. Wilson, *The Persian Gulf, An Historical Sketch* (1928).

BUSHMAN LANGUAGES. The Bushmen of S. Africa (*see* AFRICA: *Anthropology and Ethnology: South Africa*) are divided into many tribal groups, with different languages or dialects, which are all so clearly related that they must be regarded as belonging to the same language family. Because of variations in phonetics, grammatical structure and vocabulary they are generally classified into three main groups, the Southern, Northern and Central Groups, according to their relative geographical distribution. The Southern Group[1] occurs mainly in the central and western districts of the region roughly S. of the Tropic of Capricorn. It includes the languages of seven tribes, six of which are still in existence, though much broken up, while the seventh is now extinct. Of these tribes, by far the best known, both ethnologically and linguistically, is the |*xam-ka !K'e* (commonly called *Kham*) in the north-west of the Cape Province. The Northern Group is found chiefly in South West Africa and Angola, and includes three large well-known tribes—the ||*kau*||*en* (or *Auen*), the *!Kũ* (*Kung*) and the *Hei-!Kum* (*Heikum*)—together with several smaller ones. The Central Group comprises more than a dozen tribes whose territory forms a sort of wedge between the Southern and Northern Groups, and who are met with mainly in the Central and Northern Kalahari desert. The two best known of these are the *Hiechware* (*Masarwa*) of the Tati District of S. Rhodesia and the *Naron* or *!aikwe* close to the S.W. border of Bechuanaland Protectorate.

The Hottentot languages are on the whole strongly akin to those of the Bushmen, but at the same time differ from them in certain features which show an affinity with the Hamitic languages. They have therefore generally been looked upon as Hamitic languages which have been greatly modified by Bushman influence. Fundamentally, however, the Hottentot languages have far more in common with the Bushman than with the Hamitic languages, and must accordingly be included in the same language family, of which they constitute a fourth distinct group.[2] Four Hottentot languages have been differentiated: *Nama*, still spoken by the Naman in South West Africa and by their neighbours the Bergdama, a negro people whom they have subjugated; *!Kora*, almost extinct, spoken between the Vaal and Caledon Rivers, and along the Orange River towards Namaqualand; the original *Cape Hottentot*, now quite extinct; and *!Gona* of the Eastern Province of the Cape, also extinct.

Phonetics[3].—Except in the case of *Kung* and *Nama* no detailed studies have been made of the phonetic systems of Bushman or Hottentot languages. Certain characteristic features are readily observable, however. Diphthongs and nasalization of vowels are of frequent occurrence; while all the languages abound in click sounds and ejectives (consonants produced with simultaneous closure of the glottis), as well as in alveolar and velar consonants. In none of them do the labio-dentals *f* and *v* or the semi-vowel *l* occur. The famous "clicks" (*q.v.*) are in reality implosive consonants produced by rarefying the air between some outer closure (or point of tongue articulation) and an inner closure formed either at the velum or the glottis, and then releasing the outer closure so that the air is sucked in. The position of the outer closure varies with the different types of click. Four different positional types of click are used in all the languages—dental, alveolar, palato-alveolar (sometimes called cerebral), and lateral—each of which may be pronounced unvoiced, voiced or nasal, and in various combinations with other consonants. The same four types of click are also found in *Sandawe*, a language spoken in Tanganyika, which has other marked resemblances to the Bushman-Hottentot family (v. Sandawe). In the Southern Bushman Group there is further a bilabial unvoiced velaric click, not met with elsewhere, while *Kung* also has a fifth type of click, the retroflex.

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[1] Detailed lists of the Bushman tribes and their distribution are given by Miss D. F. Bleek, "The Distribution of Bushman Languages in S. Africa," in *Festschrift Meinhof* (1927), pp. 55–64; and I. Schapera, "The Tribal Divisions of the Bushmen," *Man*, vol. xxvii. (1927), pp. 68–73.

[2] D. F. Bleek, *Comparative Vocabularies of the Bushman Languages* ms.); I. Schapera, "The Relationship between the Bushmen and the Hottentots," *S. Afr. Journal of Science*, vol. xxiii. (1926), pp. 855 ff.

[3] C. M. Doke, "The Phonetics of the Language of the Chũ Bushmen," *Bantu Studies*, vol. II. No. 3 (1925) pp. 129–165; C. Meinhof, *Lehrbuch der Nama-sprache* (1909) pp. 1–44.

The grouping of sounds and the character of the syllable follow the same principles throughout. Syllables generally end in vowels or syllabic nasals, single vowels, diphthongs and nasal clicks alone often forming complete syllables and whole words. Very many syllables commence with a click, and their quick succession in speech is an outstanding feature of all the languages.

In all the languages the variation of the musical pitch of the syllable is also a most important feature. Many words, phonetically alike, but bearing different meanings, are differentiated tonically, the tone distinction being their only distinguishing feature in speech. Five species of tone are employed—high level, mid level, low level, falling and rising.

Grammatical Processes.—Grammatical categories and syntactic relationships are expressed in various ways, some common to all the languages, others found in only a few of them. The radical elements of words are to a very large extent monosyllabic, and any additional elements can usually be shown to have a functional significance. All the languages are characterized by the total absence of prefixes and by a paucity of infixes. The chief modification of the actual form of the root itself to express new denotative concepts lies in the employment of suffixes. Active suffixes are employed in all the languages with substantives and verbs, as well as in other parts of speech. In substantives they indicate such concepts as plurality, diminution, sex (in *Nama* and *Naron* only), and negation; while in verbs they denote duration, mood, reflection, reciprocation, etc. It is only in exceptional cases (as in *Kham* and *Hiechware*) that they are used for tense This extensive use of suffixes is one of the most characteristic features of these languages, and the number of different suffixes and of the uses to which they are put is extremely great.

Reduplication of the root of a word is of frequent occurrence. As an active grammatical process its use is most marked in the Southern Group of languages, especially in *Kham*, where it is the principal means of forming the plural of substantives and is only used with verbs to denote causality or to give them a transitive meaning. In the Northern, Central and Hottentot languages its chief function is to give the verb a causative significance; it is hardly ever used for forming the plural. In all the languages, however, many words occur in a reduplicated form where no apparent significance attaches to the reduplication.

Composition (the uniting into a single word of two different roots) is also common. Its most usual form of occurrence is verb plus verb, the function of the second verbal root being to modify the meaning of the first in some way, usually to indicate some sort of direction.

The extensive use of particles is another characteristic feature. They are used mainly to modify the significance of the verbal root, and two classes may be distinguished, according to their mode of occurrence and function. The verbal root is as a rule unaltered, save when, as already mentioned, suffixes are added to denote duration, mood, reciprocation, etc. Tense, however, is generally denoted by particles which precede the verbal root and which can never be used alone—they always precede the root of the verb and their function always is to indicate tense. Particles of the second class always follow the words whose significance they qualify. Their main function is to indicate direction. As a mechanism particles are frequently employed, and much of the difficulty in translating these languages is created by them.

Word order as a grammatical process is more marked in some languages than in others. In the Southern and Northern Groups, and to some extent in *Hiechware*, where, *e.g.*, there is no formal distinction between substantives and verbs or between cases, word order is of great importance in the structure of the sentence. In *Naron* and *Nama*, where there is such a distinction, the order of words is in no way rigid.

Grammatical Categories.—Distinction of sex is formally recognized and expressed only in *Nama* and *Naron*, where there are three grammatical genders, masculine, feminine and common, with different suffix endings. In the other languages, when such a distinction is desired, it is effected by qualifying the substantive with the words for "man" or "woman." In most of the languages there is also a classification of objects according to quality or size, substantives denoting objects which are large, strong, wide, etc., falling into one class, while those denoting small, weak or thin objects fall into another. In *Nama* and *Naron* this distinction is expressed by means of the suffixes indicating gender, the first class taking the masculine, the second the feminine, ending. In the other languages the words for "man" and "woman" respectively are used with the same significance. The principle is the same in both cases, although the mechanism for indicating it differs.

The diminutive is always formed by the addition to the substantive of a special suffix or, in certain languages, of a word meaning "child." Plurality is indicated in all the languages except *Kham* by the use of special suffixes; in *Kham*, suffixes are not unknown, but the most usual process is reduplication. In all the languages two numbers (singular and plural) are recognized; *Nama* and *Naron* are exceptional in having also a dual number. Three classes of persons are recognized in all the languages, but in *Kham* and *Nama* there are both inclusive and exclusive forms of the first person plural, while in *Hiechware* there is a slightly different distinction, an exclusive form being used to denote men only, and an inclusive form to denote both men and women. The other languages have apparently no such differentiation.

The genitive relationship is expressed by opposition, the possessor invariably preceding the possessed; in the Southern Group, in *Naron* and in *Nama* connecting particles are used, elsewhere they are not. The position of the adjective varies—in *Kham* it follows, in Central and Northern Bushman it precedes, the substantive; but it never alters in form to correspond with the number of the substantive it qualifies. In *Nama* two usages are found. In one the adjective, as in the Central and Northern Groups, precedes the substantive and does not alter in form to correspond with it in number or sex. In the other it follows the substantive, and then takes the corresponding endings for number and sex. Demonstrative pronouns and adjectives as a rule precede the substantives they qualify, although in *Nama* the demonstrative adjective may also follow the substantive, in which case it takes the corresponding endings for number and sex.

Tense is formed chiefly by the use of auxiliary particles which precede the verb. The verbal root as a rule is unmodified; but in both *Kham* and *Nama* there are also a few verbal suffixes of tense, while in *Hiechware* there is what appears to be a distinction between incomplete and completed action, indicated by the addition of a suffix to the verb in the latter case. Negation is expressed by the use of a special auxiliary word in all the languages. Direction is indicated in both *Nama* and *Kham* by the compounding of verbal roots, the second element of the compound verb modifying the meaning of the first.

The copula is distinguished from the adjective by word order, which is invariably: substantive, auxiliaries, attribute. The same order of words is found in the relation of subject and predicate. The accusative case is in all the Bushman languages determined chiefly by its position after the verb; in *Nama*, however, there is a special suffix ending for this case. The vocative is expressed by the addition of a suffix to the substantive. The passive voice is not indicated in the Southern and Northern Groups; in *Hiechware* and *Nama* it is formed by the addition of a suffix to the verbal root. Reciprocity is in *Kung* and *Nama* expressed by the use of a special suffix added to the verbal root. Finally, an important feature in all the languages is that there is never any modification of the verbal root to correspond with the number and person of the subject, *i.e.*, there is no conjugation.

Numerals.—The numeral systems vary somewhat. That of the Southern Group is essentially binary in principle. The languages of this group have words for numbers up to three, but are more apt to speak of "two and one" than "three." For anything above three they generally make use of the word "many." But in some cases such formations are found as 4=2 2, 5=2 2 1, and so on up to 10. In the Northern and Central Groups the same sort of system is found, *e.g.* in *Kung*, but occasionally modifications occur suggestive of a quinary system. Thus in *Naron* the words for "four" mean "two fingers and two fingers," but "five"= "hand" (occasionally, however, "2 2 1 fingers"), "six"="one hand and one," "ten"="both hands," "fifteen"="both hands, one foot"; and the same system occurs in *Auen*. In the Hottentot languages, on the other hand, there is a fully developed decimal system, with separate words for the numbers from one to ten, from which all terms for higher number are derived. Thus "twenty"= "two tens," "thirty"="three tens" etc., while "one hundred"= "large ten," and "one thousand"="full ten."

Vocabulary.—The vocabularies of these languages are necessarily very restricted along certain lines Terms for abstract ideas are rare, and terms are of course lacking to indicate the many things not connected with the mode of life of the people. But in terms dealing with veld lore, wild animals and birds, trees, herbs and roots, the chase and all the wealth of description which that entails, the languages are rich. A comparison of the vocabularies of the different languages shows that they have many words in common, and that even *Nama* shares a very large number of roots with one or other of the Bushman languages. Its greatest resemblances are with *Naron* and *Hiechware*, but many of its words occur in other Bushman languages also, sometimes in one, sometimes in another, even in the language spoken by the Lake Chrissie Bushmen of the Eastern Transvaal. There are many words in *Nama* which cannot be found in any of the other languages, just as there are words in *Kung* or *Kham* which are peculiar to these languages. Frequently synonyms are found in *Nama* of which one word is also found in the Bushman languages, while another is not. If the languages are arranged according to similarity of roots the Central Group shows most affinity with *Nama*, the Northern Group has less resemblance and the Southern Group still less. There is, however, no sharp division. The languages of the *Kakia Masarwa* and the *|nu||e:n* both of which belong to the Southern Group, have more in common with the Northern Group than has *Kham*, and *Hiechware* is a definite link between the Northern Group and *Naron*, which again is a step nearer *Nama*.

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BUSHMASTER (*Lachesis mutus*), one of the largest members of the pit viper family, reaching a length of 11 ft. It inhabits the Amazon region and is extremely venomous, with very large fangs The tail terminates in a spine which makes a rustling sound as the snake moves. The bushmaster and the diamond-back rattlesnake of the southern United States are the largest American poisonous snakes.

See C. Darwin, *Voyage of the Beagle* (1845); H. W. Bates, *A Naturalist on the River Amazons* (1884); E. G. Boulenger, *Reptiles and Batrachians* (1914).

BUSHMEN. The Kalahari desert and northern neighbourhood (south-west Africa) are the present habitats of nomad hunters and food gatherers, the Khuai or San groups known as Bushmen. The average height of the men of the southern, central and western groups is about 5ft. but in the North and East where inter-marriage and admixture with Bantu-speaking peoples have occurred, men are found occasionally of 6ft. height. The skin is yellow to olive. Steatopygia (*q.v.*) is common among the women, the head is small and flat, while the nose is very broad, the cheek-bones are prominent and the forehead bulging. The hair is short, rolled up into small knots and distributed like peppercorns. The ears frequently have no lobe and the eyes are narrow and often slightly oblique.

Social Organization.—The family consists of a man and his wife or wives and their dependent children. The unit is the small hunting band (patrilineal), within which marriage is forbidden. In some cases marriage is matrilocal until a child is born when the wife and husband join his patrilineal group. There are no chiefs but social matters are managed by the elders.

Religion.—The moon is worshipped and as the hunting group breaks up into family groups during the dry season, the main religious rites fall within the rainy season when the families mass together and form the group, each group having definite territories. In Bushmen folk lore the praying mantis plays a large part.

The Bushman formerly extended over the greater part of South Africa and evidence is accumulating to show that in the north and east of Africa Bushman peoples once existed.

See G. M. Theal, *The Yellow and Dark-skinned People of South Africa* (1910); also AFRICA: *Anthropology and Ethnology*.

BUSHNELL, HORACE (1802–76), U.S. theologian, was born in the village of Bantam, township of Litchfield, Conn., April 14, 1802. He graduated from Yale in 1827, was associate editor of the New York *Journal of Commerce* in 1828–29, and in 1829 became a tutor at Yale. Here he at first took up the study of law, but in 1831 entered the theological department of Yale college, and in 1833 was ordained pastor of the North Congregational church in Hartford, Conn., where he remained until 1859, when on account of long-continued ill-health he resigned his pastorate. Thereafter he had no settled charge, but, until his death at Hartford, Feb. 17, 1876, he preached occasionally and was diligently employed as an author. While in California in 1856, for the restoration of his health, he took an active interest in the organization, at Oakland, of the College of California (chartered in 1855 and merged in the University of California in 1869), the presidency of which he declined. As a preacher, Dr. Bushnell was a man of remarkable power. Not a dramatic orator, he was in high degree original, thoughtful and impressive in the pulpit. Four of his books were of particular importance: *Christian Nurture* (1847), in which he opposed revivalism and "effectively turned the current of Christian thought toward the young"; *Nature and the Supernatural* (1858), in which he discussed miracles and endeavoured to "lift the natural into the supernatural" by emphasizing the supernaturalness of man; *The Vicarious Sacrifice* (1866), in which he contended for what has come to be known as the "moral view" of the atonement in distinction from the "governmental" and the "penal" or "satisfaction" theories; and *God in Christ* (1849), in which he expressed, it was charged, heretical views as to the Trinity, holding, among other things, that the Godhead is "instrumentally three—three simply as related to our finite apprehension, and the communication of God's incommunicable nature." Attempts were made to bring him to trial, but they were unsuccessful, and in 1852 his church unanimously withdrew from the local "consociation," thus removing any possibility of further action against him. To his critics Bushnell formally replied by writing *Christ in Theology* (1851), in which he employed the important argument that spiritual facts can be expressed only in approximate and poetical language, and concluded that an adequate dogmatic theology cannot exist. That he did not deny the divinity of Christ he proved in *The Character of Jesus, Forbidding His Possible Classification with Men* (1861). He also published *Sermons for the New Life* (1858); *Christ and His Salvation* (1864); *Work and Play* (1864); *Moral Uses of Dark Things* (1868); *Women's Suffrage, the Reform against Nature* (1869); *Sermons on Living Subjects* (1872) and *Forgiveness and Law* (1874). Dr. Bushnell was greatly interested in Hartford, and was the chief agent in procuring the establishment of the public park named in his honour by that city.

An edition of Dr. Bushnell's works, in eleven volumes, appeared in 1876–81; and a further volume, gathered from his unpublished papers, as *The Spirit in Man: Sermons and Selections,* in 1903. New editions of his *Nature and Supernatural, Sermons for the New Life,* and *Work and Play,* were published the same year. *See* Mrs. M. B. Cheney's *Life and Letters of Horace Bushnell* (1880; new edition, 1903); Dr. Theodore T. Munger's *Horace Bushnell, Preacher and Theologian* (1899), and a series of papers in the *Minutes of the General Association of Connecticut* (Hartford, 1902). A full bibliography, by Henry Barrett Learned, is appended to Dr. Bushnell's *Spirit in Man.*

BUSHRANGERS, the name given to the Australian brigands (at first escaped convicts) who, in the early 19th century, took refuge in the "bush" and, supporting themselves by plunder, terrorized the scattered inhabitants. Their activities were checked by the Bushranging Act, passed in New South Wales in 1830 (renewed 1834). Later the gold discoveries made highway robbery a profitable enterprise, and a recrudescence of bushranging took place in the middle of the century; nor was it finally stamped out till the annihilation of the Kelly gang in 1870. (*See* KELLY, EDWARD.)

See F. A. Hare, *The Last of the Bushrangers* (1892); G. E. Boxall, *Australian Bushrangers* (3rd ed., 1908).

BUSH-WREN, the name given to a family of birds (Acanthisittidae) confined to the highland forests of New Zealand. There are four species of these tiny, wren-like forms, related to the tyrant flycatchers (*see* FLYCATCHER).

BUSINESS CODES, a term applied to principles or standards of fair and ethical practice agreed upon by particular groups engaged in the sale or exchange of goods or services. The business world, especially in America, because of rapid extension there, has, since about 1910, given them increasing attention; and this is in keeping with the history of commercial law. Thus the old law merchant, antedating and embodying a very important part of common law governing mercantile transactions, arose during the great European fairs of the middle ages. The city laws were temporarily suspended and a special universal code called "law merchant" used, which, during succeeding centuries, crystallized into modern mercantile law comprising negotiable instruments, partnership, trademarks, etc.

Development.—A similar evolution is now going on apace, particularly in America, where the conditions have given rise to similar situations that led up to the formation, during the fair days, of the code law merchant, namely, (1) inadequacy of existing law, (2) confusion and misunderstanding, (3) impediment to quick and fair trading, (4) abuse and dishonesty, (5) outcry and protest, (6) banding together of honest merchants for protection, (7) crude codification of the general consensus of opinion and fair practice, (8) efforts at enforcement, (9) refinement and general acceptance of code, (10) crystallization into law. American and English courts have always recognized that merchants' customs or codes—if they were nearly universally known and long established, and if transactions were made with knowledge of their existence—were an integral part of law merchant, which is now itself a part of common law; hence the increasing activity in setting up codes in America is significant, for it presages a modernization of mercantile law and custom to fit our "machine age" and large-scale commerce. It is adapting commercial ethics and practice to present-day needs, hastening emergence from pioneering chaos, and achieving in the United States a socialization of the sharp individualism which was inevitable in a period of extremely rapid advance. Quite markedly, this took place during the 1929–39 depression, the "New Deal" under Roosevelt attempting (admittedly too rapidly) to improve the standards and codes under which business operates.

Self-government.—Somewhat like law merchant, the first stage of present day *business codes* was styled "self-government" or "self-discipline" in business, administered by business itself. In this stage the professions set up, through their associations, codes of itemized practice standards, using group pressure and moral suasion. As has always proved to be the case, self-discipline of business could not accomplish firm enough control, and law followed.

Self-government in business, however, had a long, fair trial in America between 1911 and 1934. In 1911 the advertising clubs of America began a self-disciplining code movement to curb misstatement in advertising, a "Vigilance Committee" to secure voluntary code enforcement going into action in New York city in 1912 and nationally in 1913. This first code development in business arose, significantly, from the *professional* spirit in American business, following the examples of the medical and legal professions and their "codes of ethics." Thus professional men in business acquired a social perspective, an ethical consciousness separate from the narrower interests of their own commodity line. Other business professions, such as purchasing agents and credit men, followed with codes, to combat long-standing purchasing agent bribes, fake bankruptcy conditions, and other trade evils and malpractices.

Trade associations, serving specific commodity lines, also began about 1920 to develop a social consciousness concerning their line of goods; a collective appreciation of the problems of *their industry as a whole.* They began a career of 15 years of attempted self-government by codes, going through four distinct phases. (1) formulation of vague, idealistic, and very general code items; (2) more precise and exact phrasing of codes, and extension of the code items to more detail; (3) efforts to put "teeth" into the codes and to attach some form of penalty or loss of prestige or membership to persistent code violators; (4) disillusionment with all voluntary efforts at code enforcement. Highly organized, small membership associations succeeded with their codes, but the broader trade associations of wide-flung, highly competitive industries were usually unsuccessful in code making and code enforcement. Considerable progress, however, was made; but it was fairly widely agreed that code enforcement without the aid of government was, in all but a few industries, impractical, due to a 2 to 10% "fringe" of non-co-operators. As a result business opinion underwent a change; there was a more receptive attitude (about 1926) toward the use of the arm of government to give authority to codes.

Federal Trade Commission Aid.—This body (*see* FEDERAL TRADE COMMISSION, THE) organized in 1914, had not been received with marked favour by business men but now was turned to, after some successful efforts, such as those of the Business Standards Council, which had undertaken for trade associations an effort to secure more effective, uniform legislation, State and national, to curb the worst type of business offenders. What was sought through the FTC was the Federal authority in helping to enforce the codes already adopted by trade associations. A plan was formulated which has worked effectively, to make the trade association codes law, through FTC "trade practice conferences." An industry's trade association code, after acceptance by the FTC, was adopted as the "law merchant" of that industry, enforceable on all in the industry, outside as well as inside the association membership (reviewable of course by the courts). The FTC method (following investigation of complaints) consists of "cease and desist" orders or "stipulations" issued against the offender, and hearings held. The plan proved popular in the '20s and gradually more and more industries set up FTC administered codes, as business concluded that (in all but a relatively few cases) it could not regulate industry with codes without Federal authority.

The "NRA" Code Failure.—Encouraged in the idea by business itself, the New Deal in 1933 seized upon the accredited code device as one which might quickly help to lift business out of the depression doldrums. A gigantic project was conceived (National Industrial Recovery Act, later called NRA) which was to set wage minimums and hours of labour, as well as put into fully legal form and administered in co-operation with industry, very comprehensive industry codes of fair trade practice for the entire business world; the anti-trust laws being suspended for the purpose of facilitating the plan. There followed a remarkably stormy, protracted period of conferences by industries to settle upon such codes, which when approved by the President were to become mandatory. Confusion, over-lapping, and criticism soon developed and a pandemonium of opposition and uncertainty, resulting from the fact that there appeared to be involved in the codes price setting, centralized control of production, conflicts between interstate and intrastate trade, and other factors not originally contemplated. Some of these raised the question of constitutionality; in 1935 (Schechter case) the U. S. Supreme Court invalidated the entire NRA as unconstitutional Business considered the failure due to its interlocked double purpose: (1) wage and hour standards, (2) trade practice codes of too far-reaching a nature, too suddenly developed

NRA Code System.—The NRA admittedly was a logical extension of the voluntary trade practice submittal plan previously operated, which about 25 industries had set up, under Federal Trade Commission regulations. Under the tremendous NRA drive toward codes, 1933–35, about 800 national "code authorities" were set up to govern specific lines of trade, and in larger fields hundreds of local divisional code authorities. These code authorities attempted to administer the various codes which had been evolved out of a multitude of conferences, first between those in the lines of trade, and second, between the government NRA heads and the representatives of the lines of trade. The NRA code requirements were (1) true representation of the trade, (2) fairness to employes, consumers, competitors, (3) not monopolistic, (4) non-oppressive to small enterprise. Special emphasis was upon setting of minimum wages and maximum hours of labour, between 30 and 40 per week. President Roosevelt's final approval of each code was necessary. The act also included a licensing system for business, thus giving the President the power (which he never used) to prevent a non-cooperator from continuing in business. Each individual business was asked to sign the code adopted, and was then permitted to display the official NRA insignia, the "Blue Eagle." Violation of code provisions meant loss of this right, and the public was urged to patronize only "Blue Eagle" firms. United States attorneys had power to enjoin firms or groups not complying with the regulations. Industries not submitting codes could have one imposed upon them.

Code difficulties arose almost immediately The 7000 separate lines of trade in the U.S. overlapped confusedly, and were slow in agreeing among themselves In three months only five major and 47 minor industries had completed codes, although two years later a total of about 800 had developed some kind of code. From the start it was also evident that there was little difficulty of agreement on the basic matters of shorter hours and minimum wage, but that the fair competition and trade practice codes, as well as production and price control, and labour-consumer representation in code making, were the most controversial points. As regards fair competition and trade practice the general tendency of business men was to set up ideal conditions of trading practice and profit protection, many of which sharply advanced prices or made more rigorous terms. The NRA however aimed at destructive price-cutting, not price-fixing; but the relaxing of the anti-trust laws left open the door to price control. Thus some codes and organized industries (as for instance lumber) over-reached themselves, while many industries found that "chiselers" within their own ranks at once acted contrary to the code. There was soon widespread code demoralization, and not even the attempts of Gen. Hugh Johnson, code administrator, could stem the disaffection. Labour and consumer criticisms with regard to collective bargaining and a share in code-making became greater, and by April 1935 it was conceded even by its chairman (Donald R. Richberg) of the National Recovery Board that the code machinery was not working right. Legally there had been many court contests, 193 favourable and 31 unfavourable, as to particular questions arising in administration. 65 Federal judges had passed on the NRA but only 9 had expressed sweeping unfavourable opinion. The NRA Supreme Court decision was unanimous.

Promptly upon the Supreme Court decision in May 1935 the entire NRA organization was dissolved, and it was left to lines of trade that cared to do so to continue codes voluntarily. An NRA extension act permitted the President to approve voluntary codes up to April 1, 1936 By October 1935 it became clear that business desired to retain the code method voluntarily, and a check-up showed that about 700 out of the 800 lines of trade which had developed codes were retaining at least the wage and hour provisions; many retaining the entire code intact. There was no widespread drop in wages or rise in hours or dropping of the compulsory codes. NRA code failure, and rising business antagonism to Government participation in business during the "New Deal" administration, throttled progress for four years, in trade practice code matters. There was little activity in setting up further trade practice codes, either by completely voluntary action or in conjunction with FTC. In 1936, the Advertising Federation set up a new and more detailed code for advertisers, but when the Wheeler-Lea amendment to the FTC act was enacted in 1938, giving the FTC power to make stipulations even when no complaints had been brought to it, a decided further tightening up of advertising practice was forced by frequent FTC stipulations. In 1939, a committee of business men headed by Lincoln Filene drafted an amendment to FTC laws enabling groups in any individual industry representing its various functions (from manufacturer to retailer) to set up a code of trade practice regulations and empower the FTC to supervise and administer it. This is the likely trend of American codes in the future; business men of the 1940–50 decade appearing certain to stress greater voluntary code action; as phrased by Winthrop Aldrich in 1939, "So that in this great democracy we can use voluntary action more than compulsion, self-control more than law, a growth of public responsibility more than legislative enactment, education more than force"

Bibliography.—J. G. Frederick's *Book of Business Standards* (1924), *Primer of New Deal Economics* (1933); J. Heermance, *Codes of Ethics* (1924); Edward D. Page, *Trade Morals* (1914); J. A. Hobson, *Economics and Ethics*. (J. G. F.)

BUSINESS MAN'S INVESTMENT, a United States phrase describing stocks or bonds of companies which do not meet the requirements of "legal investments" or the "gilt edge" class, but which are comparatively sound and will ordinarily prove safe and profitable to the business man who understands how to keep in touch with business conditions and foresees the effect of such upon his holdings.

BUSINESS ORGANIZATION: *see* Office Management; Scientific Management.

BŪSĪRĪ (Abū 'Abdallāh Muhammad ibn Sa'id ul-Būsīrī) (1211–1294), Arabian poet, lived in Egypt, where he wrote under the patronage of Ibn Hinna, the vizier. His poems seem to have been wholly on religious subjects. The most famous of these is the so-called "Poem of the Mantle." It is entirely in praise of Mohammed, who cured the poet of paralysis by appearing to him in a dream and wrapping him in a mantle. Even in the poet's lifetime it was regarded as sacred. Its verses are used as amulets; it is employed in the lamentations for the dead; it has been frequently edited and made the basis for other poems, and new poems have been made by interpolating four or six lines after each line of the original. It has been published with English translation by Faizullabhai (Bombay, 1893), with French translation by R. Basset (1894), with German translation by C. A. Ralfs (1860), and in other languages elsewhere.

For commentaries, etc. *cf.* C. Brockelmann's *Gesch. der Arab. Literatur* (Weimar, 1898), vol. i. pp. 264–267.

BUSIRIS, in a Greek legend preserved in a fragment of Pherecydes, an Egyptian king, son of Poseidon and Lyssianassa. After Egypt had been afflicted for nine years with famine, Phrasius, a seer of Cyprus, arrived in Egypt and announced that the cessation of the famine would not take place until a foreigner was yearly sacrificed to Zeus or Jupiter. Busiris commenced by sacrificing the prophet, and continued the custom by offering a foreigner on the altar of the god. It is here that Busiris enters into the circle of the myths and *parerga* of Heracles, who had arrived in Egypt from Libya, and was seized and bound ready to be killed and offered at the altar of Zeus in Memphis Heracles burst the bonds which bound him, and, seizing his club, slew Busiris with his son Amphidamas and his herald Chalbes. This exploit is often represented on vase paintings from the 6th century B.C. and onwards, and the legend is referred to by Herodotus and later writers. Although some of the Greek writers made

Busiris an Egyptian king and a successor of Menes, about the 60th of the series, and the builder of Thebes, those better informed by the Egyptians rejected him altogether. Various esoterical explanations were given of the myth, and the name not found as a king was recognized as that of the tomb of Osiris. Busiris is here probably an earlier and less accurate Graecism than Osiris for the name of the Egyptian god Usiri. All shrines of Osiris were called *P-usiri* (Busiris), but the principal city of the name was in the centre of the Delta, capital of the 9th (Busirite) nome of Lower Egypt. The name Busiris in the legend may have been caught up merely at random by the early Greeks, or they may have vaguely connected their legend with the Egyptian myth of the slaying of Osiris (as king of Egypt) by his mighty brother Seth, who was in certain aspects a patron of foreigners. Phrasius, Chalbes and Epaphus (for the grandfather of Busiris) are all explicable as Graecized Egyptian names, but other names in the legend are purely Greek. The sacrifice of foreign prisoners before a god, a regular scene on temple walls, is perhaps only symbolical for the later days of Egyptian history, but foreign intruders must often have suffered harsh treatment at the hands of the Egyptians, in spite of the generally mild character of the latter.

See H. v. Gartringen, in Pauly-Wissowa, *Realencyklopädie*, for the evidence from the side of classical archaeology. (F. Ll. G.)

BUSKEN-HUET, CONRAD (1826–1886), Dutch literary critic, was born at The Hague. After studying at Geneva and Lausanne, he was appointed pastor of the Walloon chapel in Haarlem in 1851. In 1863 he resigned on grounds of conscience, and in 1868 went out to Java as editor of a newspaper. In 1872 he published the first series of his *Literary Fantasies*, a title under which he gradually gathered in successive volumes all that was most durable in his work as a critic. His one novel, *Lidewijde*, was written under strong French influences. Busken-Huet spent his later years in Paris, where he died. For the last quarter of a century he had been the acknowledged dictator in all questions of Dutch literary taste. Perfectly honest, desirous to be sympathetic, widely read and devoid of all sectarian obstinacy, Busken-Huet introduced into Holland the light and air of Europe. He was a brilliant writer, who would have been admired in any language, but whose appearance in a literature so stiff and dead as that of Holland in the 1850s was dazzling.

BUSKIN, a word of uncertain origin, existing in many European languages [Fr. *brousequin*, Ital. *borzacchino*, etc.]. A half-boot or high shoe strapped under the ankle, and protecting the shins; the thick-soled boot or *cothurnus* in the ancient Athenian tragedy, used to increase the stature of the actors, as opposed to the *soccus*, "sock," the light shoe of comedy. The term is thus often used figuratively of a tragic style.

BUSLAEV, FEDOR IVANOVICH (1818–1898), Russian author and philologist, was born on April 13, 1818, at Kerensk, the son of a government official. After a period of travel abroad he became assistant professor, and in 1881 professor, of Russian literature in Moscow. His works on the historical grammar of the Russian language are among the earliest important contributions to the subject. He maintained that the Slavonic languages had been subject to Christian influences long before the time of Cyril and Methodius. *See* S. D. Sheremetev, *Memoir of F. I. Buslaev* (1899).

BUSONI, FERRUCCIO (1866–1924), Italian pianist and composer, was born at Empoli, near Florence. After studying in Vienna and at Graz, he became a member of the Accademia Filarmonica of Bologna. In 1888 he was appointed professor at Helsingfors, and in 1890 became professor at the Moscow conservatoire. His concerts in different countries brought him world-wide fame as a virtuoso. In 1913 he became director of the Liceo Musicale at Bologna, and in 1920 of the Meisterklasse for composition in Berlin, where he died. As a pianist Busoni possessed a superb mastery over the keyboard, probably unequalled since the time of Liszt, together with a great sense of beauty. His compositions include an opera, *Brautwahl* (1913), chamber music, orchestral works, piano solos and songs. His brilliant and scholarly arrangements, notably of Bach's "well-tempered clavichord," have been invaluable to pianists, while his talent as a writer is shown in his essays, which include *Entwurf einer Neuen Ästhetik der Tonkunst* (1916).

Bibliography.—*See* H. Leichtentritt, *F. Busoni* (1916) and G. Seldon-Goth, *F. Busoni* (1922).

BUSS, FRANCES MARY (1827–1894), English schoolmistress, was born in London, the daughter of the painter-etcher R. W. Buss, one of the original illustrators of *Pickwick*. She was educated at a school in Camden Town, and continued there as a teacher, but soon joined her mother in keeping a school in Kentish Town. In 1848 she was one of the original attendants at lectures at the new Queen's College for Ladies. In 1850 her school was moved to Camden street, and under its new name of the North London Collegiate School for Ladies it rapidly increased in numbers and reputation. In 1864 Miss Buss gave evidence before the Schools Inquiry commission, and in its report her school was singled out for exceptional commendation. Indeed, under her influence, what was then pioneer work of the highest importance had been done to put the education of girls on a proper intellectual footing. Shortly afterwards the Brewers' company and the Clothworkers' company provided funds by which the existing North London collegiate school was rehoused and a Camden school for Girls founded, and both were endowed under a new scheme, Miss Buss continuing to be principal of the former. She played an active part in promoting the success of the Girls' Public Day School trust, encouraging the connection of the girls' school with the university standard by examinations, working for the establishment of women's colleges and improving the training of teachers; and her energetic personality was a potent force among her pupils and colleagues. She died in London on Dec. 24, 1894.

BUSSA, a town of Borgu, Northern Nigeria, on the west bank of the Niger, in 10° 9′ N., 4° 40′ E. It is situated just above the rapids which mark the limit of navigability of the Niger by steamer from the sea. Here in 1806 Mungo Park, in his second expedition to trace the course of the Niger, was attacked by the inhabitants and drowned while endeavouring to escape. During 1894–98 its possession was disputed by Great Britain and France, the last-named country acknowledging by the convention of June 1898 the British claim, which carried with it the control of the lower Niger. In 1925 a new town was laid out on a more sanitary site, and the old town gradually deserted (*See* Borgu.)

BUSSACO, BATTLE OF. Compelled by circumstances (*see* Peninsular War) to adopt a defensive policy in 1810, Wellington had spent the winter in creating the "lines of Torres Vedras" (*q.v.*). Before retiring behind them, however, he decided that, for the sake of the *morale* of the newly-formed Portuguese army, as well as of the government at home, it was desirable to fight one defensive battle under the most favourable conditions. By a process of elimination he had concluded that the French invasion of Portugal, which he knew to be imminent, must follow the line of the river Mondego. He therefore disposed his army, consisting of 26,000 British and 25,000 Portuguese, along the Bussaco ridge, astride the Vizeu-Mealhada road which Masséna, the French commander, was following. This ridge, 10 mi. in length and about 1,500 ft. high, ran from the Mondego on the south to the almost impassable Sierra de Caramullo in the north. Crossed by only three roads, it was itself so steep and rugged as to constitute a formidable natural obstacle. Wellington now crowned it with guns and soldiers; Hill's division, recalled at the last moment from watching the Tagus, held the extreme right; next to him Leith covered the road from San Paulo; Picton that from San Antonio; while the main Vizeu-Mealhada road was watched by Spencer on its south side and Craufurd on its north; on the extreme left, just below the slopes of the Sierra de Caramullo, lay Cole. Portuguese brigades were interspersed among the British units, and the walled convent of Bussaco on the main road was garrisoned by Pack's Portuguese brigade. Wellington was confident that any attempt to assault the position must fail, but there was one road over the Sierra de Carmullo to Sardao by which it might be turned; this road he ordered Trant, with a force of Portuguese irregulars, to block. Masséna, however, "the spoilt child of victory," was contemptuous of opposition; he considered the Portuguese troops to be valueless, and believed, too, that

Hill was still 70 mi. away at Abrantes. After a very inadequate reconnaissance, therefore, he ordered a frontal attack. Reynier's corps, on the left, was to advance on to the ridge by the San Antonio road, and having gained the summit, to sweep northward along its crest. Contingent upon this success, Ney's corps was to advance up the main Vizeu-Mealhada road, while Junot was to remain in reserve in rear of Ney. The whole French force numbered some 80,000 men. In the early morning of Sept. 27, Reynier advanced, having Merle's division in column on the right, Heudelet's on the left, with Foy in reserve. So arduous was the climb that when they reached the crest the French troops were utterly exhausted; they were struck by a storm of grape in front, by musketry on each flank; finally, a vigorous bayonet charge swept Merle's column headlong down the hill, while Heudelet's fell back in scarcely better order. Reynier now ordered Foy to try where Merle and Heudelet had failed, but Wellington had by this time ordered up Leith and Hill from the right, and Foy's column in its turn was driven off with heavy loss. In spite of Reynier's failure Ney advanced to the attack, having Loisson's division on the right of the main road, Marchand's on the left. Once again the superiority of British tactics was apparent; the overlapping fire of Craufurd's line withered the head and flanks of the solid French column, which could make no adequate reply. It needed but a vigorous bayonet charge to hurl Loisson's men down the hill. Marchand, meanwhile, had made no headway against Pack's Portuguese and, seeing Loisson's fate, withdrew. Though he still had Junot in reserve, Masséna realized that a frontal assault against such a position and such soldiers could not succeed. He therefore broke off the battle, having lost 5,000 men, against an allied loss of barely 1,300. Wellington's object, moreover, had been fully achieved; the Portuguese had seen their redoubtable enemies wither before their fire, melt away before their charge. The following day Masséna found his way through the Caramullos, Trant having been too late to block the pass; but Wellington had already begun his retreat, which took him behind the impregnable lines of Torres Vedras.

BUSSACO, SERRA DE, a mountain range on the frontiers of the Aveiro, Coimbra and Vizeu districts of Portugal. The highest point is the Ponta de Bussaco (1,795 ft.), with a magnificent view over the Serra da Estrella, the Mondego valley and the Atlantic ocean. Luso (pop. 1,870), a village celebrated for its hot mineral springs, is the nearest railway station. Bussaco's hotel, built in the Manueline style, encloses the buildings of a secularized Trappist monastery, founded in 1268. The convent woods have long been famous for their cypress, plane, evergreen, oak, cork and other ancient forest trees. A bull of Pope Gregory XV (1623), anathematizing trespassers and forbidding women to approach, is inscribed on a tablet at the main entrance; another bull, of Urban VIII (1643), threatens with excommunication any person harming the trees. In 1873 a monument was erected on the southern slopes of the Serra to commemorate the battle in which the French, under Marshal Masséna, were defeated by the British and Portuguese, under Lord Wellington, on Sept. 27, 1810.

BUSSUM, a residential suburb of Amsterdam (distance 15 mi.) in the province of North Holland, the Netherlands. Pop. (1940) 28,794.

BUSSY, ROGER DE RABUTIN, Comte de (1618–1693), known as Bussy-Rabutin, French writer, was born on April 13, 1618, at Epiry, near Autun. His father, Léonor de Rabutin, was lieutenant general of the province of Nivernais. Roger entered the army when he was only 16 and fought through several campaigns, succeeding his father in the office of *mestre de camp*. In 1641 he was sent to the Bastille by Richelieu for some months as a punishment for neglect of his duties in his pursuit of gallantry. In 1645 he succeeded to his father's position in the Nivernais and served under Condé in Catalonia. He had married in 1643, but his wife died in 1646, and he became notorious by an attempt to abduct Madame de Miramion, a rich widow. This affair was settled by a considerable payment, and he afterwards married Louise de Rouville. When Condé joined the party of the Fronde, Bussy joined him, but a fancied slight on the part of the prince finally decided him for the royal side. He fought both in the civil war and under Turenne in Flanders. He distinguished himself at the battle of the Dunes and elsewhere; but his quarrelsome disposition, his overweening vanity and his habit of composing libellous *chansons* made him eventually the enemy of most persons of position both in the army and at court. In 1659 he fell into disgrace for having taken part in an orgy at Roissy near Paris during Holy Week. Bussy was ordered to retire to his estates, and beguiled his enforced leisure by composing for the amusement of his mistress, Madame de Montglas, his famous *Histoire amoureuse des Gaules*. This book, a series of witty but ill-natured sketches of the intrigues of the chief ladies of the court, circulated freely in ms., and had many spurious sequels. It was said that Bussy had not spared the reputation of madame, and the king, angry at the report, was not appeased when Bussy sent him a copy of the book to disprove the scandal. He was sent to the Bastille on April 17, 1665, and a year later he was liberated on condition of retiring to his estates, where he lived for 17 years.

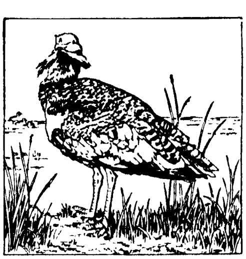
The *Histoire amoureuse* is in its most striking passages adapted from Petronius, and, except in a few portraits, its attractions are chiefly those of the scandalous chronicle. But his *Mémoires*, published after his death, are extremely lively and characteristic and have all the charm of a historical romance of the adventurous type. His voluminous correspondence yields in variety and interest to few collections of the kind, except that of Madame de Sévigné, who was his cousin, and whose letters first appeared in it.

The best edition of the *Histoire amoureuse des Gaules* is that of Paul Boiteau in the Bibliothèque Elzévirienne (1856–59). The *Mémoires* (1857) and *Correspondance* (1858–59) were edited by Ludovic Lalanne. Bussy wrote other things, of which the most important, his *Genealogy of the Rabutin Family*, remained in ms. till 1867, while his *Considérations sur la guerre* was first published in Dresden in 1746. He also wrote, for the use of his children, a series of biographies, in which his own life serves a moral purpose.

BUSTAMANTE, ANTONIO SÁNCHEZ DE (1865–1933), Cuban lawyer, statesman, publicist, was born on April 13, 1865, in Havana, Cuba, where his father was professor and dean of the faculty of medicine in the university. He received most of his education in his native city, and obtained his degree of advocate at the university there. In 1884, before he was yet 20, he won by public competitive examination the chair of international law in the university. In 1902, when the republic of Cuba was constituted, he was elected senator for the province of Pinar del Rio, and was re-elected in 1909 to represent Havana. In 1895 he was made member of the Institute of International Law, the only Cuban who gained that honour, and in 1907 he was selected as delegate plenipotentiary of Cuba to the Second Peace conference at The Hague. He was dean of the Havana bar; member of the Permanent Arbitration Tribunal of The Hague; custodian of alien enemy property, 1918. In 1928 he was chosen president of the 6th Pan-American congress, held at Havana. He is the author of numerous works pertaining to international law. Among them are: *Tratado de Derecho Internacional Privado* (Havana, 1896); *Programa de las Asignaturas de Derecho Internacional Público y Derecho Internacional Privado* (Madrid, 1891); *El Orden Público, Estudio de Derecho Internacional Privado* (Havana, 1893); *Le Canal de Panama et le Droit International* (Bruxelles, 1895); *La Segunda Conferencia de la Paz* (Madrid, 1908); *La Autarquia Personal*, a study of international private law. (W. B. P.)

BUSTARD, the common English name for medium to large game birds of the family Otidae, constituting the suborder Otides in the order Gruiformes, typified by the cranes and rails. There are some 11 genera and 23 species, confined to the old world. The best known is the great bustard (*Otis tarda*), largest European land bird, males reaching as much as 32 lb., with 4 ft. length and 8 ft. wing spread. It is found from central and southern Europe to central Asia and Manchuria. It is wary and difficult to approach on the grain fields and open steppes, where two or three olive eggs, blotched with brown, are laid. In courtship the head is bent back almost touching the uplifted tail, the white secondaries of the wing are exposed and the throat pouch is inflated (*see* Courtship of Animals). It has powerful, sustained flight. Until 1838 it bred in England and southeast Scotland. The little bustard

(*Tetrax tetrax*) ranges from western Europe and Morocco to Afghanistan. The bustards of South Africa are known as *paauw*, the largest being the great paauw (*Choriotis kori*); *C. arabs* is found in Morocco and northern tropical Africa south of the Sahara. *C. australis* in Australia where it is called "turkey," and *C. nigripes* in northwest India. *Sphcotides indica* is common over India and *Houbaropsis bengalensis* from eastern India to Indo-China. *Chlamydotis undulata* lives on deserts and high plateaus of north Africa and southwest Asia, from Algeria to Baluchistan. A number of species (five each in *Neotis* and *Eupodotis*, two each in *Lophotis* and *Lissotis*) are common in desert, savanna and thorn-brush country over Africa south of the Sahara, while *Afrotis atra* occurs in South Africa, from Bechuanaland and South-West Africa to the Cape. (G. F. Ss.)



GREAT BUSTARD (OTIS TARDA), INHABITS SOUTHERN EUROPE, WESTERN ASIA AND NORTHERN AFRICA

BUSTO ARSIZIO, urban district, Italy, province of Milan, 21 mi. N.W. of Milan. Pop. (1936) 32,820 (town), 42,995 (commune). The fine domed S Maria di Piazza (1517) is from Bramante's designs; the picture over the high altar is one of Gaudenzio Ferrari's best works. Busto Arsizio is an active manufacturing town with cotton factories, etc.

BUTADES, of Sicyon, wrongly called DIBUTADES, the first Greek modeller in clay. The story is that his daughter, who loved a youth at Corinth, where they lived, drew upon the wall the outline of his shadow, and that upon this outline her father modelled a face of the youth in clay and baked the model along with the clay tiles which it was his trade to make. This model was preserved in Corinth till Mummius sacked that town. He is also said to have invented a mixture of clay and ruddle, or to have introduced the use of a special kind of red clay (Pliny, *Nat. Hist.* xxxv. 12 [43]). He is said to have lived about 600 B.C.

BUTANE (C_4H_{10}) is the fourth in the series of paraffin hydro-carbons of the general formula C_nH_{2n+2} and has one isomer. Normal butane boils at about the freezing point of water and has a Beaumé gravity of 109. Both crude petroleum and natural gas come from wells and in most cases a mixture of oil and gas is obtained simultaneously. Butane lies in the border zone and occurs in considerable quantities in both products. In the early days of petroleum refining most of the butane was lost in both the field and refinery operations since it was too volatile to condense in ordinary condensers. To-day both field and refinery gases are being scrubbed with oil or compressed to recover the butane as a liquid, in which form it has more value than as a gas. In order to utilize liquid butane commercially it is necessary to free it from dissolved gases, such as the lower members of the same series—ethane and propane, as their presence increases the volatility of the butane to such an extent that its storage and use becomes almost impossible.

The modern development of the butane industry has come about through the perfection of processes for the manufacture of "natural gasolene" from natural gas and refinery gases and in particular for the fractionation of this hydro-carbon mixture into its components. In modern natural gasolene plants practically all of the butane is extracted from the gas and used either as part of the gasolene or as liquid butane. When propane is absent butane has a sufficiently low vapour pressure at ordinary temperatures to enable it to be shipped safely in tank cars or other containers and yet will completely evaporate when the pressure is relieved to give a gas of about four times the heating power of ordinary manufactured gas. It has been successfully tried out as a substitute for gas oil for the enrichment of illuminating gas and its uses as a solvent have been studied. Mixed with propane it is sold in cylinders for household heating and for isolated illuminating plant. Butene, the corresponding unsaturated hydro-carbon found in gases from cracking stills, shares all the properties listed above for butane and in addition serves as the starting point for the manufacture of synthetic alcohols.

BUTCHER, SAMUEL HENRY (1850–1910), British scholar, was born in Dublin and educated at Marlborough and Trinity college, Cambridge. He was senior classic (1873); assistant master at Eton; then fellow and lecturer in classics at Trinity (1874); tutor and fellow of University college (1876); and professor of Greek at Edinburgh (1882). In 1904 he resigned and settled in London. In 1906 he was elected Unionist member for Cambridge university. Butcher sat on several royal commissions on education and was president in turn of the English Classical Association, the Irish Classical Association and the British Academy. In 1908 he was made a trustee of the British Museum.

His works include *Some Aspects of the Greek Genius* (1891); *Aristotle's Theory of Poetry and Fine Art* (1895); *Greek Idealism in the Common Things of Life* (1901); and *Harvard Lectures on Greek Subjects* (1904). In 1887 he published, in collaboration with Andrew Lang, a prose translation of the *Odyssey*.

BUTCHER, one who cuts and trims meat for cooking. He must be thoroughly experienced in handling meats and must know the different qualities. If selling forms a part of his duties he should be well versed in figures and methods of salesmanship. Mutual protection societies, known as Butchers' Guilds, have existed since the 12th century, and there still stands in Haarlem, Holland, the home of the Butchers' Guild of that city, famed as a memorial both to the architecture and prevailing spirit among trade organizations of that day. The Butchers' National Protective Association of the United States of America, founded in St. Louis, Mo., in May, 1886, is its first American prototype. Preservation and proper care of meat as a matter of public health has been emphasized for centuries. In 1266 a Food act passed in England punished the sellers of diseased meat by putting the offending butchers in the pillory and slowly roasting in front of them the malodorous carcasses. The official census of 1920 estimated the number of butchers in the United States at 866 per million of population for that year.

BUTE, JOHN STUART, 3RD EARL OF (1713–1792), English prime minister, son of James, 2nd earl, and of Lady Jane Campbell, daughter of the 1st duke of Argyll, was born on May 25, 1713; he was educated at Eton and succeeded to the earldom (in the peerage of Scotland; created for his grandfather Sir James Stuart in 1703) on his father's death in 1723. He was elected a representative peer for Scotland in 1737, but not in the following parliaments, and appears not to have spoken in debate. In 1738 he was made a knight of the Thistle, and for several years lived in retirement in Bute, engaged in agricultural and botanical pursuits. From the quiet obscurity for which his talents and character entirely fitted him Bute was forced by a mere accident. He had resided in England since the rebellion of 1745, and in 1747, a downpour of rain having prevented the departure of Frederick, prince of Wales, from the Egham races, Bute was summoned to his tent to make up a whist party; he immediately gained the favour of the prince and princess, became the leading personage at their court, and in 1750 was appointed by Frederick a lord of his bedchamber. After the latter's death in 1751 his influence in the household increased. His relations with the princess formed the subject of numerous popular lampoons, but the scandal was never founded on anything but conjecture and the malice of faction. Bute became the constant companion and confidant of the young prince. In the year 1755 he took part in the negotiations between Leicester House and Pitt, directed against the duke of Newcastle, and in 1757 in the conferences between the two ministers which led to their taking office together.

On the accession of George III. in 1760, Bute became a privy councillor, groom of the stole and first gentleman of the bedchamber, and though without a seat in parliament or in the cabinet, he was the only man who enjoyed the king's complete confidence. George III. immediately proceeded in his attempt to accomplish his long-projected plans, the conclusion of the peace with France, the break-up of the long-continued Whig monopoly of power, and the supremacy of the monarchy over both parliament and the political parties.

His policy was followed with consummate skill and caution. Great care was shown not to alienate the Whig leaders in a body, which would have raised up under Pitt's leadership a formidable party of resistance, but advantage was taken of disagreements between the ministers concerning the war, of personal jealousies, and of the strong reluctance of the old statesmen who had served the crown for generations to identify themselves with active opposition to the king's wishes. They were all discarded singly and isolated, after violent disagreements, from the rest of the ministers. On March 25, 1761, Bute succeeded Lord Holderness as secretary of state for the northern department, and Pitt resigned in October on the refusal of the government to declare war against Spain.

On Nov. 3 Bute appeared in his new capacity as prime minister in the House of Lords, where he had not been seen for 20 years. Though he had succeeded in disarming all organized opposition in parliament, the hostility displayed against him in the nation, arising from his Scottish nationality, his character as favourite, his peace policy and the resignation of the popular hero Pitt, was overwhelming. He was the object of numerous attacks and lampoons. He dared not show himself in the streets without the protection of prize-fighters, while the jack-boot (a pun upon his name) and the petticoat, by which the princess was represented, were continually being burnt by the mob or hanged upon the gallows. On Nov. 9, while proceeding to the Guildhall, he narrowly escaped falling into the hands of the populace, who smashed his coach, and he was treated with studied coldness at the banquet. In Jan. 1762 Bute was compelled to declare war against Spain, though now without the advantages which the earlier decision urged by Pitt could have secured, and he supported the war, but with no zeal and no definite aim beyond the obtaining of a peace at any price and as soon as possible. In May he succeeded the duke of Newcastle as first lord of the treasury. In his eagerness for peace he conducted on his own responsibility secret negotiations for peace with France through Viri, the Sardinian minister, and the preliminary treaty was signed on Nov. 3 at Fontainebleau. A parliamentary majority was now secured, with the aid of Henry Fox, who deserted his party to become leader of the Commons, for the king's policy by bribery and threats. The definitive peace of Paris was signed on Feb. 10, 1763, and a wholesale proscription of the Whigs was begun, in which even the most insignificant adherents of the party, including widows, servants and schoolboys, incurred the vengeance of the court. Later, Bute roused further hostility by his cider tax, an ill-advised measure producing only £75,000 a year, imposing special burdens upon the farmers and landed interest in the cider counties, and extremely unpopular because extending the detested system of taxation by excise, regarded as an infringement of the popular liberties. At length, unable to contend any longer against the general and inveterate animosity displayed against him, fearing for the consequences to the monarchy, alarmed at the virulent attacks of the *North Briton*, and suffering from ill-health, Bute resigned on April 8 an office he had never desired to fill.

He still for a time retained influence with the king, but George Grenville (whom he recommended as his successor) insisted on possessing the king's whole confidence, and on the failure of Bute in Aug. 1763 to procure his dismissal and to substitute a ministry led by Pitt and the duke of Bedford, Grenville demanded and obtained Bute's withdrawal from the court. He resigned accordingly the office of privy purse, and took leave of George III. on Sept. 28. He still corresponded with the king, and returned again to London next year, but in May 1765, after the duke of Cumberland's failure to form an administration, Grenville exacted the promise from the king which appears to have been kept faithfully, that Bute should have no share and should give no advice whatever in public business, and obtained the dismissal of Bute's brother from his post of lord privy seal in Scotland. Bute continued to visit the princess of Wales, but on the king's arrival always retired by a back staircase.

He spoke against the government on the American question in Feb. 1766, and in March against the repeal of the Stamp Act. In 1768 and 1774 he was again elected a representative peer for Scotland, but took no further part in politics, and in 1778 refused to have anything to do with the abortive attempt to effect an alliance between himself and Chatham. He travelled in Italy, complained of the malice of his opponents and of the ingratitude of the king, and determined "to retire from the world before it retires from me." He died on March 10, 1792, and was buried at Rothesay in Bute.

Bute in his short administration was used by George III. as his instrument for the destruction of the Whig Party. His own principles and intentions were inspired by feelings of sincere affection and loyalty for his sovereign, and his character remains untarnished by the grosser accusations raised by faction.

See J. A. Lovat Fraser, *John Stuart, Earl of Bute* (1912); Mrs. E. Stuart Wortley, *A Prime Minister and his Son.* From the correspondence of the Earl of Bute and of Lt. General the Hon. Sir Charles Stuart (1925). *See* also WILKES, JOHN.

BUTE or BUTESHIRE, an insular county in south-west Scotland, consisting of the islands of Bute, from which the county takes its name, Arran, Great Cumbrae, Little Cumbrae, Holy Island, Pladda and Inchmarnock, all lying in the Firth of Clyde, between Ayrshire on the east and Argyllshire on the west and north. Land area, 218.2 sq.mi. Pop. (est. 1938) 16,560. In 1931 the number of persons who spoke Gaelic and English was 934. The county unites with northern Ayrshire in returning one member to parliament. Buteshire and Renfrewshire form one sheriffdom, with a sheriff-substitute resident in Rothesay. The circuit courts are held at Inveraray. There are three county districts and two small burghs, that of Rothesay being a royal burgh. Staple crops are oats, turnips, swedes and potatoes; all but oats (4,009 ac. in 1938) are small. Cattle, sheep and horses are reared. Of the 521 holdings in 1938, about 71% were of 50 ac. or less. Herring and white fisheries are of some importance. Rothesay fishery district includes all creeks in Buteshire and a few in Argyll and Dumbarton shires, the Cumbraes being grouped with the Greenock district. During the season many fishermen are employed on the Clyde yachts, Rothesay being a prominent yachting centre. There is regular steamer communication throughout the year between the county ports of Rothesay, Millport, Brodick and Lamlash and the mainland ports of Glasgow, Greenock, Gourock, Ardrossan and Wemyss bay.

BUTE, the most important, though not the largest, of the islands constituting the county of the same name, in the Firth of Clyde, Scotland, about 18 mi. S.W. of Greenock and 40 mi. by water from Glasgow. Pop. (1931) 12,112. It is bounded on the north and west by the lovely Kyles of Bute, the narrow winding strait which separates it from Argyllshire; on the east by the Firth of Clyde, and on the south and south-west by the Sound of Bute, about 6m. wide, which divides it from Arran. Its area is about 49sq.m., its length 15½m., and its breadth from 4½ to one mile. Its highest point, Kames hill, in the north, is 911 feet. This part of the island is composed mainly of the metamorphic rocks of the eastern Highlands, mica schists, interrupted by a belt of clay slate such as fringes the Highlands across the mainland right to Stonehaven; the south of the island consists mainly of upper Old Red Sandstone, with many intrinsic igneous rocks. On account of its pleasant scenery, mild climate and lower rainfall than occurs over much of the western coast, added to its fertile soil and proximity to the Clyde estuary, the island is relatively populous and a favoured residential and holiday resort from Glasgow. About two-thirds of the island are arable, yielding potatoes for the Glasgow market, oats and turnips. Many burns water the island, and there are six lochs among which Loch Fad, about 1m. S. of Rothesay, was the source of the power used in the Rothesay cotton-spinning mill, the first of the kind erected in Scotland. The island is well served by steamers from Glasgow and other Clyde ports, and there are piers at Kilchattan, Craigmore, Port Bannatyne and the chief port and old royal burgh of Rothesay (*q.v.*). The fisheries of the island are of value.

The name of the island is variously derived from the Erse, *both* (or a "cell") in allusion to St. Brendan's foundation here in the 6th century, and from the Gaelic *Ey Bhiod,* "the island of corn," in reference to its fertility. Stone monuments, barrows, cairns and cists, with the remains of ancient chapels, attest its early settlements. Bute was probably first colonized by the vanguard of Scots who came over from Ireland.

See J. K. Hewison, *Bute in the Olden Time* (1895).

BUTLER, the name of a family famous in the history of Ireland. The great house of the Butlers, alone among the families of the conquerors, rivalled the Geraldines, their neighbours, kinsfolk, and mortal foes. Theobald Walter, their ancestor, was not among the first of the invaders. He was the grandson of one Hervey Walter who, in the time of Henry I., held Witheton or Weeton in Amounderness, a small fee of the honour of Lancaster, the manor of Newton in Suffolk, and certain lands in Norfolk. Hubert his son accompanied King Richard to the Holy Land, and became bishop of Salisbury and (1193) archbishop of Canterbury. "Wary of counsel, subtle of wit," he was the champion of Canterbury and of England, and the news of his death drew the cry from King John that "now, for the first time, am I king in truth."

Theobald Walter, the eldest brother of the archbishop, went over sea to Waterford in 1185 with John, the king's son, the freight of the harness sent after him being charged in the Pipe Roll. Clad in that harness he led the men of Cork when Dermot MacCarthy, prince of Desmond, was put to the sword, John rewarding his services with lands in Limerick and with the important fief of Arklow in the vale of Avoca, where he made his Irish seat and founded an abbey. Returning to England he accompanied his uncle Randulf de Glanville to France, both witnessing a charter delivered by the king at Chinon when near to death. Soon afterwards, Theobald Walter was given by John that hereditary office of butler to the lord of Ireland, which makes a surname for his descendants.

Adding to its possessions by marriages the house advanced itself among the nobility of Ireland. On Sept. 1, 1315, its chief, Edmund Walter *alias* Edmund the Butler, for services against the Scottish raiders and Ulster rebels, had a charter of the castle and manors of Carrick, Macgriffyn and Roscrea to hold to him and his heirs *sub nomine et honore comitis de Karryk*. James, the son and heir of Edmund, having married in 1327 Eleanor de Bohun, daughter of Humfrey, earl of Hereford and Essex, high constable of England, by a daughter of Edward I., was created an Irish earl on Nov. 2, 1328, with the title of Ormonde.

From the early years of the 14th century the Ormonde earls, generation by generation, were called to the chief government of Ireland as lords-keeper, lords-lieutenant, deputies or lords-justices, and, unlike their hereditary enemies the Geraldines, they kept a tradition of loyalty to the English crown and to English custom. Their history is full of warring with the native Irish, and as the sun stood still upon Gibeon, even so, we are told, it rested over the red bog of Athy while James the White Earl was staying the Wild O'Mores. More than one of the earls of Ormonde had the name of a scholar, while of the 6th earl, master of every European tongue and ambassador to many courts, Edward IV. is said to have declared that were good breeding and liberal qualities lost to the world they might be found again in John, earl of Ormonde. The earls were often absent from Ireland on errands of war or peace. James, the 5th earl, had the English earldom of Wiltshire given him in 1449 for his Lancastrian zeal. He fought at St. Albans in 1455, casting his harness into a ditch as he fled the field, and he led a wing at Wakefield. His stall plate as a knight of the Garter is still in St. George's chapel. Defeated with the earl of Pembroke at Mortimer's Cross and taken prisoner after Towton, his fate is uncertain, but rumour said that he was beheaded at Newcastle, and a letter addressed to John Paston about May 1461 sends tidings that "the Erle of Wylchir is hed is sette on London Brigge."

The Wiltshire earldom died with him and the Irish earldom was for a time forfeited, his two brothers, John and Thomas, sharing his attainder. John was restored in blood by Edward IV.; and Thomas, the 7th earl, summoned to the English parliament in 1495 as Lord Rochford, a title taken from a Bohun manor in Essex, saw the statute of attainder annulled by Henry VII.'s first parliament. He died without male issue in 1515. Of his two daughters and co-heirs Anne was married to Sir James St. Leger, and Margaret to Sir William Boleyn of Blickling, by whom she was mother of Sir James and Sir Thomas Boleyn. The latter, the father of Anne Boleyn, was created earl of Wiltshire and Ormonde in 1529.

In Ireland the heir male of the Ormonde earls, Sir Piers Butler —"Red Piers"—assumed the earldom of Ormonde in 1515 and seized upon the Irish estates. In 1522, styled "Sir Piers Butler pretending himself to be earl of Ormonde," he was made chief governor of Ireland as lord deputy, and on Feb. 23, 1528, following an agreement with the co-heirs of the 7th earl, whereby the earldom of Ormonde was declared to be at the king's disposal, he was created earl of Ossory. But the Irish estates, declared forfeit to the Crown in 1536 under the Act of Absentees, were granted to him as "earl of Ossory and Ormonde." His son and heir, James the Lame, who had been created Viscount Thurles on Jan. 2, 1536, obtained an act of parliament in 1543–44 which, confirming the grant to his father of the earldom, gave him the old "preeminence" of the ancient earldom of 1328.

Earl James was poisoned at a supper in Ely House in 1546, and Thomas the Black Earl, his son and heir, was brought up at the English court, professing the reformed religion. His sympathies were with the Irish, although he stood staunchly for law and order, and for the greater part of his life he was wrestling with rebellion. His lands having been harried by his hereditary enemies the Desmond Geraldines, Elizabeth gave him his revenge by appointing him in 1580 military governor of Munster, with a commission to "banish and vanquish these cankered Desmonds," then in open rebellion. In three months, by his own account, he had put to the sword 46 captains, 800 notorious traitors and 4,000 others, and, after four years' fighting, Gerald, earl of Desmond, a price on his head, was taken and killed. Dying in 1614 without lawful issue, Thomas was succeeded by his nephew Walter of Kilcash, who had fought beside him against the Burkes and O'Mores. But Sir Robert Preston, afterwards created earl of Desmond, claimed a great part of the Ormonde lands in right of his wife, the Black Earl's daughter and heir. In spite of the loyal services of Earl Walter, King James supported the claimant, and the earl, refusing to submit to a royal award, was thrown into gaol, where he lay for eight years in great poverty, his rents being cut off. Although liberated in 1625 he was not acknowledged heir to his uncle's estates until 1630. His son, Viscount Thurles, being drowned on a passage to England, a grandson succeeded him.

This grandson, James Butler, is perhaps the most famous of the long line of Ormondes. By his marriage with his cousin Elizabeth Preston, the Ormonde titles were once more united with all the Ormonde estates. A loyal soldier and statesman, he commanded for the king in Ireland, where he was between the two fires of Catholic rebels and Protestant parliamentarians. In Ireland he stayed long enough to proclaim Charles II. in 1649 but defeated at Rathmines, his garrisons broken by Cromwell, he quitted the country at the end of 1650. At the Restoration he was appointed lord-lieutenant, his estates having been restored to him with the addition of the county palatine of Tipperary, taken by James I. from his grandfather. In 1632 he had been created a marquess. The English earldom of Brecknock was added in 1660 and an Irish dukedom of Ormonde in the following year. In 1682 he had a patent for an English dukedom with the same title. Buckingham's intrigues deprived him for seven years of his lord-lieutenancy, and a desperate attempt was made upon his life in 1670, when a company of ruffians dragged him from his coach in St. James's street and sought to hurry him to the gallows at Tyburn. His son's threat that, if harm befell his father he would pistol Buckingham, even if he were behind the king's chair, may have saved him from assassination. At the accession of James II. he was once more taken from active employment. He died at his Dorsetshire house in 1688. He had seen his great-great-uncle the Black Earl, who was born in 1532, and a great-grandson was playing beside him a few hours before his death. His brave son Ossory, "the eldest hope with every grace adorned," died eight years before him, and he was succeeded by a grandson James, the second duke of Ormonde, who, a recognized leader of the London Jacobites, was attainted in 1715, his honours and estates being forfeited. The duke lived 30 years in exile, chiefly at Avignon, and died in the rebellion year of

1745 without surviving issue. His younger brother Charles, whom King William had created Lord Butler of Weston in the English peerage and earl of Arran in the Irish, was allowed to purchase the Ormonde estates. On the earl's death without issue in 1758 the estates were enjoyed by a sister, passing in 1760, by settlement of the earl of Arran, to John Butler of Kilcash, descendant of a younger brother of the first duke. John, dying six years later, was succeeded by Walter Butler, a first cousin, whose son John, heir-male of the line of Ormonde, became earl of Ormonde and Ossory and Viscount Thurles in 1791, the Irish parliament reversing the attainder of 1715. Walter, son and heir of the restored earl, was given an English peerage as Lord Butler of Llanthony (1801) and an Irish marquessate of Ormonde (1816), titles that died with him. This Lord Ormonde in 1810 sold to the crown for the great sum of £216,000 his ancestral right to the prisage of wines in Ireland. For his brother and heir, created Lord Ormonde of Llanthony at the coronation of George IV., the Irish marquessate was revived in 1825 and descended in the direct line.

The earls of Carrick (Ireland 1748), viscounts Ikerrin (Ireland 1629), claim descent from a brother of the first Ormonde earl, while the viscounts Mountgarret (Ireland 1550) spring from a younger son of Piers, the Red Earl of Ossory. The barony of Caher (Ireland 1543), created for Sir Thomas Butler of Chaier or Caher-down-Eske, a descendant in an illegitimate branch of the Butlers, fell into abeyance among heirs general on the death of the 2nd baron in 1560. It was again created, after the surrender of their rights by the heirs general, in 1583 for Sir Theobald Butler (d. 1596), and became extinct in 1858 on the death of Richard Butler, 13th baron and 2nd viscount Caher, and second earl of Glengall. Buttler von Clonebough, *genannt* Haimhausen, count of the Holy Roman Empire, descends from the 3rd earl of Ormonde, the imperial title having been revived in 1681 in memory of the services of a kinsman, Walter, Count Butler (d. 1634), the dragoon officer who carried out the murder of Wallenstein.

See Lancashire Inquests, 1205-1307; Lancashire and Cheshire Record Society, xlviii.; Chronicles of Matthew Paris, Roger of Hoveden, Giraldus Cambrensis, etc ; *Dictionary of National Biography;* G.E.C.'s *Complete Peerage;* Carte's Ormonde papers; Paston Letters; Rolls of parliament, fine rolls, liberate rolls, pipe rolls, etc.

BUTLER, ALBAN (1710–1773), English Roman Catholic priest and hagiologist, was born in Northampton on Oct. 24, 1710. He was educated at the English college, Douai, where on his ordination to the priesthood in 1735, he held successively the chairs of philosophy and divinity. After some years spent in England he became president of the English seminary at St. Omer, where he remained till his death on May 15, 1773. Butler's great work *The Lives of the Saints*, the result of 30 years' study (1756–59), has passed through many editions and translations (best edition, including valuable notes, Dublin 1779–80).

See *An Account of the Life of A. B. by C. B., i.e.* by his nephew Charles Butler (1799); and Joseph Gillow's *Bibliographical Dictionary of English Catholics*, vol. i.

BUTLER, BENJAMIN FRANKLIN (1818–1893), American lawyer, soldier and politician, was born in Deerfield, N.H., on Nov. 5, 1818. He graduated from Waterville (now Colby) College in 1838, was admitted to the Massachusetts bar in 1840, began practice at Lowell, Mass., and early attained distinction as a lawyer, particularly in criminal cases. Entering politics as a Democrat, he was a member of the Massachusetts house of representatives in 1853, and of the State senate in 1859, and was a delegate to the Democratic national conventions from 1848 to 1860. In that of 1860 at Charleston he supported the movement that nominated Breckinridge and divided the party.

After the opening of the Civil War, Butler joined the Union Army, and took possession of Baltimore without bloodshed. While in command at Fortress Monroe, he agreed to return fugitive slaves to their owner only on the condition that the owner, a Virginian colonel, take an oath of allegiance to the United States. In commenting on the decision, Blair wrote Butler he was correct in regarding negroes as "contraband of war," thus originating the phrase "contrabard" as applied to the negroes. In the conduct of tactical operations Butler was almost uniformly unsuccessful, and his first action at Big Bethel, Va., was a humiliating defeat for the national arms. In 1862 he commanded the force which occupied New Orleans. In the Administration of that city he showed firmness and severity. Many of his acts, however, gave great offence, particularly the seizure of $800,000 which had been deposited in the office of the Dutch consul, and an order, issued after some provocation on May 15, that if any woman should "insult or show contempt for any officer or soldier of the United States, she shall be regarded and shall be held liable to be treated as a woman of the town plying her avocation." This order provoked a storm of protests and was doubtless the cause of his removal in Dec. 1862. In the campaign of 1864 he commanded the Army of the James creditably in several battles. But his mismanagement of the expedition against Ft. Fisher (N.C.), led to his recall by General Grant in December.

He was a Republican representative in Congress from 1867 to 1879, except in 1875–77. In Congress he was conspicuous as a Radical Republican in reconstruction legislation, and helped to conduct the impeachment of President Johnson; he was regarded as President Grant's spokesman in the House, and one of the foremost advocates of the payment in "greenbacks" of the Government bonds. As a candidate for governor of Massachusetts, he was twice defeated, but in 1882 he was elected by the Democrats. After bitterly opposing Grover Cleveland as presidential nominee for the Democratic Party he ran on the ticket of the Greenback Party, and was defeated (1884). He was an able but erratic administrator and soldier, and a brilliant lawyer. Many charges of corruption were made against him, apparently well substantiated. He died at Washington, D.C. on Jan. 11, 1893.

See James Parton, *Butler in New Orleans* (1863), *The Autobiography and Personal Reminiscences of Major-General B. F. Butler: Butler's Book* (1893), none too accurate; and Gamaliel Bradford, *Damaged Souls* (1923).

BUTLER, CHARLES (1750–1832), British lawyer and miscellaneous writer, was born in London on Aug. 14, 1750, and died there on June 2, 1832. He was educated at Douai and in 1775 entered Lincoln's Inn. He practised conveyancing, and after the passing of the Roman Catholic Relief Act 1791 he was the first Roman Catholic to be called to the bar, since 1688. Butler acted as secretary to the Committees on Penal Reform formed by Roman Catholic laymen in 1782 and 1787. The number of his published works comprises about fifty volumes.

A complete list of Butler's works is contained in Joseph Gillow's *Bibliographical Dictionary of English Catholics*, vol. i. pp. 357–364.

BUTLER, HENRY MONTAGU (1833–1918), English educationist, head master of Harrow School (1859–85), and master of Trinity college, Cambridge (1886–1918), was born at Gayton, Northants, on July 2, 1833, the son of Dr. GEORGE BUTLER, dean of Peterborough, who had been head master of Harrow (1805–29). His elder brother was GEORGE BUTLER (1819–90), canon of Winchester, whose wife, Josephine, is separately mentioned. H. M. Butler was educated at Harrow and Trinity college, Cambridge. He became President of the Union and Senior Classic in 1855, and in 1856 was appointed private secretary to W. F. Cowper, afterwards Lord Mount Temple. He was also secretary to the commission for rebuilding the National Gallery. He became head master of Harrow in 1859, and made many important changes in the school, notably by giving science a formal place in the curriculum, but although he insisted on efficient "modern" teaching, his rule at Harrow is principally associated with the development of the traditions of the school, and by the added importance given to music. In 1885 he became dean of Gloucester, and though his mastership at Harrow terminated, he continued to take an interest in the school, and in 1901 was elected a governor. He became master of Trinity college, Cambridge in 1886, and was vice-chancellor of Cambridge University in the years 1889–90. Under Butler, Trinity college became a centre for many outside activities, and its head formed a link between religious bodies of different kinds. Butler began the annual reunions of Trinity men. His first wife, Georgina Elliot, had died in 1883, and he married in 1888 Agnata Frances, daughter of Sir James Ramsay of Bamff, the historian. Mrs. Butler had been placed by the examiners above the Senior Classic at Cambridge in 1887. Butler died at Cambridge on Jan. 14, 1918.

See his *Leisure Hours of a Long Life* (1914); J. R. M. Butler, *Henry Montagu Butler, Master of Trinity College, Cambridge, 1886–1918* (1925).

BUTLER, JOSEPH (1692–1752), English divine and bishop of Durham, was born on May 18, 1692, at Wantage, Berkshire. He came of Presbyterian parentage, and was sent to the dissenting academy of Samuel Jones at Gloucester, and later to Tewkesbury. While there, Butler became dissatisfied with Presbyterianism, and after much deliberation resolved to join the Church of England. In 1715 he entered Oriel college, Oxford, and after taking his degree three years later, was ordained deacon and priest. He was nominated preacher at the Rolls Chapel where he continued until 1726. It was there that he preached his famous *Fifteen Sermons* (1726) including the well-known three on human nature. In 1721 he received a prebend at Salisbury from Bishop Talbot, who on his translation to Durham gave Butler the living of Houghton-le-Skerne and in 1725 presented him to the wealthy rectory of Stanhope where he remained for ten years. In 1733, Butler was made chaplain to Lord Chancellor Talbot, and three years later prebendary of Rochester. In the same year he was appointed clerk of the closet to the queen and published the *Analogy of Religion, Natural and Revealed, to the Constitution and Course of Nature.*

In 1737 Queen Caroline died. Her recommendation of Butler to the favour of her husband led to his appointment in 1738 to the bishopric of Bristol, the poorest see in the kingdom. The severe but dignified letter to Walpole accepting the preferment showed that the slight was resented. Two years later, however, Butler was presented to the rich deanery of St. Paul's, and in 1746 was made clerk of the closet to the king In 1747 the primacy was offered to him but declined on the ground that "it was too late for him to try to support a falling church." Nevertheless in 1750 he accepted the see of Durham. He died on June 16, 1752, at Bath, and was buried in Bristol cathedral, a monument with an epitaph by Southey being erected over his grave in 1834. According to his wishes, all his mss. were burned after his death. Butler never married.

Butler's great work, *The Analogy of Religion, Natural and Revealed, to the Course and Constitution of Nature*, which was so often appealed to in the 19th century, is essentially a work of its period, being an indirect attack on the prevailing deistical speculations (*see* DEISM). Its author begins by presupposing with the deists the existence of God, and contending that religion cannot lie wholly within the sphere of reason, aims to show that the difficulties raised by the deists against religion have analogies in nature. That there should be these difficulties in both realms is inevitable because of the limitations of our imperfect human faculties. No *a priori* construction of experience is possible; we must slowly advance through the individual facts of the universe which lead us only to a greater degree of probability. If we had a complete knowledge of the parts, we should, like God, know the whole.

Butler next considers certain religious tenets that have been selected by the deists as unreasonable and attempts to prove that there is every ground for inferring their probable truth. Thus he asserts that the conception of the future life, with which all our hopes and fears are bound up, is not unreasonable because not irreconcilable with what we know of the course of nature. Declaring that we do not really know the soul to be extended and therefore, destructible. Butler proceeds to show that the conception of the future life is supported by the changes in man during his lifetime, by the possibility of certain of our faculties being suspended during sleep, etc., without being destroyed, by the teaching of experience regarding our temporal rewards and punishments, by the strong evidence for the moral government of this world by God, and by the disciplinary character of this life.

Part II. of the *Analogy* deals with revealed religion. Here Butler urges the importance of revelation as supplementing and not contradicting reason, though he admits that its content can only be obscurely comprehended. True revelation cannot oppose the dictates of conscience, for both come from God. After putting the case for miracles and emphasizing the importance of the death of Christ as the means of redemption, Butler restrikes the keynote of the *Analogy* by declaring in the final chapter that while the evidences for revealed religion, *i.e.*, Christianity, do not amount to demonstration, they are in the highest degree probable.

BIBLIOGRAPHY.—Of the many editions of the *Analogy* the best are those by W. Fitzgerald (1849) containing a valuable biography, by W. E. Gladstone (1897) the second vol., including the *Sermons*, and by J. H. Bernard (1900) which also includes the *Sermons*. *See* T. Bartlett, *Memoirs of Butler* (1839); A. E. Baker, *Bishop Butler* (1923). For the religious history of Butler's times, *see* M. Pattison, *Essays and Reviews* (1889); J. Hunt, *Religious Thought in England* (1870–73); L. Stephen, *English Thought in the 18th century* (1902); J. H. Overton and F. Relton, *The English Church from the Accession of George I. to the End of the 18th century* (1906).

BUTLER, JOSEPHINE ELIZABETH (1828–1906), English social reformer, daughter of John Grey, agriculturist; born April 13, 1828, at Milfield Hill, Northumberland, of Huguenot descent through her mother, Hannah Annett. She died December 30, 1906, at Wooler, Northumberland. She married (1852) George Butler, educator, finally canon of Winchester. They lived first at Oxford, then Cheltenham, and settled in Liverpool in 1866 where, with her husband, she established homes for prostitutes. In 1869 she organized the Ladies' National Association to repeal the Contagious Diseases acts; the first, passed almost secretly by Parliament (1864), was strengthened and extended territorially in 1866 and 1869. The "C.D. acts" were designed primarily to protect garrison towns and naval stations; they permitted on mere suspicion the arrest of women by special police, required compulsory medical examination by justices' order, and detention in hospitals if found affected. Mrs. Butler's "Protest of the Ladies" signed by Florence Nightingale (*q.v.*), Harriet Martineau (*q.v.*) and many other notable women, published in the *London Daily News* (1869), initiated the "Abolitionist" crusade. Urging that the acts deprived the most defenseless class of its constitutional rights and failed as public health measures, she agitated for their repeal by numerous publications (notably *The Constitution Violated*, 1871), by intervention in elections, and by organizing debates in parliament. A royal commission (1870–71) and a select committee of the house of commons (1879–82) were obtained to investigate their operation. The acts were suspended in 1883 and repealed in 1886. Mrs. Butler also influenced European governments against licensed brothels and state regulation of prostitution (*q.v.*). Victor Hugo, Mazzini and Garibaldi were among her continental, and William Lloyd Garrison among her American, supporters. She founded the International Abolitionist Federation, which held its first world congress in Geneva (1877). She revealed the licensed brothel as the market for the white-slave traffic (*q.v.*) and sale of children for "infamous purposes." The League of Nations International Convention for the Suppression of the Traffic in Women and Children (1921) and world-wide developments therefrom undoubtedly stemmed directly from her agitation. An early suffragist, Mrs. Butler worked also for equal educational and economic opportunities for women. Dame Millicent G. Fawcett (*q.v.*) states: "No other woman in history has had such far-reaching influence, or effected so widespread a change in public opinion."

See *The New Abolitionists* (1876); W. T. Stead, *The Maiden Tribute* (1885); Benjamin Scott, *A State Iniquity* (1890); Josephine Butler, *Personal Reminiscences of a Great Crusade* (1896, 1913); Millicent G. Fawcett and E. M. Turner, *Josephine Butler* (1927); *Social Service Review*, vol. ii, 1928. (A. H. M.)

BUTLER, NICHOLAS MURRAY (1862–   ), American educator and publicist, was born at Elizabeth (N.J.) on April 2, 1862. He graduated at Columbia college in 1882, was a graduate fellow in philosophy there from 1882 to 1884, taking the degree of Ph.D. He then studied for a year in Paris and Berlin. He was an assistant in philosophy at Columbia in 1885–86, tutor in 1886–89, adjunct professor of philosophy, ethics and psychology in 1889–90, becoming full professor in 1890, and dean of the faculty of philosophy in 1890–1902. From 1886 until 1891 he was the first president of the New York college for the training of teachers (later Teachers' college of Columbia university), which he had personally planned and organized. In 1889 he founded and for 30 years edited *The Educational Review*, an influential educational magazine. He soon came to be looked upon as one of the foremost authorities on educational matters in America, and in 1894 was elected president of the National educational association. He was also a member of the New Jersey State board of education from 1887 to 1895, and was president of the Paterson (N.J.) board of education in 1892–93. He was president of Columbia university from 1901 to his retirement in 1945 when he became president emeritus. He was also president of Barnard college, Teachers college, the New York college of pharmacy (1904–45) and of St. Stephen's college, Annandale-on-Hudson (1928–45).

He was elected a member of the American academy of arts and letters in 1911. In 1912 he was chairman of the New York State Republican convention and also a delegate of the Republican national convention. Vice-President Sherman was renominated, but died shortly before the general election, and the Republican electoral votes were cast for Dr. Butler for vice president. He was, however, overwhelmingly defeated on the ticket with President Taft, Wilson receiving an electoral vote of 435 (40 States), Roosevelt 88 (6 States) and Taft 8 (2 States). In 1916, 1920, 1924 and 1928 he was a delegate to the Republican national convention. He was an early and pronounced advocate of the repeal of the 18th Amendment on the grounds (1) that it was a revolutionary departure from the plan of Federal government with its distribution of powers between the Nation and the States as established by the Constitution, and (2) that it was a most ineffective method of combating the evils of the saloon and the liquor traffic. He favoured woman suffrage and advocated the short ballot. At the Republican national convention in 1920 he received 69½ votes for the presidential nomination on the first ballot, the number gradually falling to two on the tenth and last ballot.

As an educator Butler was a bold critic of many contemporary tendencies in American education. He upheld the old theory of mental discipline, and in the face of widespread vocational movement in schools and colleges remained a steadfast and eloquent defender of liberal education. Under his guidance Columbia university became a cosmopolitan institution, and its total registration in 1928, including university extension and summer session, Barnard, Teachers' college and the College of Pharmacy, was 36,639. He was chairman of the national committee of the United States for the restoration of the University of Louvain, destroyed by the Germans in 1914. In 1920 he resigned the editorship of *The Educational Review*. In 1921 he was made grand officier de la Légion d'honneur (officier 1906, commandeur, 1912). In addition he has received decorations from Belgium, Czechoslovakia, Greece, Italy, Poland, Prussia, Rumania and Serbia. In 1923 he became a member of the *Institut de France*, taking the place of the late Lord Bryce, and in the same year, as Watson professor of American history, literature and institutions, he delivered a series of lectures at eight British universities. He has been a trustee of the Carnegie foundation for the advancement of teaching since 1905, and of the Carnegie Corporation since 1925. He has been a strong advocate of international understanding and the betterment of international relations. In 1907 and 1909–12 he was chairman of the Lake Mohonk conference on international arbitration. Since its organization in 1910 he has been a trustee of the Carnegie endowment for international peace and director of its division of intercourse and education, and president of the endowment since 1925. In 1924 he was elected chancellor of the American academy of arts and letters. In addition to editing *The Educational Review* for 30 years he has also edited several series of books, including "The Great Educators" and "The Teachers' Professional Library," and *Education in the United States*, a series of monographs prepared for the United States exhibit at the Paris exposition, 1900 (1900, new ed., 1910). His writings include: *The Meaning of Education* (1898, rev. ed 1915); *True and False Democracy* (1907); *The American as he is* (1908); *Philosophy* (1911); *Why Should We Change Our Form of Government?* (1912); *The International Mind* (1913); *Progress in Politics* (1913, a pamphlet); *The Meaning of Education* (1915, an enlargement of one published in 1898); *A World in Ferment* (1918, interpretations of the War for a new world); *Is America Worth Saving?* (1920); *Scholarship and Service* (1921); *Building the American Nation* (1923); *The Faith of a Liberal* (1924).

BUTLER (or Boteler), **SAMUEL** (1612–1680), English poet, author of *Hudibras*, son of Samuel Butler, a small farmer, was baptized at Strensham, Worcestershire, on Feb. 8, 1612. He was educated at the King's school, Worcester, under Henry Bright, the record of whose zeal as a teacher is preserved by Fuller (*Worthies*, Worcestershire). After leaving school he served a Mr. Jeffereys of Earl's Croome, Worcestershire, in the capacity of justice's clerk. Later on he was recommended to Elizabeth, countess of Kent. At her home at Wrest, Bedfordshire, he had access to a good library, and there, too, he met Selden, who sometimes employed him as his secretary. But his third sojourn, with Sir Samuel Luke at Cople Hoo, Bedfordshire, was not only apparently the longest, but also much the most important in its effects on his career and works. We are nowhere informed in what capacity Butler served Sir Samuel Luke, or how he came to reside in the house of a noted Puritan and Parliament man. In the family of this "valiant Mamaluke," who, whether he was or was not the original of Hudibras, was certainly a rigid Presbyterian, "a colonel in the army of the Parliament, scoutmaster-general for Bedfordshire and governor of Newport Pagnell," Butler must have had the most abundant opportunities of studying from the life those who were to be the victims of his satire; he is supposed to have taken some hints for his caricature from Sir Henry Rosewell of Ford abbey, Devonshire. But we know nothing positive of him until the Restoration, when he was appointed secretary to Richard Vaughan, 2nd earl of Carbery, lord president of the principality of Wales, who made him steward of Ludlow castle, an office which he held from Jan. 1661 to Jan. 1662. About this time he married a rich lady variously described as a Miss Herbert and as a widow named Morgan. His wife's fortune was afterwards, however, lost.

Early in 1663 *Hudibras: The First Part: written in the Time of the Late Wars*, was published, but this, the first genuine edition, had been preceded in 1662 by an unauthorized one. On Dec. 26 Pepys bought it, and though neither then nor afterwards could he see the wit of "so silly an abuse of the Presbyter knight going to the wars," he repeatedly testifies to its extraordinary popularity. A spurious second part appeared within the year. This determined the poet to bring out the second part (licensed on Nov. 7, 1663, printed 1664), which if possible exceeded the first in popularity. From this time till 1678, the date of the publication of the third part, we hear nothing certain of Butler. On the publication of *Hudibras* he was sent for by Lord Chancellor Hyde (Clarendon), says Aubrey, and received many promises, none of which was fulfilled. He is said to have received a gift of £300 from Charles II., and to have been secretary to George Villiers, 2nd duke of Buckingham, when the latter was chancellor of the University of Cambridge. Butler's satire on Buckingham in his *Characters* (*Remains*, 1759) shows such an intimate knowledge that it is probable the second story is true. Two years after the publication of the third part of *Hudibras* he died, on Sept. 25, 1680, and was buried in the churchyard of St. Paul's, Covent Garden. It appears that he died in extreme poverty. He was, we are told, "of a leonine-coloured hair, sanguine, choleric, middle-sized, strong."

Hudibras itself, though probably quoted as often as ever, has dropped into the class of books which are more quoted than read. The poem is of considerable length, extending to more than ten thousand verses, yet Hazlitt hardly exaggerates when he says that "half the lines are got by heart"; indeed a diligent student of later English literature has read a great part of *Hudibras* though he may never have opened its pages. The tableaux or situations, though few and simple in construction, are ludicrous enough. The knight and squire setting forth on their journey; the routing of the bear-baiters; the disastrous renewal of the contest; Hudibras and Ralph in the stocks; the lady's release and conditional acceptance of the unlucky knight; the latter's deliberations on the means of eluding his vow; the Skimmington; the visit to Sidrophel, the astrologer; the attempt to cajole the lady, with its woeful consequences; the consultation with the lawyer, and the immortal pair of letters to which this gives rise, complete the argument of the whole poem. But the story is as nothing; throughout we have little really kept before us but the sordid vices of the sectaries, their hypocrisy, their churlish ungraciousness, their greed of money and authority, their fast and loose morality, their inordinate pride. The extraordinary felicity of the means taken to place all these things in the most ridiculous light has never been questioned. The doggerel metre, never heavy or coarse, but framed as to be the very voice of mocking laughter, the astounding similes and disparates, the rhymes which seem to chuckle and to sneer of themselves, the wonderful learning with which the abuse of learning is rebuked, the subtlety with which subtle casuistry is set at nought can never be missed.

It signifies nothing whether Hudibras was Sir Samuel Luke of Bedfordshire or Sir Henry Rosewell of Devonshire, still less whether Ralph's name in the flesh was Robinson or Pendle, least of all that Orsin was perhaps Mr. Gosling, or Trulla possibly Miss Spencer. Butler was probably as little indebted to mere copying for his characters as for his ideas and style. These latter are in the highest degree original. The first notion of the book, and only the first notion, Butler undoubtedly received from *Don Quixote*. His obligations to the *Satyre Ménippée* have been noticed by Voltaire, and though English writers have sometimes ignored or questioned them, are not to be doubted. The art, perhaps the most terrible of all the weapons of satire, of making characters without any great violation of probability represent themselves in the most atrocious and despicable light, was never perhaps possessed in perfection except by Pithou and his colleagues, and by Butler. Against these great merits some defects must certainly be set. As a whole, the poem is no doubt tedious, if only on account of the very blaze of wit, which at length almost wearies us by its ceaseless demands on our attention. It should, however, be remembered that it was originally issued in parts, and therefore, it may be supposed, intended to be read in parts, for there can be little doubt that the second part was written before the first was published. A more real defect, but one which Butler shares with all his contemporaries, is the tendency to delineate humours instead of characters, and to draw from outside rather than within.

Attempts have been made to trace the manner and versification of *Hudibras* to earlier writers, especially in Cleveland's satires and in the *Musarum Deliciae* of Sir John Mennis (Pepys's Minnes) and Dr. James Smith (1605–67). But if it had few ancestors it had an abundant offspring. A list of 27 direct imitations of *Hudibras* in the course of a century may be found in the Aldine edition (1893). Complete translations of considerable excellence have been made into French (London, 1757 and 1819) by John Townley (1697–1782), a member of the Irish Brigade; and into German by D. W. Soltau (Riga, 1787); specimens of both may be found in R. Bell's edition. Voltaire tried his hand at a compressed version, but not with happy results.

Bibliography.—Butler's works published during his life include, besides *Hudibras: To the Memory of the most renowned Du Vall: A Pindaric Ode* (1671); and a prose pamphlet against the Puritans, *Two Letters, one from J. Audland . . . to W. Prynne, the other Prynne's Answer* (1672). In 1715–17 three vols., entitled *Posthumous Works in Prose and Verse . . . with a key to Hudibras by Sir Roger l'Estrange . . .* were published with great success. Most of the contents, however are generally rejected as spurious. The poet's papers, now in the British Museum (Addit. mss. 32, 625–626), remained in the hands of his friend William Longueville, and after his death were left untouched until 1759, when Robert Thyer, keeper of the public library at Manchester, edited two volumes of verse and prose under the title of *Genuine Remains in Verse and Prose of Mr. Samuel Butler.* This collection contained *The Elephant in the Moon*, a satire on the Royal Society; a series of sketches in prose, *Characters;* and some satirical poems and prose pamphlets. Another edition, *Poetical Remains*, was issued by Thyer in 1827. In 1726 Hogarth executed some illustrations to *Hudibras*, which are among his earliest but not, perhaps, happiest productions. In 1744 Dr. Zachary Grey published an edition of *Hudibras*, with copious and learned annotations; and an additional volume of *Critical and Historical and Explanatory Notes* in 1752. Grey's has formed the basis of all subsequent editions.

Other pieces published separately and ascribed to Butler are: *A Letter from Mercurius Civicus to Mercurius Rusticus, or London's Confession but not repentance . . .* (1643), represented in vol. iv. of Somers's tracts; *Mola Asinarum, on the unreasonable and insupportable burthen now pressed . . . upon this groaning nation . . .* (1659), included in his posthumous works, which is supposed to have been written by John Prynne, though Wood ascribes it to Butler; *The Acts and monuments of our late parliament . . .* (1659, printed 1710), of which a continuation appeared in 1659; a "character" of Charles I. (1671); *A New Ballad of King Edward and Jane Shore . .* (1671); *A Congratulatory Poem . . . to Sir Joseph Sheldon* . (1675); *The Geneva Ballad, or the occasional conformist display'd* (1674); *The Secret History of the Calves head club, compleat* . (4th ed. 1707); *The Morning's Salutation, or a friendly Conference between a puritan preacher and a family of his flock* . (reprinted, Dublin, 1714). Two tracts of his appear in Somers's *Tracts*, vol. vii.; he contributed to *Ovid's Epistles translated by several hands* (1680); and works by him are included in *Miscellaneous works, written by George Duke of Buckingham . . . also State Poems* . (*by various hands*) (1704); and in *The Grove . . .* (1721), a poetic miscellany, is a "Satyr against Marriage," not found in his works.

The life of Butler was written by an anonymous author, said by William Oldys to be Sir James Astrey, and prefixed to the edition of 1704. The writer professes to supplement and correct the notice given by Anthony à Wood in *Athenae Oxonienses*. Dr. Threadneedle Russel Nash, a Worcestershire antiquarian, supplied some additional facts in an edition of 1793. *See* the Aldine edition of the *Poetical Works of Samuel Butler* (1893), edited by Reginald Brimley Johnson, with complete bibliographical information. There is a good reprint of *Hudibras* (ed. by A. R. Waller, 1905) in the *Cambridge Classics*.

BUTLER, SAMUEL (1774–1839), English classical scholar and schoolmaster, and bishop of Lichfield, was born at Kenilworth. He had a brilliant career at Cambridge. In 1798 he became headmaster of Shrewsbury school. In 1802 he was presented to the living of Kenilworth, in 1807 to a prebendal stall in Lichfield cathedral, and in 1822 to the archdeaconry of Derby; all these appointments he held with his headmastership, but in 1836 he was promoted to the bishopric of Lichfield. It is in connexion with Shrewsbury school that Butler will be chiefly remembered. During his headmastership its reputation greatly increased, and in the standard of its scholarship it stood as high as any public school in England. His edition of Aeschylus, with the text and notes of Stanley, appeared 1809–16, and was severely criticized in the *Edinburgh Review*. He also wrote a *Sketch of Modern and Ancient Geography* (1813), and brought out atlases of ancient and modern geography. His library included a fine collection of Aldine editions and Greek and Latin mss.; the Aldines were sold by auction, the mss. purchased by the British Museum.

Butler's life has been written by his grandson, Samuel Butler, author of *Erewhon* (*Life and Letters of Dr. Samuel Butler*, 1896); *see* also Baker's *History of St. John's College, Cambridge* (ed. J. E. B. Mayor, 1869); W. E. Heitland, *Dr. Butler of Shrewsbury School* (1897); Sandys, *Hist. Class. Schol.* (ed. 1908), vol. iii. p. 398.

BUTLER, SAMUEL (1835–1902), English author, son of the Rev. Thomas Butler, and grandson of Samuel Butler, Bishop of Lichfield (*q.v.*), was born at Langar, Notts., on Dec. 4, 1835. He was educated at Shrewsbury School and at St. John's College, Cambridge, where he narrowly missed a classical fellowship. He wished to be a painter, and refused, on grounds of religious doubt, to enter the Church, for which he had been intended. After some differences with his father on this head, he emigrated in 1859 to New Zealand, and established a sheep-run on the Rangitata, with capital advanced by his father. He had already been connected at St. John's with an undergraduate paper, *The Eagle*, and in New Zealand he contributed various articles to the press, including a dialogue, *Darwin and the Origin of Species* (1862), and a sketch, *Darwin among the Machines* (1863), which was the germ of his best-known work, *Erewhon*. His first book, *A First Year in Canterbury Settlement* (1863), describing his New Zealand experiences, was edited and published by his father from his letters during his absence from England. In 1864, having doubled his capital, he sold his sheep-run, and returned to England, taking rooms in Clifford's Inn, where he lived for the rest of his life. At this time he possessed a competence; but this was subsequently lost in speculative ventures, and from 1874 to 1886 his circumstances were embarrassed. In 1886, however, his father's death ended his monetary troubles. On his return to England he had begun to study painting seriously, and from 1868 to 1876 he exhibited regularly at the Royal Academy. One of his pictures, "Mr. Heatherley's Holiday," is now in the National Gallery of British Art. At Heatherley's school of painting in Newman Street he met Eliza Mary Anne Savage, who became his closest friend. He corresponded regularly with her until her death in 1885. It appears that she was in love with him; but she was lame, in poor health, and not beautiful. Butler never married. In his later years his closest friend was Henry Festing Jones, who wrote his life, and collaborated with him in the illustrating of his Italian books and in his musical compositions. These include *Gavottes, Minuets, Fugues, and other Short Pieces for the Piano* (1885), *Narcissus: a Cantata in the Handelian form* (1888), and *Ulysses: an Oratorio* (1904). Butler was throughout his life passionately devoted to Handel, whom he ranked very much above all other composers.

Butler lives, not by his musical compositions or his pictures, but by his books. His first important work was *Erewhon, or Over the Range* (1872), a story of a visit to an imaginary country shut off from the world. The account of Erewhonian manners enables Butler to proclaim his own philosophy of life in satirizing the manners of his age. *Erewhon,* which had a popular success denied, in Butler's lifetime, to all his later books, was followed by *The Fair Haven* (1873), a satirical defence of "the miraculous element in Our Lord's ministry here on earth," purporting to be written by one, John Pickard Owen, of whom a satirical biography is prefixed. *The Fair Haven,* based on a pamphlet on *The Evidence for the Resurrection,* which Butler had printed privately in 1865, appeared without his name, and was taken seriously by some reviewers. In a second edition, issued in the same year, Butler disclosed his authorship and intention. Meanwhile, he had been following up his early interest in the doctrine of evolution. In 1872 he twice stayed with Charles Darwin, with whom, and with his son, Francis, he was on terms of friendship. But his study of evolution led him to a sharp dissent from Darwin's views, and to the upholding of a doctrine which he traced back in part to Buffon, Lamarck, and Erasmus Darwin, whose contributions to the theory of evolution seemed to him to have been overlaid by the praise accorded to Charles Darwin's theory of Natural Selection. In 1877 he published the first of his books on this subject, *Life and Habit,* in which he developed the doctrine that heredity, and therefore evolution, depended not on the natural selection of chance variations or "sports," but on an "unconscious memory," transmitted as habit from generation to generation, and tending constantly to grow with the life of the race. *Life and Habit* was followed by *Evolution Old and New* (1879), *Unconscious Memory* (1880), and *Luck or Cunning?* (1886), in which Butler's biological theories were further developed. These writings, by means of which he held that he had achieved "the re-introduction of teleology into organic life," received no serious notice from his contemporaries, though they have been far more favourably considered by later scientists [*cf.* Prof. Bateson, in the Darwin centenary volume, *Darwin and Modern Science* (1909)]. Natural selection, as interpreted by Darwin, seemed to Butler to remove all idea of purpose from the universe, and to depend on the occurrence of variations, or "sports," whose appearance it left totally unexplained. Against this view, he maintained that variation was due, not to "luck," but to the striving (or "cunning") of the individual in adapting itself to its environment, and handed on by the inheritance of "unconscious memory" or "habit."

Having completed his contribution to the theory of evolution, Butler found himself attracted to a problem of a very different order—the Homeric question. He developed the belief that the *Iliad* and the *Odyssey* were by different writers—the *Iliad* by a native of the Troad, veiling his sympathy for the Trojans against the Greeks, and the *Odyssey* by a woman, a native of Trapani in Sicily. These views were first put forward in periodical writings and in two pamphlets, *The Humour of Homer* (1892) and *On the Trapanese Origin of the Odyssey* (1893). His views about the *Odyssey* were further developed in *The Authoress of the Odyssey* (1897), and he also translated both the *Iliad* (1898) and the *Odyssey* (1900) into colloquial prose. His remaining works include his charming *Alps and Sanctuaries of Piedmont and the Canton Ticino* (1881) and *Ex Voto: an Account of the Sacro Monte or New Jerusalem at Varallo-Sesia* (1888), memorials of his frequent holidays in Italy, first visited by him as an undergraduate, and subsequently re-visited on all possible occasions. He also wrote *The Life and Letters of Samuel Butler* (1896), a voluminous study of his grandfather's life and work, a book on *Shakespeare's Sonnets* (1899), and *Erewhon Re-visited* (1901), an amusing sequel to *Erewhon.*

Butler's one novel, *The Way of All Flesh* (1903), not published until after his death, though it was written between 1873 and 1885, is by far his most important work. It is largely autobiographical, and the characters are mostly taken, with changes, from real life. Theobald and Christina Pontifex are based on Butler's parents, Alethea on Miss Savage, and Dr. Skinner on Dr. Kennedy, Butler's head master at Shrewsbury, while Butler himself appears twice, as both Overton and Ernest Pontifex. *The Way of All Flesh* is the quintessence of its author's commonsense philosophy. It wages war on all extremes (*surtout point de zèle* was a favourite maxim of Butler's), on all shams and pretences—above all those of which the pretenders are unconscious—on all attempts to take either life or death too seriously. It is full of a faintly bitter irony, which the author turns on occasion against himself as well as his victims. It is caricature; but no book gives a better satiric picture of family life and manners in mid-Victorian England. With Butler's books on evolution, it has notably influenced Bernard Shaw, especially in his writings on parents and children.

Butler wrote a good, plain, vigorous English, almost devoid of ornament. "A man," he wrote at the age of 22, "should be clear of his meaning before he endeavours to give it any kind of utterance, and, having made up his mind what to say, the less thought he takes how to say it, more than briefly, pointedly, and plainly, the better." His *Notebooks,* from which a selection was published in 1912, are full of good and characteristic things said briefly, pointedly and plainly. There will be found also his famous *Psalm of Montreal,* first published in the *Spectator* in 1878.

See *Samuel Butler: Records and Memorials* (privately printed, 1903), H. F. Jones, *Charles Darwin and Samuel Butler* (1911), H. F. Jones *The Life of Samuel Butler* (1919), and, for a critical study, C. E. M. Joad, *Samuel Butler* (1924). (G. D. H. C.)

BUTLER, SIR WILLIAM FRANCIS (1838–1910), British soldier, entered the army as an ensign in 1858, becoming captain in 1872 and major in 1874. He took part with distinction in the Red river expedition (1870–71) and the Ashanti operations of 1873–74 under Wolseley, and received the C.B. in 1874. He served with the same general in the Zulu War (brevet lieutenant-colonel), the campaign of Tel-el-Kebir, after which he was made an aide-de-camp to the queen, and the Sudan 1884–85, being employed as colonel on the staff 1885, and brigadier-general 1885–86. In the latter year he was made a K.C.B. He was colonel on the staff in Egypt, Feb. 1890 to Dec. 1892, and brigadier-general till Nov. 1893, then appointed to Aldershot as major-general. Later he commanded the south-eastern district. In 1898 he succeeded General Goodenough as commander-in-chief in South Africa, with the local rank of lieutenant-general. For a short period (Dec. 1898–Feb. 1899), during the absence of Sir Alfred Milner in England, he acted as high commissioner, and as such and subsequently in his military capacity he expressed views on the subject of the probabilities of war which were not approved by the home government; he was consequently ordered home to command the western district, and held this post until 1905. He was promoted lieutenant-general in 1900. He had long been known as a descriptive writer, since his publication of *The Great Lone Land* (1872) and other works, and he was the biographer (1899) of Sir George Colley. Sir William Butler died at Tipperary on June 7 1910. He married in 1877 Miss Elizabeth Thompson, an accomplished painter of battle-scenes.

Among Lady Butler's more famous works were "The Roll Call" (1874), "Quatre Bras" (1875), "Rorke's Drift" (1881), "The Camel Corps" (1891), and "The Dawn of Waterloo" (1895). *See* her *Autobiography* (1923).

BUTLER, a city of Pennsylvania, U.S.A., on Connoquenessing creek, about 30 mi. N. of Pittsburgh; the county seat of Butler county. It is served by the Baltimore and Ohio, the Pennsylvania, and the Bessemer and Lake Erie railways. The population in 1930 was 23,568, and was 24,477 in 1940 by the federal census. It is built on a hill about 1,010 ft. above sea level and commands extensive views of the valley. Oil, natural gas, limestone, coal, and iron abound in the vicinity, and the city has manufactures, including steel cars, bantam automobiles, strip and stainless steel, plate glass, standard steel pipe and electrical conduit, oil well supplies, petroleum products, car wheels, rubber goods, auto chains, steel drums and shirts and overalls. The factory output in 1940 was $55,000,000. When Butler county was formed in 1802, this site was selected for the county seat, and in 1803 the borough was incorporated. A city charter was secured in 1917. County and city were named after General Richard Butler, a Revolutionary soldier.

BUTLER, a domestic servant who superintends the wine-cellar and acts as the chief male servant of a household; among his other duties are the conduct of the service of the table and the custody of the plate. The butler of a royal household was an official of high rank, whose duties, though primarily connected with the supply of wine for the royal table, varied in the different courts in which the office appears. In England, as superintendent of the importation of wine, a duty was payable to him (*see* PRISAGE AND BUTLERAGE); the butlership of Ireland, *Pincerna Hiberniae*, was given by John, king of England, to Theobald Walter, who added the name of Butler to his own; it then became the surname of his descendants, the earls, dukes and marquesses of Ormonde (*see* BUTLER [family]). Butler is from the Late Lat. *buticularius*, *buticula*, a bottle, through the O.Fr. *bouteillier*.

BUTLERAGE and **PRISAGE:** *see* PRISAGE AND BUTLERAGE.

BUTO, the Greek name of the Egyptian goddess Uto (hierogl. *W'ȝy·t*), confused with the name of her city Buto (*see* BUSIRIS). She was a cobra-goddess of the marshes, worshipped especially in the city of Buto in the north-west of the Delta, and at another Buto (Hdt. ii. 75) in the north-east of the Delta, now Tell Nebēsheh. This western Buto was the capital of the kingdom of Northern Egypt in prehistoric times before the two kingdoms were united; hence the goddess Buto was goddess of Lower Egypt and the North. To correspond to the vulture goddess (Nekhbi) of the south she sometimes is given the form of a vulture; she is also figured in human form. As a serpent she is commonly twined round a papyrus stem, which latter spells her name; and generally she wears the crown of Lower Egypt. The Greeks identified her with Leto; partly by the resemblance of name, partly by the myth of her having brought up Horus in a floating island, resembling the story of Leto and Apollo on Delos. Herodotus describes the temple and other sacred places of (the western) Buto, and refers to its festival, and to its oracle. It eventually became, at a very late date, the capital of a nome, in this case called Phtheneto, "the land of (the goddess) Buto." The second Buto (hierogl. *'Im·t*) was capital from early times of the 19th nome of Lower Egypt.

BUTON (Dutch, *Boetoeng*), island S.E. of Celebes, one of a group of which the most important are Buton, Muna, Kabena, and Wowoni. Buton Strait, between Buton and Muna (port, on the E. coast, Raha), is narrow, and difficult to navigate, but beautiful. It is over 100 mi. long; the area is about 2,000 sq.mi. It has an axial chain of limestone hills (highest point Kepala-Ogena, 3,740 ft.) thickly forested, as is the whole island. Pop. (1930) 106,730. The coast people are mostly Mohammedan Buginese, but the interior also has pagan peoples. There are three classes —descendants of nobles, free inhabitants, and slaves. They carry on weaving and copperwork, but are chiefly trading sailors and fishermen, and their well built *prahus* traverse all the seas of the Archipelago. Houses are built of wood, on piles, and sometimes villages are in shallow water off shore in more or less circular form, with approach by a bamboo causeway. Buton formerly had an evil reputation for piracy, and on the S. coast the old pirate haunt of Wasumba is still to be seen, surrounded by thick walls of chalk-blocked coral, and not far from the village of Wabula. Buton comes under the jurisdiction of Celebes, but there is a local sultan, who is elected by a council in which Dutch officials participate and who lives at Wabula, in a *kraton*, or fortress, which has bastions, with loop-holes, and is situated on the top of a steep hill, at some distance from the coast. Teak is found, and is used for boat-building, coconuts are grown, and there is some trade in copra and a kind of small dried fish. A few of the natives engage in pearl-dealing, but not all the pearls are genuine. Buton yields a considerable amount of natural asphalt. The port for the island is Buton, at the N.W. end of the strait. An assistant-resident is stationed in Bau-Bau (Buton). Japan occupied the island in World War II.

BÜTOW, chief town of an eastern sub-division in the district of Köslin, in the Prussian province of Pomerania, Germany. Pop. (9,404). It is a railway junction and a local agricultural centre.

BUTRINTO, a small Albanian town which can be reached from Argyrocastro but less easily from Janina, from which it is separated by a range of hills. The town occupies the site of an ancient fortress on a headland facing the northern end of Corfu It is on the shores of a fine bay a mile in length with an anchorage of 14 to 16 fathoms. The harbour is too far to the south to be worth developing and it is badly served by communications inland. It is only a few miles from the Graeco-Albanian frontier and lies on a rough coast-road that leads northwards to Valona. Extensive fisheries are carried on at Butrinto and the markets of Corfu are ordinarily supplied from this source. The lakes and marshes near the town abound in waterfowl of many kinds. The town is scantily populated and in no sense modernized. The entrance to the harbour is largely silted up.

Butrinto is usually identified with the ancient Buthrotum, a city said to have been founded in the time of the Trojan war. It seems to have been an Illyrian or Epirote town of no great importance and not a Greek city state. It became, however, a Roman colony by the time of Strabo. In the middle ages it was made a Venetian fortress with fortifications that still survive. It remained in Venetian hands until 1797 when Ali Pasha of Tepelen occupied it. During the Graeco-Italian war of 1940–41 it was occupied by the Greeks, but the Italians regained it (having previously occupied Albania in 1939) after the German victory over Greece in April 1941.

BUTT, DAME CLARA (1873–1936), English contralto singer, was born at Southwick, Sussex, on Feb. 1, 1873. She was trained at the Royal College of Music, and made her debut in a students' performance of Gluck's *Orfeo* at the Lyceum theatre in 1892. She possessed a contralto voice of exceptional power and wide range, and became a public favourite as a ballad and oratorio singer. In 1900 she married the singer Kennerley Rumford (b. 1870), and with him sang constantly at concerts in all parts of Great Britain, also undertaking various long tours in the colonies. During the World War she devoted the proceeds of many of her concerts to war charities, and was in 1917 created D.B.E.

BUTT, ISAAC (1813–1879), Irish lawyer and Nationalist leader, was born at Glenfin, Donegal, in 1813, his father being rector of Stranorlar. He was a brilliant student at Trinity college, Dublin, where he helped to found the *University Magazine* in 1833, and where he was appointed professor of political economy in 1836. Called to the Irish bar in 1838, he was made a Q.C. in 1844, and took part in all the important Irish law cases of the time, being engaged in the defence of Smith O'Brien in 1848, and of the Fenians between 1865 and 1869. He began by taking an active part in politics as a Conservative, was a defender of the old corporation, and of Protestantism, and started the *Protestant Guardian*, which later became part of the Orange *Warder;* in 1840 he was chosen to defend the old corporation of Dublin before the bar of the House of Lords. Butt was also a warm supporter of the union. In 1852 he was returned to parliament by Youghal as a Liberal-Conservative, and retained this seat till 1865. During his parliamentary career he drifted away from conservatism, and by 1865, when he returned to Ireland, he was definitely Liberal. Disappointment at the disestablishment of the Irish church drove Butt with other Irish Protestants into union with the Nationalists, and as leader of this coalition he evolved the federal theory of Home Rule. At a large meeting on May 19, 1870, in Dublin he inaugurated the Home Rule movement, and after his election in 1871, for Limerick, he found himself at the head of a party of 57 members. The Home Rule league was founded in 1872, but gradually the Protestant and Conservative members dropped out; Butt himself disapproved of violent methods and obstruction in parliament, and remained convinced that the union between Ireland and England must stand. The party got beyond his control, and extremists accused him of being a political traitor, his false position assisted in breaking down his health, and he died in Dublin, on May 5, 1870.

BUTT. (*1*) A cask for ale or wine, with a capacity of about two hogsheads (108 gal.; *see* HOGSHEAD). (*2*) The thick end of anything, as of a fishing-rod, or the wooden end of a rifle, shaped to fit against the firer's shoulder, also the stump of a tree. (*3*) A mark for shooting, or a mound or bank, sometimes called a "stop-butt," in front of which are placed the targets in artillery or musketry practice (Fr. *but*, a goal, and *butte*, a target, a rising piece of ground). The word is used figuratively of a person or object at which derision or abuse is levelled.

BUTTE, the largest city of Montana, U.S.A., on the west slope of the continental divide, at an elevation of 5,755 ft.; the county seat of Silver Bow county. It is on federal highways 10 and 91, and is served by four trans-continental railways: the Chicago, Milwaukee, St. Paul and Pacific, the Great Northern, the Northern Pacific, and the Union Pacific. It has a fine airport covering nearly 60 acres. The area is 5 sq. miles. The population in 1920 was 41,611, of whom 11,454 were foreign-born white, and was 37,081 in 1940 by the federal census; in 1880 the population was 3,363, and in 1900, 30,470.

Butte is the principal railroad and business centre of the Rocky mountain northwest, largest city between Minneapolis and Spokane north of Salt Lake City. Basically it is a huge mining camp, on "the richest hill in the world." Its surface in the mining district is gridironed with railway tracks to the mines and dotted with shaft-houses, smokestacks, and steel hoist-frames. Underground the rocks are honeycombed with workings, some to a depth of 3,600 feet. It is also an important trading centre, wholesale and retail, and has a large tourist traffic. It has three high schools, 18 public schools and 11 parochial schools. Fumes from smelters killed all vegetation, and the general appearance of the city was desolate indeed by day, though at night it had a fantastic beauty. At present, however, most of the ore is treated at Anaconda and Great Falls; trees and grass have reappeared, and some beautiful residential districts and parks have been developed. The assessed valuation of property in 1940 was $15,840,140. The Montana school of mines, established in 1893, is situated here.

Gold was panned from gravel near the present site of Main street in 1864, and before these placer operations were worked out (1867) they had yielded about $1,500,000. Silver ores were first successfully treated in 1875. Production of silver reached its peak in 1887, and practically disappeared as a primary industry with the drop in the price in 1893. Production of copper on a large scale began in 1882, and by 1900 the output amounted to nearly half the total for the country. To the end of 1939 the Butte district of a few square miles produced 11,532,755,240 lb. of copper, besides 306,497,607 lb. of lead, 2,871,842,238 lb. of zinc, 1,926,651 oz. of gold, and 503,990,814 oz. of silver, amounting in value to $2,333,611,391. The city was laid out in 1866, and incorporated in 1879. It grew slowly until the railways reached it in the '80s. The population was 241 in 1870; 3,363 in 1880; 10,723 in 1890; and 30,470 in 1900. There are hot medicinal springs at several points near by. To the west is Big Butte, a sharp conical peak, from which the city takes its name. The Lewis and Clark national monument, 45m. East, includes a cavern 600 x 400ft. in size, not yet fully explored, with intricate passages and numerous chambers filled with curious stalagmites and stalactites.

BUTTE or **BUTE** (Fr. *butte*, a hillock or rising ground), a word used in the Western States of North America for a flat-topped hill surrounded by a steep escarpment from which a slope descends to the plain. It is sometimes used for "an elevation higher than a hill but not high enough for a mountain." The butte capped by a horizontal platform of hard rock is characteristic of the arid plateau region of Western U.S.A. The term "knob" is occasionally used for the same feature and represents a reasonable English description of the shape.

BUTTER. Before World War II the international trade in butter was extensive. Great Britain was much the largest buyer, taking about six times as much as all other importing countries and thus dominating the trade. But in the aggregate the exports to other countries were considerable. In Europe, Belgium, Switzerland, Norway, Czechoslovakia, France, Austria and Germany were importing countries, while outside Europe the United States, Central America, Egypt, Algiers and South Africa also took greater or less quantities. Some of these countries, such as France, exported as well as imported butter, but ranked as importing countries if their imports normally exceeded their exports. Even Great Britain, although typically an importing country, exported annually a small quantity of native and a considerable quantity of imported butter. Butter was transshipped to the Irish Free State, Germany, Holland, Belgium, the United States and France.

One explanation of this apparent anomaly is that there are various kinds and qualities of butter on the wholesale markets with different levels of price. A country may export one quality and import another. On the English markets, home produce is seldom or never quoted in bulk, but if of first quality it usually sells at a higher price per lb. than imported butters. Among these, Danish and Irish creamery butter rank highest in price, Dutch, New Zealand, Australian and Argentina next, and Siberian last.

As margarine competes with, and is a substitute for butter, it should be added, in this connection, that the imports into Great Britain of that commodity amounted to 132,720,000 lb. before World War II, nearly all of which came from Holland.

During the critical years of World War II the continental butter supplies were cut off and 20% of the edible fats consumed in Great Britain was imported from Canada, South America and the United States.

Changes in the taste of the public affect the demand for particular kinds of butter. At one time, not so long ago, a rather heavily salted, highly coloured butter was generally favoured, but the main bulk of the supplies now are very lightly salted and uncoloured. This change in taste is attributable largely to the influence of Danish butter which has set a standard to which the mass of the people have become accustomed. The natural colour of butter is a pale yellow unless it is made from the milk of cows such as Jerseys, which give exceptionally rich milk. The artificial colouring of butter is now very little practised. Another influence in the same direction has been the institution of instruction in, and demonstration of, buttermaking. The "working dairy" was an innovation 40 years ago, but at every important agricultural show it is now one of the regular attractions. Buttermaking competitions at the Royal Agricultural show and the Dairy show, attract competitors from all parts of Great Britain and the art of buttermaking by the most modern methods and with the latest appliances is there demonstrated. (*See* DAIRY FARMING.)

United States.—The butter industry in the United States is one of the principal channels through which the dairy farmer markets his products, 30 to 40% of the total milk-fat produced being marketed as butter.

Butter is also the "balance wheel" of the dairy industry. During seasons of flush production the surplus butter-fat that otherwise could not find a market, is made into butter, stored and utilized throughout the year. During seasons of low production, on the other hand, the whole milk normally separated for butter may be diverted to fluid milk markets wherever there is a shortage. Thus a uniform supply of both milk and butter can be maintained.

Butter was first made in the United States on farms. The pioneers who went "west" to take up grain farming soon realized the value of cattle in the maintenance of soil productivity and built up sizable herds as quickly as possible. When this situation led to the production of butter in excess of the farm family's requirements, the surplus was disposed of either to neighbours for cash or to the village store in exchange for necessary commodities.

Enterprising individuals saw an opportunity for commercializing buttermaking. The first creamery established in the United States was built by R. S. Woodhull at Campbell Hall, Orange county, New York in 1856. Other creameries sprang up in various sections of New York and gradually moved westward to the Great Lakes and beyond.

The change of butter from a farm to a factory commodity is mirrored in the statistics of the United States department of agriculture. In the year 1850 the United States produced 313,345,566 lb. of butter, all farm-made. In 1910 the country's output was 1,619,415,263 lb., 60% of which was made in commercial plants. In 1942, 1,764,054,000 lb. of creamery butter and 362,570,000 lb. of farm butter were manufactured in the United States.

The first creameries purchased whole milk from the farmers and separated it by letting the milk stand until the cream rose to the top. Then either the cream was skimmed from the top or the skim milk drawn from the bottom. With the introduction of a farm-sized mechanical separator in 1890, however, the farmer was able to market his butter-fat in the form of cream rather than as whole milk. The development of the Babcock test by Dr. S. M. Babcock in the same year enabled the creamery to give the farmer a cash return on the actual fat delivered rather than on the amount of whole milk.

The first neighbourhood factory handled only a few hundred pounds of butter a day; now the small creamery has an average annual output of about 250,000 lb. of butter marketed through the city wholesale dealer or jobber. In a few cases a number of small creameries have organized a co-operative marketing agency. The most outstanding association of this kind is the Land O'Lakes creameries which distribute the butter for some 420 creameries of Minnesota and Wisconsin.

The largest butter factories are found in large cities where the finished product is marketed soon after it is made. A few single factories have an annual production of approximately 15,000,000 lb., and a few companies with a series of 15 or 20 creameries are manufacturing over 60,000,000 lb. of butter in a year.

The normal annual per capita consumption of butter in the United States is about 16.5 lb., but during the war years it has been reduced to from 12 to 13 lb. by rationing. The total amount of butter produced in the United States is about 2,000,000,000 lb. annually, which is about twice that of any other nation. In normal times the imports of butter into the United States are approximately balanced by the exports.

Butter is made as follows: as quickly as the milk is separated the cream is cooled. The cream is delivered to the creamery once every two or three days, where it is graded in at least two classes, sweet and sour. If sour, the acidity is standardized to about .25% lactic acid by the use of a carbonate or a lime. Then it is pasteurized, and if ripened cream butter is to be made a pure culture of *streptococcus lactis* is introduced to start the desirable souring process. If sweet cream butter is to be made no starter is added. The best storage butter is made from unripened or sweet cream. After pasteurization and ripening the cream is held over night, when it is churned, washed, salted and worked in the combined churn and worker. The market requirements determine the amount of colour and salt that should be used. The legal standard for butter requires 80% butter-fat. Good creamery butter has a composition of about 80.5% fat, 16.4% water, 2.2% salt and 0.9% casein and ash. Butter, which is a valuable food and an effective appetizer, should have a firm, waxy body, a pleasant, creamy flavour and should be delivered to the consumer in a pleasing package.

United Kingdom.—The butter industry of the United Kingdom, utilizing in normal years about 2,250,000,000 lb. of milk, was developed as a farm industry. In more recent years, however, farmers in increasing numbers have marketed their milk to commercial creameries to the extent that in 1936 commercial creameries produced slightly greater amounts of butter than farms. This is illustrated by the following table:

*United Kingdom Total Butter Production**

Year	
1930–31 .	00 lb.
1935–36	00 lb.
1936–37 .	00 lb.

estimate Approximately 20% of the farm butter is consumed on the farms where it is produced.

Although butter has been made on farms in the United Kingdom from the earliest days, it is one of the less important farm products and its value represents less than 3% of the total farm income. The sale of milk for distribution in the fluid form is generally more profitable than buttermaking. Consequently, to a large degree, butter is made primarily in regions where there is not a ready market for fluid milk or at such times as there is an excess of this product above market requirements. This is demonstrated by the sharp reduction in butter production during the war period. The per capita consumption of fluid milk has increased during the war years, and the per capita consumption of butter has been reduced on a ration basis to 2 oz. per week.

In normal times the imports of butter into Great Britain have been large, amounting to approximately five times the total butter production of the United Kingdom. In 1927 Great Britain imported 652,624,000 lb. of butter, the chief contributors being the following countries:

Country	Lb.	Country	Lb.
Denmark . .	223,440,000	Finland . .	22,960,000
New Zealand	141,232,000	Netherlands .	10,010,000
Irish Free State .	65,632,000	Sweden . .	18,592,000
Australia .	54,768,000	France	7,302,000
Argentina .	47,040,000	U S A	75,264
U.S.S.R. . . .	39,200,000	Canada . . .	47,376

BUTTER-AND-EGGS, the name commonly given in the United States to the yellow toadflax (*q.v.*), widely naturalized from the Old World as a wayside weed. (*See* TOADFLAX.)

BUTTERCUP, various crowfoots which bear bright yellow, broadly cup-shaped flowers. Among the best known are the tall or meadow buttercup (*Ranunculus acris*), 2 ft. to 3 ft. high, with stiffly erect stems; the creeping buttercup (*R. repens*), which spreads by runners, and the bulbous buttercup (*R. bulbosus*), 1 ft. high, with the stem thickened at the base into a bulb. These plants, all Eurasian and abundant in the British Isles, have become widely naturalized in North America. Among native American species are marsh buttercup (*R. septentrionalis*) and California buttercup (*R. californicus*). The turban or Persian buttercup (*R. asiaticus*) is widely cultivated for ornament. *See* CROWFOOT.

BUTTER-FAT, the fatty constituent of cows' milk. Butter, which is a solid emulsion containing fat, water, curd, milk-sugar and inorganic salts, is melted and allowed to settle; the clear butter-fat rises to the top and is separated by decantation. It does not become rancid as readily as butter, for the albuminous curd and the water present in the latter favour the growth of the organisms which promote rancidity. Butter-fat is chiefly manufactured in India and Egypt; before the war it was also prepared in Siberia (whence it was exported to Turkey), and to a less extent in Germany (Schmelzbutter). In India, where it is prepared in large quantities, butter-fat is known as "*ghi*"; it is commonly mixed with the milk-fat of the buffalo, while in Egypt the chief adulterants are the milk-fats of sheep and goats. In the latter country the fat is termed *Samna.* Butter-fat occupies a unique position among the natural animal fats because it contains considerable amounts of the glycerides of the water-soluble fatty acids—butyric, caproic, caprylic and capric acids. The Reichert-Meissel (Reichert-Wollny) value, which is a measure of the amount of these acids, is a valuable characteristic in butter-fat analysis. Especially characteristic is the presence of butyric acid, which is absent from coconut and palm-kernel oils, from which butter-fat is also distinguished by its smaller content of lauric acid. (*See* also OILS, FATS AND WAXES.)

BUTTERFIELD, DANIEL (1831–1901), American soldier, was born in Utica, New York. He graduated at Union college in 1849 and when the Civil War broke out he became colonel of the 12th New York militia regiment. On May 14, 1861 he was transferred to the regular army as a lieutenant-colonel, and in September was made a brigadier-general U.S. volunteers. He served in Virginia in 1861 and in the Peninsular campaign of 1862; took part in the campaign of second Bull Run (Aug. 1862), became major-general U.S. volunteers, and in July 1863 Colonel U.S. army. After Gen. Hooker succeeded Burnside, Butterfield was appointed chief of staff, army of the Potomac, and served in the Chancellorsville and Gettysburg campaigns. He was sent as chief of staff to Hooker, with the XI. and XII. corps to Tennessee, and took part in the battle of Chattanooga (1863), and the Atlanta campaign of the following year. His services were recognized by the brevets of brigadier-general and major-general in the regular army. He resigned in 1870 to engage in civil and commercial pursuits. In 1862 he wrote a manual of *Camp and Outpost Duty* (1862). He died at Cold Spring, N.Y., on July 17, 1901.

A *Biographical Memorial,* by his widow, was published in 1904.

BUTTERFIELD, WILLIAM (1814–1900), English architect, was born in London, and educated for his profession at Worcester, where he laid the foundations of his knowledge of Gothic architecture. He settled in London and became prominent in connection with the Cambridge Camden Society, and its work in the improvement of church furniture and art. His first important building was St. Augustine's, Canterbury (1845), and his reputation was made by All Saints', Margaret Street, London (1859), followed by St. Alban's, Holborn (1863), the new part of Merton College, Oxford (1864), Keble College, Oxford (1875), and many houses and ecclesiastical buildings. He executed many restorations.

BUTTERFISH, a small fish, *Poronotus triacanthus,* caught along the Atlantic coast of the United States and sometimes known as the "dollar fish." The flavour is very delicate especially when the fish is fried in butter until lightly browned. Its maximum length is about 12 in. The name butterfish is also applied to various other fishes, particularly to species of blenny (*q.v.*) on account of the slippery nature of their bodies.

BUTTERFLY and **MOTH,** the common English names for insects forming the order Lepidoptera (*q.v.*).

BUTTERFLY FISH, the common name of the Chaetodonts, laterally compressed and often brilliantly coloured fishes of tropical seas, especially abundant in the vicinity of coral. (*See* FISHES.)

BUTTERFLY WEED (*Asclepias tuberosa*), a North American plant of the milkweed family (Asclepiadaceae), known also as pleurisy-root, orange-root and orange milkweed. It is native to dry fields from Maine to Ontario and Minnesota and southward to Florida, Texas, Arizona and Chihuahua. The butterfly weed is a stout, rough-haired perennial, with long horizontal roots. The usually erect, somewhat branching stem, 1 ft. to 3 ft. high, is very leafy throughout, and about midsummer bears numerous clusters of bright orange flowers. Unlike most milkweeds, this plant has a very scanty milky juice. The root was used in medicine, especially for pulmonary affections.

BY COURTESY OF THE WILD FLOWER PRESERVATION SOCIETY

BUTTERFLY WEED, A NORTH AMERICAN FIELD PLANT BEARING ORANGE FLOWERS

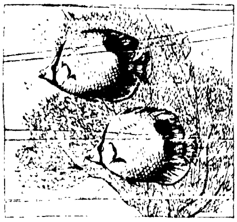
Butterfly weed is often planted in wild gardens and is sparingly grown as a border plant.

BUTTERMILK, the liquid residue after removing the butter from cream by the churning process. It consists mainly of water some 90%, together with milk sugar, about 5%, and casein, about 3%. In addition it contains small quantities of butter fat and lactic acid. To the latter, which is formed during the ripening of the cream, buttermilk owes its slightly acid taste. In North America until about 1900 buttermilk was used chiefly for feeding pigs, especially in the leading dairy districts, but, owing to its healthful and nutritious qualities, it has since become widely popular as a beverage. In the United States and Canada it is extensively bottled for the market and sold at dairies, grocery stores, delicatessens, soda fountains and restaurants. In some sections, most of the buttermilk sold commercially is "cultivated." Certain bacteria are added to skimmed milk to produce fermentation. The resulting product is somewhat thicker than natural buttermilk, but is in other respects similar. (*See* DAIRY FARMING.)

BUTTERNUT, the tree or fruit of the North American white or long walnut, *Juglans cinerea*, a native of rich woods from New Brunswick to North Dakota and south to Georgia and Arkansas, although not abundant below the latitude of Pennsylvania and Iowa. The nut is oblong-cylindrical with jagged, hard shell. The kernel has a pleasing flavour and is popular in confections and baked goods. This name is also sometimes used for certain nuts of South America, as the Brazilnut and souarinut. (*See* WALNUT.)

BUTTERWORT, the popular name of a small insectivorous plant, *Pinguicula vulgaris*, which grows in wet, boggy land. It is a herb with a rosette of fleshy, oblong leaves, 1 to 3in. long, appressed to the ground, of a pale colour, and with a sticky surface. Small insects settle on the leaves and are caught in the viscid secretion. This, like the secretion of the sundew and other insectivorous plants, contains a digestive enzyme which renders the nitrogenous substances of the body of the insect soluble and capable of absorption by the leaf. In this way the plant obtains nitrogenous food by means of its leaves. The leaves bear two sets of glands, the larger borne on usually unicellular stalks, the smaller almost sessile. When a fly is captured, the viscid secretion becomes strongly acid and the naturally incurved margins of the leaf curve still further inwards, rendering contact between the insect and the leaf-surface more complete. The plant is widely distributed in the north temperate zone, extending into the arctic zone. In North America it ranges from the high northern tundras southward to Newfoundland, New York, Minnesota, Montana and British Columbia. The butterwort belongs to the bladderwort family (Lentibulariaceae) which comprises various other carnivorous plants. (*See* UTRICULARIA; CARNIVOROUS PLANTS.)

See also F. E. Lloyd, *The Carnivorous Plants* (1942).

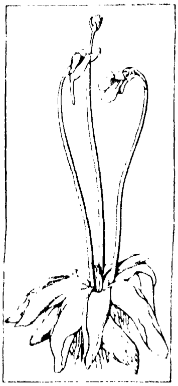

BY COURTESY OF N.Y. ZOOL. SOCY.

BUTTERFLY FISH, SO NAMED BECAUSE OF ITS BRIGHT COLOURING

BUTTERY, a place for storing wine (O.Fr. *boterie*, Late Lat. *botaria*, a place where liquor is stored, from *butta*, a cask). Later, by confusion with "butter," a storeroom for food; at Oxford and Cambridge universities, a place where food is kept.

BUTTON, a small piece of metal or other material which, pushed through a loop or buttonhole, serves as a catch between different parts of a garment, etc. The word is also used of other objects which have a projecting knob-like character, *e.g.*, button-mushrooms, the button of an electric bell-push, or the guard at the tip of a fencing foil; or which resemble a button in size and shape, as the button of metal obtained in assaying operations. The derivation is from Fr. *bouton*, apparently from the same root as *bouter*, to push.

At first buttons were apparently used for purposes of ornamentation; in *Piers Plowman* (1377) mention is made of a knife with "botones ouergylte," and in Lord Berners's translation of *Froissart's Chronicles* (1525) of a book covered with crimson velvet with "ten botons of syluer and gylte." While this use has continued, especially in connection with women's dress, they began to be employed as fastenings at least as early as the 15th century. As a term of comparison for something trivial or worthless, the word is found in the 14th century. Buttons of distinctive colour or patterns, or bearing a portrait or motto, are often worn, especially in the United States, as a decoration, or sign of membership of a society or of adherence to a political party; among the most honoured of such buttons are those worn by members of the military order of the Loyal Legion of the United States, organized in 1865 by officers who had fought in the Civil War. Chinese officials during the Empire wore a button or knob on their hats as a mark of rank, the grade being denoted by its colour and material (*see* MANDARIN). Many varieties of buttons are used on clothing, but they may be divided into two main classes according to the arrangement by which they are attached to the garment; in one class they are provided with a shank which may consist of a metal loop or of a tuft of cloth or similar material, while in the other they are pierced with holes through which are passed threads. To these two classes roughly correspond two broad differences in the method of manufacture, according as the buttons are composite and made up of two or more pieces, or are simply shaped discs of a single material; some composite buttons, however, are provided with holes, and simple metal buttons sometimes have metal shanks soldered or riveted on them. From an early period buttons of the former kind were made by needlework with the aid of a mould or former, but about 1807 B. Sanders, a Dane who had been ruined


BUTTERWORT, SHOWING THE FLOWER STEM GROWING OUT OF A ROSETTE OF GROUND LEAVES

by the bombardment of Copenhagen, introduced an improved method of manufacturing them at Birmingham. His buttons were formed of two discs of metal locked together by having their edges turned back on each other and enclosing a filling of cloth or pasteboard; and by methods of this kind, carried out by elaborate automatic machinery, buttons are readily produced, presenting faces of silk, mohair, brocade or other material required to harmonize with the fabric on which they are used. Sander's buttons at first had metal shanks, but about 1825 his son invented flexible shanks of canvas or other substance through which the needle could pass freely in any direction. The mechanical manufacture of covered buttons was started in the United States in 1827 by Samuel Williston, of Easthampton (Mass.), who in 1834 joined forces with Joel and Josiah Hayden, of Haydenville.

Buttons 140 Guineas a Gross.—The number of materials that have been used for making buttons is very large—metals such as brass and iron for the cheaper kinds, and for more expensive ones, gold and silver, sometimes ornamented with jewels, filigree work, etc.; ivory, horn, bone, and mother-of-pearl or other nacreous products of shellfish; vegetable ivory and wood; glass, porcelain, paper, celluloid and artificial compositions; and even the casein of milk, and blood. Brass buttons were made at Birmingham in 1689, and in the following century the metal button industry underwent considerable development in that city. Matthew Boulton, the elder, about 1745, introduced great improvements in the processes of manufacture, and when his son started the Soho works in 1767 one of the departments was devoted to the production of steel buttons with facets, some of which sold for 140 guineas a gross. Gilt buttons also came into fashion about the same period. In this "Augustan age" of the Birmingham button industry, when there was a large export trade, the profits of manufacturers who worked on only a modest scale amounted to £3,000 and £4,000 a year, and workmen earned from £2 to £4 a week. At one time the buttons had each to be fashioned separately by skilled artisans, but gradually the cost of production was lessened by the adoption of mechanical processes, and instead of being turned out singly and engraved or otherwise ornamented by hand, they came to be stamped out in dies which at once shape them and impress them with the desired pattern. Ivory buttons are among the oldest of all. Horn buttons were made at Birmingham at least by 1777; towards the middle of the 19th century Émile Bassot invented a widely-used process for producing them from the hoofs of cattle, which were softened by boiling. Pearl buttons are made from pearl oyster shells obtained from various parts of the world, and after being cut out by tubular drills are shaped and polished by machinery. Buttons of vegetable ivory can be readily dyed. Glass buttons are especially made in Czechoslovakia, as also are those of porcelain, which were invented about 1840 by an Englishman, R. Prosser of Birmingham.

The Birmingham Button Trade.—The English button industry has always been centred in Birmingham, though considerable quantities are also manufactured in London. A large proportion of the industry is in the hands of a combine formed in 1907 by the amalgamation of several of the largest concerns. Rates of wages in the British industry are governed by a Trade Board that was established in 1920. In 1927, when an application was made by the British Button Manufacturers' Association for a duty on imports, it was stated that the industry was then carried on by 53 firms employing 3,620 people, whereas it was estimated that in 1913 the number of persons employed was about 6,850. Twelve of these 53 firms, it was said, were responsible for 85% of the total production, and the turnover of the whole trade was estimated at £750,000. Figures of production given by the manufacturers at the inquiry into their application for protection were, in gross, as follow: 1921, 4,300,000; 1922, 6,300,000; 1923, 5,700,000; 1924, 5,600,000; 1925, 6,200,000; 1926, 5,000,000. During the same years imports of buttons were, in gross: 1921, 4,474,000; 1922, 7,270,000; 1923, 6,966,000; 1924, 9,099,000; 1925, 10,645,000; 1926, 9,000,000.

All types of buttons are manufactured by English firms, but their principal output consists of linen, mother-of-pearl, composition, metal and fancy buttons. Germany, a big button manufacturing country, concentrates chiefly on fancy and Galalith buttons; France on mother-of-pearl and fancy metal; Italy on so-called vegetable ivory (the product of the corozo nut from South America); Japan on certain classes of mother-of-pearl; and Czechoslovakia on glass, china and paste (imitation precious stones). London is the centre of the world's trade in mother-of-pearl shells for buttons, which are brought from the Colonies (principally Australia) and auctioned in Mincing Lane in their raw state. They sell at anything from 80s. to 110s. per cwt., according to quality. These shells are distinct from the river mother-of-pearl which are used to make a cheaper class of button. Buttons are measured by the diameter, the unit being a "line." In all countries except France 10 lines are the equivalent of approximately ¼in. and sizes commence at 8 lines, rising in 2's to as much as 100 lines. Three French lines are the equivalent of 10 English. In the United States few buttons were made until the beginning of the 19th century, when the manufacture of metal buttons was started at Waterbury (Conn.), which became a centre of that industry. In 1812 Aaron Benedict began to make ivory and horn buttons at the same place. Buttons of vegetable ivory, now one of the most important branches of the American button industry, were first made at Leeds (Mass.), in 1859 by an Englishman, A. W. Critchlow, and in 1875 commercial success was obtained in the production of composition buttons at Springfield (Mass.). Pearl buttons were made on a small scale in 1855, but their manufacture received an enormous impetus in the last decade of the 19th century, when J. F. Boepple began, at Muscatine (Iowa), to utilize the unio or "niggerhead" shells found along the Mississippi.

By 1850, there were 59 United States button manufacturing concerns, using materials valued at $324,837, the output being worth $964,359. In 1919 the number of firms had risen to 557, producing buttons valued at $41,840,000, and employing 15,000 persons. The United States, however, do not do a large export trade, being principally employed in meeting domestic requirements—or, rather, helping to meet them, for large quantities are also imported.

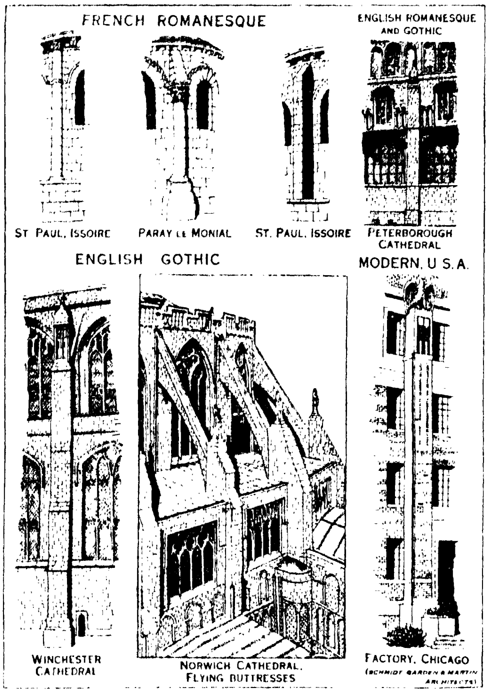
See *The Button Industry*, by W. Unite Jones; Sir Isaac Pitman and Sons, Ltd. (1924).

BUTTON-BUSH (*Cephalanthus occidentalis*), a North American shrub or small tree of the madder family (Rubiaceae), called in California button willow and also honey-balls. It grows in swamps almost throughout North America, and in Mexico and Cuba. In the northern parts of its range it is a shrub 3 ft. to 12 ft. high, but in southern Arkansas and eastern Texas it attains a height of 40 ft. to 50 ft., with a straight trunk a foot in diameter. It bears ovate, entire, pointed leaves and small, fragrant, creamy white flowers in globular stalked heads about an inch in diameter.

In the northeastern states the button-bush is sparingly cultivated as an ornamental plant.

BUTTON SNAKEROOT (*Liatris*), a genus of North American plants of the family Compositae, comprising about 30 species, found chiefly in the central and eastern United States and southern Canada. Various species, because of their showy flowers, are also called blazing star. They are erect, perennial, mostly unbranched herbs, with the stem usually rising from a globular tuber, whence the name *button* snakeroot. The leaves are narrow, often rigid, and sometimes strongly dotted; the rose-purple or rarely white flowers are borne in hemispherical or cylindrical heads, usually in long dense spikes or narrow racemes. Noteworthy examples are the rattlesnake master (*L. squarrosa*), 1 ft. to 2 ft. high, found from Ontario to South Dakota south to Florida and Texas; the handsome blazing star (*L. elegans*), 2 ft. to 3 ft. high, native to dry soil from Virginia to Arkansas and southward; the large button snakeroot (*L. scariosa*), found from Maine to Manitoba and southward to Florida and Texas; the dense button-snakeroot (*L. spicata*), called also gay-feather, colicroot and devil's-bit, 2 ft. to 6 ft. high, with blue-purple or white flowers, found from Massachusetts to Wisconsin and southward; and the prairie button snakeroot (*L. Bebbiana*), with very numerous rigid leaves and a long dense spike of purple flowers, native to the prairie region. The name is also applied to *Eryngium aquaticum*. (*See* SNAKEROOT.)

BUTTRESS, *a mass of masonry projecting from the face of* a wall, either to strengthen the wall or to resist the side thrust of an arch, roof or vault abutting against that wall (*see* ABUTMENT). Until the extensive development of vaulting there was little need for buttresses, and therefore they are not found prior to the Roman period. In such buildings, however, as the great *thermae* of the Roman empire, the enormous vaults rendered careful buttressing a necessity. The Romans always attempted to combine their buttresses with necessary cross walls in the plan. Even when this could not be done and the buttresses showed externally (as in portions of the villa of Hadrian at Tivoli and the baths of Diocletian at Rome) no special architectural treatment was developed for them. Byzantine buttresses follow Roman precedent. In early Romanesque work buttresses occasionally occur as mere pilaster strips used largely for decorative purposes, and it was only with the rapid development of the vaulting of churches, in the 12th century, that buttresses of large size became necessary. Employed first around the apses of French churches these buttresses took form originally as engaged columns, complete with capital and base, and sometimes topped with a cone; then, as projecting masses of masonry with a steep slope at the top to shed the water. When naves came generally to be vaulted with ribbed and groined vaults, the tremendous concentration of thrusts at each bay rendered necessary an entirely new study of the buttress problem The solution was only reached satisfactorily in the Gothic period. The Gothic builders seized upon this structural necessity and transformed it into one of their greatest opportunities for achieving architectural effect. The flying buttress (*q.v.*), the pinnacles which by weighting a buttress at its top increased its efficiency, the gables, and the moulded offsets all helped the buttress to function. In the later period of French Gothic, sculpture was frequently added; in the late Gothic styles in all countries the tendency was towards over-elaboration and thinness. In modern work, due to the almost universal abandonment of structural vaults, buttresses are used only to strengthen thin walls as in retaining walls and the like, and are usually treated in the simplest manner possible. (T. F. H.)



DEVELOPMENT OF THE BUTTRESS FROM THE EARLY COLUMNAR TYPE TO THE FINAL GOTHIC FLYING BUTTRESS AND ONE MODERN TREATMENT

BUTURLINOVKA, a town in the Voronezh province of the Russian Soviet Federated Socialist Republic, situated on the edge of a plateau, and on the branch railway to Kalach. Lat. 50° 48′ N. Long. 40° 35′ E. Pop. (1935) 25,216. It has sulphur mineral springs. It trades chiefly in cattle, and has tallow, tanning and leather factories. Its sheepskin coats and caps are noted.

BUTYL ALCOHOLS. Organic compounds with the formula C_4H_9OH are known as butyl alcohols. Four members of this important class of alcohols are known. These, together with their more detailed formulas and boiling points are listed below.

Name	*Formula*	*Boiling Point* (°*C.*)
Normal butyl alcohol	$CH_3CH_2CH_2CH_2OH$	117.7
Secondary butyl alcohol	$CH_3CH_2CHOHCH_3$	99.5
Isobutyl alcohol	$(CH_3)_2CHCH_2OH$	108
Tertiary butyl alcohol	$(CH_3)_3COH$	82.4

These alcohols are slightly viscous liquids with penetrating odours. They are somewhat poisonous if taken internally, but can be handled with safety if ordinary precautions are taken.

Normal butyl alcohol (butanol) is made commercially by fermentation of corn or molasses and also from acetylene by a series of reactions involving addition of water, condensation and reduction. Secondary butyl alcohol is ordinarily produced from butylene present in cracking gases from petroleum refineries by solution in sulphuric acid followed by reaction with water. Tertiary butyl alcohol is similarly produced from isobutylene. Isobutyl alcohol is made commercially by causing carbon monoxide and hydrogen to react at high pressure.

Normal, secondary and isobutyl alcohol find extensive use as solvents for lacquers. They are also used extensively in the manufacture of various esters. Tertiary butyl alcohol is used mostly in the manufacture of derivatives.

BUTYRIC ACID is the first acid in the fatty acid series to show structural isomerism (*q.v.*). There are two acids of the formula $C_3H_7.CO_2H$. Normal butyric acid or fermentation butyric acid is found in butter, as an hexyl ester in the oil of *Heracleum giganteum*, as an octyl ester in parsnip (*Pastinaca sativa*), and in the oil of *Eucalyptus Perriniana* as *n*-butyl butyrate; it has also been noticed in meat juice, in perspiration and in excrementa. The acid is an oily liquid of unpleasant smell, solidifies at −19° C., and boils at 162.3° C. It is easily soluble in water and alcohol, and is thrown out of aqueous solution by calcium chloride. The calcium salt, $Ca(C_4H_7O_2)_2.H_2O$, is less soluble in hot water than in cold. It may be synthesised by hydrolysing ethylacetoacetic ester (*see* CHEMISTRY: *Organic: Aliphatic Division*). It is ordinarily prepared by the fermentation of sugar or starch, brought about by the addition of putrefying cheese, calcium carbonate being added to neutralize the acids formed in the process. A. Fitz (b. 1878) found that the butyric fermentation of starch is aided by the direct addition of *Bacillus subtilis* (hay bacillus).

Isobutyric acid, $(CH_3)_2.CH.COOH$, is found in the free state in carobs (*Ceratonia siliqua*) and in the root of *Arnica dulcis*, and as an ethyl ester in croton oil. It is a liquid of somewhat unpleasant smell, boiling at 155.5° C. It may be artificially prepared by the hydrolysis of isopropylcyanide with alkalis, by the oxidation of isobutyl alcohol with potassium dichromate and sulphuric acid (I. Pierre and E. Puchot, 1873), or by hydrolysing dimethylacetoacetic ester (*cf. supra*). Alkaline potassium permanganate oxidizes it to α-hydroxyisobutyric acid, $(CH_3)_2.C(OH).COOH$, while concentrated nitric acid converts it into 2,2-dinitropropane. Its salts are more soluble in water than those of the normal acid, the calcium salt differing from its normal isomeride in being more soluble in hot than in cold water.

BUXACEAE, a small family of dicotyledonous plants with 7 genera and about 50 species, mostly shrubs or small trees, in the warmer parts of both hemispheres. Representatives of the genus *Buxus* known as boxwood (*q.v.*) are highly prized for garden hedges and borders.

BUXAR or **BAXAR,** a sub-divisional town of northeastern India, in the Shahabad district of Bihar, on the south bank of the Ganges, with a station on the East Indian Railway. Pop. (1941) 14,879. There is a dismantled fort of small size which was important from its commanding the Ganges. A celebrated victory was gained here on Oct. 23, 1764, by the British forces under Major (afterwards Sir Hector) Munro, over the united armies of Shuja-ud-Dowlah and Kasim Ali Khan. The action raged from 9 o'clock till noon, when the enemy gave way. Pursuit was, however, frustrated by Shuja-ud-Dowlah sacrificing a part of his army to the safety of the remainder. A bridge of boats had been constructed over a stream about 2 mi. distant from the field of battle, and this the enemy destroyed before their rear had passed over. Through this act 2,000 troops were drowned, or otherwise lost; but destructive as was this proceeding, it was, said Maj. Munro, "the best piece of generalship Shuja-ud-Dowlah showed that day, because if I had crossed the rivulet with the army, I should either have taken or drowned his whole army in the Karamnasa, and come up with his treasure and jewels, and Kasim Ali Khan's jewels, which I was informed amounted to between two and three millions."

BUXTEHUDE, DIETRICH (1637–1707), organist and composer, was born at Helsingborg, Sweden, the son of Johann Buxtehude (d. 1674), organist of the Olai church at Helsingör, Denmark. Dietrich studied under his father, and in 1668 was appointed organist of the Marienkirche, Lübeck, where he instituted the *Abendmusiken*, sacred concerto held in the church during Advent each year, which J. S. Bach walked 50 miles to attend. Buxtehude was one of the most eminent musicians of his day and greatly influenced the earlier writings of Bach. His organ works were edited (2 vols., 1876–78) by Spitta, and some of his cantatas by M. Seiffert in *Denkmäler deutscher Tonkunst* (1904).

BUXTON, SIR THOMAS FOWELL (1786–1845), English philanthropist, was born at Earl's Colne, Essex, on April 1, 1786, and was educated at Trinity College, Dublin. In 1807 he married Hannah Gurney, sister of Elizabeth Fry. He entered in 1808 the brewery of Truman, Hanbury & Company, of which his uncles, the Hanburys, were partners. He became a partner in 1811, and soon had the whole concern in his hands. In 1816 he made a famous speech on behalf of the Spitalfields weavers, and in 1818 he published his able *Inquiry into Prison Discipline*. The same year he was elected M.P. for Weymouth, a borough he represented till 1837. In the House of Commons Buxton worked for the abolition of slavery in British colonies, but when success came in 1833 he was compelled to admit into the bill some clauses against which his better judgment had decided. He travelled on the continent in 1839 to recruit his health, which had given way, and took the opportunity of inspecting foreign prisons. He was made a baronet in 1840, and then devoted himself to a plan for ameliorating the condition of the African natives. The failure of the Niger expedition of 1841 was a blow from which he never recovered. He died on Feb. 19, 1845.

See *Memoir and Correspondence of Sir T. F. Buxton* (1848), by his third son, Charles Buxton (1823–71).

BUXTON, municipal borough and health-resort, in the High Peak parliamentary division of Derbyshire, England, on the L.M.S. railway, 36 mi. N.W. of Derby. Pop. (1938) 16,720. Area 9.3 sq.mi. It is in the centre of the Peak district, and has the reputation of being the highest town in England. It lies between 1,000 and 1,150 ft. above sea level, in a basin protected by hills of grit and limestone rising to 1,800 ft., whence flows the river Wye on the southeast. The old town (High Buxton) is at a higher level than the new, and consists of one wide street. The mineral waters of Buxton are tasteless and odourless, and have long enjoyed a great reputation. The waters were known and used by the Romans, but no remains of their baths survive. Roman roads connected the place with Derby, Brough in Edale and Manchester. Buxton (Bawdestanes, Bue-stanes) is first mentioned, as Buchestanes, in William Peverell's foundation charter of Lenton priory, Notts., in 1108. After the departure of the Romans the baths seem to have been long neglected, but have again been frequented since the 16th century, when the chapel of St. Anne acquired fame for the "cures" effected. At the close of the 18th century the duke of Devonshire, lord of the manor, spent large sums of money on improvements in the town. There are numerous public and private baths, open all the year round, for the treatment of nervous diseases, gout, rheumatism, etc. A clinic for the treatment of rheumatic diseases was opened in 1936. The waters are of two distinct classes: thermal and chalybeate. The thermal waters issue at a constant temperature of 82° F. The Pump Room, presented by the duke of Devonshire, contains both thermal and chalybeate springs. Features of note in the town are the Buxton gardens and the Cavendish terrace. A library and museum, containing a valuable collection of archaeological works, was opened in 1928. There are annual theatre and drama festivals, and a municipal orchestra is maintained. In the neighbourhood are Poole's hill, a stalactite cave; Diamond hill, so called from the quartz crystals in its rocks; and Chee tor, a 300 ft. cliff on the bank of the Wye. Buxton is an important centre for horse-breeding, a large fair being held annually. The busiest season at Buxton is from May to October, but it is also popular as a winter resort. Buxton was incorporated in 1917.

BUXTORF or **BUXTORFF, JOHANNES** (1564–1629), German Hebrew and Rabbinic scholar, was born at Kamen in Westphalia. At the instance of Grynaeus, he undertook the duties of the Hebrew chair in the University of Basle, and after two years was unanimously appointed to the vacant office. From this date (1591) to his death he remained in Basle, and devoted himself to the study of Hebrew and rabbinic literature. He received into his house many learned Jews, that he might discuss his difficulties with them, and he was frequently consulted by Jews themselves on matters relating to their ceremonial law. On one occasion this brought him into trouble with the authorities of the city, but, on the whole, his relations with the city of Basle were friendly. He corresponded with the most distinguished scholars of the day; the library of the University of Basle contains a collection of letters, which are valuable for a literary history of the time.

WORKS.—*Manuale Hebraicum et Chaldaicum* (1602; 7th ed., 1658); *Synagoga Judaica* (1603 in German; afterwards enlarged and translated into Latin), a valuable repertory of information regarding the opinions and ceremonies of the Jews; *Lexicon Hebraicum et Chaldaicum cum brevi Lexico Rabbinico Philosophico* (1607; reprinted at Glasgow, 1824); his great rabbinical Bible, *Biblia Hebraica cum Paraphr. Chald. et Commentariis Rabbinorum* (1618; 1618–19).

BIBLIOGRAPHY.—For additional information regarding his writings see *Athenae Rauricae*, p. 444–448; articles in Ersch and Gruber's *Encyklopädie*, and Herzog-Hauck, *Realencyk.*; J. P. Niceron's *Mémoires*, vol. xxxi., p. 200–215; J. M. Schroeckh's *Kirchengeschichte*, vol. v. (Post-Reformation period), p. 72 *seq.* (Leipzig, 1806); G. W. Meyer's *Geschichte der Schrift-Erklärung*, vol. iii. (Göttingen, 1804); and E. Kautsch, *Johannes Buxtorf der Ältere* (1879).

BUXTORF or **BUXTORFF, JOHANNES** (1599–1664), son of the preceding, concentrated on theological and Semitic studies, and in 1622 published at Basle a *Lexicon Chaldaicum et Syriacum*, as a companion work to his father's great Rabbinical Bible. On the death of his father in 1629, he was unanimously designated his successor in the Hebrew professorship at Basle, where he remained till his death. In 1647 a third theological professorship was founded specially for him, but when the professorship of the Old Testament became vacant in 1654, Buxtorf accepted that chair instead.

Much of Buxtorf's public life was spent in controversy on biblical criticism. The Reformed churches at this time, having renounced the dogma of an infallible church, thought it necessary to maintain that of an infallible Bible and, as the necessary foundation of this, of a Bible handed down from the earliest ages without textual alteration. Even the vowel points and accents were held to have been given by divine inspiration. The Massoretic text of the Old Testament, therefore, as compared with that of the Samaritan Pentateuch, the Septuagint or the Vulgate, alone contained the true words of the sacred writers. Although many of the Reformers, as well as learned Jews, had long seen that these views could not be made good, there had been as yet no formal controversy. Louis Cappel (*q.v.*) was the first to dispel these illusions by a work on the modern origin of the vowel points and accents, published anonymously in 1624, under the title *Arcanum Punctationis revelatum.* In 1648 Buxtorf published his *Tractatus de punctorum origine, antiquitate, et authoritate, oppositus Arcano punctationis revelato Ludovici Cappelli.* He tried to prove by citations from the rabbinical writers, and by various arguments, that the points were at least as old as the time of Ezra, and thus possessed the authority of divine inspiration. Cappel replied in a second edition, which, however, was not published until 1685. Buxtorf engaged in three other controversies with the same antagonist, on the subject of the integrity of the Massoretic text of the Old Testament, on the antiquity of the present Hebrew characters, and on the Lord's Supper.

Besides the works mentioned in this article, Buxtorf edited the great *Lexicon Chaldaicum, Talmudicum, et Rabbinicum,* on which his father had spent 20 years, and the great Hebrew *Concordance.*

BUYER, one who purchases or acquires by barter. The individual buyer purchases commodities for himself through the expenditure of his own money, or its equivalent. As commonly used, however, the term refers to the authorized purchasing agent for some other individual, firm or institution. On the stock exchange, the buyer or broker is an individual or a firm legally invested with the power of buying stocks and bonds upon order from the purchaser.

The term "buyer" in business parlance, refers usually to an individual buying for the retail and wholesale trade. Large department stores are composed of a great number of departments, each specializing in a given line of commodities. Each of these departments is headed by a buyer, that is, a man or woman employed by the store owner, to buy on the market such articles as are required to keep the department running. The department store buyer differs from a stock exchange broker in that all the buying of the former is done on the department store's credit, the buyer serving as an intermediary between the manufacturer and the store-keeper. Invested with the right of buying what he considers his store's clientèle demands, he selects his goods and instructs the manufacturer from whom he buys to submit the bill directly to the store owner. He is responsible for seeing that the merchandise he buys is fresh and strong in selling appeal. It is his duty to select the best quality at the lowest possible price, and to undersell corresponding departments in other stores, whenever possible. In the highly organized systems of operation recently adopted by the larger and more progressive department stores a merchandise manager is put in charge of three or four kindred departments. Such a manager is responsible for the profit and loss figures of the departments under his control. The buyer, however, is still the active purchasing agent for his particular department, and his relationship to the merchandise manager is one of co-worker, rather than subordinate.

BUYER'S OPTION, a written contract under the terms of which a buyer of securities need not accept delivery until the end of a specified time but may demand delivery at any time within the limit upon one day's notice. On the New York Stock Exchange a buyer's option must be for a term of not less than 4 nor more than 60 days. The buyer, unless the contract is "flat" (without interest), pays the seller interest on the price of the security at the legal rate up to the date of delivery.

BUYING IN. On the London stock exchange, a transaction by which, if a member has sold securities which he fails to deliver on settling day, or any of the succeeding 10 days following the settlement, the buyer may give instructions to a stock exchange official to "buy in" the stock required. The official announces the quantity of stock, and the purpose for which he requires it, and whoever sells the stock must be prepared to deliver it immediately. The original seller has to pay the difference between the two prices, if the latter is higher than the original contract price. A similar practice, termed "selling out," prevails when a purchaser fails to take up his securities. (*See* Stock Exchange.)

BUYS BALLOT'S LAW, in meteorology, the name given to a law which may be expressed as follows:—"Stand with your back to the wind; the low-pressure area will be on your left-hand." This rule, the truth of which was first recognized by the American meteorologists J. H. Coffin and W. Ferrel, is a direct consequence of Ferrel's Law (*q.v.*). It is approximately true in the higher latitudes of the northern hemisphere, and is reversed in the southern hemisphere, but the angle between barometric gradient and wind is seldom a right angle in low latitudes. The law takes its name from C. H. D. Buys Ballot, the chief of the Dutch Meteorological Services from 1854–89, who introduced a new instrument called the aeroclinoscope which indicated the position of the centre of a depression and the barometric gradient. The original formulation of the law was modified later, but an early form of it appears in the *Jaarboek* of the Meteorological Institute of the Netherlands for 1857.

BUYSSE, CYRIEL (1859–1932), Flemish writer, published his first book in 1893. In his portrayal of the lives and people of eastern Flanders he was a follower of the French naturalists. No writer of fiction has shown us with more realism every aspect of the Flemish people. He was an excellent story-teller, not without humour, and with his virile art and sober yet vivid style he knew how to accentuate the essential characteristics of men and things never losing sight of their natural environment. He wrote more than 40 novels and short stories.

BUZĂU, a town of Rumania, capital of the department of the same name, situated near the right bank of the river Buzău, between the Carpathian mountains and the fertile lowlands of south Moldavia and east Walachia. Pop. (1930) 36,115. Buzău is important as a market for petroleum, timber and grain. It is the meeting-place of railroads from Ramnicu Sarat, Brăila and Ploesti. Amber is found by the riverside, and there are cloth-mills in the city. Buzău is the seat of a bishop, whose cathedral was erected in 1640 by Prince Matthias Bassarab of Walachia, on the site of an older church. In the neighbourhood there are many monasteries. Buzău was formerly called Napuca or Buzograd. The department of Buzău is rich in oil, and produces some lignite.

BUZOT, FRANÇOIS NICOLAS LEONARD (1760–1794), French revolutionist, at the outbreak of the Revolution was an advocate in his native town (Evreux). In 1789 he was lected deputy to the States-General, and there became known for his advanced opinions. In 1792 he was elected deputy to he convention, and took his place among the Girondists. He demanded the formation of a national guard from the departments to defend the convention against the populace of Paris. His proposal was carried, but never put into force; and the Parisians were extremely bitter against him. Proscribed with the Girondists on June 2 1793, he took refuge in Normandy, where he contributed to organize a federalist insurrection against the Convention, which was speedily suppressed. Buzot was outlawed, fled, and committed suicide in the woods of St. Émilion on June 18 1794.

See *Mémoires de Pétion, Barbaroux, Buzot,* published by C. A. Daubon (1866).

BUZULUK, a town in the Chkalov region of the Russian Socialist Federal Soviet Republic, situated on the left bank of the Samara river near its junction with the Buzuluk and Domashke. Lat. 52° 48′ N., long. 52° 12′ E. Pop. (1935) 28,980, mainly Russians and Mohammedan Tatars. It is on the railway, has telegraphic connection with the south and is a river port with an elevator. It trades chiefly in corn and cattle, and has tallow, soap, leather, brick and oil pressing (from sunflower seed) industries. Its position on the northern edge of the dry steppe area makes it liable to famine, from which it suffered in 1921.

BUZZARD, a bird of prey. The buzzards are distinguished from the eagles by their bill, which is decurved from the base. The head, too, in buzzards is short and round, while in the eagles it is elongated. In a general way buzzards are smaller than eagles, and have their plumage more mottled. Furthermore, most if not all of the buzzards assume their adult dress at the first moult, while the eagles take longer to reach maturity. The buzzards are fine looking birds, but are slow and heavy of flight. Their food consists of small mammals, young birds, reptiles, amphibians and insects. Buzzards are found over the whole world with the exception of the Australian region. In the British Isles are two species, one resident (*Buteo buteo*) and now confined to a few wooded districts; the more northern, the rough-legged buzzard (*B. lagopus*), a somewhat irregular winter visitant. The honey buzzard (*Pernis apivorus*), a summer visitor from the east, and breeding, or attempting to breed, yearly in the New Forest, is the type of a distinct genus of which there are other races in Asia. In America the name "buzzard" is popularly given to the turkey buzzard or turkey vulture (*Cathartes aura*). There are also several species of the genus *Buteo* in North America: the red-tailed hawk (*B. jamaicensis*), and red-shouldered hawk (*B. lineatus*), each with a number of subspecies; and Swainson's hawk (*B. swainsoni*) in the western states. (G. F. Ss.)

BYBLIS. A genus belonging to the Byblidaceae, according to Domin. There are two species inhabiting western and northwestern Australia. They grow in somewhat drier localities than other carnivorous plants found in the same general environment. It is a low perennial, herbaceous except at the somewhat woody base, and produces long, slender, linear leaves armed with sessile glands which have a digestive function, and numerous stalked glands which secrete mucilage. This entraps small insects. The whole operation of catching and digesting prey appears to be similar to that in *Drosophyllum* from which Byblis differs in having mucilage and digestive glands of much simpler structure. (F. E. L.)

BYBLOS: *see* JEBEIL.

BYELAYA TSERKOV (White Church), a town in the Ukrainian Soviet Socialist Republic, on the left bank of the Rosi river, on a branch railway and on the main road from Kiev to the Crimea. Lat. 49° 50′ N., Long. 30° 8′ E. Pop. (1935) 42,004. It has an elevator and a radio station, trades in cattle and grain, and has numerous fairs. It is first mentioned in 1155, but was destroyed by the Mongols in the 13th century. In 1550 the Prince of Kiev built a castle there and gave the inhabitants various privileges. From 1651 it was subject alternately to Poland and to independent hetmans (Cossack chiefs), but became Russian after 1793.

BYELEV, a town in the province of Tula in the Russian Soviet Federated Socialist Republic, on the left bank of the Oka river. Lat. 53° 48′ N., Long. 36° 9′ E. Pop. (1935) 13,919. It has an annual fair trading in grain, hemp, oil, cattle and tallow, and has tallow, oil, tanning, sugar refining and distilling industries. It is first mentioned in 1147, belonged to Lithuania at the end of the 14th century and in 1468 became a principality dependent on Lithuania.

At the end of the 15th century it began to attach itself to the grand duchy of Moscow and was united to Russia by Ivan III. It was repeatedly attacked by the Tatars in the 16th century.

The Empress Elizabeth died there while going from Taganrog towards Leningrad. Its public library (1858) is a memorial to the poet Zhukovsky, who was born in 1782 in a neighbouring village.

BYELGOROD (White Town), a town in the Kursk province of the Russian Soviet Federated Socialist Republic, on a chalk hill on the right bank of the Donetz river. Lat. 50° 38′ N., Long. 36° 37′ E. Pop. (1935) 30,576. It is a railway junction and has a radio station. It is situated near a patch of timber-bearing land and trades in honey, wax, leather, grain and cattle, and has lime and brickworks. It became an archiepiscopal see in 1666, and its two cathedrals and its theological college date from the 16th century. In the 17th century it was frequently attacked by Tatars, and an earthen wall, with 12 forts, called the Byelgorod line, was built across the 200 mi. between the Vorskla river and the Don river.

BYEZHETSK, a town in the Kalinin, formerly Tver, province of the Russian Soviet Federated Socialist Republic, on the right bank of the Mologa river. Lat. 57° 48′ N., Long. 36° 39′ E. Pop. (1935) 12,851. It is on a railway, and has a radio station. Its scythes, agricultural implements and hardware are noted and it also trades in grain, linen, hemp and flax. It is mentioned in the chronicles of 1137 and, on the fall of Novgorod, to which it had belonged, it was incorporated, in 1479, with the Moscow grand duchy.

BY-LAW or **BYE-LAW,** either (1) a regulation made by a common law corporation, one of the legal incidents of which is the power to make regulations for the government of its members, or (2) a regulation made by a statutory corporation which, unlike the former, has no power to make such regulations unless it is expressly conferred upon it. Thus a municipal corporation, which is always a common law corporation created by charter, has an inherent power to make such by-laws, while a statutory corporation, a term which includes both county councils and railway companies, always has its powers defined by statute. The power of town councils to make such regulations is, however, now defined and extended by the Municipal Corporation Act of 1882, while various general acts, such as the Public Health Act of 1875, had already given them and other Public Health authorities the power to make by-laws for the particular purpose of those acts.

It is a rule of law that when the power to make by-laws exists, whether at common law or by statute, its existence imports the power to enforce the by-law by penalties, but obedience to it cannot be enforced by the imprisonment of the offender; the only penalty is a pecuniary one, *i.e.*, the infliction of a fine or the recovery by action of a money penalty (see *Hall* v. *Nixon*, 1875, L.R. 10 Q.B. 159). It is usual, however, for any statute giving power to make by-laws to incorporate by reference the Summary Jurisdiction Acts, in which case the offender against the by-law is, in default of a fine, liable to imprisonment. County councils are expressly given by s. 16 of the Local Government Act of 1888 the same power of making by-laws in relation to their county as the council of a borough have in relation to their borough There is an important difference between statutory rules and orders (*q.v.*) and by-laws, in that the latter, unlike the former, can be quashed by the courts, even when they are otherwise *intra vires*, on the mere ground that they are "unreasonable," *i.e.*, oppressive or in conflict with the common law. The courts have further laid it down (*Salt* v. *Scott Hall*, 1903, K.B. 245) that even though a by-law may be reasonable in its general operation and therefore not to be quashed as such, the subject is protected against its oppressive enforcement in a particular case by the rule that the magistrates are not bound to convict in every case of infringement of a by-law that comes before them. The magistrates have power under s. 16 of the Summary Jurisdiction Act of 1879, if they think the circumstances warrant such a course, to dismiss the summons.

There is another check upon the abuse of the power of making by-laws, viz., the superior power of a central department to "disallow" them. The by-laws of a county council require the assent of the Ministry of Health; the by-laws of a municipal corporation may be disallowed by the king on the advice of the Privy Council. This, however, is a negative power, and the fact that a Government department has not disallowed a by-law, or has approved it, in no way deprives the courts of the power to pronounce it unreasonable. The by-laws of railway companies require the approval of yet another Government department, the Board of Trade.

The courts have laid down the important principle that in the exercise of their power to declare a by-law "unreasonable" they will extend more latitude to the interpretation of by-laws made by local authorities than to that of by-laws made by "profit-making companies," which latter "the courts must scrutinize jealously" (see *Kruse* v. *Johnson*, 1898, 2 Q.B.) 91, which may now be regarded as the leading case on the subject). In that case the court held that the by-law of a local authority "ought to be supported unless it was manifestly partial and unequal in its operation between different classes, or unjust, or made in bad faith, or clearly involving an unjustifiable interference with the liberty of those subject to it." The Interpretation Act of 1889 enacts that a statutory power to make by-laws includes a power to rescind, revoke, amend and vary them, a fact which, as the court observed in that case, means that a local authority can always, under the pressure of the public opinion of the locality, be compelled to alter them if they are unpopular or unnecessary. Furthermore, the Municipal Corporation Act of 1882 has interposed certain safeguards in the exercise of this legislative function such as the requirement of a two-thirds majority of the council and of 40 days notice to the burgesses. By-laws may therefore be regarded as a class of "subordinate" or "delegated" legislation which is wholly free from the oppressive and arbitrary character which too often attaches to the legislative activities of Government departments, invested by statutes of their own devising with the power to make "statutory orders" having the full force of a statute and, as such, uncontrollable by the courts of law.

(J. H. Mo.)

United States.—In America the term by-law refers to the rules made by a private corporation for the regulation of corporate affairs. Their binding force is derived from mutual assent, either express or implied, on the part of the members. Non-members and non-assenting members are not subject to them. Usually the power to make by-laws is specifically granted in the charter, which may also expressly limit the scope, application, use and purpose of such corporate legislation. Ordinarily, special persons, such as the directors, are vested with the power of making by-laws. Where this is not done, power lies in the members-at-large. In contradistinction to the British usage, the term by-law does not include municipal ordinances.

BYLES, MATHER (1706–88), American clergyman, was born in Boston (Mass.), March 26 1706, and was descended, on his mother's side, from John Cotton and Richard Mather. He was graduated at Harvard in 1725, and in 1733 became pastor of the Hollis Street church (Congregational), Boston. He was noted for his scholarly sermons and his ready wit, and he and his friend Joseph Green were prominent figures in what was one of the most barren periods in American poetry. A Tory during the Revolution, he was tried by his church and in 1777 by the civil authorities, who sentenced him to deportation. This sentence was later changed to imprisonment in his own house. He was soon released, but never resumed his pastorate. He died in Boston July 5 1788. Besides many sermons, he published various short pieces, such as "The Conflagration" (1720) and a collection of verse, *Poems on Several Occasions* (1744).

See A. W. H. Eaton, *The Famous Mather Byles* (1914).

BYNG, JOHN (1704–1757), British admiral, was the fourth son of George Byng, Lord Torrington, and entered the navy in 1718. On the approach of the Seven Years' War the island of Minorca was threatened by an attack from Toulon and was actually invaded in 1756. Byng, who was then serving in the Channel with the rank of admiral, which he attained in 1755, was ordered to the Mediterranean to relieve the garrison of Fort St. Philip, which was still holding out. The squadron was not very well manned, and Byng was in particular much aggrieved because his marines were landed to make room for the soldiers who were to reinforce the garrison, and he feared that if he met a French squadron after he had lost them he would be dangerously undermanned. His correspondence shows clearly that he left prepared for failure, that he did not believe that the garrison could hold out against the French force landed, and that he was already resolved to come back from Minorca if he found that the task presented any great difficulty. He wrote home to that effect to the ministry from Gibraltar. The governor of the fortress refused to spare any of his soldiers to increase the relief for Minorca, and Byng sailed on May 8. On the 10th he was off Minorca, and endeavoured to open communications with the fort. Before he could land any of the soldiers, the French squadron appeared. A battle was fought on the following day. Byng, who had gained the weather gauge, bore down on the French fleet of M. de la Galissonière at an angle, so that his leading ships came into action unsupported by the rest of his line. The French cut the leading ships up, and then slipped away. When the flag captain pointed out to Byng that by standing out of his line he could bring the centre of the enemy to closer action, he declined on the ground that Thomas Mathews had been condemned for so doing. The French, who were equal in number to the English, got away undamaged. After remaining near Minorca for four days without making any further attempt to communicate with the fort or sighting the French, Byng sailed away to Gibraltar leaving Fort St. Philip to its fate. The failure caused a savage outburst of wrath in the country. Byng was brought home, tried by court-martial, condemned to death, and shot on March 14, 1757 at Portsmouth. The severity of the penalty, aided by a not unjust suspicion that the ministry sought to cover themselves by throwing all the blame on the admiral, led in after time to a reaction in favour of Byng. It became a commonplace to say that he was put to death for an error of judgment. The court has indeed acquitted him of personal cowardice or of disaffection, and only condemned him for not having done his utmost. But it must be remembered that in consequence of many scandals which had taken place in the previous war the Articles of War had been deliberately revised so as to leave no punishment save death for the officer of any rank who did not do his utmost against the enemy either in battle or pursuit. That Byng had not done all he could is undeniable, and he therefore fell under the law. In 1745 an unhappy young lieutenant, Baker Phillips by name, whose captain had brought his ship into action unprepared, and who, when his superior was killed, surrendered the ship when she could no longer be defended, was shot by sentence of a court-martial. This savage punishment was approved by the higher officers of the navy, who showed great lenity to men of their own rank. The contrast had angered the country, and the Articles of War had been amended precisely in order that there might be one law for all. The facts of Byng's life are fairly set out in Charnock's *Biogr. Nav.* vol. iv. pp. 145 to 179. The number of contemporary pamphlets about his case is very great, but they are of no historical value, except as illustrating the state of public opinion.

(D. H.)

BYNG, JULIAN HEDWORTH GEORGE BYNG, 1ST VISCOUNT (1862–1935), British general, was born Sept. 11, 1862, son of the 2nd earl of Strafford, and joined the 10th Hussars in India in 1883. He passed through the Staff college, and served in the South African War. In 1912 he was sent to Egypt to take command of the army of occupation. In Oct. 1914 he took the 3rd Cavalry Division to France, and he succeeded to command of the Cavalry Corps in June 1915. But two months later he was despatched to the Dardanelles to take charge of the IX. Army Corps there and he became responsible for the Suvla area, from which he withdrew his troops most skilfully in the following December. Called back to the Western Front, in May 1916, he took over the Canadian Army Corps, a tenure distinguished by the capture of Vimy Ridge on April 9, 1917. In June 1917 he succeeded to the leadership of the III. Army, which he retained till the close of the war. On Nov. 20 he carried out the now famous tank surprise attack on the Cambrai front. In Oct. 1919 he received a barony and a grant of £30,000. He was Governor-General of Canada from 1921 until 1926, when he was created a viscount. From 1928 to 1931 he was Commissioner of the Metropolitan Police. He was gazetted field-marshal in 1932.

BYNKERSHOEK, CORNELIUS VAN (1673–1743), Dutch jurist, was born at Middelburg, Zeeland. He studied law at Franeker, Friesland, and was called to the bar at The Hague. In 1703 he was appointed a member of the supreme court of Holland and Zeeland, of which in 1724 he became president. In that position he enjoyed very great prestige, but his judicial career did not prevent him from publishing a large and varied number of works of legal scholarship. His writings on Roman and Dutch municipal law are important, but his fame rests chiefly on what he did for the development of international law on positive lines. To a greater extent than any of his predecessors in this field he took actual usage, as appearing from ordinances issued by the States General or other Governments and from treaties concluded between Christian States as the basis of his studies. On questions like the sovereignty of the seas, the legal position of ambassadors, private property in war time, prizes, neutrality, contraband, blockade, his opinions have always been regarded as carrying great weight and have exercised considerable influence.

BIBLIOGRAPHY.—Bynkershoek's principal works in the domain of international law are *De Dominio Maris* (1702), *De Foro Legatorum* (1721), *Quaestiones juris Publici* (1737). Complete editions of his works were published after his death, one at Geneva in 1761, and another at Leiden in 1766. *See* O. W. S. Numan, *Cornelis van*

Bynkershoek (Leiden, 1869); J. Delpech, in *Les fondateurs du droit international* (1904); Coleman Philipson, in *Journal of the Society of Comparative Legislation* (1908).

BYRD, RICHARD EVELYN (1888–), American naval officer, explorer, and scientist, was born in Winchester, Va., Oct. 25, 1888. After attending the Shenandoah Valley Military Academy, the Virginia Military Institute (1904–07), and the University of Virginia (1907–08), he entered the U.S. Naval Academy in 1908, graduating in 1912. In 1917 he was ordered to the air station at Pensacola, Fla., for training as an aviator. Receiving his wings in 1918, he was advanced to the temporary rank of lieut.-commander and given command of two U.S. naval air bases in Canada, which he directed throughout the World War. In 1919 he was detailed in charge of navigational preparations for the Navy's first trans-Atlantic flight, accompanying the squadron of NC flying boats on the first two legs of the flight. In 1925 he commanded the naval unit of the Navy-MacMillan expedition to Greenland.

In 1926 he made the first aeroplane flight to the North Pole. Taking off from King's bay, Spitsbergen, at 12:50 A.M., May 9, with Floyd Bennett as co-pilot, he reached the pole at 9:02 A.M., circled it several times, and returned to his base. He next attempted a flight from New York to Paris. On June 29, 1927, he took off from Roosevelt field, L.I., with a crew of two, a passenger, 800 pounds of pay-load, and the first official trans-Atlantic air mail. Reaching Paris in a driving rain with zero visibility he found it impossible to land on Le Bourget field. He headed for the coast and brought the plane down in the surf at Ver-sur-Mer. The flight covered approximately 4,200 miles and was made in 42 hours, 6 minutes.

An expedition to the Antarctic was Byrd's next effort. It left America in Sept. 1928, reaching Antarctica in December. A base camp, named Little America, was established on the Bay of Whales in the Ross sea. While pursuing a comprehensive program of exploration and scientific research, he conditioned a tri-motored aeroplane for a flight to the South Pole. At 3:29 P.M. Nov. 28, 1929, accompanied by a crew of three, he took off. At 1:14 A.M. November 29, the plane reached the pole—the first aeroplane to penetrate to the earth's southermost point. Before his return to the United States, Congress, by special act, advanced him to the rank of rear admiral, retired.

In 1933 Admiral Byrd led his second expedition to Antarctica. Little America was again the base of operations. In March 1934, he took up a vigil at Bolling Advance Weather Base, a 9x13-foot hut buried in the snow 123 miles south of Little America, to remain alone throughout the six-months winter night, making weather observations and collecting auroral data. He assumed the post himself because he would not order any of his men to this dangerous, but necessary, duty. On May 28 he was overcome by monoxide poisoning, the result of continued breathing of fumes thrown off by an improvised oil stove and a small gasoline engine. Critically ill, he concealed his desperate situation from his men at the base, choosing to die rather than send out an SOS endangering the lives of any of his comrades who might attempt to reach him during the Antarctic night. His solitary fight for survival was ended on August 11 by the arrival of a meteor-observation party headed by Dr. Thos. C. Poulter, his second-in-command.

In May 1935, the expedition returned to America. The admiral was greeted by President Roosevelt, and presented with an illuminated scroll carrying a special resolution of Congress expressing the country's appreciation of his achievements.

In 1936 he announced his intention to devote the major portion of his time to the promotion of better international co-operation. In 1939 he led his third expedition to Antarctica. Admiral Byrd has been honoured with 17 degrees from colleges and universities, holds more than 75 medals for contributions to human progress, and has 21 citations on his naval record.

BYRD, WILLIAM (1542 or 1543–1623), one of the greatest of English musical composers, was probably a member of one of the numerous Lincolnshire families of that name who were to be found at Lincoln, Spalding, Pinchbeck, Moulton and Epworth in the 16th century. According to Wood, he was "bred up to musick under Thomas Tallis." He was appointed organist of Lincoln cathedral on Feb. 27, 1563, and on Sept. 14, 1568, was married at St. Margaret in the Close to Ellen or Julian Birley. On Feb 22, 1570, he was sworn in as a member of the Chapel Royal, but he does not seem to have left Lincoln immediately. In the Chapel Royal he shared with Tallis the honorary post of organist, and on Jan. 22, 1575, the two composers obtained a licence for twenty-one years from Elizabeth to print and sell music and music-paper, a monopoly which does not seem to have been at all remunerative. In 1575 Byrd and Tallis published a collection of Latin motets for five and six voices, printed by Thomas Vautrollier.

In 1578 Byrd and his family were living at Harlington, Middlesex. As early as 1581 his name occurs among lists of recusants, and though he retained his post in the Chapel Royal he was throughout his life a Catholic. In 1579–80 he set a three-part song in Thomas Legge's Latin play *Ricardus Tertius.* In 1588 he published *Psalmes, Sonets and Songs of Sadnes and Pietie*, and in the same year contributed two madrigals to Nicolas Yonge's *Musica Transalpina.* In 1589 appeared *Songs of Sundrie Natures*, a second edition of which was issued in 1610. In the same year he published *Liber Primus Sacrarum Cantionum*, a second series of which was brought out in 1591. In 1590 two madrigals by Byrd were included in Thomas Watson's *First Sett of Italian Madrigalls Englished;* one of these seems to have been sung before Queen Elizabeth on her visit to Lord Hertford at Elvetham in 1591. In April 1592 Byrd was still living at Harlington, but about 1593 he became possessed of the remainder of a lease of Stondon Place, Essex, a farm of some 200 acres, belonging to William Shelley, who was shortly afterwards convicted of high treason. The property was sequestrated, and on July 15, 1595, Byrd obtained a Crown lease of it for the lives of his eldest son Christopher and his daughters Elizabeth and Rachel.

In 1603 Easte published a work (no copies of which are known to exist) entitled *Medulla Musicke. Sucked out of the sappe of two [of] the most famous Musitians that ever were in this land, namely Master Wylliam Byrd . . . and Master Alphonso Ferabosco . . . either of whom having made 40*^{tie} *severall waies (without contention), showing most rare and intricate skill in 2 partes in one upon the playne song Miserere.* In 1607 appeared two books of *Gradualia*, a second edition of which was issued in 1610. In the following year he published *Psalmes, Songs and Sonnets; some solemne, others joyfull, framed to the life of the Words.* Probably in the same year was issued *Parthenia*, a collection of virginal music, in which Byrd was associated with Bull and Orlando Gibbons. The last work to which he contributed was Sir Thomas Leighton's *Teares or Lamentacions of a Sorrowfull Soule* (1614). His death took place on July 4, 1623. He is entered in the Chapel Royal *Cheque Book* as a "father of musicke." His will, dated Nov. 15, 1622, shows that he remained a Catholic until the end of his life.

Besides the works already mentioned Byrd was the composer of three masses, for three, four and five voices respectively, which seem to have been published with some privacy about 1588. There exists a second edition (also undated) of the four-part mass; all three have recently appeared in modern editions, and increase Byrd's claim to rank as the greatest English composer of his age. In addition to his published works, a large amount still remains in ms., comprising nearly every kind of composition. The Fitzwilliam *Virginal Book* contains a long series of interesting pieces for the virginal, and more still remains unpublished in Lady Neville's *Virginal Book* and other contemporary collections. Byrd's industry was enormous, and though his work is unequal and the licences he allowed himself cannot always be defended on strict grounds, his Latin church music and his instrumental compositions entitle him to the highest rank among his contemporaries. As a madrigalist he was inferior to Morley, Wilbye and Gibbons, though even in this branch of his art he often displays charm and individuality.

In general the estimation in which this great English master is held by scholars and students has steadily advanced, this increased appreciation of his importance finding notable expression in the many celebrations held all over the country in connection with the tercentenary of his death in 1923, when also memorial tablets were erected in Lincoln cathedral and the parish church of Stondon Massey. (W. B. S.)

BYRD, WILLIAM (1674–1744), Virginia planter and first man of letters in North America, was born at Belvidere, near the James river in Virginia, on Mar. 28, 1674. After receiving his education for the law in England, he returned, in 1696, to Westover, which he made "the quintessence of Virginia Aristocracy," and where he became one of the most brilliant figures in colonial Virginia. For 35 years he was a member of the King's Council, and during the last year of his life its president. He was one of the commissioners who established the North Carolina-Virginia boundary, and in 1733 founded Richmond, Va. Interested in art and science, a wit and a lover of books, he acquired probably the largest colonial library. Occasionally he forsook his fields of that "bewitching vegetable, tobacco," for the field of letters. His "Westover Manuscripts," first published in 1841, include: *The History of the Dividing Line; A Journey to the Land of Eden; A Progress to the Mines.* He died at Westover on Aug. 26, 1744.

See *The Writings of Colonel William Byrd of Westover in Virginia Esq.*, edit. by J. S. Bassett (New York, 1901).

BYRNIE, a coat of linked mail (Icelandic, *brynja*). The chain-mail body armour worn by early Scandinavians and others. Mid: English *brinie*— a coat of mail which hung from the neck to the knees, the skirt being slit to facilitate riding on horseback. The Normans called it the *hawberk*. The back and front were so much alike that mistakes in putting it on were common, the classic example being that of William the Conqueror before the battle of Hastings.

BYROM, JOHN (1692–1763), English poet, writer of hymns and inventor of a system of shorthand, was born at Kersal Cell, near Manchester, on Feb. 29, 1692, and died on Sept. 26, 1763, in London. He became a fellow of Trinity College, Cambridge, in 1714. His first poem, "Colin to Phoebe," a pastoral, appeared in the *Spectator*, No. 603. The heroine is said to have been Dr. Bentley's daughter, Joanna, the mother of Richard Cumberland, the dramatist. After leaving the University Byrom went abroad, ostensibly to study medicine, but possibly his errand was political, for he was an adherent of the Pretender. He was elected a member of the Royal Society in 1724. On his return to London he taught a new method of shorthand of his own invention. His diary gives interesting portraits and letters of the many great men of his time whom he knew intimately. A collection of his poems was published in 1773, and he is included in Alexander Chalmers's *English Poets.* His system of shorthand was not published until after his death, when it was printed as *The Universal English Shorthand; or the way of writing English in the most easy, concise, regular and beautiful manner, applicable to any other language, but particularly adjusted to our own* (Manchester, 1767).

The *Private Journal and Literary Remains of John Byrom, related by Richard Parkinson, D.D.*, was published by the Chetham Society (1854–57).

BYRON, GEORGE GORDON BYRON, 6th Baron (1788–1824), English poet, was born in London at 16 Holles street, Cavendish square, on Jan. 22, 1788. The Byrons were of Norman stock, but the founder of the family was Sir John Byron, who entered into possession of the priory and lands of Newstead in the county of Nottingham in 1540. From him it descended (but with a bar-sinister) to a great-grandson, John (1st Baron) Byron (*q.v.*), a Cavalier general, who was raised to the peerage in 1643. The first Lord Byron died childless, and was succeeded by his brother Richard, the great-grandfather of William, the 5th lord, who outlived son and grandson, and was succeeded by his great-nephew, the poet. Admiral the Hon. John Byron (*q.v.*) was the poet's grandfather. His eldest son, Captain John Byron, the poet's father, was a libertine by choice and in an eminent degree. He caused to be divorced, and married (1779) as his first wife, the marchioness of Carmarthen (born Amelia D'Arcy), Baroness Conyers in her own right. One child of the marriage survived, the Hon. Augusta Byron (1783–1851), the poet's half-sister, who, in 1807, married her first cousin, Col. George Leigh. John Byron's second marriage to Catherine Gordon (b. 1765) of Gight in Aberdeenshire took place at Bath on May 13, 1785. He is said to have squandered the fortunes of both wives. It is certain that Gight was sold to pay his debts (1786), and that the sole provision for his wife was a settlement of £3,000. It was an unhappy marriage. There was an attempt at living together in France, and, when this failed, Mrs. Byron returned to Scotland. On her way thither she gave birth to a son, christened George Gordon after his maternal grandfather, who was descended from Sir William Gordon of Gight, grandson of James I. of Scotland. After a while her husband rejoined her, but went back to France and died at Valenciennes on Aug. 2, 1791. His wife was not a bad woman, but she was not a good mother. Vain and capricious, passionate and self-indulgent, she mismanaged her son from his infancy, now provoking him by her foolish fondness, and now exciting his contempt by her paroxysms of impotent rage. In the conduct of her affairs she was praiseworthy. She hated and avoided debt, and when relief came (a civil list pension of £300 a year) she spent most of it upon her son. The violence of her temper was abnormal. Her father committed suicide, and it is possible that she inherited a tendency to mental derangement.

The poet's first years were spent in lodgings at Aberdeen. His mother found him two tutors, first a clergyman named Ross, and then a good Latin scholar named Paterson, the son of the Byrons' shoemaker. From 1794 to 1798 he attended the grammar school, "threading all classes" till he reached the fourth. He was lame from his birth. His right leg and foot, possibly both feet, were contracted by infantile paralysis, and, to strengthen his muscles, his mother sent him in the summers of 1796–97 to a farm house on Deeside. To his Scottish upbringing he owed his love of mountains, his love and knowledge of the Bible, and too much Calvinism for faith or unfaith in Christianity. The death of his great-uncle (May 19, 1798) placed him in possession of the title and estates. Early in the autumn Mrs. Byron travelled south with her son and his nurse, and for a time made her home at Newstead Abbey. Byron was old enough to know what had befallen him. "It was a change from a shabby Scotch flat to a palace," a half-ruined palace, indeed, but his very own. It was a proud moment, but in a few weeks he was once more in lodgings. The shrunken leg did not improve, and acting on bad advice his mother entrusted him to the care of a quack named Lavender, truss-maker to the general hospital at Nottingham. His nurse who was in charge of him maltreated him, and the quack tortured him to no purpose. At his own request he read Virgil and Cicero with a tutor.

In August 1799, he was sent to a preparatory school at Dulwich. The master, Dr. Glennie, gave the boy the free run of his library. He read a set of the *British Poets* from beginning to end more than once. This, too, was an initiation and a preparation. He remained at Dulwich till April 1801, when, on his mother's intervention, he was sent to Harrow, then under Dr. Drury. His school days, 1801–05, were fruitful in two respects. He learned enough Latin and Greek to make him a classic, if not a classical scholar, and he made friends with his equals and superiors. He learned something of his own worth and of the worth of others. "My school-friendships," he says, "were with me passions." Two of his closest friends died young, and from Lord Clare, whom he loved best of all, he was separated by chance and circumstance. He was an odd mixture, now lying dreaming on his favourite tombstone in the churchyard, now the ring-leader in whatever mischief was afoot. He was a "record" swimmer, and, in spite of his lameness, enough of a cricketer to play for his school at Lord's, and yet he found time to read and master standard works of history and biography.

When he was a boy between eight and ten at Aberdeen he had "fallen in love" with his cousin, Mary Duff. Now, in the midsummer of 1803, when he was in his sixteenth year, he fell in love, seriously, with his distant relative, Mary Anne Chaworth, a "minor heiress" of the hall and park of Annesley, which marches with Newstead. Two years his senior, she was already engaged to a neighbouring squire. Mary Chaworth is the subject of at least five of his early poems, including the pathetic stanzas, "Hills of Annesley," and there are allusions to his love story in *Childe Harold* (c. 1 *s.v.*), and in "The Dream" 1816. The Easter holidays of 1804 were spent at Burgage Manor, Southwell, where Mrs. Byron had established herself, leaving Newstead Abbey to a tenant, Lord Grey of Ruthyn.

Byron went into residence at Trinity College, Cambridge, in Oct. 1805. Cambridge did him no good. "The place is the devil," he said, and according to his own showing he did homage to the *genius loci*. There he made friends who were worthy of his choice. Among them were the scholar-dandy Scrope, Charles Skinner Matthews, Berdmore Davies, Francis Hodgson, who died provost of Eton, and, best friend of all, John Cam Hobhouse (afterwards Lord Broughton). And there was another friend, a chorister named Edleston, a "humble youth" for whom he formed an attachment. He died whilst Byron was still abroad (May 1811), and the Thyrza poems of 1811–12 have been said, though on questionable evidence, to refer to his death. During the vacation of 1806, and in 1807 which was one "long vacation," he wrote most of his "Juvenile Poems," which were printed in a thin quarto of 66 pages by S. and J. Ridge of Newark. The "advertisement" is dated Dec. 23, 1806, but before that date he had begun to prepare a second collection for the press. One poem ("To Mary") contained at least one stanza which was frankly indecent, and yielding to advice he gave orders that the entire issue be thrown into the fire. Early in January 1807 an expurgated collection entitled *Poems on Various Occasions* was ready for private distribution. Encouraged by Henry Mackenzie and Lord Woodhouselee, he determined to recast this second issue and publish it under his own name. *Hours of Idleness*, "by George Gordon Lord Byron, a minor," was published in June 1807. The fourth and last issue of *Juvenilia*, entitled *Poems, Original and Translated*, was published in March 1808.

Hours of Idleness enjoyed a brief triumph. *The Critical* and other reviews were "very indulgent," but the *Edinburgh Review* for Jan. 1808 contained a scathing article, not, as Byron believed, by Jeffrey, but by Brougham. The sole result was that it supplied fresh material and a new title for some rhyming couplets on "British Bards" which he had begun to write. A satire on Jeffrey, the editor, and Lord Holland, the patron of the *Edinburgh Review*, was slipped into the middle of "British Bards," and the poem, rechristened *English Bards and Scotch Reviewers* was published March 1, 1809

In April 1808, whilst he was still "a minor," Byron entered upon his inheritance, and established himself at Newstead in September on leaving Cambridge. The possession of this lordly and historic domain was an inspiration in itself. It was an ideal home for one who was to be hailed as the spirit or genius of romance.

On March 13, 1809, he took his seat in the House of Lords. He had determined, as soon as he was of age, to travel in the East, but first he invited Hobhouse and three others to a house-warming. Perhaps the story of the revels of the party, as told in *Childe Harold* (canto 1, stanzas 5–9), need not be taken too seriously. Byron was angry because Lord De La Warr did not wish him good-bye, and visited his displeasure on friends and "lemans" alike. May and June were devoted to the preparation of an enlarged edition of his satire. At length, accompanied by Hobhouse and a small staff of retainers, he set out on his travels. He sailed from Falmouth on July 2, and reached Lisbon on July 7, 1809. The first two cantos of *Childe Harold's Pilgrimage* contain a record of the principal events of his first year of absence.

Childe Harold and the Eastern tales which followed laid English contemporary readers under a great debt to Byron. They were a liberal education in the manners and customs of "the gorgeous East," in the scenery, the art, the history and politics of Italy and Greece. He widened the horizon of his contemporaries, bringing within their ken wonders and beauties hitherto unknown or unfamiliar, and in so doing he heightened and cultivated, he "touched with emotion," the unlettered and unimaginative many, that "reading public" which despised or eluded the refinements and subtleties of less popular writers.

Byron sailed from Gibraltar on Aug. 16, and spent a month at Malta making love to Mrs. Spencer Smith (the "Fair Florence" of c. II. s. xxix.-xxxiii.). He anchored off Prevesa on Sept. 28. The second canto records a journey on horseback through Albania, then almost a *terra incognita*, as far as Tepeleni, where he was entertained by Ali Pacha (Oct. 20), a yachting tour along the shores of the Ambracian gulf (Nov. 8–23), a journey by land from Larnaki to Athens (Dec. 15–25), and excursions in Attica, Sunium and Marathon (Jan. 13–25, 1810). Of the tour in Asia Minor, a visit to Ephesus (March 15, 1810), an excursion in the Troad (April 13), and the famous swim across the Hellespont (May 3), the record is to be sought elsewhere. The stanzas on Constantinople (lxxvii.-lxxxii.), where Byron and Hobhouse stayed for two months, though written at the time and on the spot, were not included in the poem till 1814. They are, probably, part of a projected third canto. On July 14 Hobhouse set sail for England and Byron returned to Athens.

Of Byron's second year of residence in the East little is known beyond the bare facts that he was travelling in the Morea during August and September, that early in October he was at Patras, having just recovered from a severe attack of malarial fever, and that by Nov. 14 he had returned to Athens and taken up his quarters at the Franciscan convent. Of his movements during the next five months there is no record, but of his studies and pursuits there is substantial evidence. He learnt Romaic, he compiled the notes to the second canto of *Childe Harold*. He wrote (March 12) *Hints from Horace* (published 1831), an imitation or loose translation of the *Epistola ad Pisones* (Art of Poetry), and (March 17) *The Curse of Minerva* (published 1815), a skit on Lord Elgin's deportation of the metopes and frieze of the Parthenon. He left Athens in April, passed some weeks at Malta, and landed at Portsmouth (*c.* July 20). Arrived in London he consulted his literary adviser and cousin, R. C. Dallas, with regard to the publication of *Hints from Horace*. Of *Childe Harold* he said nothing, but after some hesitation produced the ms. from a "small trunk," and, presenting him with the copyright, commissioned Dallas to offer it to a publisher. It was finally accepted by Murray of Fleet street, who undertook to share the profits of an edition with Dallas.

Meanwhile Mrs. Byron died suddenly from a stroke of apoplexy. Byron set off at once for Newstead, but did not find his mother alive. He had had but little affection for her while she lived, but her death touched him to the quick. "I had but one friend," he exclaimed, "and she is gone." Another loss awaited him. Whilst his mother lay dead in his house, he heard that his friend Matthews had been drowned in the Cam. Edleston and Wingfield had died in May, but the news had reached him on landing. There were troubles on every side. On Oct. 11 he wrote the "Epistle to a Friend" ("Oh, banish care," etc.) and the lines "To Thyrza," which, with other elegies, were appended to the second edition of *Childe Harold* (April 17, 1812). This cry of desolation, this open profession of melancholy, first excited the interest of contemporaries.

Towards the close of the year he made friends with Moore. Some lines in *English Bards* (ii. 466–467), taunting Moore on fighting a duel with Jeffrey with "leadless pistol," had led to a challenge, and it was not till Byron returned to England that explanations ensued, and that the challenge was withdrawn. The friendship which sprang up between them still serves Byron in good stead. Moore's *Life of Byron* (1830) is no doubt a picture of the man at his best, but it is a genuine likeness. At the end of October Byron moved to London and settled at 8 St. James's street. On Feb. 27, 1812, he made his first speech in the House of Lords on a bill which made the wilful destruction of certain newly invented stocking-frames a capital offence, speaking in defence of the riotous "hands" who feared that their numbers would be diminished by improved machinery. It was a brilliant speech and won the praise of Burdett and Lord Holland. He made two other speeches during the same session. *Childe Harold* (4to) was published on Tuesday, March 10, 1812. "The effect," says Moore, "was . . . electric, his fame . . . seemed to spring, like the palace of a fairy king, in a night." A fifth edition (8vo) was issued on Dec. 5, 1812. Just turned 24, he "found himself famous," a great poet, a rising statesman. Society was now at his feet. But the excitement and absorption of one reigning passion after another destroyed his peace of mind. His first affair of any moment was with Lady Caroline Lamb the wife of William Lamb (Lord Melbourne). The culmination of this tragic episode—tragic for the enamoured woman—was an unbelievable scene at Lady Heathcote's ball in June 1813, which was the talk of all London.

To Lady Caroline succeeded Lady Oxford, who was double his own age, and Lady Frances Wedderburn Webster, the "Ginevra" of his sonnets, the "Medora" of *The Corsair.*

There was no slackening of his poetical energies. In Feb. 1813 he published *The Waltz* (anonymously), he wrote and published *The Giaour* (published June 5, 1813) and *The Bride of Abydos* (published Nov. 29, 1813), and he wrote *The Corsair* (published Feb. 1, 1814). The Turkish Tales were even more popular than *Childe Harold.* Murray sold 10,000 copies of *The Corsair* on the day of publication.

In the summer of 1813 a new and potent influence came into his life. Mrs. Leigh, whose home was at Newmarket, came up to London on a visit. After a long interval the brother and sister met, and whether there is or is not any foundation for the dark story obscurely hinted at in Byron's lifetime, and afterwards made public property by Mrs. Beecher Stowe (*Macmillan's Magazine*, 1869, pp. 377–396), there is no question as to the depth and sincerity of his love for his "one relative." Byron passed the seasons of 1813–14 in London Socially he was on the crest of the wave. He was a welcome guest at the great Whig houses, at Lady Melbourne's, at Lady Jersey's, at Holland House. Sheridan and Moore, Rogers and Campbell were his intimates and companions. He was a member of the Alfred, of Watier's, of the Cocoa Tree, and half a dozen clubs besides. After the publication of *The Corsair* he had promised an interval of silence, but the abdication of Napoleon evoked an Ode in his dishonour (April 16). *Lara, a Tale*, an informal sequel to *The Corsair,* was published anonymously on Aug. 6, 1814.

Newstead had been put up for sale, but pending the completion of the contract was still in his possession. During his last visit but one, whilst his sister was his guest, he became engaged to Miss Anne Isabella (Annabella) Milbanke (b. May 17, 1792; d. May 16, 1860), the only daughter of Sir Ralph Milbanke, Bart., and the Hon. Judith (born Noel), daughter of Lord Wentworth. She was an heiress, and in succession to a peerage in her own right (becoming Baroness Wentworth in 1856). She was a pretty girl of "a perfect figure," highly educated, a mathematician, and, by courtesy, a poetess. She had rejected Byron's first offer, but, believing that her cruelty had broken his heart and that he was an altered man, she was now determined on marriage. On her side there was ambition touched with fancy—on his, a wish to be married and some hope perhaps of finding an escape from himself. The marriage took place at Seaham in Durham on Jan. 2, 1815. Bride and bridegroom spent three months in paying visits, and at the end of March settled at 13 Piccadilly terrace, London.

Byron was a member of the committee of management of Drury Lane theatre, and devoted much of his time to his professional duties. He wrote but little poetry. *Hebrew Melodies* (published April 1815), begun at Seaham in October 1814, were finished and given to the musical composer, Isaac Nathan, for publication. *The Siege of Corinth* and *Parisina* (published Feb. 7, 1816) were got ready for the press. On Dec. 10, Lady Byron gave birth to a daughter christened Augusta Ada. The tale of their strange honeymoon shows that there were difficulties from the beginning. It is certain that before and after the child was born his conduct was so harsh, so violent and so eccentric, that his wife believed, or tried to persuade herself, that he was mad. Money difficulties were acute; and both Annabella and Augusta suffered from Byron's conduct.

On Jan. 15, 1816, Byron ordered his wife to leave the Piccadilly house, the bailiffs were in it, and he wished to break up the establishment. Lady Byron went home, claimed her father's protection, and demanded a separation from her husband. In 1869 Mrs. Beecher Stowe affirmed that Lady Byron had expressly told her that Byron was guilty of incest with his half-sister, Mrs. Leigh; and in 1905 the second Lord Lovelace (Lord Byron's grandson) printed *Astarte*, which is now held by most judges to prove the truth of this charge. At the time, neither Lady Byron nor her advisers supported their demand by this or any other charge of misconduct. Lady Byron continued to correspond with Augusta, whom she certainly desired to shield, and Byron used Augusta as a means of communication with his wife. The tangled story is too complicated to be related here, and the reader must be referred to the authorities cited at the end of this article. To the end Byron hoped for a reconciliation, and he never ceased to lament the separation from his daughter.

The separation of the Byrons was the talk of the town. There was a balance of opinion, but politics turned the scale. Byron had recently published some pro-Gallican stanzas, "On the 'Star of the Legion of Honour,'" in the *Examiner* (April 7). The Whigs defended Byron as best they could, but his own world, with one or two exceptions, ostracized him. The "excommunicating voice of society," as Moore put it, was loud and insistent. The articles of separation were signed on or about April 18, and on Sunday, April 25, Byron sailed from Dover for Ostend. The "Lines on Churchill's Grave" were written whilst he was waiting for a favourable wind. Byron's ostracism in London was in a sense his liberation. It made him great. "The howl of contumely," wrote Macaulay, "followed him across the sea, over the Alps; it gradually waxed fainter; it died away. . . . His poetry became more popular than it had ever been; and his complaints were read with tears by thousands and tens of thousands who had never seen his face." He was from that moment the typical figure of the romantic movement, the artist who found his subject in his own sorrows, in his own remorse. His cry, "My pang shall find a voice," was the cry of René and of Werther. He displayed to the world, as Arnold has said, "the pageant of a bleeding heart."

Byron's route lay through the Low Countries, and by the Rhine to Switzerland. On his way he halted at Brussels and visited the field of Waterloo. He reached Geneva on May 25, where he met by appointment at Dejean's Hôtel d'Angleterre, Shelley, Mary Godwin and Jane (or "Claire") Clairmont. The meeting was probably at the instance of Claire, who had recently become Byron's mistress. On June 10 Byron moved to the Villa Diodati on the southern shore of the lake. Shelley and his party had already settled at an adjoining villa, the Campagne Montalègre. The friends were constantly together. On June 23 Byron and Shelley started for a yachting tour round the lake. They visited the castle of Chillon on June 26, and, being detained by weather at the Hôtel de l'Ancre, Ouchy, Byron finished (June 27–29) the third canto of *Childe Harold* (published Nov. 18), and began the *Prisoner of Chillon* (published Dec. 5, 1816). These and other poems of July–September 1816, *e.g.* "The Dream" and the first two acts of *Manfred* (published June 16, 1817), betray the influence of Shelley. Byron passed the summer at the Villa Diodati, where he also wrote the *Monody on the Death of Sheridan,* published Sept. 9, 1816. The second half of September was spent and devoted to "an excursion in the mountains." His journal (Sept. 18–29), which was written for and sent to Mrs. Leigh, is a great prose poem, the source of the word pictures of Alpine scenery in *Manfred.* His old friend Hobhouse was with him and he enjoyed himself, but at the close he confesses that he could not lose his "own wretched identity" in the "majesty and the power and the glory" of nature. Remorse was scotched, not killed. On Oct. 6 Byron and Hobhouse started via Milan and Verona for Venice, which was reached early in November. For the next three years Byron lived in or near Venice—at first, 1816–17, in apartments in the Frezzeria, and after Jan. 1818 in the central block of the Mocenigo palace. At Venice he pursued a life of deliberate profligacy. Of two of his amours we learn enough or too much from his letters to Murray and to Moore—the first with his landlord's wife, Marianna Segati, the second with Margarita Cogni (the "Fornarina"), a Venetian of the lower class, who amused him with her savagery and her wit. Nevertheless he worked hard, and about the middle of April 1817 set out for Rome, where, with Hobhouse as companion and guide, he stayed three weeks. He returned to Venice on May 28, but shortly removed to a villa at Mira on the Brenta, some 7m. inland. A month later (June 26) when memory had selected and reduced to order the first impressions of his tour, he began to work them up into a fourth canto of *Childe Harold.* Among the books which Murray sent out to Venice was a copy of Hookham Frere's *Whistlecraft.* Byron took the hint and produced *Beppo, a Venetian Story* (published anonymously on Feb. 28, 1818). He attributes his choice of the mock heroic *ottava-rima* to Frere's example, but he was certainly familiar with Casti's *Novelle,* and, according to Stendhal, with the poetry of Buratti. The success of *Beppo* and a growing sense that "the excellent manner of *Whistlecraft*" was the manner for him, led him to study Frere's masters and models, Berni and Pulci. An accident had led to a great discovery.

The fourth canto of *Childe Harold* was published on April 28, 1818. In September he began *Don Juan.* His own account of the inception of his last and greatest work is characteristic but misleading. He says (Sept. 9) that his new poem is to be in the style of *Beppo,* and is "meant to be a little quietly facetious about everything." A year later (Aug. 12, 1819), he says that he neither has nor had a *plan*—but that "he had or has *materials.*" By materials he means books, such as Dalzell's *Shipwrecks and Disasters by Sea,* or de Castelnau's *Histoire de la nouvelle Russie,* etc., which might be regarded as poetry in the rough. The "building up of the drama," as Shelley puts it, was a slow and gradual process. Cantos I., II. were published (4to) on July 15, 1819; Cantos III., IV., V., finished in Nov. 1820, were not published till Aug. 8, 1821. Cantos VI.-XVI., written between June 1822 and March 1823, were published at intervals between July 15, 1823 and March 26, 1824. Canto XVII. was begun in May 1823, but was never finished. A fragment of 14 stanzas, found in his room at Missolonghi, was first published in 1903.

He did not put all his materials into *Don Juan. Mazeppa, a tale of the Russian Ukraine,* based on a passage in Voltaire's *Charles XII.,* was finished by Sept. 30, 1818 and published with an Ode on Venice on June 28, 1819. In the spring of 1819 Byron met in Venice, and formed a connection with, an Italian lady of rank, Teresa (born Gamba), wife of the Cavaliere Guiccioli. She was young and beautiful, well-read and accomplished. Married at 16 to a man nearly four times her age, she fell in love with Byron at first sight, soon became and for nearly four years remained his mistress. A good and true wife to him in all but name, she won from Byron ample devotion and a prolonged constancy, though he found the position of accredited *cavaliere servente* irksome. Her volume of *Recollections* (*Lord Byron jugé par les témoins de sa vie,* 1869), taken for what it is worth, is testimony in Byron's favour. The countess left Venice for Ravenna at the end of April; within a month she sent for Byron, and on June 10 he arrived at Ravenna and took rooms in the Strada di Porto Sisi. The house (now No. 295) is close to Dante's tomb, and to gratify the countess and pass the time he wrote the *Prophecy of Dante* (published April 21, 1821). According to the preface the poem was a metrical experiment, an exercise in *terza rima;* but it had a deeper significance. It was "intended for the Italians." Its purport was revolutionary. In the fourth canto of *Childe Harold,* already translated into Italian, he had attacked the powers, and "Albion most of all" for her betrayal of Venice, and he appeals to the country of his adoption to strike a blow for freedom—to "unite." It is difficult to realize the force or extent of Byron's influence on continental opinion. His own countrymen admired his poetry, but abhorred and laughed at his politics. Abroad he was the prophet and champion of liberty. His hatred of tyranny, his defence of the oppressed, made him a power in Europe. It brought consolation and encouragement, and it was not spoken in vain. It must, however, be borne in mind that Byron was more of a king-hater than a people-lover. He was against the oppressors, but he disliked and despised the oppressed. He was aristocrat by conviction as well as birth, and if he espoused a popular cause it was *de haut en bas.* His connection with the Gambas brought him into touch with the revolutionary movement, and thenceforth he was under the espionage of the Austrian embassy at Rome. He was suspected and "shadowed," but he was left alone.

Early in September Byron returned to La Mira, bringing the countess with him. A month later he was surprised by a visit from Moore, who was on his way to Rome. Byron installed Moore in the Mocenigo palace and visited him daily. Before the final parting (Oct. 11) Byron placed in Moore's hands the ms. of his *Life and Adventures* brought down to the close of 1816. Moore, as Byron suggested, pledged the ms. to Murray for 2,000 guineas, to be Moore's property if redeemed in Byron's lifetime, but if not, to be forfeit to Murray at Byron's death. On May 17, 1824, with Murray's assent and goodwill, the ms. was burned in the drawing-room of 50 Albemarle street. Neither Murray nor Moore lost their money. The Longmans lent Moore a sufficient sum to repay Murray, and were themselves repaid out of the receipts of Moore's *Life of Byron.* Byron told Moore that the memoranda were not "confessions," that they were "the truth but not the whole truth." They did not explain the cause or causes of the separation from his wife. An anonymous work entitled *The Life, Writings, etc., of . . . Lord Byron* (3 vols., 1825) purports to give "Recollections of the Lately Destroyed Manuscript." To judge by internal evidence (*see* "The Wedding Day," etc., ii. 278–284) there is some measure of truth in this assertion, but the work as a whole is untrustworthy.

At the close of 1819 Byron finally left Venice and settled at Ravenna in his own apartments in the Palazzo Guiccioli. At Ravenna his literary activity was greater than ever. His translation of the first canto of Pulci's *Morgante Maggiore* (published in *The Liberal,* No. IV., July 30, 1822), a laborious and scholarly achievement, was the work of the first two months of the year. From April to July he was at work on the composition of *Marino Faliero, Doge of Venice,* a tragedy in five acts (published April 21, 1821). Moved by the example of Alfieri he strove to reform the British drama by "a severer approach to the rules." He would read his countrymen a "moral lesson" on the dramatic propriety of observing the three unities. Eighteen additional sheets of the *Memoirs* and a fifth canto of *Don Juan* were written in the autumn, and in Jan. 1821 Byron began to work on his second "historical drama," *Sardanapalus.* But politics intervened, and little progress was made. He had been elected *capo* of the "*Americani,*" a branch of the Carbonari, and his time was taken up with buying and storing arms and ammunition, and consultations with leading conspirators. Meanwhile a controversy had arisen between Bowles and Campbell with regard to the merits of Pope. Byron rushed into the fray. To avenge and exalt Pope, to decry the "Lakers," and to lay down his own canons of art, Byron addressed two letters to * * * * * * * * * * (*i.e.,* John Murray), entitled "Strictures on the Life and Writings of Pope." The first was published in 1821, the second in 1835. Byron, the protagonist of the romantic movement, was, paradoxically, the persistent admirer of Pope and the classical English school, and the violent assailant of the Lake poets.

The revolution in Italy came to nothing, and by May 28, Byron had finished his work on *Sardanapalus.* The *Two Foscari,* a third historical drama, was begun on June 12 and finished on July 9. On the same day he began *Cain, a Mystery. Cain* startled and shocked the orthodox. It was not irreverent or blasphemous, but it treated accepted dogmas as open questions. *Cain* was published in the same volume with the *Two Foscari* and *Sardanapalus,* Dec. 19, 1821. The *Blues,* a skit upon literary coteries and their patronesses, was written in August. It was first published in *The Liberal,* No. III., April 26, 1823. When *Cain* was finished Byron turned from grave to gay, from serious to humorous theology. Southey had thought fit to eulogize George III. in hexameter verse. He called his funeral ode a "Vision of Judgment." In the preface there was an obvious reference to Byron. The "Satanic School" of poetry was attributed to "men of diseased hearts and depraved imaginations." Byron's revenge was complete. In his "Vision of Judgment" (published in *The Liberal,* No. I., Oct. 15, 1822) the tables are turned. The laureate is brought before the hosts of heaven and rejected by devils and angels alike. In October Byron wrote *Heaven and Earth, a Mystery* (*The Liberal,* No. II., Jan. 1, 1823), a lyrical drama based on the legend of the "Watchers," or fallen angels of the Book of Enoch.

The countess and her family had been expelled from Ravenna in July 1821, but Byron still lingered on in his apartments in the Palazzo Guiccioli. At length (Oct. 28) he set out for Pisa. On the road he met his old friend, Lord Clare, and spent a few minutes in his company. Rogers, whom he met at Bologna, was his fellow-traveller as far as Florence. At Pisa he rejoined the countess, who had taken on his behalf the Villa Lanfranchi on the Arno. At

Ravenna Byron had lived amongst Italians. At Pisa he was surrounded by a knot of his own countrymen, friends and acquaintances of the Shelleys. Among them were E. J. Trelawny, Thomas Medwin, author of the *Conversations of Lord Byron* (1824), and Edward Elliker Williams. His first work at Pisa was to dramatize Miss Lee's *Kruitzner, or the German's Tale.* He had written a first act in 1815, but as the ms. was mislaid he made a fresh adaptation of the story which he rechristened *Werner, or the Inheritance* (1822). Alone of Byron's plays *Werner* took hold of the stage. Macready's "Werner" was one of his most famous impersonations.

In the early spring Allegra, his daughter by Claire Clairmont, died at the convent of Bagna Cavallo on April 20, 1822. He had insisted on having the guardianship of the child, and had himself placed her in the convent. Soon after the death of Allegra, Byron wrote the last of his eight plays, *The Deformed Transformed* (published by John Hunt, Feb. 20, 1824). With the idea of having a paper of his own in which he could answer his critics and put forward his own theories he invited Leigh Hunt to Pisa, and undertook to lodge him with his wife and six children in the Villa Lanfranchi. The outcome of this arrangement was *The Liberal—Verse and Prose from the South.* Four numbers were issued between Oct. 1822 and June 1823. *The Liberal* did not succeed financially, and the joint ménage was a lamentable failure. *Correspondence of Byron and some of his Contemporaries* (1828) was Hunt's revenge for the slights—sometimes fancied slights—which he suffered in Byron's service. Yet Byron made generous allowances to the Hunts, and made over to John Hunt copyrights of enormous value. Yachting was one of the chief amusements of the English colony at Pisa. A schooner, the "Bolivar," was built for Byron, and a smaller boat, the "Don Juan" re-named "Ariel," for Shelley. Hunt arrived at Pisa on July 1. On July 8 Shelley, who had remained in Pisa on Hunt's account, started for a sail with his friend Williams and a lad named Vivian. The "Ariel" was wrecked in the Gulf of Spezia, and Shelley and his companions were drowned. On Aug. 16 Byron and Hunt witnessed the "burning of Shelley" on the seashore near Via Reggio. Byron told Moore that "all of Shelley was consumed but the *heart.*" Whilst the fire was burning Byron swam out to the "Bolivar" and back to the shore. The violent emotion caused by the death of Shelley and the improvident swim brought on one of the many fevers which weakened his constitution and shortened his life.

The Austrian Government would not allow the Gambas or the countess Guiccioli to remain in Pisa. As a half measure Byron took a villa for them at Montenero near Leghorn, but as the authorities were still dissatisfied they removed to Genoa. At Genoa Byron took up his quarters with the Gambas at the Casa Saluzzo, and Hunt and his party at the Casa Negroto with Mrs. Shelley. Life at Genoa was uneventful. Of Hunt and Mrs. Shelley he saw as little as possible. Though his still unpublished poems were at the service of *The Liberal,* each number was badly received. Byron had broken with Murray and was offering *Don Juan* (cantos vi.-xii.) to John Hunt, the publisher of *The Liberal,* but he meditated a "run down to Naples" and a recommencement of *Childe Harold.* Home politics and the congress of Verona (Nov.–Dec. 1822) suggested a satire entitled *The Age of Bronze* (published April 1, 1823). By the middle of February (1823) he had completed *The Island; or Christian and his Comrades* (published June 26, 1823), based on Bligh's *Narrative of the Mutiny of the Bounty,* and Mariner's *Account of the Tonga Islands.* When *The Island* was finished, Byron went on with *Don Juan,* his last, and his greatest, work. In *Don Juan* he set himself to depict life as a whole. The style is often misnamed the mock-heroic. It might be more accurately described as humorous-realistic. His "plan was to have no plan" in the sense of synopsis or argument, but in the person of his hero to "unpack his heart," to avenge himself on his enemies, personal or political, to suggest an apology for himself and to disclose a criticism and philosophy of life. As a satirist in the widest sense of the word, as an analyser of human nature, he ranks among the greatest. It is a test of the quality of *Don Juan* that its reputation has slowly increased and that, in spite of occasional grossness and voluptuousness, it has come to be recognized as Byron's masterpiece. *Don Juan* will be read for its own sake, for its beauty, its humour, its faithfulness. It is a "hymn to the earth," but it is a human sequence to "its own music chaunted."

Early in March the news reached him that he had been elected a member of the Greek Committee, a small body of influential Liberals who had taken up the cause of the liberation of Greece. Byron at once offered money and advice, and after some hesitation on the score of health, determined "to go to Greece." His first step was to sell the "Bolivar" to Lord Blessington, and purchase the "Hercules," a collier-built tub of 120 tons. On July 23 the "Hercules" sailed from Leghorn, and anchored off Cephalonia on Aug. 3. The party on board consisted of Byron, Pietro Gamba, Trelawny, Hamilton Browne, and six or seven servants. The next four months were spent at Cephalonia, at first on board the "Hercules," in the harbour of Argostoli, and afterwards at Metaxata. Byron took time to ascertain the real state of affairs in Greece. The revolutionary Greeks were split up into parties, not to say factions, and there were several leaders. At length he received a message from Prince Alexander Mavrocordato, urging him to come at once to Missolonghi, and enclosing a request from the legislative body "to co-operate with Mavrocordato in the organization of western Greece." Byron sailed from Argostoli on Dec. 29, 1823, and after an adventurous voyage landed at Missolonghi on Jan. 5, 1824. He met with a royal reception. Byron may have sought, but he did not find, "a soldier's grave." During his three months' residence at Missolonghi he advanced large sums of money for the payment of troops, for repair and construction of fortifications, for the provision of medical appliances. He brought opposing parties into line, and served as a link between Odysseus, the democratic leader of the insurgents, and Mavrocordato. He was eager to take the field, but a revolt in the Morea, and the repeated disaffection of his Suliote guard prevented him from undertaking the capture of Epacto, an exploit which he had reserved for his own leadership. On March 18 he received an invitation from Odysseus and other chiefs to attend a conference at Salona, and by the same messenger an offer from the government to appoint him "governor-general of the enfranchised parts of Greece." He promised to attend the conference but did not pledge himself to the immediate acceptance of office. But "roads and rivers were impassable," and the conference was inevitably postponed.

His health had given way, but he does not seem to have realized that his life was in danger. On Feb. 15 he was struck down by a fit, which left him speechless though not motionless. He recovered sufficiently to conduct his business as usual, and to drill the troops. But he suffered from dizziness in the head and spasms in the chest, and a few days later he was seized with a second though slighter convulsion. These attacks may have hastened but they did not cause his death. On April 9 a letter from his sister raised his spirits and tempted him to ride out with Gamba. It came on to rain, and though he was drenched to the skin he insisted on dismounting and returning in an open boat to the quay in front of his house. Two hours later he was seized with ague and violent rheumatic pains. On the 11th he rode out once more through the olive groves, attended by his escort of Suliote guards, but for the last time. Whether he had got his deathblow, or whether copious blood-letting by his incompetent attendant Bruno, made recovery impossible, he gradually grew worse, and on the ninth day of his illness fell into a comatose sleep. It was reported that in his delirium he had called out, half in English, half in Italian, "Forward—forward—courage! follow my example—don't be afraid!" and that he tried to send a last message to his sister and to his wife. He died at six o'clock in the evening of Easter Monday, April 19, 1824, aged 36 years and three months. Mavrocordato gave orders that 37 minute-guns should be fired at daylight and decreed a general mourning of 21 days. His body was embalmed and lay in state. On May 25 his remains, all but the heart, which is buried at Missolonghi, were sent back to England, and were finally laid beneath the chancel of the village church of Hucknall-Torkard on July 16, 1824. The authorities would not sanction burial in Westminster Abbey, and there is neither bust nor statue of Lord Byron in Poets' Corner.

The title passed to his first cousin as 7th baron, from whom the subsequent barons were descended. The poet's daughter Ada (d. 1852) predeceased her mother, but the barony of Wentworth went to her heirs. She was the first wife of Baron King, who in 1838 was created 1st earl of Lovelace, and had two sons (of whom the younger, b. 1839, d. 1906, was 2nd earl of Lovelace) and a daughter, Lady Anne, who married Wilfrid S. Blunt (*q.v.*). On the death of the 2nd earl the barony of Wentworth went to his daughter and only child, and the earldom of Lovelace to his half-brother by the 1st earl's second wife.

Throughout his stormy life Byron was faithful to his vocation as a poet. Poetry was often but not always an exaltation and a relief. He could fulfil his tasks in "hours of gloom." If he had not been a great poet, he would have gained credit as a painstaking and laborious man of letters. His habitual temperance was the outcome of a stern resolve. He had no scruples, but he kept his body in subjection as a means to an end. In his youth Byron was a cautious spendthrift. Even when he was "cursedly dipped" he knew what he was about; and afterwards, when his income was sufficient for his requirements, he kept a hold on his purse. He loved display, and as he admitted, spent money on women, but he checked his accounts and made both ends meet. On the other hand, the "gift of continency" he did not possess, nor trouble himself to acquire. He was, to use his own phrase, "passionate of body," and his desires were stronger than his will. Byron was kindly and generous by nature. He took pleasure in helping necessitous authors, men and women, not at all *en grand seigneur*, or without counting the cost, but because he knew what poverty meant, and a fellow-feeling made him kind. Even in Venice he set aside a fixed sum for charitable purposes. It is to his credit that neither libertinism nor disgrace nor remorse withered at its root this herb of grace. Cynical speeches with regard to friends and friendship, often quoted to his disadvantage, need not be taken too literally. Byron talked in accordance with the whim of the moment. His acts do not correspond with his words. He rejected both Protestant and Catholic orthodoxy, but like the Athenians he was "exceedingly religious." He could not, he did not wish to, detach himself from a belief in an Invisible Power. "A fearful looking form of judgment" haunted him to the last. Whatever his faults may have been, Byron had certain noble qualities which did not fail him at his worst. He was courageous, he was often kind, and he loved truth rather than lies. He was a worker and a fighter. He hated tyranny, and was prepared to sacrifice money and ease and life in the cause of popular freedom.

In his own lifetime Byron stood higher on the continent of Europe than in England or even in America. His works as they came out were translated into French, German, Italian and Russian, and the stream of translation has never ceased to flow. The *Bride of Abydos* has been translated into ten, *Cain* into nine languages. Of *Manfred* there is one Bohemian translation, two Danish, two Dutch, two French, nine German, three Hungarian, three Italian, two Polish, one Romaic, one Rumanian, four Russian and three Spanish translations. The dictum or verdict of Goethe that "the English may think of Byron as they please, but this is certain that they show no poet who is to be compared with him" was and is the keynote of continental European criticism. A survey of European literature is a testimony to the universality of his influence. Victor Hugo, Lamartine, Delavigne, Alfred de Musset, in France; Börne, Müller and Heine in Germany; the Italian poets Leopardi and Giusti; Pushkin and Lermontov among the Russians; Mickiewicz and Slowacki among the Poles—more or less as eulogists or imitators or disciples—were of the following of Byron. The part he played in revolutionary politics endeared him to those who were struggling to be free. He had the passion and the energy, the brilliance—in a word the genius—which made his voice heard throughout Europe. He was the least insular, the most European, of British poets. It was as the creator of new types, "forms more real than living man," that Byron appealed to the artistic sense and to the imagination of Latin, Teuton or Slav. That "he taught us little" of the things of the spirit, that he knew no cure for the sickness of the soul, were considerations which lay outside the province of literary criticism. "It is a mark," says Goethe (*Aus meinem Leben: Dichtung und Wahrheit*, 1876, iii. 125), "of true poetry, that as a secular gospel it knows how to free us from the earthly burdens which press upon us, by inward serenity, by outward charm." Now of this "secular gospel" the redemption from "real woes" by the exhibition of imaginary glory and imaginary delights, Byron was both prophet and evangelist.

Byron was 5ft. 8in. in height, and strongly built; only with difficulty and varying success did he prevent himself from growing fat. At 35 he was extremely thin. He was "very slightly lame," but he was painfully conscious of his deformity and walked as little and as seldom as he could. He had a small head covered and fringed with dark brown or auburn curls. His forehead was high and narrow, of a marble whiteness. His eyes were of a light grey colour, clear and luminous. His nose was straight and well-shaped, but "from being a little too thick, it looked better in profile than in front face." Moore says that it was in "the mouth and chin that the great beauty as well as expression of his fine countenance lay." The upper lip was of a Grecian shortness and the corners descending. His complexion was pale and colourless. Scott speaks of "his beautiful pale face—like a spirit's, good or evil." Charles Matthews said that "he was the only man to whom he could apply the word beautiful." Coleridge said that "if you had seen him you could scarce disbelieve him . . . his eyes the open portals of the sun—things of light and for light." He was likened to "the god of the Vatican," the Apollo Belvedere.

The best-known portraits are: (1) Byron at the age of seven by Kay of Edinburgh; (2) a drawing of Lord Byron at Cambridge by Gilchrist (1808); (3) a portrait in oils by George Sanders (1809); (4) a miniature by Sanders (1812); (5) a portrait in oils by Richard Westall, R.A. (1813); (6) a portrait in oils (Byron in Albanian dress) by Thomas Phillips, R.A. (1813); (7) a portrait in oils by Phillips (1813); (8–9) a sketch for a miniature, and a miniature by James Holmes (1815); (10) a sketch by George Henry Harlow (1818); (11) a portrait in oils by Vincenzio Camuccini (in the Vatican) *c.* 1822; (12) a portrait in oils by W. H. West (1822); (13) a sketch by Count D'Orsay (1823). Busts were taken by Bertel Thorwaldsen (1817) and by Lorenzo Bartolini (1822). The statue (1829) in the library of Trinity College, Cambridge, is by Thorwaldsen after the bust sculptured in 1817.

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BYRON, HENRY JAMES (1834–1884), English playwright, was born in Manchester in Jan. 1834. He entered the Middle Temple as a student in 1858, but soon joined a provincial company as an actor. He was the first editor of the weekly comic paper *Fun*, and started the short-lived *Comic Trials*. His first successes were in burlesque; but in 1865 he joined Miss Marie Wilton (afterwards Lady Bancroft) in the management of the Prince of Wales's theatre, near Tottenham Court road. Here several of his pieces, comedies and extravaganzas were produced with success; but, upon starting management on his own account in the provinces, he was financially unfortunate. The commercial success of his life was secured with *Our Boys*, which was played at the Vaudeville from Jan. 1875 till April 1879—a then unprecedented "run." *The Upper Crust*, another of his successes, gave a congenial opportunity to Mr. J. L. Toole for one of his inimitably broad character-sketches. H. J. Byron was the author of some of the most popular stage pieces of his day. He wrote one novel, *Paid in Full* (1865). He had many friends, among whom he was justly popular for geniality and imperturbable good temper. He died at Clapham on April 11, 1884.

BYRON, JOHN BYRON, 1st Baron (*c.* 1600–1652), English cavalier, was the eldest son of Sir John Byron (d. 1625), a member of an old Lancashire family which had settled at Newstead, near Nottingham. During the third decade of the 17th century Byron was member of parliament for the town and afterwards for the county of Nottingham. In Dec. 1641, the king made him lieutenant of the Tower of London, but in consequence of the persistent demand of the House of Commons he resigned in 1642. Byron fought at the skirmish at Powick Bridge; he commanded his own regiment of horse at Edgehill and at Roundway Down; and at the first battle of Newbury Falkland placed himself under his orders. His defeat at Nantwich, in Jan. 1644, compelled him to retire into Chester, and he was made governor of this city by Prince Rupert. At Marston Moor, as previously at Edgehill, Byron's rashness gave a great advantage to the enemy; then, after fighting in Lancashire and north Wales, he returned to Chester, which he held for about twenty weeks in spite of the king's defeat at Naseby and the general hopelessness of the royal cause. Having obtained favourable terms he surrendered the city in Feb. 1646. Byron took some slight part in the second Civil War, and was one of the seven persons excepted by parliament from all pardon in 1648. But he had already left England, and he lived abroad in attendance on the royal family until his death in Paris on Aug. 23, 1652. Although twice married Byron left no children, and his title descended to his brother Richard (1605–79), who had been governor of Newark. Byron's five other brothers served Charles I. during the Civil War, and one authority says that the seven Byrons were all present at Edgehill.

BYRON, HON. JOHN (1723–1786), British vice-admiral, second son of the 4th Lord Byron, and grandfather of the poet, was born on Nov. 8, 1723. While still very young, he accompanied Anson in his voyage of discovery round the world. He saw a great deal of hard service and stormy weather, and was nicknamed by the sailors, "Foul-weather Jack." It is to this that Lord Byron alludes in his *Epistle to Augusta*:—

> A strange doom is thy father's son's, and past
> Recalling as it lies beyond redress,
> Reversed for him our grandsire's fate of yore,
> He had no rest at sea, nor I on shore.

In 1768 he published a *Narrative* of some of his early adventures with Anson, which was to some extent utilized by his grandson in *Don Juan*. In 1769 he was appointed governor of Newfoundland. In 1775 he attained his flag rank, and in 1778 became vice-admiral. In the same year he was despatched with a fleet to watch the movements of the Count d'Estaing, and in July, 1779 fought an indecisive engagement with him off Grenada. He died on April 10, 1786.

BYSTROM, JOHAN NIKLAS (1783–1848), Swedish sculptor, was born on Dec. 18, 1783, at Philipstad, and died at Rome on March 13, 1848. The greater part of his life was spent in Italy. His colossal statues of the Swedish kings, in Stockholm, form his most celebrated work.

BYTOWNITE (named from Bytown, now Ottawa, in Canada), a rock-forming mineral of the plagioclase (*q.v.*) group of felspars. The name is now restricted to felspars intermediate in composition between labradorite (*q.v.*) and anorthite (*q.v.*), and arbitrarily reserved for solid solutions of composition-range $Ab_{30}\,An_{70}$ to $Ab_{10}\,An_{90}$.

BYWATER, INGRAM (1840–1914), English classical scholar, was born in London June 27 1840, and died there Dec. 17 1914. He was university reader in Greek at Oxford, 1883, and regius professor 1893–1908, and was an authority on Aristotle.

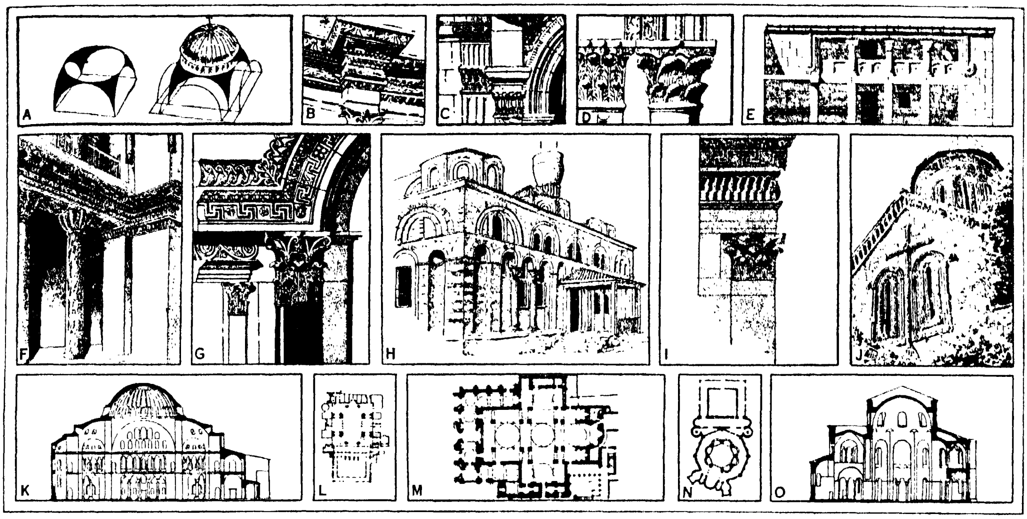
Chief works: *Heracliti Ephesii Reliquiae* (1877); *Prisciani Lydi quae extant* (edited for the Berlin Academy in the *Supplementum Aristotelicum*, 1886); Aristotle, *Ethica Nicomachea* (1890), *De Arte Poetica* (1898); *Contributions to the Textual Criticism of the Nicomachean Ethics* (1892).

BYZANTINE AND ROMANESQUE ARCHITECTURE. Byzantine architecture is that which was developed under the Eastern Roman empire from the time of Constantine (323–337) down to its fall in 1453. Offshoots of this style in Russia (*see* RUSSIAN ARCHITECTURE) and the Balkans, and along the east coast of Italy are frequently included. Romanesque architecture is the style which grew up in western and central Europe after the fall of Rome, 476, and prior to the development of Gothic. (*See* GOTHIC ARCHITECTURE.) The Romanesque type, found in Rome itself, is usually termed Early Christian or Basilican. (*See* BASILICA.)

BYZANTINE ARCHITECTURE

Origin and Development.—In the 100 years preceding Constantine, Eastern influence on Roman culture increased continually. In architecture, the Syrian provinces developed a vivid style of their own, which by the time of Hadrian (117–138) already showed marked changes from classic practice. These resulted from three things: an abundance of hard stone, a lack of timber and Eastern love of surface ornament. The differences in building materials produced great originality in stone vaulting, and the love of surface ornament reduced the projections in Roman carving. (*See* de Vogüé, *Syrie Centrale*, and Butler, *Architecture and Other Arts.*)

Many builders working in the later Roman empire seem to have had Syrian training, and the palace of Diocletian at Spalato (*c.* 300) shows how profoundly this influence affected Roman ornament. When Constantine moved his capital to Constantinople (330) the importance of the Syrian influence in its architecture was inevitable. The germ of the style first appeared in utilitarian works. In Constantine's great cistern, known as the Binbirderek (the reservoir of a thousand and one columns), a truncated, pyramidal block, known as an impost block or dosseret and used as a column capital appears. Moreover, the vault consists of square, groined bays with the crowns so raised at the centre that they approach the pendentive dome in shape. Throughout their history the Romans sought unsuccessfully a method of placing a dome over a square or polygonal room by means of squinches (*q.v.*), diagonal arches, etc. It remained for Byzantine architects to solve the problem and realize the structural and artistic possibilities of the true pendentive, which is merely the section of a



A, pendentives (black portions) and dome; B, proto-Byzantine detail from tomb, Spalato; C, D, Syrian Byzantine details, Kalat Siman; E, Syrian house; F, Byzantine columns and entablature, SS. Sergius and Bacchus, Constantinople; G, I, Syrian proto-Byzantine details, Sanamen and Ataman; H, S. Theodore Tyrone, Constantinople; J, Armenian Byzantine church, Ani; K, L, S. Sophia, Constantinople; M, St. Mark's, Venice; N, O, San Vitale, Ravenna. (For sources, see end of article, page 488d.)

spherical dome. The church of S. Sophia, Salonika (*c.* 450) is probably the earliest building in which the pendentive is used in connection with a dome at the crossing of a church.

Ornament of this period also shows many changes from Roman precedent. These comprise the extended use of the impost block, the flattening of carving, the elimination of entablature mouldings, and the development of coloured surface decoration by means of marble panels and glass mosaic. Where entablatures occur, the members of architrave and cornice blend together in continuous bands of carved richness. These transitional details appear in the 5th century churches of S. John the Baptist, Constantinople, and S. Demetrius, Salonika. In the church of SS. Sergius and Bacchus in Constantinople (*c.* 523), ornament of this new type is first found decorating a domical building of large size. Here, however, the dome springs directly from an octagon, without pendentives; this church, however, shows a definite attempt to combine a large dome with a polygonal plan of Syrian type and to decorate the whole with columned galleries in which there are many variations from classical prototypes.

With the beginning of the church of S. Sophia at Constantinople in 532, the Byzantine style came to its maturity; a perfect blend of Roman planning and Eastern structure and ornament. The architects, Isidorus of Miletus and Anthemius of Tralles, both from the East, conceived the daring idea of substituting for the groined vault of the Roman basilica of Constantine an enormous dome on pendentives and a half dome at each end. From the semi-circular walls supporting the half domes, small apses are opened out and pierced by arcades carried on columns, so that the sense of openness is tremendous and the great weights involved are concentrated on a few colossal piers. The side aisles are separated from the nave, by arcades, pierced by means of wide arched passages, the great piers supporting and buttressing the dome. The aisles are in two storeys, the second, as always in Byzantine churches, used for a woman's gallery. In front of this building was a long, narrow narthex (*q.v.*), groin vaulted and opening by many doors into the nave and aisles. The church is a historical one because here, at last, Byzantine structural and decorative genius achieved complete definitive expression. In it complete freedom from Roman precedent is won and the ornament, even when the effect is produced by carving, is frankly a surface ornament. The richness of this carving is the richness of lace. It combines admirably with the veined marble panels which sheath the walls and the piers, the intricate decoration of the arcade spandrels, and the glass mosaics, mainly on a gold ground, of the vaults, to produce an interior of a character and power hitherto unknown. The success of such a building had a profound effect, not only in Constantinople but even in Ravenna, in the distant Italian exarchate where the church of S. Vitale (547) is entirely in the Byzantine style. It was Byzantine influence which dominated the early architecture of Venice 500 years later. Byzantine architecture soon separated into local schools, Constantinople, Greece, the Balkans, Armenia, Italy and Russia.

Constantinople.—In its later phases this school is characterized by the use of the drum, which is a vertical cylindrical wall, pierced with windows, between the top of the pendentives and the base of the dome proper, which it carries. This appears first in the dome of S. Irene (probably *c.* 712). The greater number of churches still existing in Constantinople are of comparatively small size, and the dome drum is frequently of disproportionate height. As time went on, more and more attention was given to exterior design, especially by the use of alternating courses of brick and stone, arched recesses and decorative cornices, often in brick. Frequently, too, the walls of the drum were carried up above the spring of the dome, which was covered by a conical roof, as, for instance, in the church of S. Theodore Tyrone, in Constantinople Decorative wall panelling of geometric marble mosaic, as in the palace hall of the Tekfur Serai at Constantinople, also became more common. Internally, the decorative scheme of the later churches is merely a development of that of S. Sophia, Constantinople, with gradually increasing complexity in the mosaics, of which beautiful examples remain in the 12th century church now known as Kahriyeh Djami, Constantinople.

Greece.—In all Greek churches there seems to be a love of small scale for its own sake, quite different from the Constantinople tradition. Proportions are always high and narrow and drums carrying miniature domes are of extravagant height (*e.g.*, the Holy Apostles, Salonika, 12th century). There is, also, a love of marble for exterior panelling, used much as the Constantinople architects employed it for interior work. In the small cathedral at Athens, an interesting effect is gained by building into the exterior walls heterogeneous, decorative panels of carved marble.

The Balkans.—Jugoslavia and Albania contain many churches of Byzantine type, dating from a late period (*c.* 1500–1800). In almost all of these the high, stilted character is still further increased by the breaking up of the façade into many long, slim, arched recesses frequently emphasized by painting the arches white against the yellow wall. Occasionally, further exterior richness is given by complicated carving of Armenian character. The lavishness of the outside of these Balkan churches increased continually, until, in the 17th and 18th centuries, there began to appear signs of influences from western Europe; the resulting adulterated mixture had a certain naive extravagance, but was without vitality and soon died.

Armenia.—Here a vivid and characteristic Byzantine style existed between the 4th and the 11th centuries. Armenian architecture is peculiarly interesting historically because its monuments are built out of cut stone, instead of the brick common in Constantinople, and is closely related to Syrian examples. Although often later in date, the monuments show forms transitional between early Christian art of Syria (such as the basilica of Kalaat Simaan) and the matured Byzantine of Constantinople. Armenian churches are built of carefully cut ashlar, or smooth stone masonry; the entire outside faces are decorated with rich patterns of incised lines and softly modulated mouldings, which frequently take the form of decorative arches with no relation to the structure. The cross and the interlace were common. The eastern apse or apses were frequently in the thickness of the wall. The most characteristic examples of the Armenian style are the many churches of the ruined city of Ani.

Italy.—In addition to the early work in Ravenna (*e.g.*, S. Vitale, noted for its mosaics) a Byzantine school of quite different character developed in Venetia, from the 10th century on. The Venetians, whose wealth was based on commerce with the East, turned naturally to Constantinople for artistic inspiration, but they put the stamp of their own character on their Byzantine work. This is especially true of their domestic architecture, for the typical Venetian palace, marble sheathed, with arched windows and pierced balconies, took form during the Byzantine period. St. Mark's, the great monument of Venice, is the second most important Byzantine monument in the world. Here the structural idea, five domes covering a plan of Greek cross type, was borrowed from the Church of the Holy Apostles in Constantinople, and built in a thoroughly Byzantine manner, and the decorative marble sheathing and glass mosaics were similar. In detail the Roman influence is stronger than that of Constantinople; capitals often closely resemble the Roman Corinthian; the acanthus leaf is treated with its full, classic, curving relief. In capitals and bands, a touch of fresh naturalism is found; birds, animals and human figures are used with a verve quite different from the conventionalized lace of Constantinople. The columns of the screens which separate nave and aisles carry a full classic entablature. The front of St. Mark's, as it exists at the present time, represents many alterations and rebuildings during the Gothic period. Only the essential structural framework and the tiers of marble columns are of the original Byzantine design. The onion outer domes, with their elaborate metal finials, are also of a later date.

Russia.—A style originally Byzantine, but developed in accordance with Russian taste, continued in use in that country down to the beginning of the 19th century. (*See* RUSSIAN ARCHITECTURE.) Like the Byzantine of Greece and the Balkans, its churches tend toward high and slim proportions. Details, however, show wide divergences from those in Constantinople. Particularly characteristic is the decoration of dome drums and gables with a succession of small semi-circular arches, like scales, one above the other; onion domes; towers with fantastically domed tops; column shafts moulded like balusters, with simple capitals; and, on the interior, the frequent use of mural paintings instead of marble and mosaic. The result is an impression of rich and sombre mystery. The great cathedral of S. Basil in Moscow is a good example.

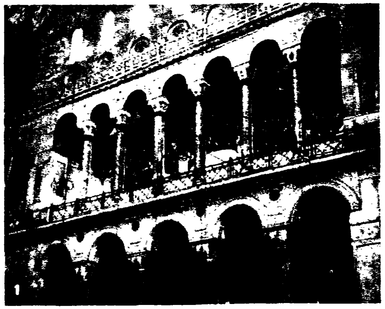
ROMANESQUE ARCHITECTURE

Origin and Development.—Conditions in the western part of the Roman empire during the 5th, 6th and 7th centuries were chaotic. The invading barbarians from the north made Roman provinces their highway, occasionally, like the Goths and Vandals, passing on to Africa, but usually settling in the districts which they conquered and mixing with the native stock. In the resultant confusion, the Roman material civilization died. Men of alien tradition, with pastoral and nomadic backgrounds, filled the cities of France, Spain and Italy, where the Roman buildings fell into decay and were looted of their furnishings. The new peoples born from this condition needed buildings, and especially, because of their recently acquired Christianity, churches. Yet their building traditions and skill were unequal to the task. Naturally they turned to Roman buildings for their inspiration, and their attempts to imitate them constitute the earliest Romanesque, which is well represented by certain Roman basilicae (*q.v.*), in which crude, new buildings were decorated with architectural details looted from Roman work and confusedly used.

Charlemagne (768–814) made a real attempt to resurrect Roman culture, and the church that he built at Aachen (Aix-la-Chapelle) was, in its day, the most advanced building in Europe. In building it, he turned to Byzantine work for inspiration, and in many ways the church strongly resembles S. Vitale at Ravenna. It is an octagonal building with two storeys of side aisles round a central domed area; the details are as Byzantine as the general scheme. This was a unique example to which later architecture owes little. A more interesting effort was made in the barbaric kingdom of the Lombards, where under Liutprand, towards the end of the 8th century, legal recognition was given to a builders' gild known as the *Maestri Comacini*. These builders attacked the building problem realistically, gave up the sterile attempt to imitate Roman work and developed forms to fit their own crude technique and ornament to express their own emotions.

It is difficult to trace the exact growth of Romanesque art during these chaotic times. It developed from various sources. In France, the influence of Roman precedents was strong (*e.g.*, S. Jean, Poitiers, probably 6th century; complete contemporary descriptions of other lavish buildings exist). In northern Spain, there was a crude art of great vitality, sometimes known as Visigothic art. It was not, however, until the 10th century that an architecture thus engendered achieved definite form; examples from then on become increasingly numerous and important. All Romanesque architecture has certain common features. National boundaries were then non-existent and the unifying power of the Church, exerted especially through the widely spread monasteries, particularly of the Benedictine and Cistercian orders, was everywhere dominant. Monasticism was the ecclesiastical expression of the same social and political influences that produced feudalism. To cultivate the arts was a cardinal tenet of the Benedictine order, and although lay architects begin to appear in increasing numbers in the 12th century, the earlier master builders were undoubtedly monks who carried building traditions from one monastery to another, and so spread the Romanesque style. All the common factors of Romanesque architecture are the result of the attempt to build an adequately lighted, impressive church building, as richly decorated as possible, with incomplete technical skill and crude materials. Knowledge of structural engineering grew from year to year, by trial and error, through the frequent collapse of earlier buildings, but never enough to give builders complete mastery of their problem. Romanesque walls are universally heavy, usually of small stones or brick; windows and doors are almost always small and round arched; columns are short and stumpy, with heavy capitals. In the place of columns, square or clustered piers are often used to separate nave and aisles.

The church plan went through an extensive evolution. Although occasional circular churches of Eastern type are found (S. Sepolcro, Bologna, 11th century; St. Sepulchre's, Cambridge, England, 1101), it is the Roman basilica type that is dominant. Side aisles are low and frequently vaulted with groined vaults. In order to get clerestory windows, naves are made as high as the builder dared; in earlier cases they are usually roofed with wood, but increasingly the attempt was made to vault them completely in masonry. The triforium (*q.v.*) gallery appears between the arcades of the side aisle and the clerestory windows, sometimes occupying merely the space under the sloping roof of the side aisles, sometimes existing as a full second storey gallery. Apses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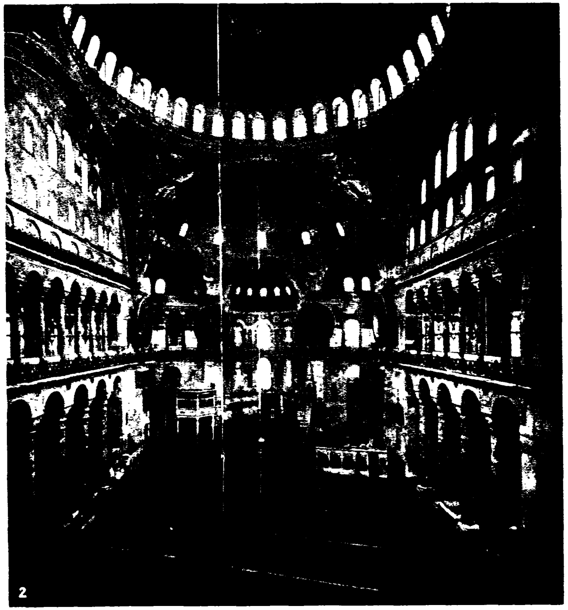
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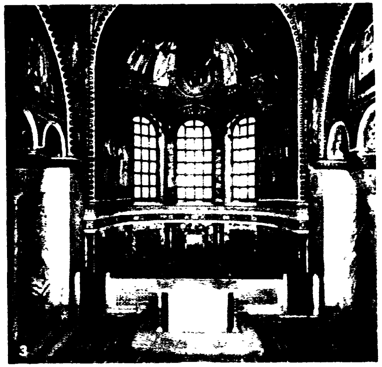
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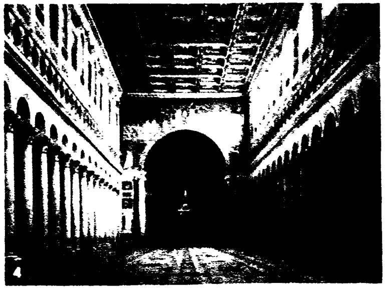
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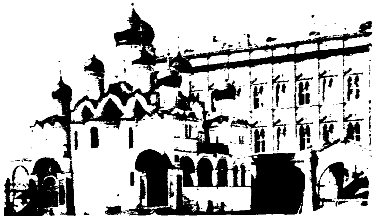

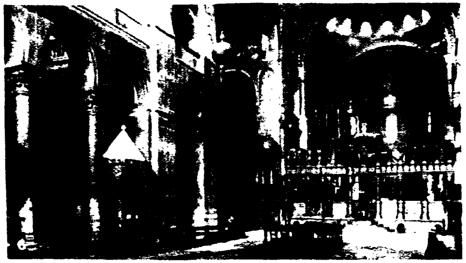
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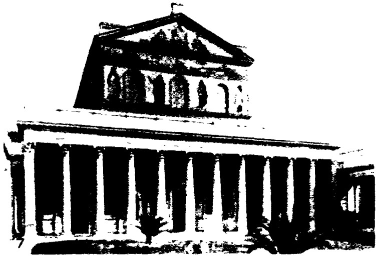
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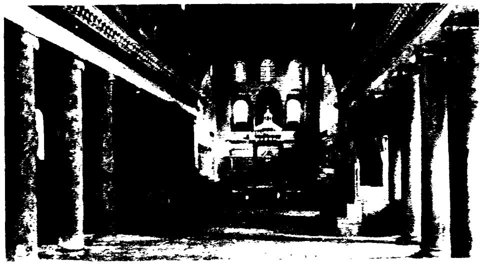

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EXAMPLES OF THE BYZANTINE STYLE

1 and 2. Interior views of S. Sophia, Constantinople, built by Justinian (532–7)

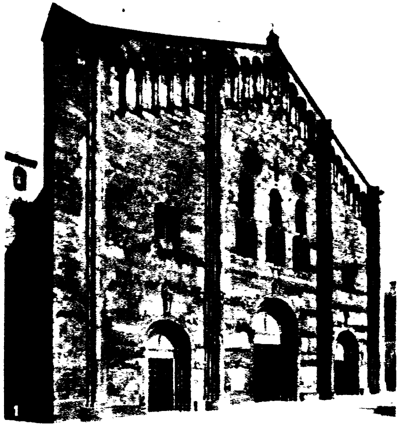
3. Ravenna. Choir of the basilica of San Vitale (542)

4 and 7. St. Paul's Outside the Walls, Rome. Interior and exterior views of a characteristic early Christian (Byzantine) basilica

5. Baptism and marriage church, the Kremlin, Moscow, begun 1397. Late Byzantine

6. S. Mark's, Venice (1063–67). Interior, showing influence of S. Sophia (see fig. 2)

8. S. Lorenzo Outside the Walls, Rome. View toward early portion (588) from 13th century nave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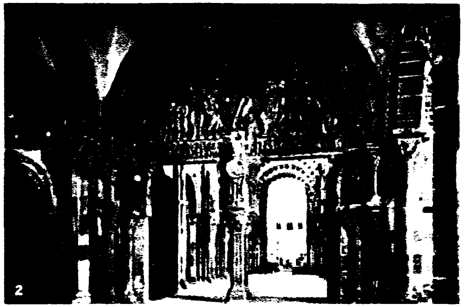
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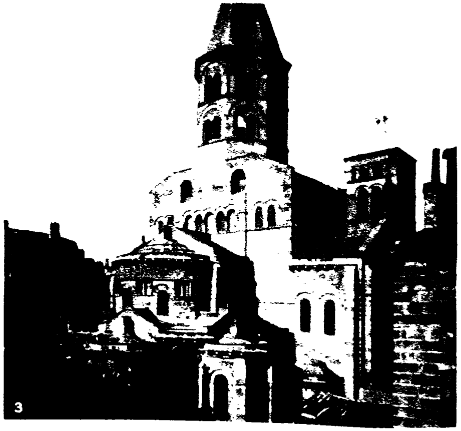
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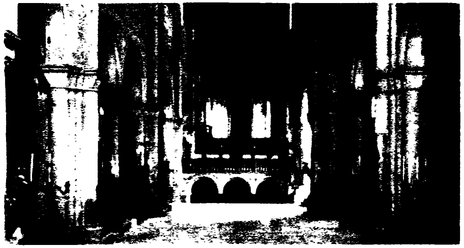
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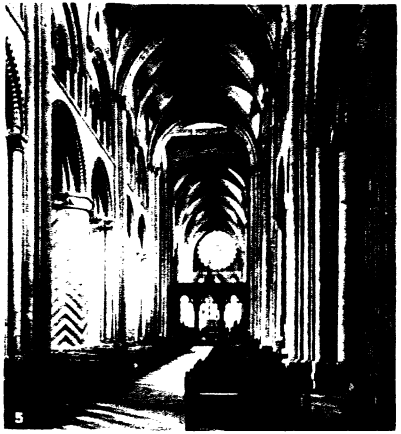
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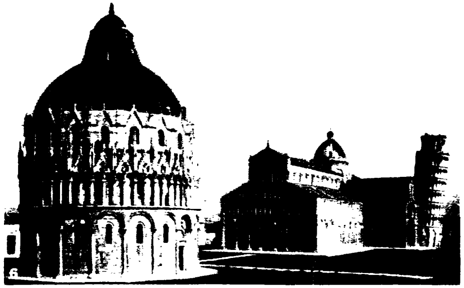
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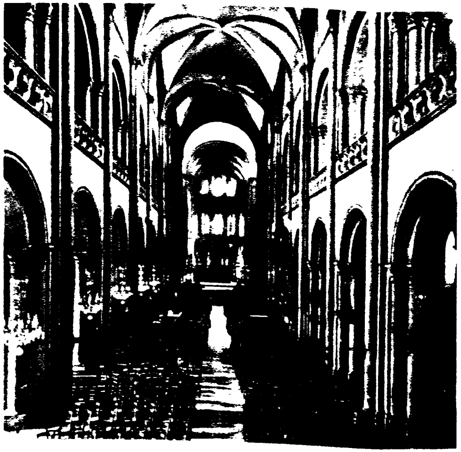
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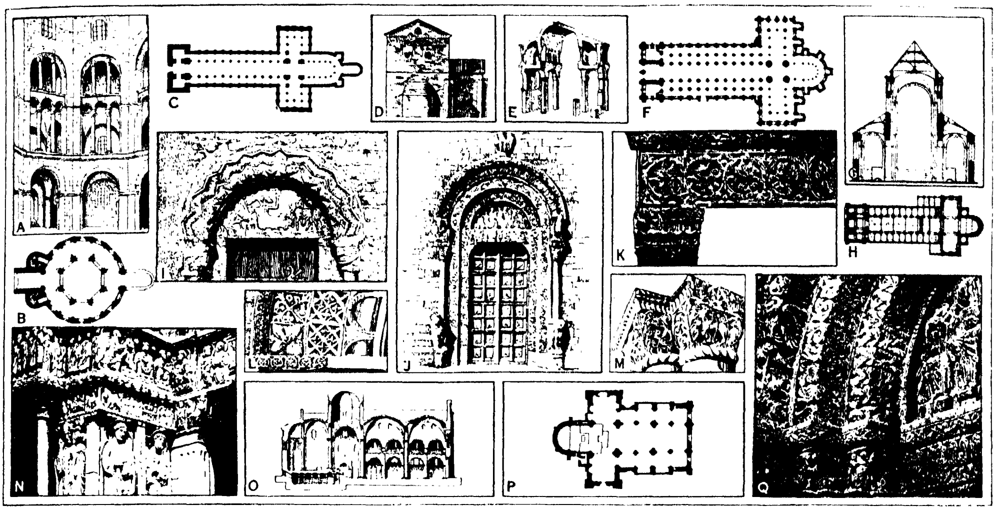
ROMANESQUE ARCHITECTURE IN ITALY, FRANCE AND ENGLAND

1. Pavia. Facade of S. Michele, characteristic Lombard Romanesque
2. The abbey of Vézelay (1130), French Romanesque doorway
3. Clermont-Ferrand. Church of Notre Dame-du-Port (1100), apse with chapels
4. Verona. Church of S. Zeno, Lombard Romanesque nave, begun 1138
5. Durham cathedral. Norman nave, late 11th century, showing large decorated columns typical of the style in England
6. Cathedral group at Pisa (1067–1173). Tuscan Romanesque characterized by strong classical feeling
7. Interior of the Abbaye-aux-Hommes at Caen, Normandy, begun 1066



A, B. Charlemagne's Chapel, Aachen, Germany; C. Romanesque cathedral, Winchester; D. Baptistry of St. Jean, Poitiers; E. Structure of typical barrel vaulted Romanesque church; F. St. Sernin, Toulouse; G, H. Speiers Cathedral; I. door from church at Stow Longa, English; J. Bitonto cathedral, Southern Italian; K. San Giusto, Lucca; L and M. St. Peter's, Northampton; N. porch of St. Trophime, Arles; O, P. San Michele, Pavia; Q. door of St. Pierre, Aulnay

usually terminate nave and choir at the east and, as the ritualistic requirements of the church increased, first transepts, and later minor apses, and additional chapels, were added. The interior decoration is simple, consisting merely of carved capitals of the columns of piers, steppings or simple mouldings in the arches, occasional carved panels round doorways or in other important positions, and simple horizontal mouldings separating side aisle arcade, triforium and clerestory. Lavish colour decoration is found on simple surfaces. There are extensive remains in the church of St. Benoit sur Loire, 12th century. The lower portions of the wall are painted to represent drapery, while above, groups of saints and angels are indicated in a stiff but forcefully Byzantine manner.

The Romanesque period saw the development of the Latin cross type of church plan and the complex but systematized east end or chevet (*q.v.*) consisting of an apse (*q.v.*) with the side aisle carrying around it as an ambulatory (*q.v.*) and with chapels, generally apsidal, opening from it. Significant, also, is the common use of clustered piers, carefully designed with reference to the members which they carry. A typical pier between nave and aisle is frequently of cross shape; the two longitudinal arms carry the pier arches, the projection toward the aisle carries a cross rib of the aisle vault, and the projection into the nave continues up in front of the triforium and clerestory walls to carry either a cross rib of the nave vault or the nave truss. In addition, minor members on the nave side were occasionally added under the groin of the nave vault, and if the pier arches are heavily moulded there may be subsidiary shafts under the main moulding members. In exterior design, decoration consists of simple cornices, sometimes supported by little arches and frequently with corbels (brackets), carved with human heads or leaves and the use of projecting buttresses or buttress stripes occasional wall arcading.

The typical Romanesque door, although itself small, was made a large decorative motive by stepping outward the sides and covering arch in several layers in the thickness of the wall. Each step, known as an order, was treated as a separate decorative entity. Columns, carrying additional arch mouldings, were frequently inserted in the re-entrant angles of the steps. The space between the arch and the top of the door, known as lunette or tympanum, is usually decorated with reliefs of biblical stories or the lives of saints. In addition, there is much rich foliage, frequently intermingled with birds, animals and grotesques (for the elaborate symbolism of these reliefs, *see* E. Male, ***Religious Art of the Twelfth Century in France***). Among the most common subjects and motives of this decoration are: The Last Judgment; Christ enthroned, surrounded by the four evangelists; and the Virgin, enthroned. Christ and the Virgin are usually represented within an oval frame, known as the vesica or mandorla. In the carving of capitals and running mouldings, there is frequent evidence of influence from Mohammedan textiles. The Romanesque period also saw the growth of the church tower as an integral part of ecclesiastical architecture. (*See* CAMPANILE and TOWER.)

The most important development of Romanesque architecture was the result of continual experimentation with vaulting. (*See* VAULT.) Completely stone vaulted churches were necessitated by frequent disastrous fires in wooden-roofed buildings, and the problem of counteracting the thrust, or outward pressure, of high, heavy, nave vaults without obscuring clerestory windows, was a controlling factor in Romanesque design. The barrel, or continuous vault, is found in early examples, in which the thrust is only imperfectly braced by the brutally heavy walls. This was soon abandoned in favour of the groined or intersecting vault, in which the weights and thrusts are concentrated at the piers. Intersecting vaults, themselves, brought difficulties, for the nave and aisles, being of different widths, would, in true intersecting vaults, have different bay spacings. To obviate this, the Lombards made one bay of the nave include two bays of the aisle (*e.g.*, S. Ambrogio, Milan, 10th and 11th centuries). They were followed in this by the Rhenish builders. In other localities, various types of oblong vault bays were used, and in Normandy, the sexpartite vault (*q.v.*) was invented in the attempt to combine the advantages of both schemes. The final solution came only with the pointed arch in Gothic architecture (*q.v.*). Another difficulty lay in the heavy centring or temporary timber bracing required during the construction of great vaults. To cope with this, the vault was divided into small sections by ribs, *i.e.*, independent arches, easily built. From these, centring for the intervening sections could be supported. At first ribs were only used across the nave and aisles, but, later ribs were also built under the groins (the diagonal intersections between the two surfaces that make up the intersecting, or groined vault). These still further diminished the surface for which centring was necessary at one time. The last stage in the development came with the slight arching of all of the surfaces between the ribs, so that the ribs carried the entire weight of the vault. Complete ribbed vaults of this type, with cross ribs, and groin or diagonal ribs, came into use in several places at almost the same time. It is generally agreed that the earliest example is that over the nave of the Lombard church of S. Ambrogio, Milan, probably dating from the second half of the 11th century (Cattaneo, *L'architettura in Italia dal secolo VI al mille circa*, 1888). Other early instances exist in France at Morienval, Oise (*c.* 1120), and at Durham cathedral in England (1093–1133).

In the development of Romanesque architecture four historical influences are apparent. The first is a direct legacy of pagan Rome. The second is the influence of the Byzantine Eastern empire, which was known in the western world through the wide circulation of manuscripts, jewel work, ecclesiastical furniture and carved ivory, all made in Constantinople, and also by means of the occasional use of Syrian masons and Greek decorative artists. The third is the influence of the builders' own northern background, shown in a certain structural vitality, and the use of ornament of a bold and almost savage intricacy. The last is a direct influence from the Near East, due to commerce in oriental textiles and memories brought back by the crusaders. The various ways in which these influences were intermingled and the varying materials occurring in different localities necessarily produced a series of important local styles which, with their chief characteristics, may be summarized as follows:

Lombard.—This style shows great structural genius, with development of the arcaded cornice, the buttress strip and the campanile. The carved ornament is crude, with much use of grotesques and interlaces borrowed from the Byzantine. (S. Ambrogio, Milan; S. Michele, Pavia.)

Tuscan and Central Italian.—A style developed by skilled decorators, showing little structural initiative; the buildings follow Roman basilican types. Byzantine influence causes the use of coloured marbles, especially in bands alternately dark and light. Decorative arcades (*q.v.*) and colonnades (*q.v.*) are developed to a high degree, as in the fronts of Pisa (*c.* 1020) and Lucca (12th century) cathedrals.

South Italian and Sicilian.—Here the style is a confused mixture of Lombard, Byzantine, Roman and oriental influences. There is a rich use of mosaic, which in the Capella Palatina in Palermo and in the apse of Monreale cathedral, both of the late 12th century, achieves its highest possibilities. In Apulia, strong Lombard characteristics are evident, as in Troia and Bitonto cathedrals.

Provence.—The barrel vaulted naves, low proportions, rich entrances are characteristic, and all decorative work reveals the attempt to copy, with very little change, the motives of Roman ornament. This is the most classic of the Romanesque styles in France (*e.g.*, S. Trophime, Arles).

Aquitaine.—Unique in its adoption of Byzantine structural ideas, with the consequent use of the dome on pendentives. Its greatest monument, S. Front at Périgueux (begun 1120), in plan strikingly resembles S. Mark's at Venice. The pointed, scaled, exterior spire and dome forms are characteristic, as also the great façade richness through the use of many tiers of crude wall arcading filled with sculpture. Pointed arches are occasionally used, as in Cahors cathedral.

Auvergne.—Byzantine, Roman and Lombard influences are all present, and barrel vaults, groined vaults and domes are found. There is much use of polychrome masonry for exterior decoration. This style is important because of its vaulting experiments and its elaborate development of the chevet (*e.g.*, N. Dame-du-Port, Clermont-Ferrand, cathedral at Le Puy en Veldy).

Burgundy.—Here there is evidence of strongly-marked structural genius, coupled with interesting adaptations of Roman decorative forms (*e.g.*, cathedral at Autun). Very elaborate entrance doors are frequently found, and occasionally enclosed porches, as in the Abbey of Vezelay.

Normandy.—Little Roman or Byzantine influence is found in Normandy. The Lombard influence is strong owing to the fact that an abbot of Pavia, Lanfranc, was in charge of Norman monasteries in the 11th century. The ingenious experiments in vaulting reached their climax in the Abbaye aux Hommes and the Abbaye aux Dames in Caen (last quarter 11th century), where rudimentary flying buttresses first appeared, and in Durham cathedral. The architectural forms are used for decorative purposes (arcades, buttresses, etc.) and the highly finished geometric ornament is characteristic. The Romanesque architecture of England, known as Norman, is largely of this type. An English peculiarity is enormous length in church plans, as in Ely and Peterborough cathedrals.

Rhineland.—Here the Lombard influence is dominant. The development of height in church interiors is noteworthy, and the churches frequently have an apse at each end. The use of many towers resulted in fantastic silhouettes, and the carved ornament is often vividly grotesque (*e.g.*, cathedrals at Mainz and Speyer, Church of the Holy Apostles, Cologne).

Spain.—There was vital development in Spain at a very early period (Visigothic art). Later manifestations show strong Moorish influence in geometric ornament and conventionalized foliage, and unusual skill in figure sculpture. Through the great church of Santiago at Compostela, one of the most thronged pilgrimage spots of the period, and the existence of a brilliant school of manuscript decoration, this style was of the greatest importance in the development of decorative sculpture throughout Europe. (*See* Male, *loc. cit.*, and Arthur Kingsley Porter, *Sculpture of the Pilgrimage Roads*, 1923.)

The general effect of Romanesque architecture, both structurally and decoratively (except in southern Italy), is that of power, incomplete achievement and sombre gloom. Its grotesque ornament, often full of a perverse cruelty, instinct with a sense of terror, expresses a mentality under terrific nervous strain—the same emotional instability revealed in the popular fear of the end of the world in the year 1000, and later expressing itself in such extraordinary manifestations as the Children's crusade. Whatever the symbolic or religious explanation of these carvings may be, they are one of the best expressions of the time. The entire population of Europe, struggling to create an as yet inchoate civilization and hampered by feudalism, was confronted by the remains and the tradition of the Roman world. They could not produce buildings or art comparable to those of Rome, and this fact engendered in them, especially in those who were artists, a profound sense of inferiority and frustration, which could only find expression in such an art as that which built the moving mystery of St. Sernin at Toulouse, or painted the savage Last Judgment of Torcello cathedral. (*See* also ARCHITECTURE.)

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Text-cut, page 485; A, F, H, L, M, N, from Jackson, "*Byzantine and Romanesque Architecture*" (Cambridge University Press); B, from Hamlin, "History of Ornament" (Century Co.); C, E, from Vogüé, "*Syrie Centrale*," *Tome II.* (Ch. Beranger); J, from Sturgis and Frothingham, "*History of Architecture*" (Doubleday, Doran and Co.); K, O, from Kimball and Edgell, "*History of Architecture*" (Harper and Bros.)

Text-cut, page 487; A, B, C, F, I, K, L, M, from Jackson, "*Byzantine and Romanesque Architecture*" (Cambridge University Press); D, from Porter, "*Mediaeval Architecture*" (Yale University Press); E, from Joseph Pijoan "*History of Art*" (Salvat); G, from Simpson, "*History of Architectural Development*" (Longmans, Green and Co.); O, P, from Dartein, "*Étude sur l'Architecture Lombarde*" (Dunod); Q, from Sturgis and Frothingham, "History of Architecture" (Doubleday, Doran and Co.).

BYZANTINE ART takes its name from Byzantium, the Greek city on the Bosporus of which Constantine the Great made a capital in A.D. 324. For the next 1,100 years, Constantinople was the centre of the Greek civilization that produced Byzantine art. Signs of a forthcoming revolution in plastic ideas occur before the foundation of Constantinople, such as the four porphyry emperors set in an outer wall of S. Mark's at Venice (*c.* A.D. 300), whose simple planes bring out the quality of the material with a new technique. But it is characteristic of the transitional period that these figures are still scowling, close-cropped soldiers, and it was only after Constantinople had received its name that the imperial semblance itself was composed in accordance with the new aesthetic principles. On the coins produced not only at Constantinople but by the other Greek mints, the new type may be seen in its purity, while western coins attempt the imitation of the Greek style. In portrait sculpture, enough fragments remain to show that the movement there was parallel. Religious art, meanwhile, gradually divested itself of the well-worn stock of formulae, taken over from antiquity, common in Early-Christian sarcophagi and wall paintings. It took, however, two centuries for Byzantine principles to extend to the whole field, religious art included, and even so they only triumphed completely in the Greek parts of the empire

Characteristics.—Regard for the material and stylization by simplifying outline and colour are characteristics of the Byzantine architect, sculptor, enameller and weaver. Coloured marbles are widely used; mosaics composed of glass cubes enrich wall-surfaces; translucent enamel, pearls and cabochon stones are set in simple mounts; coloured and figured silks appear in costume as well as in decoration. The Byzantine artist contrives so to choose and handle his material that it perpetually looks fresh and living, even in a modern museum.

THE EARLY PERIOD: CONSTANTINE TO JUSTINIAN

Of the surviving vestiges of the 4th and 5th centuries not all, by any means, are Byzantine, but in the 6th, the triumph of Byzantine ideas is recorded in S. Sophia at Constantinople and in numerous well-known monuments at Ravenna and elsewhere. However, the 4th century was the turning point, as is shown by a gilt bronze head, probably representing Constantius II. (A.D. 361), in the National Museum at Budapest (Pl. I., fig. 1). Here, the flat, simple planes, the expression of the face, the frontal pose, the treatment of the hair, the exaggerated eyes, the diadem and the drapery are essentially Byzantine; this bust stands quite outside the antique, and belongs to a new order which was to endure for many centuries.

Unity of Style.—Unity of style underlies surface-changes throughout the history of Byzantine art. S. Fosca at Torcello shows the application to architecture of the principles of mass-composition, analogous to those that transformed sculpture in the 4th century. A careful study shows that the wall-surface of the arcade catches the light as one solid mass broken only by the shadow of the openings. The supporting columns are smaller than the classical canon would demand and allow the wall-space behind to play its rôle. In all Byzantine building the exterior surfaces, including the roofs, are presented as simple planes. Even the arcade, which often precedes or surrounds churches, does not break up the wall-surface after the manner of a classical portico. In Byzantine buildings in Ravenna and elsewhere in Italy this is not always evident, as mouldings and other ornaments have frequently been added in comparatively recent times.

These principles of mass composition are also strikingly illustrated in interior design; for example, in S. Sophia. Just as in S. Fosca the eye is led by the sloping roof of the exterior gallery up to the gable ends which, in turn, lead up to the central roof, so in S. Sophia do the minor conches, sunk into the walls supporting the semi-domes, lead to the semi-domes and thence to the cupola. No such grouping of surfaces and spaces occurs in classical architecture. (*See* BYZANTINE AND ROMANESQUE ARCHITECTURE.)

Decoration.—The glass mosaics which decorated the upper walls and vaults of the typical Byzantine ecclesiastical interior tended more and more to become a flat surface of colour, symmetrically adorned. This tendency may be observed, in the 5th century, eliminating what remains of the classical mosaic technique; in the 6th it triumphs. Green, blue and gold dominate in the 4th and 5th centuries; white, purple and gold in the 6th. Early wall-mosaics of the 5th and 6th centuries survive at Ravenna; those in S. Vitale representing Justinian and Theodora are particularly well known; these, unfortunately, have been radically restored. The 6th century work at Parenzo has also suffered. Purer examples of the 5th century survive in Milan (S. Aquilino), and also, more abundantly, in the magnificent dome of S. George and in the Paraschevė at Salonika. The Salonika examples are precious witnesses to the quality of early Byzantine mosaic, which cannot be appreciated at Ravenna.

The floor, like all the other surfaces of a Byzantine building, is treated as part of the composition. The colour scheme of the mosaic pavement is duller than that of the surfaces above: earthy browns and yellows are enlivened by black and white, by red and green, and rarely, as at Aquileia, by a few tesserae of coloured glass. On this pavement are set the great white cubes of the bases from which rise columns of grey-green cipollino, red porphyry or dark green verde antico. The lower walls are wainscoted with slabs of similar marbles, to which are often added red cipollino and other marbles, the veins of which are disposed in symmetrical designs. Between the zone of coloured marbles and the mosaic runs a white line of imposts and capitals. Doors are plated with bronze, and enriched with scrolls in relief or with silver inlay. In such a decorative system, built up of precious materials, the painted plaster of frescoes can have no place except where the community is unable to afford anything better.

The system that came to culmination in S. Sophia may also be studied in SS. Sergius and Bacchus in Constantinople; in S. Sophia in Salonika and in S. Vitale at Ravenna. Fifth and 6th century basilicas in which the same principles are applied to a simpler scheme of construction exist in Ravenna, Grado and Parenzo; at Salonika; in Asia Minor, Syria, Palestine and North Africa.

Sculpture.—Little sculpture in the round remains from the early period. Indeed the general scheme of the Byzantine church does not require figure sculpture. The remains are chiefly fragments of imperial portraits. Plate I., fig. 5 shows a highly accomplished head in the Castello at Milan, which may represent the Empress Theodora. With the exception of a porphyry head at Venice mentioned below, this is the last Byzantine imperial portrait in the round known to us. We have some 30 pieces of 4th century imperial sculpture, of which may be mentioned: a colossal bronze head, probably of Constantius II., in the Conservatori Museum at Rome, a colossal bronze statue, perhaps of Valentinian I., at Barletta, the reliefs on the base of the obelisk of Theodosius in the Hippodrome at Constantinople, and a porphyry torso in the Archbishop's palace at Ravenna (possibly 5th century). Three female heads in chalky white marble, one in the Louvre and two in Rome, probably represent the Empress Ariadne (*c.* 500), and are inferior to the heads reproduced on Plate I. Early Byzantine religious sculpture is even rarer. A series of busts of prophets from Asia Minor, now in the Constantinople museum, show a tolerable 4th century Byzantine style, and a white marble head from Ephesus in the Vienna National Museum (Pl. I., fig. 6) is one of the very rare examples of quality. A group of sarcophagi apparently carved in Asia Minor, and taking their name from one found at Sidamara, show Byzantine characteristics in some of the later examples. Small figures representing the Good Shepherd in the Constantinople museum may also be mentioned. Egypt, then a province of the empire, has given us carved tombstones and a certain amount of decorative sculpture, which can only be dated by reference to 5th and 6th century monuments in the capital. The flat carving of the tombstones is a provincial variation of the Constantinople style. Small figures disporting themselves among the architectural ornament of doors and windows show a more local manner with a predilection for the nude treated in a rather jocose spirit. The dry soil of Egypt has also preserved early wood-carving. In wood and ivory-carving, as well as in the woollen textiles, great numbers of which survive, showing a wealth of decorative motive, this Copto-Byzantine art merges into the early Islamic art of Egypt.

Decorative Arts.—In the middle of the 6th century, the Chinese monopoly of silk-growing was broken, and silk-weaving became a Byzantine industry. The Cluny Museum possesses a typical textile of this period, showing a chariot-racer in the hippodrome. This scene, which was repeated in the other medallions, is perfectly symmetrical. The style is that of dated consular diptychs of the earlier 6th century. The spandrels, however, have a Persian look about them. Thus, at the very inception of Byzantine silk-weaving, a phenomenon, later common, appears: the choice of Sassanian subjects. To what extent the result can properly be described as Oriental is uncertain. No known textiles can be proved to be Sassanian, and few of the Sassanian monuments, such as rock-reliefs and figured silver dishes, show the balanced composition characteristic of Byzantine textiles. Such compositions do appear on the reverses of the 4th century Byzantine coins and, for instance, on the 4th century silver discs of Valentinian II. (at Geneva) and of Theodosius (at Madrid). The Cluny charioteer silk is lead-blue shot with red, the design being in tawny yellow. It has been supposed that this rather simple scheme of colour is characteristic of Constantinople, and that brighter and more varied hues mark Alexandrian manufacture. However, other textiles in which simple, sombre colours prevail have also been found in Egypt. Fragments illustrating these may be seen in most of the big museums and church treasures.

Ivory carving takes on new life in the 4th century. Panels cut out of large tusks were carved with Christian, secular and even Pagan scenes. A series of dated consular diptychs, of which the earliest is that of Probus (406) at Aosta, and none later than 541 when the consulate was abolished, assist in dating other carvings. The qualities of the material lead the ivory carver to use round contours, and perhaps for this reason, even in the 6th century, his work keeps a superficial resemblance to the antique. The most important example of this art is the throne of Maximian at Ravenna, probably made between 545 and 556. (Pl. II., fig. 5.)

In silver plate, the Byzantines allowed the metal to produce its effect in simple masses, instead of covering it with the typical Roman naturalistic ornament. Plain round, square and triangular dishes with pearl borders, and large votive discs are typical of the 4th century. For the 5th and 6th we have mostly church plate, much of it bearing religious scenes. Some of the best 6th century examples appear to have been made in Syria. The compositions on them, although symmetrical, are often dramatic, and recall paintings on Syriac manuscripts such as the Rabula Gospels at Florence (dated 586).

Few illuminated manuscripts of this period have come down to us. Two Virgils in the Vatican and one in Milan are probably of the late 4th century or of the early 5th, and have about them little that is Byzantine except a vivid scheme of colouring which Wickhoff has conveniently called impressionistic. The Rabula Gospels are not only dated but are known to have been written in Mesopotamia. Their artistic merit is small, but they help to date better examples: a codex preserved at Rossano, and the Sinope fragment in the Bibliothèque Nationale in Paris. These illuminations are as gorgeous as mosaics: the parchment is stained a deep imperial purple, the lettering is gold or silver and the other colours are intense. White is much used as in 6th century Mosaics. A Genesis in Vienna and the charred remains of the Cotton Bible in the British Museum show a style like that of the Rossano codex.

Sixth century representations of imperial personages in mosaic (S. Vitale) or sculpture, on ivory carvings and coins, display masses of heavy jewellery and ropes of enormous pearls. Examples of such jewellery exist: gold earrings with pearl, garnet or sapphire pendants, and gold and silver gilt brooches enriched with stones, paste or enamel. Votive crowns hung over the altar of S. Sophia, perhaps not unlike those preserved in the treasure at Monza and in the Cluny museum. The gold circlets are studded with sapphires, garnets, emeralds and pearls, and long pendants hang from them. The Byzantines never cut precious stones into small regular facets which, while making the jewel sparkle, detract from the colour and the quality of the stone. Very few existing examples of enamel (*q.v.*) can be dated as early as the 6th century.

THE MIDDLE PERIOD: 8TH AND 9TH CENTURIES

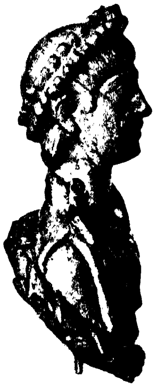
The obscure 7th century seems to be a period of transition. The coins of Justinian II. (d. 711) are designed in a new flat style.

Representations of Royalty.—From the foundation of Constantinople to the beginning of the reign of Phocas (602–610) rulers are, with very few exceptions, represented as beardless youths. In the 7th century, mature emperors are shaggy, bearded warriors. From the 8th century onwards, the reigning emperor has a carefully trimmed, pointed beard, long hair and an oval head tapering to the chin. The princes often appearing on the reverses of coins are beardless. The imperial costume is no longer classic or military, but consists of long, stiff, jewelled robes usually covered with pearls in a lozenge pattern. The type of royalty thus created pervades not only the empire but, in the course of the middle ages, all Europe. The extreme rarity of human representations in any other medium for the whole middle period makes it necessary to have recourse to coins in order to bring out this most significant change. A well-preserved silk textile in Sens Cathedral, the shroud of S. Victor, traditionally held to have been given by Willicarius (d. 769), presents a lion-tamer whose oval head, long hair and lozenged breast-piece closely resemble representations on the coins. This shroud is of a rough texture; on a background of tawny yellow the design stands out in greenish blue enlivened by gold in the lion-tamer's hair and white dots in the border. Even on textiles, human shapes are rare, but the type of animal seen on the shroud of S. Victor and on other silks, some of which are associated with the 8th century, appears on many carved slabs and on an enamelled ewer at S. Maurice d'Agaune, which, according to tradition, was a gift of Charlemagne (d. 814).

Sculpture in Relief.—The slabs found on Greek territory, in Athens, Salonika and Constantinople, are undated. A characteristic example in Salonika is reproduced on Pl. I., fig. 4. In the West, some slabs of corresponding style are dated; for instance, one at Cividale bears the name of Sicvald, Patriarch of Aquileia (762–776). The interlace, which in the East is sparsely used (*see* the shroud of S. Victor at Sens), tends in the West to crowd out animal shapes. On the Salonika slab, there is a new variety of tree ornament with simple trilobed leaves. This type of flat relief showing beasts, birds and monsters, often combined with foliage or with interlace borders and crosses, is almost the only existing sculpture of the 8th and 9th centuries. Other things must have existed, for it is recorded that Constantine V., Copronymus (reigned 741–775) had statues made of himself and his empress, as did also Philippicus (711–713) and Constantine VI. (780–797). High up on a mighty cliff in north-eastern Bulgaria there is a colossal relief of a horse and rider, a lion and a hound, accompanied by a long Greek inscription, as yet incompletely deciphered, in which occur the names of Krum, Sublime Khan of the Bulgars, of his son Omurtag and of the Byzantine emperor Nicephorus I., who was defeated and slain by Krum in 811. The manner in which this magnificent relief is placed on the face of the cliff may recall Sassanian rock-sculpture. In character it is more like the riders on the famous silk from Mozac now in the Lyons museum, which is Byzantine. This carving, probably by a Greek, is in higher relief than are the slabs mentioned above and its planes are more rounded. In the museum at Constantinople, in Top Kapu Gate in the same city, and in the Byzantine museum at Athens there are fragments of beasts in similar high relief though on a small scale. The art of the middle period is thus known principally by carved slabs and textiles.

The gold ground of the few remaining mosaics of this period in the East, such as those in the apse and bema (*q.v.*) of S. Sophia in Salonika and in the bema of S. Irene in Constantinople, is tawnier than the earlier golds. In Roman work of the early 9th century the gold is also tawny although far inferior to the Eastern.

The distaste for human representation which characterizes the middle period culminates in the official prohibition of sacred im-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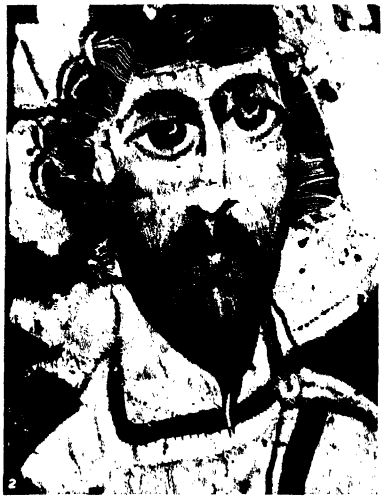
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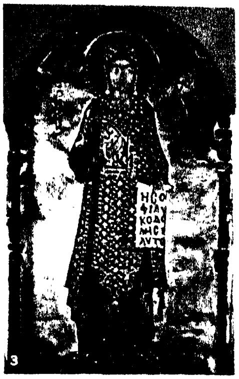
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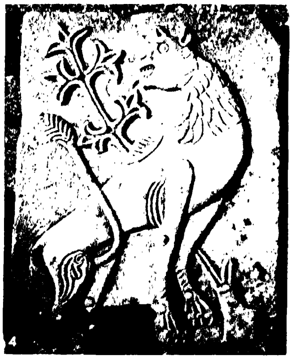
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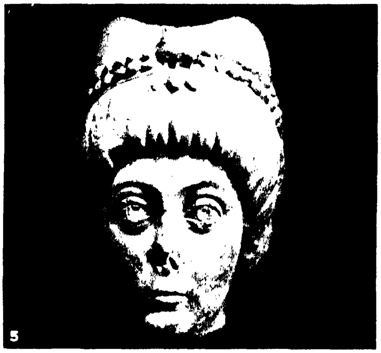
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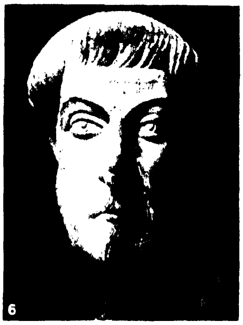
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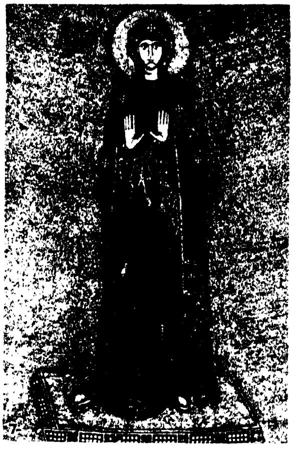
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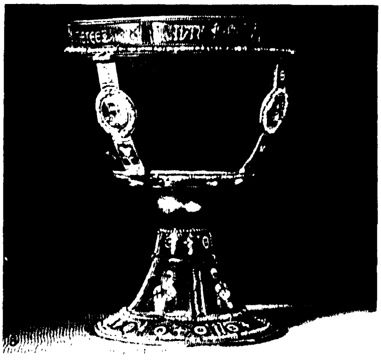
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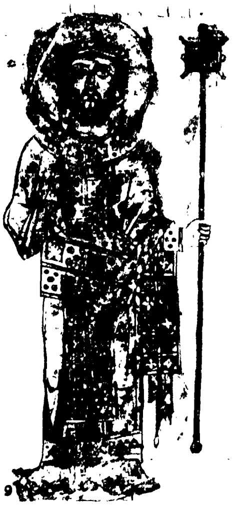
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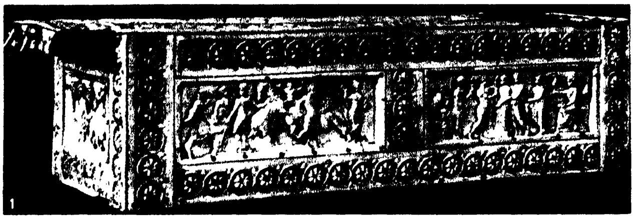
BYZANTINE SCULPTURE AND DECORATIVE ART OF THE 4TH–12TH CENTURIES

1. Gilt bronze bust, possibly of Constantine II. 4th century. 2. Head of Saint. Fragment from Byzantine tapestry, 12th century. 3. Enamelled panel, figure on gold ground. St Mark's, Venice. 4. Marble slab from Salonika showing decorative treatment of animal characteristic of Byzantine work in the 8th and 9th centuries. 5. Marble head of the 6th century Castello Sforzesco, Milan. 6. White marble head from Ephesus, 4th century. 7. 11th century apse mosaic of the Virgin Murano cathedral, Venetia. 8. Chalice of sardonyx with enamelled silvergilt mounts. 10th or 11th century. St. Mark's, Venice 9 Illumination on an 11th century Exultet roll in Bari cathedral depicting the Emperor Constantine VIII. (A.D. 1025–28)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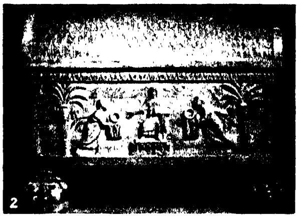
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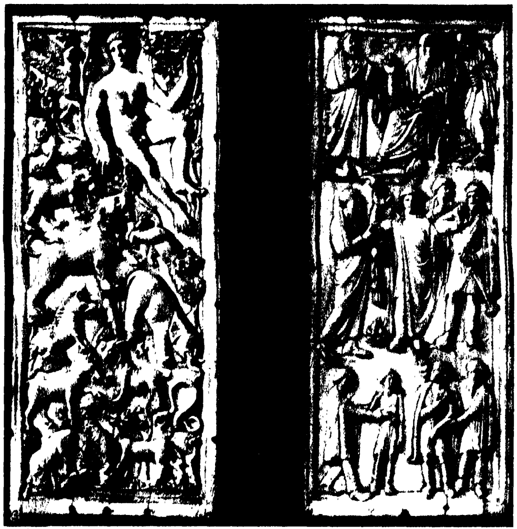
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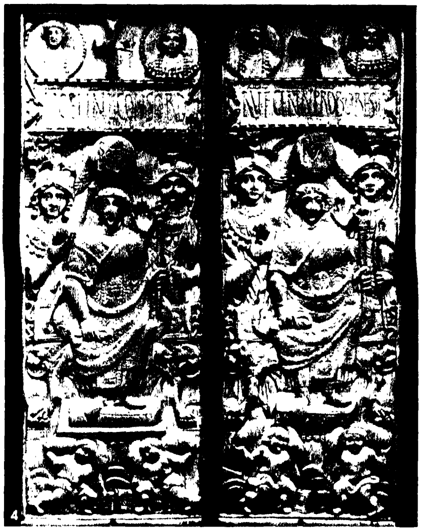
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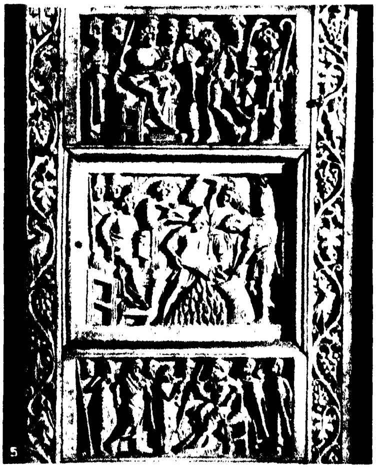
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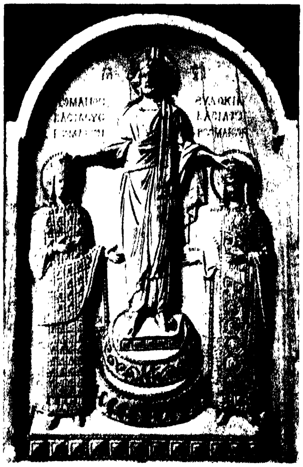

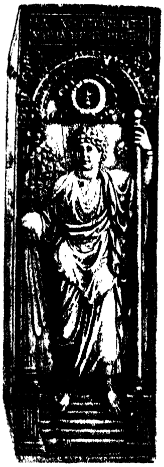
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BYZANTINE DECORATIVE ART OF THE 4TH–11TH CENTURIES

1. Carved ivory casket known as the Veroli casket. 10th–11th centuries
2. The Urn of Saint Rinaldo in the cathedral, Ravenna
3. 4th century carved ivory panels representing Adam in the Garden of Eden and St. Paul with other figures. Museo Nazionale, Florence
4. 6th century diptych of ivory with similar designs on the leaves
5. Ivory panel carved in bas-relief, from the throne of Saint Maximian (6th century) in the cathedral, Ravenna
6. Ivory panel depicting Romanus II. and his wife, Eudocia. About A.D. 945. From the Cabinet des Medailles, Paris
7. Leaf of an early ivory diptych representing the Archangel Michael

ages. From 726 to 842, with interludes, not only was the making of images a punishable offence, but existing images were destroyed or covered with whitewash. The seated Virgin in the apse of S. Sophia at Salonika is believed to have been executed in one of the pauses in the iconoclastic struggle under Irene (787–797). If this dating is correct, a decorative system, the 11th century examples of which are numerous and well known, had been mastered before the 8th was over. The semi-dome of the apse is covered with a gold ground, on which stands out alone the figure of Our Lady holding the Child. Here again, the Byzantines let simple surfaces play their reasoned part in the composition of interiors.

The Decorative Arts.—Perhaps because the supply of tusks was cut off from Constantinople by the Arab wars, very few carvings survived that can be assigned to the 8th or 9th century. A group that takes its name from the Veroli casket (Pl. II., fig. 1) in the Victoria and Albert museum, London, is by some supposed to be of this period, but more likely dates from the 10th and 11th centuries. Few painted manuscripts can be attributed to this period; these show the same style of fantastic animal decoration met with on slabs and in textiles, but in coarse, washy colours. Among the very numerous manuscripts of the Carolingian age in the West, there are in all probability types which represent imitations of Eastern originals now lost.

The origins of the cloisonné enamelling technique so much used by the later Byzantines are lost. Descriptions of the altar given by Justinian to S. Sophia appear to refer to such enamels, and a small panel at Poitiers may be the central part of a reliquary sent by Justin II. about 569 to S. Radegonde. The Beresford-Hope cross in the Victoria and Albert museum and a cross-shaped box in the Vatican have translucent enamels of brilliant colour and quality. In them the designs made by the cloisons are clumsy, and there are stylistic and iconographical reasons for assigning to them an early date, perhaps the 7th century. They are surely earlier than the highly accomplished convex enamels on the ewer of Charlemagne at S. Maurice d'Agaune, which tradition and style agree in dating somewhere about 800. In the Cámara Santa at Oviedo there is a cross with enamels not unlike those in the ewer, but perhaps earlier.

No outstanding Byzantine plate or jewellery is certainly of this period. Western treasures which contain Carolingian goldsmith's work, ivories and illuminated manuscripts in plenty preserve many Byzantine textiles and a few enamels. We know that the West could not weave silk, and was unable to produce enamels of the quality attained by Eastern artists, but it appears to have been satisfied with its own ivory carving, goldsmith's work and illumination.

THE LATER PERIODS

After the fantastic creatures and ornament of the 8th and 9th centuries, and without any transition, comes the art, at once refined and realistic, of the Macedonian revival. The old Greek taste for representation again prevails. A series of ivory carvings, manuscripts and enamels, which there is solid ground for dating, presents a small, gentle world in which every grade of the celestial and terrestrial hierarchies has its place.

Examples of the Later Style.—A suggestion of this change may be caught on one of the coins of Basil I. (867–886) and the new style is clearly seen on a few pages bound into the celebrated Gregory of Naziansus manuscript in the Bibliothèque Nationale, Paris. Here, the imperial portraits can be dated between 879 and 886. These paintings and a sketch revealed by flaking on one of the pages have delicacy and distinction. There are few datable monuments between these pages and the Romanus and Eudocia ivory panel in the Cabinet des Medailles (Pl. II., fig. 6) which has recently been shown to represent Romanus II. and his first wife, who died 949, and not Romanus IV. (1067–1071). Thus one of the few dated ivory carvings is the most beautiful of all and represents both divine and worldly persons. Many ivories are closely related to the Romanus panel in style, but few approach it in quality. The triptych, such as the Harbaville ivory in the Louvre and the Borradaile in the British Museum, makes its appearance. It is covered with figures of Our Lord, Our Lady, the apostles and other saints in a great variety of costume, imperial, military, ecclesiastical and monastic; a precisely defined hierarchy like that described in the contemporary writings of Constantine Porphyrogenitus. As may be seen in the Romanus ivory, features and limbs are delicate and in correct proportion, unlike those of the 6th century carvings, which are somewhat burly. Where there is exaggeration it is in attenuation and elongation: an almost effeminate elegance.

This style in metal-work may be seen in a gilt bronze triptych in the Victoria and Albert museum and in a beautiful bronze relief in the museum at Philippopoli in Bulgaria, as well as on an enamelled reliquary at Limburg-on-the-Lahn (probably between 948 and 959), showing a composition similar to those in the ivories. Of the few illuminated manuscripts that can be assigned to the 10th century, Grec 70 in the Bibliothèque Nationale has paintings in much the same spirit. The famous "Parisinus," Grec 139, in the same library, is characterized by pseudo-antique style. A marvellous collection of hard stone vases, glass and rock-crystal vessels, the mounts of some of them adorned with enamels (Pl. I., fig. 8) or with rich and delicate filigree tracery, a great deal of which is probably of the 10th century, exists in the treasure of St. Mark's at Venice.

No 10th century mosaics are known except the floral decoration in the Mihrab of the Mosque at Cordova, executed by Greeks imported for the purpose by Abd-er-Rahman III. (929–961). Numerous marble slabs, used in galleries, choir enclosures and even in windows and fountains out of doors, survive, mostly re-employed in later buildings in Constantinople, Athens, Salonika, Mt. Athos and Venice. Some continue the animal decoration of an earlier period, but the animals have become tame, round and gentle. Most of these slabs, however, are ornamented with interlaced strap-work and rosettes carved in a peculiar S-shaped profile. Figure sculpture is rare, but a marble roundel set in the wall of a house in the Campiello Angaran in Venice bears a relief of an emperor, about half life-size, who may be of this period. Basil I.'s famous church, the Nea, has vanished, and surviving architecture of the 9th and 10th centuries is on a humble scale. A superb porphyry head in the round on the parapet over the west porch of S. Mark's is certainly Byzantine, and very probably late 10th century. Some magnificent silk textiles, several of which are happily dated by woven inscriptions, show much the same change as that seen on the slabs. Animals, birds and monsters are still represented, but in another spirit, more often *passant* than *rampant* and their ferocity is rather that of menagerie beasts behind bars. The weaving is finer and the colours more delicate.

The art of the 11th century is richer than that of the 10th. Here again, the change comes out in a coin: the gold nomisma of Constantine VIII. (1025–28). The portrait of this monarch on the Exultet roll at Bari (Pl. I., fig. 9) shows an aggressive personage far removed from the benign and decorous court represented on the ivories discussed above. Figures are no longer small, delicately proportioned, and nicely arranged against a spacious background, but tend to spread out over the field. Heads grow too big for their bodies. There is a suggestion of high living about these fleshly shapes, to be expected in the somewhat scandalous court of Constantine VIII., his daughter Zoe and her numerous husbands. Towards the end of the century, attenuated figures again become fashionable.

Mosaics.—After 400 years for which only enough scraps of mosaics are left to show that the art did not die out, we come, in the 11th century, to a rich series. The greatest uncertainty prevails as to their chronological order. However, S. Sophia at Kiev, which still contains important mosaics, was founded in 1037 or 1038, and its decoration was probably not much later. The well-preserved cycle at S. Luke in Phocis is very near the Kiev examples in style; those at Daphni near Athens are probably later. In the Greek Islands and in Asia Minor there are less extensive remains. Greek artists also worked in Venetia and at Trieste. An instance is the praying Virgin in the apse of Murano cathedral, which is a characteristic 11th century composition, the single figure on its ground of gold peppered with red and black cubes standing in the exact axis of the church as the point of focus for the eyes of the congregation.

Church pavements, such as those of Venice and Murano, are rich, and more complicated and heterogeneous than those of the 6th century, containing, besides stone mosaic and opus sectile, re-employed marble slabs. A few low reliefs representing the praying Virgin, which doubtless once decorated the walls of churches, have recently come to light. The most beautiful of these was discovered at Salonika (Plate I., fig. 3).

The Decorative Arts.—The arts of the goldsmith and the enameller continue to flourish in the 11th century. At a period not easily determined, perhaps only in the 12th century, the designs of the cloisons become rectilinear and perfunctory. Here, as in the apses, the figure is backed by a flat gold ground. The colours are, a brilliant translucent green never equalled in Western work, a sub-translucent marine blue and opaque but rather nacreous whites, yellows and reds. The purples common in earlier work become rare.

In painted manuscripts also gold grounds occur frequently, and an elaborate head-piece in brilliant colours almost suggesting enamel is common. These head-pieces are usually found in books of the Gospels, opposite full-page portraits of the Evangelists. Psalters such as one in the British Museum dated 1066 are abundantly illuminated with small marginal paintings, some of them illustrating scenes of everyday life. Profane subjects, treated with evident enjoyment, are frequently found in other religious manuscripts, as well as in treatises on the chase and histories. Textile designs tend to grow more mechanical and conventional than in paintings. There still remain examples of the best of the rare late Byzantine examples of tapestry weaving. Ivory carving dies out: no example of the first quality can well be attributed to the later 11th or 12th centuries, but carved steatite panels come into favour.

The 12th to the 15th Centuries.—The 12th century produces no new movement of importance; it is significant that the imperial gold coinage, which had set a standard for the world since the time of Augustus, becomes corrupt as early as the reign of Michael VII. (1071–78) and never recovers. Even silver is debased, and the artistic merit of coins deteriorates. The 13th century, broken by the Latin occupation of Constantinople, is obscure and poverty-stricken. For the 14th we have the dated mosaics of Kahrié Djami at Constantinople, which mark a definite breach with the principles of Byzantine monumental decoration. Their picturesque qualities have led some to see in them Italian influence. The same may be said of numerous frescoes at Mistra and throughout the Balkans, and of the small portable mosaics, composed of cubes of solid gold and semi-precious stones, of which a few brilliant examples survive in Western museums. The only monuments left of any interest by the 15th century are a few manuscripts with imperial portraits in which velvety but coarse reds enliven mediocre drawings.

The later arts of the Orthodox countries have kept Byzantine iconography alive to the present day, but they lie outside the scope of the present article. (*See* also PERIODS OF ART.)

(H. PE., R. T.)

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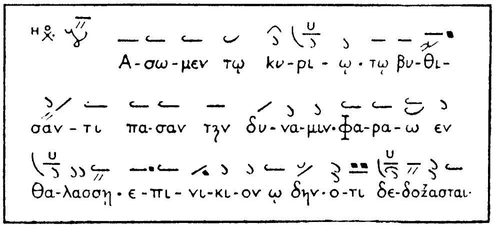
BYZANTINE MUSIC. The name Byzantine is usually given to the music of the mediaeval Greek Orthodox Church. Our knowledge of it rests partly on the writings of theorists, partly on the hymns themselves preserved in liturgical manuscripts. The earlier musical signs or neumes have survived from the 10th century A.D., but their exact interpretation is not yet possible. In the 13th century the Round or Hagiopolitan notation was invented, which can be deciphered. The signs expressed *intervals;* the initial signature showed the Mode and gave the starting-note. Byzantine music was vocal and was sung by a professional cantor or by a trained choir in unison. No instruments were used in the Greek Church; but at the Palace of the Emperors at Constantinople there were two organs in the 15th century; and they were always used to accompany the choir on state occasions.

St. John of Damascus, in the 8th century, is said to have given Byzantine musical theory a definite form. Possibly he fixed more accurately the eight mediaeval modes, which were common to the Eastern and Western churches, and exemplified them in his own compositions. It is likely that many of the simpler melodies, which have come to us in the Round notation, had been handed down with slight variations from the time when most of the hymns were written—the poet being also the composer—that is, from the 8th, 9th and 10th centuries.

We cannot say with certainty from what sources the Eastern Church derived her music before the 8th century. It is usually assumed that the prevalent Graeco-Roman type of melody formed the basis in early Christian times, with a free inclusion of Hebrew tunes, borrowed along with the Psalms and Canticles. But the other branches of the Christian church in the East, particularly the Syrian and, later, the Armenian, probably contributed something also. After the conversion of the East Slavonic races, their churches took over the Byzantine musical system.

Byzantine music had no fixed rhythm or regular division into bars or measures. The tune follows the words according to the stress accents, ignoring the ancient quantities of the vowels, and as the text is nearly always rhythmical prose (like the Psalms in both the Greek and English Bibles) the total effect is a rather lively and melodious recitative rather than a tune in the modern sense.


Α-σω-μεν τῳ κυ-ρι-ῳ·τῳ βυ-θι-
σαν-τι πα·σαν τηv δυ-να-μιν·φα-ρα-ω εν
θα-λασσῃ·ε-πι-νι-κι-ον ῳ δην·ο-τι δε-δοξασται·

GREEK HYMN WITH MUSIC IN THE ROUND SYSTEM OF NOTATION

As no instruments were used in the Greek Church, Byzantine music was entirely vocal. It had no fixed rhythm or regular division into measures

The Modes are numbered in a different order from the Gregorian, which they otherwise resemble, and exhibit several by-forms. The classification as Authentic and Plagal had more theoretical than practical value. The normal types require the following initial and final notes. Authentic—Mode I., a or d; Mode II., b or g, Finalis e; Mode III., c′ or a, Finalis f; Mode IV., theoretically d′, but usually g. Plagal—Mode I., d; Mode II., Pl., e; Mode III., Pl. (also called Barys or Grave Mode) f, rarely low B-flat; Mode IV., Pl. g. All these seem to have used the diatonic vocal scale with Just Intonation.

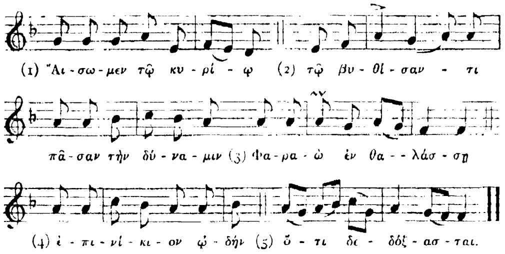
In the 15th century Byzantine music becomes more ornate and florid, while the notation adopts many subsidiary signs, as guides to execution and expression. Some of these had already been invented by the famous singer John Cucuzeles about 1300; and this ornate notation is often called Cucuzelian. In the 16th and early 17th centuries the art declined; and the notation was only known to a few precentors. A revival took place about 1670, the work of a school of composers, whose centre was the Patriarchal church at Constantinople. These musicians were accustomed to Oriental music, and some of them composed Turkish songs. Consequently, though the notation does not differ greatly from the 15th century, the spirit of the music is decidedly Eastern; and the Turkish scales, with their irrational intervals, were probably employed, at any rate in new compositions.

This Graeco-Oriental school lasted until 1821, when Chrysanthus, an Archimandrite, introduced a simplified notation, also consisting of interval-signs, in which the music could be printed. Although Chrysanthus had studied Western theory, he accepted the Oriental scales and invented symbols to describe them. His principles seem to have been too complicated for general use; and complete uniformity of rendering was not secured. The Chrysanthine notation is still in use; and the traditional manner of singing, often painfully nasal, with a drone or holding-note kept by one or two voices, may be heard in most of the smaller Greek churches and monasteries.

It is a common mistake to believe that this modern system is the same as mediaeval Byzantine music. Since 1870 some of the larger city Churches have introduced four-part unaccompanied singing, perhaps under Russian influence. But more recently there has been a set-back in favour of the Chrysanthine usage.

Example of a mediaeval Byzantine hymn (about 1400 A.D.), viz.:—

First Ode of a Canon from ms. No. 1165, at Trinity College, Cambridge. Mode III. Plagal (Barys or Grave) from f, Finalis f.


(1) Ἄι-σω-μεν τῷ κυ-ρί-ῳ (2) τῷ βυ-θί-σαν-τι
πᾶ-σαν τὴν δύ-να-μιν (3) Φα-ρα-ὼ ἐν θα--λάσ-σῃ
(4) ἐ-πι-νί-κι-ον ᾠ-δὴν (5) ὅ-τι δε-δόξ-ασ-ται.

Translation. "Let us sing unto the Lord, who sank all the might of Pharaoh in the sea, a song of victory, for He hath triumphed gloriously."

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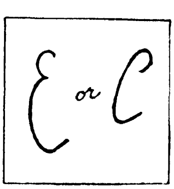
BYZANTIUM, a Greek city on the shores of the Bosporus, occupying the most easterly of the seven hills of modern Constantinople. It was founded by Megarians and Argives under Byzas about 657 B.C., but destroyed in the reign of Darius Hystaspes by the satrap Otanes; it was recolonized by the Spartan Pausanias (479 B.C.). Its situation was remarkable for beauty and security. It controlled the Euxine grain trade; the depth of its harbour rendered its quays accessible to vessels of large burden; while the fisheries were so lucrative that the curved inlet near which it stood became known as the Golden Horn. The population was partly Lacedaemonian and partly Athenian; it was thus a subject of dispute between these States, and was alternately in the possession of each, till it fell into the hands of the Macedonians. About seven years after its second colonization, the Athenian Cimon wrested it from the Lacedaemonians; but in 440 B.C. it returned to its former allegiance. Alcibiades, after a severe blockade (408 B.C.), gained possession of the city through the treachery of the Athenian party; in 405 B.C. it was retaken by Lysander and placed under a Spartan harmost. It was under the Lacedaemonians when the Ten Thousand, exasperated by the conduct of the governor, made themselves masters of the city, and would have pillaged it but for the eloquence of Xenophon. In 390 B.C. Thrasybulus expelled the Lacedaemonian oligarchy, and restored democracy and the Athenian influence.

Byzantium joined with Rhodes, Chios, Cos, and Mausolus, king of Caria, in throwing off the yoke of Athens, but sought Athenian assistance when Philip of Macedon advanced against it. The Athenians under Chares suffered a severe defeat from Amyntas, the Macedonian admiral, but in the following year gained a decisive victory under Phocion and compelled Philip to raise the siege. The deliverance of the besieged from a surprise, by means of a flash of light which revealed the advancing Macedonian army, has rendered this siege memorable. As a memorial of the miraculous interference, the Byzantines erected an altar to Torch-bearing Hecate, and stamped a crescent on their coins, a device which is retained by the Turks to this day.

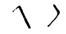
During the reign of Alexander, Byzantium was compelled to acknowledge the Macedonian supremacy; after the decay of the Macedonian power it regained its independence, but suffered from the incursions of the Scythians. The losses which they sustained by land roused the Byzantines to indemnify themselves from the vessels which crowded the harbour, and the merchantmen which cleared the straits; but this had the effect of provoking a war with the neighbouring naval Powers. The exchequer being drained to buy off the Gauls about 279 B.C., and by the imposition of an annual tribute of 80 talents, they were compelled to exact a toll on all the ships which passed the Bosporus—a measure which the Rhodians avenged by a war wherein the Byzantines were defeated.

During the first years of its alliance with Rome, Byzantium held the rank of a free confederate city; but, having sought arbitration on some of its domestic disputes, it was subjected to the imperial jurisdiction, and gradually stripped of its privileges. The Emperor Claudius remitted the heavy tribute which had been imposed on it; but the last remnant of its independence was taken away by Vespasian, who taunted the inhabitants with having "forgotten to be free." The city was besieged and taken (A.D. 196) by Severus, who destroyed it, demolished the famous wall, and put the principal inhabitants to the sword. This overthrow of Byzantium was a great loss to the empire, since it might have served as a protection against the Goths, who afterwards sailed past it into the Mediterranean. Severus afterwards relented, and, rebuilding a large portion of the town, gave it the name of Augusta Antonina. It had scarcely begun to recover its former position when, through the capricious resentment of Gallienus, the inhabitants were once more put to the sword and the town was pillaged. From this disaster the inhabitants recovered so far as to be able to give an effectual check to an invasion of the Goths in the reign of Claudius II., and the fortifications were strengthened during the civil wars which followed the abdication of Diocletian. Diocletian had resolved to transfer his capital to Nicomedia; but Constantine, struck with the advantages which the situation of Byzantium presented, resolved to build a new city there on the site of the old and transfer the seat of government to it (A.D. 330). (*See* Constantinople.)

C THE third letter of the alphabet, corresponds to Semitic 𐤂 *gimel*, and Greek Γ. *gamma*. Greek forms were Γ, Γ, Λ, ⟨. From the last derived the round form C, which occurs at Corinth and in the Chalcidic alphabet. Both ⟨ and C are found in the early Latin alphabet, as well as in Etruscan. The rounded form survived and became general, and the shape of the letter has since altered but little. In certain mediaeval forms of writing the minuscule letter tended to become pointed, *e.g.*, c. Roman cursive forms are shown in the illustration to the right.



The sound represented by the letter in Semitic and in Greek was the voiced velar stop, represented in English by the "hard" *g*. In the Latin alphabet it came to represent the unvoiced velar stop, and was for some time, it appears, used for both the voiced and unvoiced sounds. This change must in all probability be due to Etruscan influence, for the voiced stops apparently did not exist in the Etruscan language, with the result that the third letter of the alphabet, as taken over by the Etruscans in Asia Minor from a source which was also that of the Greek alphabet, was used for the corresponding unvoiced sound. An early Latin inscription exists in which the word RECEI occurs, the letter being still employed to represent the voiced sound. Finally a new symbol G was used for the voiced sound, and C displaced K as the representative of the unvoiced stop.

NAME OF FORM	APPROXIMATE DATE	FORM OF LETTER
PHOENICIAN	BC 1,200	
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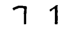
THERAEAN	700-600	
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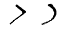
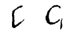
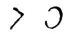
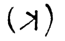
ATTIC	600	
CORINTHIAN	600	
CHALCIDIAN	600	
IONIC	400	
ROMAN COLONIAL	PRE-CLASSICAL AND CLASSICAL TIMES	
URBAN ROMAN		
FALISCAN		
OSCAN		
UMBRIAN		
CLASSICAL LATIN AND ONWARDS		

DEVELOPMENT OF THE LETTER C FROM ITS EARLIEST TO ITS PRESENT FORM

In modern English the letter represents two separate sounds: (1) the unvoiced velar stop as in the Latin alphabet, and (2) the unvoiced sibilant, identical with the sound represented by *s* in certain positions. The letter represents the sibilant when preceding either of the front vowels, *e* and *i* (*e.g.*, in *receive, cider*); in all other cases (except before *h*) the velar (*e.g., call, come, clear, crumb, epic*). This is due to the palatalization of the velar in early mediaeval times before the front vowel, the stages of sound-change being *k*>*ki̯*>*tš*>*ts*>*s*. The letter *c* was applied by French orthographists in the 12th century to represent the sound *ts* in English, and this sound developed into the simpler sibilant *s*. Gradually the use of the letter *c* to represent the velar before front vowels (for example, in the Middle English *cyng*) gave way to that of *k*, ambiguity being thus as far as possible avoided. *C* takes the place of *s* in words such as *mice, advice*, in which *s* would represent a *voiced* sibilant (identical with the sound of *z*), and in words such as *practice* merely as a means of grammatical distinction.

Before *k* the letter is often redundant (*e.g.*, in *thick, clock*, etc.). The combination *ch* represents a double unvoiced palatal (*tš*), as in *church*.

In music, C is the name of the third note of the musical alphabet, this note being at the same time one which has always occupied a peculiarly distinctive position, in that it is the keynote of what used to be called, from the fact that it contains no accidentals, the "natural scale." Thus on the pianoforte it consists entirely of white notes and hence has come to be regarded as the simplest and most fundamental of all keys. C is further one of the three notes (F and G being the others) which have served for centuries, in conjunction with the appropriate signs, to indicate the clefs. (*See* CLEF.)

CAB. A colloquial abbreviation of the French *cabriolet*, originally a passenger-vehicle drawn by two or four horses. It was introduced into London from Paris in 1820. London not only turned "cabriolet" into "cab" (a word which became officially enshrined in an act of Parliament, the London Cab act of 1896) but further invented for it the terms "four-wheeler" and "growler." The fashionable horse-cab, however, was the "hansom," a one-horsed form, with two big wheels, of very uncertain equilibrium and dangerous character, in which the driver was perched in a dicky placed high up at the back of the vehicle and took his instructions through a small trap-door in the roof. It was difficult to enter a hansom without soiling one's clothes. As originally invented by J. A. Hansom in 1834, however, it was a comparatively safe vehicle, with the driver placed at the side. Horse-cabs quickly became obsolete in great cities with the appearance of the taxicab, a licensed motor vehicle fitted with a taximeter. Cabs plying publicly for hire are in all countries subject to local licensing laws and official fare determinations which are constantly under review. (*See* TAXIMETER.)

CABAL, a private organization or party engaged in secret intrigues, and applied also to the intrigues themselves (through the Fr. *cabale,* from the Cabbala or Kabbalah, the theosophical interpretation of the Hebrew scriptures). In England the word had been jealously used throughout the 17th century, with the alternative junto or cabinet (*q.v.*), to describe any secret and extralegal council of the king, more particularly the foreign committee of the Privy Council. The invidious meaning attached to the term was stereotyped by the coincidence that the initial letters of the names of Charles II's ministers, Clifford, Arlington, Buckingham, Ashley and Lauderdale, spelled cabal.

CABALETTA, a musical term which is really a modified form of *cavatinetta* (It.), and therefore means strictly a small cavatina (*q.v.*), but in practice it has come to be applied to the quick concluding section or final phrases of a vocal number.

CABALLERO, FERNÁN (1796–1877), the pseudonym adopted by the Spanish novelist Cecilia Francisca Josefa Böhl de Faber. Born at Morges in Switzerland, she was the daughter of Johan Nikolas Böhl von Faber, a Hamburg merchant, known to the students of Spanish literature as the editor of the *Floresta de rimas antiguas castellanas* (1821–25), and the *Teatro español anterior á Lope de Vega* (1832). Educated principally at Hamburg, she visited Spain in 1815, married and settled there, and in 1849 became famous as the author of *La Gaviota.* She had already published in German an anonymous romance, *Sola* (1840), and curiously enough the original draft of *La Gaviota* was written in French. This novel was translated into most European languages, and, though it scarcely seems to deserve the intense enthusiasm which it excited, it is the best of its author's works, with the possible exception of *La Familia de Alvareda* (which was written, first of all, in German). Less successful attempts are *Lady Virginia* and *Clemencia;* but the short stories entitled *Cuadros de Costumbres* (1862) are interesting in matter and form, and *Una en otra* and *Elia ó la España treinta años ha* are excellent specimens of picturesque narration. It would be difficult to maintain that Fernán Caballero was a great literary artist, but it is certain that she was a born teller of stories and that she has a graceful style very suitable to her purpose. She came into Spain at a most happy moment, before the new order had perceptibly disturbed the old, and she brought to bear not alone a fine natural gift of observation, but a freshness of vision, undulled by long familiarity. She combined the advantages of being both a foreigner and a native. In later publications she insisted too emphatically upon the moral lesson, and lost much of her primitive simplicity and charm; but though she occasionally idealized circumstances, she was conscientious in choosing for her themes subjects which had occurred in her own experience. Hence she may be regarded as a pioneer in the realistic field, and this historical fact adds to her positive importance.

See M. A. Morel-Fatio, *Études sur l'Espagne* (1904), iii, pp. 279–370. (J.F.-K.)

CABANATUAN, a municipality (with administrative centre and 18 *barrios* or districts) and capital of the province of Nueva Ecija, Luzon, Philippine Islands; and one of the chief commercial centres of the province. Pop. (1939) 46,626, of whom 23,719 were males and 8 were whites. It has rail transportation by the Manila-Dagupan line, water transportation by the Pampanga river, and automobile roads connect it with other towns. Of the population between the ages of 6 and 19, 40.6% were reported as attending school, and of those ten years old and over, 64.4% were reported as literates. The population almost trebled after 1918. Pampango is the leading vernacular.

CABANEL, ALEXANDRE (1823–1889), French painter, was born at Montpellier on Sept. 28, 1823, and died in Paris on Jan. 23, 1889. He studied under Picot, and gained the Prix de Rome in 1845. As director of the École des Beaux-Arts under Napoleon III he exercised some influence. His subject pictures were enormously popular in their day—an example is the "Birth of Venus" in the Luxembourg—but he is now remembered only for some of his portraits.

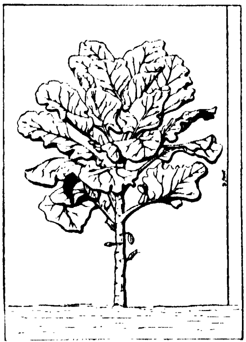
CABARRUS, FRANÇOIS (1752–1810), French-Spanish financier, was born at Bayonne in 1752 and died at Seville on April 27, 1810. He settled in Madrid as a soap manufacturer and presently became one of the financial advisers of Charles III. He devoted his considerable financial talents to the organization of a bank, to the formation of a company to trade with the Philippine Islands and to a reformation of the currency and taxation. But these financial measures were hindered by the death of Charles III in 1788. There was no place in the reactionary government of Charles IV for the group of reformers. Cabarrus spent two years in prison on a charge of embezzlement. He was presently restored to some degree of favour and was nominated Spanish ambassador to Paris, but the directory raised objection to his appointment on the grounds of his French birth. Cabarrus took no part in the intrigues by which Charles IV was compelled to abdicate and his son deprived of the succession in favour of Joseph Bonaparte, but he became minister of finance under Joseph's government and held that post until his death. His daughter, Thérèse, became well known as Madame Tallien, afterward princess of Chimay.

CABASILAS, NICOLAUS (d. 1371), Byzantine mystic and theologian. In 1355 he succeeded his uncle Nilus Cabasilas, like himself, a determined opponent of the union of the Greek and Latin churches, as archbishop of Thessalonica. In the Hesychast controversy he took the side of the monks of Athos but refused to agree to the theory of the uncreated light. His chief work is his Περὶ τῆς ἐν Χριστῷ ζωῆς (*ed.pr.* of the Greek text with copious introduction, by W. Gass, 1849; new ed. by M. Heinze, 1899), in which he declares that union with Christ is effected by three great mysteries of baptism, confirmation and the eucharist. He also wrote homilies on various subjects and a speech against usurers, printed in Migne, *Patrol. Graeca.*

See C. Krumbacher, *Geschichte der byzantinischen Literatur* (1897), and Herzog-Hauck, *Realencyklopädie.*

CABATUAN, a municipality (with administrative centre and 47 *barrios* or districts) of the province of Iloilo, Panay, Philippine Islands, on a branch of the Suague river, 15 mi. N. of Iloilo, the capital, and a short distance from the railway. Pop. (1939) 21,054, of whom 10,236 were males, and 4 were whites. The fertile countryside produces palay (rice), maize (corn), tobacco, sugar, coffee and various tropical fruits. Of those inhabitants aged 6 to 19, inclusive, 40.4% were reported as attending school, and of those 10 years old and over, 56.2% were reported as literates. The vernacular is a dialect of Bisayan. (C. S. L.)

CABBAGE, a biennial table vegetable and fodder plant whose various forms are said to have been developed by long cultivation from the wild or sea cabbage (*Brassica oleracea*) found near the sea coast of various parts of England and continental Europe. The cultivated varieties, however, have departed widely from the original type, and they present marked and striking dissimilarities among themselves. The wild cabbage is a comparatively insignificant plant, growing 1 to 2 ft. high, in appearance similar to charlock (*Sinapis alba*) but having smooth leaves. The wild plant has fleshy, shining, waved and lobed leaves (the uppermost being undivided but toothed), large yellow flowers, elongated seed pod, and seeds with conduplicate cotyledons. Notwithstanding the fact that the cultivated forms differ in habit so widely, the flower, seed pods and seeds present no appreciable difference.

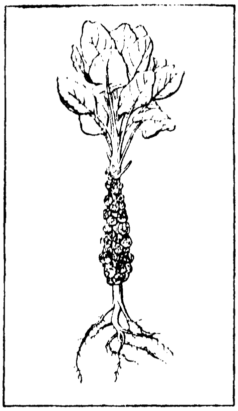


FROM ROBBINS, "BOTANY OF CROP PLANTS"

FIG. 1.—KALE (BRASSICA OLERACEA ACEPHALA), SHOWING THE BRANCHED AND LEAFY STEM RESEMBLING WILD CABBAGE

John Lindley proposed the following classification for the various forms: (1) All the leaf buds active and open, as in wild cabbage and kale or greens; (2) all the leaf buds active, but forming heads, as in Brussels sprouts; (3) terminal leaf bud alone active, forming a head, as in common cabbage, savoys, etc.; (4) terminal leaf bud alone active and open, with most of the flowers abortive and succulent, as in cauliflower and heading broccoli; (5) all the leaf buds active and open, with most of the flowers abortive and succulent, as in sprouting broccoli. The last variety bears the same relation to heading broccoli as Brussels sprouts do to the common cabbage. Of all these forms there are numerous gardeners' varieties including cabbage varieties resistant to the disease known as yellows.

Under Lindley's first class, common or Scotch kale or borecole (*Brassica oleracea*, form *acephala*), includes several varieties which are among the hardiest of our esculents, and yield winter greens. They should be sown early, so as to be well established and hardened before winter. The plants send up a stout central stem, growing upright to a height of about 2 ft., with close-set, large, thick leaves, plain or curled. In Great Britain and Europe the lower leaves are stripped off as the plants grow up, and used for the preparation of broth of "Scotch kale," a dish at one time in great repute in northeastern Scotland. In the United States the entire plant is harvested before the stem elongates. A remarkable variety of open-leaved cabbage is cultivated for stock feed in the Channel Islands under the name of the Jersey or branching cabbage. It commonly grows to a height of 8 ft., but it has been known to attain double that height. It throws out branches from the central stem, which are firm and woody. A hardy, broad-leaved variant of this form, called collards, is grown extensively as a fall and winter garden crop in the southern United States. Several varieties of kale are cultivated as ornamental plants on account of their beautifully coloured, frizzed and laciniated leaves.



FROM ROBBINS, "BOTANY OF CROP PLANTS"

FIG 2.—BRUSSELS SPROUTS (BRASSICA OLERACEA GEMMIFERA), SHOWING MODIFICATION OF LEAVES FROM WILD CABBAGE TYPE

Brussels sprouts (*Brassica oleracea*, form *gemmifera*) are miniature cabbageheads, about an inch in diameter, which form in the axils of the leaves along the much elongated stem.

The third class is chiefly represented by the common or drumhead cabbages (*Brassica oleracea*, form *capitata*), the varieties of which are distinguished by size, form and colour. It is eaten raw, boiled or is converted into *Sauerkraut* by packing a mixture of finely sliced cabbage and salt into a wooden or earthen container. An acid fermentation sets in, which after a few weeks is complete, when the vessel is tightly covered over and the product kept for later use. The savoy (*B. oleracea*, form *subanda*) is a hardy green variety, characterized by its wrinkled leaves.

Cabbages contain a very small percentage of nitrogenous compounds as compared with most other articles of food. Their food value apart from their salt and vitamin content is therefore small.

The red cabbage (*Brassica oleracea*, form *capitata rubra*), of which the Dutch red is the most commonly grown in Great Britain, is much used for pickling. In the United States Mammoth Rock Red is a common red variety.

Cauliflower, the chief representative of class four, consists of the inflorescence of the plant modified to form a compact succulent white mass or head. The cauliflower (*Brassica oleracea*, form *botrytis cauliflora*) is said to have been introduced from Cyprus. It is one of the most delicately flavoured of vegetables, the dense cluster formed by its incipient succulent flower buds being the edible portion.

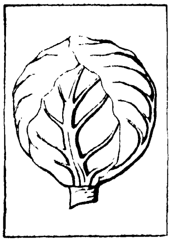
Heading broccoli (*Brassica oleracea*, form *botrytis*) is merely a kind of cauliflower, differing in the form and colour of its inflorescence, its hardiness and rate of development.

Sprouting broccoli, the representative of the fifth class, consists of the main axis and flowering sprouts springing from the axils of the leaves. The purple-leaved variety is very hardy and much-esteemed. (*See* BROCCOLI.)

Kohl-rabi (*Brassica oleracea*, form *gongylodes* or *caulorapa*) is a peculiar form in which the stem, just above the ground, swells into a fleshy turniplike mass. It is much cultivated in certain districts as a food for stock, for which purpose the drumhead cabbage and the thousand-headed kale are also largely used. Kohl-rabi is exceedingly hardy, withstanding both severe frosts and drought. It is not much grown in English or American gardens.

Cabbage and its related forms are cool season crops adapted to winter culture in the warmer parts of the temperate zones, and to summer culture in the middle and northerly parts. They all do best on rich, sandy loam to loamy soils, well supplied with moisture. Small cabbage plants, kale, collards and kohlrabi endure hard freezing without injury. Long periods of cold weather generally induce flowering upon the return of mild temperatures. Premature flowering, when heads or other edible parts are desired, is sometimes the cause of serious crop loss.

Both for commercial culture and home gardens, common cabbage is much the most important form of this species, followed by cauliflower (and heading broccoli), then kale and sprouting broccoli. From 1935 to 1941 in the United States alone about 1,000,000 tons of cabbage were grown annually for shipment fresh, or storage, and about 180,000 tons for making kraut. During the same period about 15,700 tons of cauliflower and heading broccoli were grown. (V. R. B.)

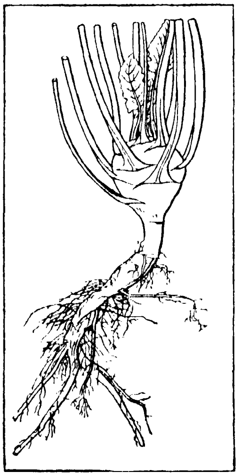


FROM ROBBINS, "BOTANY OF CROP PLANTS"

FIG. 3.—COMMON HEAD CABBAGE KNOWN AS BALL HEAD

CABBAGE MAGGOT, the common name of *Hylemya brassicae*, of the family Muscidae, of the order Diptera (*q.v.*). Also known as the radish maggot when it attacks radishes. The eggs are laid singly on the ground close to the base of newly set cabbage, cauliflower and related plants, and the young larvae feed on the roots, often killing the plants. Plants set out very early escape serious damage, but late set plants may be almost wholly destroyed. A special disk of stiff paper surrounding each plant prevents egg laying. The larvae eat the rootlets and also mine in the main root of radishes. Modern control on all plants consists of treatment with a solution of corrosive sublimate. Other members of the same genus have similar habits and are often injurious to field and garden crops.

(*See* ENTOMOLOGY: ECONOMIC.)

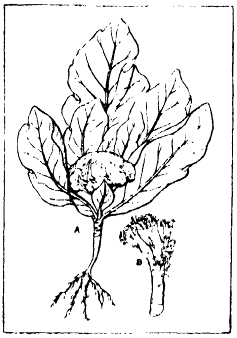


FROM ROBBINS, "BOTANY OF CROP PLANTS"

FIG. 4.—KOHL-RABI (BRASSICA OLERACEA CAULORAPA), SHOWING TURNIPLIKE STEM WHICH STANDS MOSTLY ABOVE THE GROUND

CABEIRI, an important group of deities, perhaps of Phrygian origin, worshipped over a large part of Asia Minor, on the islands near by, particularly Lemnos and Samothrace, and in Macedonia and northern and central Greece, especially Boeotia.(*κάβειροι*, in Boeotian *κάβιροι* is commonly identified with Phoen. *Qabirim*, "mighty ones." *cf.* their common Gr. and Lat. appellation "great gods"; but this is seriously doubted by several scholars, who take it to be an Anatolian word of unknown meaning). They were underworld powers of fertility, perhaps originally indefinite in number; in classical times there appear to have been two male deities, Axiocersus and his son and attendant Cadmilus or Casmilus, and a less important female pair, Axierus and Axiocersa (meaning of names unknown). These were variously identified by the Greeks with gods of their own pantheon (Hephaestus, Dionysus, Demeter and Kore, the Dioscuri, etc.). The cult included worship of the power of fertility, symbolized by the male organ of generation; there were also, as usual in mysteries such as these were, rites of purification, which seem ultimately at least to have included insistence on moral purity; also initiation, presumably into the favour and intimacy of the gods. An obscure legend preserved by ecclesiastical writers says that there were three male Cabeiri, of whom two killed and beheaded the third.

They are often called the Samothracian gods, from the fame of their cult at Samothrace. There, as early as the 5th century B.C., their mysteries attracted great attention, and initiation was looked upon as a general safeguard against all misfortune, particularly against shipwreck. But it was in the period after the death of Alexander the Great that their cult reached its height, and initiation was sought, not only by large numbers of pilgrims, but by persons of distinction. The island possessed the right of asylum or sanctuary, for which purpose it was used by Arsinoë, wife and sister of Ptolemy Ceraunus, who, to show her gratitude, afterwards caused a monument to be erected there, the ruins of which were explored in 1874 by an Austrian archaeological expedition. In 1888 interesting details as to the Boeotian cult of the Cabeiri were obtained by the excavations of their temple in the neighbourhood of Thebes, conducted by the German archaeological institute. The two male deities worshipped were Cabeirus and a boy (probably Axiocersus and Cadmilus). The Cabeirus resembles Dionysus. The Cabeiri were held in even greater esteem by the Romans, who, claiming Trojan descent, identified them with the *Penates publici* (*see* PENATES).



FROM ROBBINS, "BOTANY OF CROP PLANTS"

FIG. 5.—CAULIFLOWER (BRASSICA OLERACEA BOTRYTIS)

A. The entire plant

B. A portion of the "head" consisting of the fleshy stalks of inflorescence with small flowers and buds (enlarged)

See Preller-Robert, i. p. 847 ff.; W. H. Roscher, *Lexikon der Mythologie* (*s.v.*) "Megalio Theoi"; F. Lenormant in Daremberg and Saglio, *Dictionnaire des Antiquités;* O. Kern in Pauly-Wissowa, *s.v.* "Kabeiros und Kabeiroi."

CABELL, JAMES BRANCH (1879–), American author, was born at Richmond (Va.), April 14 1879. He was instructor in French and Greek at William and Mary College in 1896–97, graduating with the degree of B.A. in 1898. He began newspaper work at Richmond and was on the staff of the *New York Herald* in 1899–1901. He later engaged in coal mining in West Virginia, contributed short stories to magazines, and interested himself in genealogical and historical research. His work has a distinct individuality, presenting a central conception of human life fitted chiefly to an imaginary mediaeval country, Poictesme, in which the principal actions take place, its inhabitants being ancestors of the other characters in his novels.

His various volumes fit into what he called the "Biography" in approximately the following order: *Beyond Life* (1919); *Figures of Earth* (1921); *The Silver Stallion* (1926); *Domnei* (1920); revised edition of *The Soul of Melicent* (1913); *Chivalry* (1909); *Jurgen* (1919); *The Line of Love* (1905); *The High Place* (1923) *Gallantry* (1907); *The Certain Hour* (1916); *The Cords of Vanity* (1909); *From the Hidden Way* (1916), verse; *The Rivet in Grandfather's Neck* (1915); *The Eagle's Shadow* (1904); *The Cream of the Jest* (1917); *Straws and Prayer-Books* (1924); *Something About Eve* (1929); and *The Way of Ecben* (1929). An ironic romancer whose professed object was "to write perfectly of beautiful happenings," Cabell had to wait for the suppression of *Jurgen* to win him a wide reputation, although he early secured a small, devoted following.

See Carl Van Doren, *James Branch Cabell* (1925), and Guy Holt, *A Bibliography of the Writings of James Branch Cabell* (1924), which contains valuable references.

CABER TOSSING, a Scottish athletic game which consists in throwing a section of a trunk of a tree, called the "caber" (Gaelic *cabar*, a pole or beam), in such a manner that it shall turn over in the air and fall on the ground with its small end pointing in the direction directly opposite to the "tosser." Tossing the caber is usually considered to be a distinctly Scottish sport, although "casting the bar," an exercise evidently similar in character, was popular in England in the 16th century but afterwards died out. The caber is the heavy trunk of a tree from 16 to 20 ft long. It is often brought upon the field heavier than can be thrown and then cut to suit the contestants, although sometimes cabers of different sizes are kept, each contestant taking his choice. The toss is made after a run, the caber being set up perpendicularly with the heavy end up by assistants on the spot indicated by the tosser, who sets one foot against it, grasps it with both hands, and, as soon as he feels it properly balanced, gives the word to the assistants to let go their hold. He then raises the caber and gets both hands underneath the lower end. "A practised hand, having freed the caber from the ground, and got his hands underneath the end, raises it till the lower end is nearly on a level with his elbows, then advances for several yards, gradually increasing his speed till he is sometimes at a smart run before he gives the toss. Just before doing this he allows the caber to leave his shoulder, and as the heavy top end begins to fall forward, he throws the end he has in his hands upwards with all his strength, and, if successful, after the heavy end strikes the ground the small end continues its upward motion till perpendicular, when it falls forward, and the caber lies in a straight line with the tosser" (W. M. Smith). The winner is he who tosses with the best and easiest style, according to old Highland traditions, and whose caber falls straightest in a direct line from him. The champion caber tossers of Scotland were E. W. Currie and Wm. Perrie and Dr. C. Ross; their performances included tosses of 40 to 42 ft., made during 1880–95. In America a style called the Scottish-American prevails at Caledonian games. In this the object is distance alone, the same caber being used by all contestants and the toss being measured from the tosser's foot to the spot where the small end strikes the ground. This style is repudiated in Scotland. Donald Dinnie, born in 1837 and still a champion in 1890, was the best tosser of modern times.

Caber tossing is usually held annually under the auspices of the New York Caledonian Club and included in the programme of track and field sports, although the game is not as popular in America as it used to be. James Cumming, born in Scotland, is the record-holder in America.

See W. M. Smith, *Athletics and Athletic Sports in Scotland* (1891).

CABET, ETIENNE (1788–1856), French Socialist, was born at Dijon in 1788, the son of a cooper. He practised at the bar in Dijon until 1820, and then settled in Paris, where he became director of the "Vente Suprême," the local association of Carbonari. After the revolution of 1830, he was made procureur-général in Corsica; but was dismissed for an attack on the Government in his *Histoire de la révolution de 1830*. Elected for Dijon to the chamber of deputies, he was prosecuted for his bitter criticism of the Government, and went into exile in England in 1834, where he became an ardent disciple of Robert Owen. On the amnesty of 1839 he returned to France, and wrote his *Histoire de la Révolution française* (1840), and published his *Voyage en Icarie* (1840), which he had written in London after reading the *Utopia* of Sir Thomas More. The *Voyage en Icarie* contains his theories on progressive taxation, on compulsion to work, old age pensions, and the division of the products of industry. Like Owen, he sought to realize his ideas in practice. By negotiations in England favoured by Owen, he bought a tract of land on the Red river, Texas, and drew up a scheme for the intended colony, community of property being the distinctive principle of the society. In 1848 an expedition of 1,500 "Icarians" sailed to America; but unexpected difficulties arose and the complaints of the disenchanted settlers soon reached Europe. Cabet went out in 1849, but on his arrival, finding that the Mormons had been expelled from their city Nauvoo, in Illinois, he transferred his settlement there. With the exception of a journey to France, where he returned to defend himself successfully before the tribunals he remained at Nauvoo, the dictator of his little society. After a time dissensions arose and Cabet, with some 200 of the community left Nauvoo to form a new settlement. He died at

St. Louis (Mo.), on Nov. 8, 1856. He placed his Socialism on a religious basis, and wrote a book entitled *Le vrai christianisme de Jésus Christ* (1846).

See Nordhoff, *Communistic Societies of the United States* (1875); Félix Bonnaud, *Cabet et son œuvre, appel à tous les socialistes* (1900); J. Prudhommeaux, *Icaria and its Founder, Etienne Cabet* (1907).

CABIN, originally a small, roughly built hut or shelter; the term is particularly applied to the cottages of the Negroes of the southern states of the United States of America, or of the poverty-stricken peasantry of Ireland or the crofter districts of Scotland. In a special sense it is used of the small rooms or compartments on board a vessel used for sleeping, eating or other accommodation.

CABINDA: *see* ANGOLA.

CABINET, THE. The word "cabinet," like most British constitutional terms, is of foreign extraction, and originally signified a small room (compare the 18th century use of the word "closet"). Hence cabinet counsel came to mean secret counsel and cabinet council the body of persons that gave such counsel. Thus Bacon, in a famous passage, discussing the disadvantages of large councils, writes that "the doctrine of Italy and practice of France, in some kings' times, hath introduced cabinet councils, a remedy worse than the disease, . . . that is . . . councils of gracious persons recommended chiefly by flattery and affection."

Organically, the cabinet derived from the Privy Council. Even in Tudor times, owing to the large number of counsellors and to facilitate the subdivision of labour, there were appointed many standing and temporary *ad hoc* committees of the council; and the practice was continued under the Stuarts. James I., it is true, preferred the advice of individual favourites, and the same may be said of Charles I. at the beginning of his reign. But, after the murder of Buckingham, one of these committees, usually called the foreign committee, gradually developed outstanding importance. On it sat the king's most intimate advisers and debated the most serious affairs of State, as well domestic as foreign, decisions being frequently taken in this committee before the subject of the decision had even been broached before the Privy Council, the functions of which were thus to a large extent usurped. Contemporary opinion strongly disapproved of such procedure; the Grand Remonstrance, presented to the king on Dec. 1, 1641, refers to the grievance in clause 59, and the Commons returned to the charge more explicitly in an address of Feb. 1642. "Reproachfully" and "enviously," to use Clarendon's expressions, such committees were called "junctos," "cabals" or "cabinet councils."

The Committee for Foreign Affairs.—At the Restoration, under the auspices of Clarendon, who had survived the deluge, the practice was revived with "that secret committee with the chancellor, which under the notion of foreign affairs, was appointed by the king to consult all his affairs before they came to public debate." On Clarendon's fall, the precedent was followed by a standing committee of the Privy Council, called the committee for foreign affairs, which committee, owing to the coincidence of the initial letters of the names of some of the members (Clifford, Ashley, Buckingham, Arlington and Lauderdale), has passed into history as *the* Cabal, and, even under Danby, although opposition forced the king to greater circumspection, similar caballing in committee unofficially went on.

The position then up to 1679, when, owing to the revelations of Titus Oates and the consequent triumph of the country party, Charles was obliged to submit to conciliar reform, was as follows. There existed, first, a privy council of some 47 members, among whom the highest officials formed the effective nucleus; secondly, many standing and temporary *ad hoc* committees of the Privy Council, limited in membership, on all of which committees the greatest officials sat *ex officio* (from time to time certain other individuals were by royal favour appointed to all committees); and, thirdly, a committee for foreign affairs, sometimes, but not always, a properly constituted formal standing committee of council, variously termed by contemporaries a cabal, juncto or cabinet, and mainly, though not exclusively, composed of persons holding high political office, on which committee domestic, as well as foreign, affairs were debated and settled, formal decision only—and sometimes not even that—being left to the Privy Council.

The Committee of Intelligence.—It was the object of what is usually known as Temple's scheme to reduce the size of the Privy Council and to include in its membership representatives of every shade of parliamentary opinion. The new council thus contained enemies, as well as friends, of the king, as did also its committees, the most important of which was "a Committee of Intelligence for the opening and considering all Advices as well foreign as domestic." Here, at last, was an official committee of council, legally empowered to undertake all those labours (except the short-circuiting of the Privy Council) hitherto extra-legally performed by the foreign committee. Since, however, it was composed of enemies as well as friends, Charles, in spite of recent promises to cease caballing, began at once to consult informally in his cabinet with those members of the committee who were of the court party, occasionally summoning to such discussions other individual friends, who were not members of the committee at all. There were thus a formal committee of intelligence, composed of friends and enemies, and an informal cabinet, composed of the friendly members of the committee reinforced by a friend or two from without. It was not long before the Opposition representatives on council and committees came to realize that their membership was a farce, since Charles did not take them into his confidence. Gradually they forbore attendance. By Feb. 1681 they had ceased to attend. The vacancies thus occasioned on the committee of intelligence left room for the inclusion of those members of the cabinet who had not hitherto been members of the committee. On the other hand, with the defection of the opposition members of the Privy Council, Temple's scheme might be said to have broken down. If the experiment had failed, if the Privy Council had reverted to its former constitution, what authority for its continued existence had the committee of intelligence, which owed its origin to that experiment? This doubt may account for the fact that, with the disappearance of the country party members from the council, the committee of intelligence ceases to call itself by that name, ceases in fact to exist, and is replaced, or rather continued, under the older and more familiar title of "the committee for foreign affairs." A year or so later, dropping all prefix and suffix, it becomes known simply as "the committee," partly, no doubt, because, being by far the most important committee of council, it ran no danger of confusion with the others, and partly, perhaps, because all the other committees of the Privy Council were at this time in process of being opened up to all members of the council, and *the* committee was thus the only one to retain limited membership.

Routine.—The routine of "committee" and "cabinet" survived the Catholic caballing of James II. and the idiosyncrasies of William III., who understood ministers but not ministries, to become under Anne the accepted, if still unpopular, machinery of executive government. The committee, meeting as often as necessary throughout the week in the office of the senior secretary of State at the Cockpit in Whitehall, deliberated upon all business of government and prepared it for the sovereign. Once a week (unless emergency dictated an extra meeting), the lords of the committee attended the sovereign in her cabinet, where the business prepared in committee would be brought to the royal notice and final decisions would be taken. By this time, only formal business would be transacted at meetings of the Privy Council, discussion and debate there being prohibited, although it might still be a wise precaution, in view of the possibility of later enquiries, for ministers to bring their most controversial measures before the board for formal ratification. As long as the sovereign continued to attend the meetings of the cabinet, the system of separate meetings of the committee at the Cockpit and of the cabinet in the royal palace possessed certain obvious advantages. But when George I., who had no English, from 1717 onwards ceased to attend, those advantages disappeared. Less and less frequently in the succeeding years did the lords of the committee come to the palace to wait upon a king who never turned up. Their business, whether preparative or decisive, could now equally well be dealt with at the Cockpit. Nor was there any longer need for two titles whereby to describe what was now one and the same body. The designation, "the committee," is dropped. It is as "the cabinet," since that had been the title of the decisive body, that the executive is in future known; and, gradually, as its presiding officer, to take the place of an absentee sovereign, there evolves a prime minister.

Personnel.—Even in the early 17th century, before the foreign committee had begun to usurp the functions of the Privy Council, the main work of the latter was done by a small number of the most important officials, who alone were constant in their attendance. These included the archbishop of Canterbury, the lord chancellor, the lord treasurer, the lord president (when there was one), the lord privy seal, the two secretaries, and a number of household officials (all the royal ministers were, of course, originally household servants), of whom the most important were the lord steward and the lord chamberlain. These again formed the nucleus of the committees of council, and, although it would not be true to say that the foreign committee normally contained these officials, or indeed the majority of them, yet it is a fact that, in proportion as the foreign committee and its descendants developed into the recognized executive of the nation, so did it tend to be composed more and more exclusively of the greatest political officials, for the simple reason that their collaboration, and their collaboration alone, was necessary to the conduct of government. When the cabinet and committee system emerges towards the close of Charles II.'s reign, these bodies possess only from six to seven members; in William III.'s reign there are sometimes nine; under Anne, ten or 12. Now we cannot call even a dozen an excessive total for the great officers of State or for the proper conduct of business. But later, under the Hanoverians, there was a constant tendency, difficult to check, towards an increase of membership by the inclusion of individuals, either (1) holding offices which, although of no great political weight, had occasionally, in the past, carried cabinet rank, or (2) possessing great political connections and borough interests which it might be necessary to placate, or (3) personally dear to the sovereign. Thus by 1740 the cabinet had from 16 to 17 members, by 1745 20, and in 1761, when the high water mark of 21 was reached, we read that cabinet councillor is "a rank that will soon become indistinct from that of privy councillor by growing as numerous."

"The Inner Cabinet."—Not unnaturally the more "efficient" members had begun to concert business privately. As long as the sovereign continued to preside at cabinet meetings, such informal gatherings, of course, would not be tolerated, nor indeed for a decade after his abstention did the cabinet swell to such a size as would necessitate or justify such a proceeding. It is during Walpole's long administration that the practice originates and develops into a regular habit. From 1727 to 1729 we hear of "select lords who are usually consulted in foreign affairs"; by 1738 this reference of foreign negotiations to a select few has become "the usual practice." From 1735 we begin to hear of "private meetings at Sir Robert Walpole's." All this is informal. But from 1739–1741, as a result of war, of the absence of the king abroad and of the greater need in consequence both of secrecy and of formality of communication with the sovereign, there emerges a recognized group of five officials, the first lord of the Treasury (who was also chancellor of the exchequer), the lord chancellor, the lord president and the two secretaries of State, virtually in sole charge of affairs. This group deals with the most important business of every kind. It meets frequently, as occasion demands. It keeps minutes. It communicates directly with the sovereign and not via the cabinet. It meets at Walpole's house, whereas the cabinet sits at Whitehall. Its membership is definitely approved by the king, and the responsibility of members of this inner ring is recognized as greater than that of other cabinet ministers. But it could not actually supplant the cabinet, until it had expanded to include all the really efficient members of the cabinet. This was effected in the course of the next quarter of a century. In 1752 the first lord of the admiralty was added to the inner group, in 1755 the lord privy seal, and in 1766 the chancellor of the exchequer, an office that since the Treasury had been put into commission, had usually been held by the first lord of the Treasury, was admitted on an independent footing. By that date the entire cabinet was only summoned on formal occasions for the transaction of formal business; by 1775 it had become "a nominal cabinet"; and by 1783, when the younger Pitt formed his administration, it had to all intents and purposes ceased to exist.

Until the middle of the 19th century, the small, efficient cabinet suffered practically no greater increase in membership than can be accounted for by the creation of additional secretaries of State. From then on, however, the total rose rapidly. In 1867 it stood at 16; in 1900 at 20; during the World War it reached 23; and since then all efforts to keep it below a score have failed. This increase is due, not, as in the 18th century, to the accretion of "inefficient" members, but to the creation of new and important governmental departments, each with a responsible ministerial chief, to administrate the ever-swelling bulk of social legislation. The concentration of the control of policy into the hands of a small, inner group—a proposal advocated by many as the best solution to the problem of an overgrown executive—is not, therefore, so easy a matter as it was two centuries ago. Nevertheless, something of the sort did develop during the war, although again in contradistinction to the inner cabinet of the 18th century the war cabinet was at times composed, not of the greatest office-holders, but on the contrary to a large extent of ministers without portfolio, deliberately so chosen, in order that, free from departmental duties, they might devote the whole of their time to general policy. After the World War there were further rumours of an informal inner ring of ministers, and one writer on the subject (Carthill, *Rods and Axes*, 1928) declares that: "A practice has sprung up of constituting an inner cabinet within the cabinet. This is not a true managing committee, nor is it a true regulator; it is an informal council of close political friends of the premier, and its existence is not formally recognized."

Principles of Cabinet Government.—Functionally, the cabinet may be described as a committee of privy councillors, with seats in parliament, united by political principle and professing unanimity in public, under the leadership of the acknowledged head of the party commanding a majority in the House of Commons, by whom, with the sovereign's assent, they have been appointed to the control of the principal government departments, to act through him as the sovereign's sole advisers, and to be severally and jointly responsible to the sovereign, the prime minister, parliament and the people, for their individual and collective actions, so long as they are supported by a majority of the House of Commons. The principles of cabinet government set forth in this definition have achieved recognition as the result of nearly three centuries of ministerial and party conflict. There is, of course, no law compelling ministers to be members of parliament. On the contrary, for two centuries, through fear, at first of the influence of the Crown, and later of ministerial corruption, repeated efforts were made to exclude all placemen from the House of Commons. It was only when with the carriage of "economical" reform by the Rockingham administration of 1782 and with the passage of the Reform bill of 1832 the dangers of a bought majority had been removed, that the advantages of the presence of the executive in the legislature were fully understood. During the 18th century, the majority of cabinet ministers were peers; in the 19th and 20th centuries, commoners; but each of the chief departments has usually a ministerial representative *in either* house. That ministers should be united by political principle was a doctrine first, and prematurely, enforced on his cabinet by Walpole. Later, it was enunciated as the official Whig doctrine, in opposition to the personal government of George III. and Chatham's dogma of "men not measures," by Burke in his "*Thoughts on the Causes of the Present Discontents*" (1770), and, with the fall of personal government, may be said to have triumphed, although even to this day coalition governments occasionally violate the principle. Unanimity in public is an obvious corollary. The principle is summed up in Lord Melbourne's dictum "I don't care what we say, but we'd better all say the same thing." Since then independent action, contrary to the policy of the Government, has always been followed by the resignation of the individual concerned, for instance Lord Palmerston's congratulation of Napoleon III. on the *coup d'état* of 1851 and E. Montagu's publication of a protest of the Indian Government against the treaty with Turkey in 1922.

The principles governing the relations between the cabinet and its chief belong to the story of the evolution of the office of prime minister (*q.v.*), that the latter should be the head of the party commanding a majority in the lower house is the natural outcome of the Reform bills of the 19th century, although, even to this day, if there are more than two parties in existence, none of which commands an absolute majority, it is possible for the head of a minority to be in power, *e.g.*, J. Ramsay MacDonald and the Labour Government of 1924. The sovereign's assent to ministerial appointments made by the prime minister is the residue of the former unfettered powers of the council to appoint what ministers it pleased; but the statement that members of the cabinet are in control of the principal government departments needs some qualification. In the 18th century there were several instances of cabinet ministers without portfolio (Pulteney in 1742, Hardwicke in 1757, Conway in 1770 and Camden in 1798); during the World War, at one period, of a war cabinet of seven, four ministers held no departmental office; and, among the offices which habitually carry cabinet rank, there are several, as, for instance, the lord president and the lord privy seal, which nowadays involve no departmental duties. The doctrine that the king should be advised solely by his ministers was slow in achieving recognition. It may properly be said to have done so during the younger Pitt's administration (1783–1801). As regards the minor household posts, the controversy revived for a moment with the Bedchamber Question of 1839, but was finally settled with the queen's surrender on Peel's assumption of office in 1841.

The cabinet it has been said, is responsible to the sovereign, to the prime minister, to parliament and to the people; but the nature of the responsibility varies in each case. The sovereign must be kept fully informed, his advice taken and his consent obtained. Between Crown and cabinet the prime minister ordinarily acts as intermediary, but it is always possible for the sovereign to reprimand a minister who has failed in respect or duty, as did Queen Victoria in her famous memorandum to Lord Palmerston in 1850. The responsibility of the cabinet to the prime minister is twofold: collective, in that, when he resigns the whole cabinet follows suit, a practice first (without prearrangement) adopted on the dismissal of the Pelhams in 1746, though not finally established till much later, and individual in that the prime minister appoints each member of the cabinet to his post and can at any time demand his resignation. As regards parliament, the responsibility is in the main collective, since the individual action of each is usually covered by the collective responsibility of all. "Each minister acts in his own department as the recognized agent of his colleagues in that particular department, subject, however, to enquiry and control by the whole body." And, if an individual minister takes publicly an independent line, either contrary to, or without consulting the general opinion of his colleagues, it is usual, as has been shown above, for the prime minister to demand his resignation. But there have been cases when such individual or improper action, having been passed over by the prime minister, has been taken notice of by parliament in such a way, however, as not to involve the resignation of the cabinet. Thus in 1855 Lord John Russell resigned when Bulwer Lytton gave notice of a motion of censure on "the minister charged with negotiations at Vienna," and in 1865 Lord Westbury was forced to resign as a result of a motion of censure carefully worded so as to confine responsibility to the chancellor alone. Lastly, in speaking of the responsibility of the cabinet to the people, we mean something more than the continuous modification of policy by public opinion, something more than the increasing tendency of ministers in their parliamentary utterances to address the nation at large at least as much as their immediate hearers. The responsibility is greater and more direct than that, and is best illustrated by the practice, which in the last 100 years has become common, of dissolving parliament instead of resigning, on defeat, thus appealing from parliament to the people, and by that other practice now generally followed of accepting the verdict of the electorate as final and resigning on defeat at the polls. (F. L. B.)

Twentieth Century Developments.—In July 1914 the cabinet system proved unequal to the demands imposed upon it by the diplomatic strain that led up to the declaration of war. In 1916 it had completely broken down. One of the salient char-

Presidents	Secretaries of State	^*	Secretaries of War	^*	Secretaries of the Treasury	^*	Secretaries of the Navy	^*	Attorneys-General	^*
Washington	John Jay*		Henry Knox	1789	Alexander Hamilton	1789			Edmund Randolph	1789
,,	Thomas Jefferson	1789	Timothy Pickering	1795	Oliver Wolcott, Jr.	1795			William Bradford	1794
,,	Edmund Randolph	1794	James McHenry	1796					Charles Lee	1795
,,	Timothy Pickering	1795								
Adams	,,	1797	,,	1797	,,	1797	Benjamin Stoddert	1798	,,	1797
,,	John Marshall	1800	Samuel Dexter	1800	Samuel Dexter	1801				
Jefferson	James Madison	1801	Henry Dearborn	1801	,,	1801	,,	1801	Levi Lincoln	1801
,,					Albert Gallatin	1801	Robert Smith	1802	John Breckinridge	1805
,,									Caesar A Rodney	1807
Madison	Robert Smith	1809	William Eustis	1809	,,	1809	Paul Hamilton	1809	,,	1809
,,	James Monroe	1811	John Armstrong	1813	George W. Campbell	1814	William Jones	1813	William Pinkney	1811
,,			James Monroe	1814	Alexander J. Dallas	1814	B W. Crowninshield	1814	Richard Rush	1814
,,			William H Crawford	1815	William H Crawford	1816				
Monroe	John Quincy Adams	1817	Geo. Graham (*ad in*)	1817	,,	1817	,,	1817	,,	1817
,,			John C. Calhoun	1817			Smith Thompson	1818	William Wirt	1817
,,							Samuel L. Southard	1823		
J Q Adams	Henry Clay	1825	James Barbour	1825	Richard Rush	1825	,,	1825	,,	1825
,,			Peter B. Porter	1828						
Jackson	Martin Van Buren	1829	John H Eaton	1829	Samuel D. Ingham	1829	John Branch	1829	John McP. Berrien	1829
,,	Edward Livingston	1831	Lewis Cass	1831	Louis McLane	1831	Levi Woodbury	1831	Roger B. Taney	1831
,,	Louis McLane	1833	Benjamin F. Butler	1837	William J Duane	1833	Mahlon Dickerson	1834	Benjamin F. Butler	1833
,,	John Forsyth	1834			Roger B. Taney	1833				
,,					Levi Woodbury	1834				
Van Buren	,,	1837	Joel R Poinsett	1837	,,	1837	,,	1837	,,	1837
,,							James K. Paulding	1838	Felix Grundy	1838
,,									Henry D. Gilpin	1840
Harrison	Daniel Webster	1841	John Bell	1841	Thomas Ewing	1841	George E. Badger	1841	John J Crittenden	1841
Tyler	,,	1841	John C. Spencer	1841	,,	1841	,,	1841	,,	1841
,,	Hugh S. Legaré	1843	James M Porter	1843	Walter Forward	1841	Abel P. Upshur	1841	Hugh S. Legaré	1841
,,	Abel P. Upshur	1843	William Wilkins	1844	John C. Spencer	1843	David Henshaw	1843	John Nelson	1843
,,	John C Calhoun	1844			George M Bibb	1844	Thomas W Gilmer	1844		
,,							John Y. Mason	1844		
Polk	James Buchanan	1845	William L. Marcy	1845	Robert J. Walker	1845	George Bancroft	1845	John Y. Mason	1845
,,							John Y. Mason	1846	Nathan Clifford	1846
,,									Isaac Toucey	1848
Taylor	John M. Clayton	1849	George W. Crawford	1849	William M. Meredith	1849	William B. Preston	1849	Reverdy Johnson	1849
Fillmore	Daniel Webster	1850	Charles M. Conrad	1850	Thomas Corwin	1850	William A. Graham	1850	John J. Crittenden	1850
,,	Edward Everett	1852					John P. Kennedy	1852		
Pierce	William L. Marcy	1853	Jefferson Davis	1853	James Guthrie	1853	James C. Dobbin	1853	Caleb Cushing	1853

*John Jay was Secretary for Foreign Affairs under the Confederation, and continued to act, at the President's request, until Jefferson returned from Europe March 21, 1790.

^* = Date appointed.

acteristics of cabinet government was the secrecy of its discussions. The privacy of its meetings had been rigidly observed. No secretary was present, no minutes of proceedings were kept. On rare occasions a document called a "minute of the cabinet" was drawn up, the names of the ministers approving or disapproving were attached, and the record was placed in the archives of the sovereign. The prime minister was in the habit of writing to the sovereign after the cabinet meetings a short precis of its decisions, in the form of a confidential letter. Many of these letters are preserved in the royal archives, but they are not used for purposes of reference. Recent biographies and published correspondence of ministers show that important cabinet decisions were sometimes not acted upon through misunderstanding or forgetfulness.

So archaic was the system, so unsatisfactory its results, that in Aug. 1914 H. H. Asquith instituted a change in cabinet procedure. Some years before the war he had been provided with a secretariat for the purposes of the committee of imperial defence, over which as prime minister he presided. The services of this secretariat he adapted to the use of the prime minister himself and his cabinet in 1914. Up to that time the prime minister had not possessed a departmental staff, and no "office," other than a few private secretaries. Downing street contained no records. The evolution of the secretariat of the committee of imperial defence into the secretariat of the cabinet was, under the stress of the World War, natural and easy. When in 1916 D. Lloyd George became prime minister and superposed upon the cabinet of 23 the war cabinet of four or five, the cabinet secretariat was strengthened. By gradual processes inevitably arising out of the immense business accumulating in the hands of the head of the cabinet, owing to the closer relations with the dominions, by the ramifications of imperial defence which, as the war showed, affect every department of State, and by the growth of centralized Government, the institution of a "cabinet office" or prime minister's department was found to be and has remained an essential condition of directing the business of the nation.

From its inception until his resignation in July 1938, Sir Maurice Hankey was the head of the cabinet office and also of the defence committee secretariat. Suggestions have been made that the functions should be separated, but so far the opinion of those best qualified to judge is that the service to the prime minister would be less efficiently rendered if the present plan of one permanent civil servant in control of both secretariats were changed.

Since 1916, records of cabinet proceedings have been preserved. They are the property of the sovereign, their secrecy is safeguarded by the privy councillor's oath, and they are under the constitutional guardianship of the ministry for the time being. No public use can be made of them except by leave of the sovereign acting on the advice of the prime minister.

In normal times the tendency had been for the numbers of cabinet ministers to increase, until in 1914 there were 23 holders of cabinet office. In times of national difficulty and peril when legislative and departmental questions are subordinate to rapid decisions and executive action, the tendency has been to restrict the cabinet to the smallest possible number. It is impossible to predict the future of cabinet government, but those who have studied with care the tendencies of popular government in England incline to the view that the authority of the prime minister is more likely to be enhanced than shared by his cabinet colleagues. It does not seem probable that any serious attempt will be made to revert to the methods of conducting cabinet business which prevailed before 1916.

The cabinet meetings are held in Sir Robert Walpole's house, 10 Downing street, which he bequeathed to the nation, and which prime ministers continue to occupy to this day. For tables of the cabinets and ministers of the English Crown, *see* MINISTRY.

(E.)

UNITED STATES

In the United States the president's cabinet is composed of the heads of the ten co-ordinate executive departments But this is a matter of custom rather than of law, for the cabinet, as a collective body, has no legal existence or power. The Constitution contains no provision for a cabinet and makes only incidental reference to heads of departments, from whom the president may ask opinions. Neither did Congress, in creating the first three departments in 1789, recognize in any way the possibility of a cabinet council composed of the department heads. In fact, as the Constitution would seem to indicate, the Senate was then regarded as the real executive council on account of its powers to ratify

Postmasters-General	$\hat{*}$	Secretaries of the Interior	$\hat{*}$	Secretaries of Agriculture	Secretaries of Commerce and Labor	Secretaries of Commerce	Secretaries of Labor
Samuel Osgood	1789						
Timothy Pickering	1791						
Joseph Habersham	1795						
"	1797						
"	1801						
Gideon Granger	1801						
"	1809						
Return J. Meigs, Jr.	1814						
"	1817						
John McLean	1823						
"	1825						
William T. Barry	1829						
Amos Kendall	1835						
"	1837						
John M. Niles	1840						
Francis Granger	1841						
"	1841						
Charles A. Wickliffe	1841						
Cave Johnson	1845						
Jacob Collamer	1849	Thomas Ewing	1849				
Nathan K. Hall	1850	T. M. T. McKennan	1850				
Samuel D. Hubbard	1852	Alex. H. H. Stuart	1850				
James Campbell	1853	Robert McClelland	1853				

$\hat{*}$=Date appointed.

Presidents	Secretaries of State	↕	Secretaries of War	↕	Secretaries of the Treasury	↕	Secretaries of the Navy	↕	Attorneys-General	
Buchanan	Lewis Cass	1857	John B Floyd	1857	Howell Cobb	1857	Isaac Toucey	1857	Jeremiah S. Black	1857
„	Jeremiah S Black	1860	Joseph Holt	1861	Phillip F Thomas	1860			Edwin M Stanton	1860
„					John A Dix	1861				
Lincoln	William H Seward	1861	Simon Cameron	1861	Salmon P. Chase	1861	Gideon Welles	1861	Edward Bates	1861
„			Edwin M Stanton	1862	William P Fessenden	1864			James Speed	1864
„					Hugh McCulloch	1865				
Johnson	„	1865	U.S. Grant (*ad in*)	1867	„	1865	„	1865	„	1865
„			John M. Schofield	1868					Henry Stanbery	1866
„									William M. Evarts	1868
Grant	Elihu B. Washburne	1869	John A Rawlins	1869	George S Boutwell	1869	Adolph E Borie	1869	Ebenezer R Hoar	1869
„	Hamilton Fish	1869	William T Sherman	1869	Wm A Richardson	1873	George M. Robeson	1869	Amos T. Akerman	1870
„			William W Belknap	1869	Benjamin H Bristow	1874			George H. Williams	1871
„			Alphonso Taft	1876	Lot M Morrill	1876			Edwards Pierrepont	1875
„			James Don Cameron	1876					Alphonso Taft	1876
Hayes	William M Evarts	1877	George W. McCrary	1877	John Sherman	1877	R W. Thompson	1877	Charles Devens	1877
„			Alexander Ramsey	1879			Nathan Goff, Jr.	1881		
Garfield	James G Blaine	1881	Robert T. Lincoln	1881	William Windom	1881	William H Hunt	1881	Wayne MacVeagh	1881
Arthur	„	1881	„	1881	„	1881	„	1881	„	1881
„	F T. Frelinghuysen	1881			Charles J Folger	1881	William E. Chandler	1882	Ben H. Brewster	1881
„					Walter Q Gresham	1884				
„					Hugh McCulloch	1884				
Cleveland	Thomas F Bayard	1885	William C Endicott	1885	Daniel Manning	1885	William C. Whitney	1885	Augustus H. Garland	1885
„					Charles S Fairchild	1887				
B Harrison	James G Blaine	1889	Redfield Proctor	1889	William Windom	1889	Benjamin F. Tracy	1889	William H. H Miller	1889
„	John W Foster	1892	Stephen B Elkins	1891	Charles Foster	1891				
Cleveland	Walter Q Gresham	1893	Daniel S Lamont	1893	John G Carlisle	1893	Hilary A. Herbert	1893	Richard Olney	1893
„	Richard Olney	1895							Judson Harmon	1895
McKinley	John Sherman	1897	Russell A Alger	1897	Lyman J Gage	1897	John D. Long	1897	Joseph McKenna	1897
„	William R Day	1898	Elihu Root	1899					John W. Griggs	1898
„	John Hay	1898							Philander C. Knox	1901
Roosevelt	„	1901	„	1901	„	1901	„	1901	„	1901
„	Elihu Root	1905	William H Taft	1904	Leslie M Shaw	1902	William H Moody	1902	William H Moody	1904
„	Robert Bacon	1909	Luke E. Wright	1908	George B Cortelyou	1907	Paul Morton	1904	Charles J Bonaparte	1906
„							Charles J. Bonaparte	1905		
„							Victor H Metcalf	1906		
„							T H. Newberry	1908		
Taft	Philander C Knox	1909	Jacob M Dickinson	1909	Franklin MacVeagh	1909	George von L. Meyer	1909	Geo W. Wickersham	1909
„			Henry L. Stimson	1911						
Wilson	William J Bryan	1913	Lindley K Garrison	1913	William G McAdoo	1913	Josephus Daniels	1913	J C. McReynolds	1913
„	Robert Lansing	1915	Newton D. Baker	1916	Carter Glass	1919			Thomas W. Gregory	1914
„	Bainbridge Colby	1920			David F Houston	1920			A. M. Palmer	1919
Harding	Charles E Hughes	1921	John W. Weeks	1921	Andrew W. Mellon	1921	Edwin Denby	1921	H. M. Daugherty	1921
„										
„										
Coolidge	„	1923	„	1923	„	1923	„	1923	„	1923
„	Frank B Kellogg	1925	Dwight F. Davis	1925			Curtis D. Wilbur	1924	Harlan F Stone	1924
„									John G Sargent	1925
Hoover	Henry L. Stimson	1929	James W Good	1929	„	1929	Charles F Adams	1929	William D. Mitchell	1929
„			Patrick J Hurley	1929	Ogden L Mills	1932				
Roosevelt	Cordell Hull	1933	George H Dern	1933	Wm H Woodin	1933	Claude A Swanson	1933	Homer S. Cummings	1933
„			Harry H Woodring	1936	Henry Morgenthau, Jr.	1934	Charles Edison	1940	Frank Murphy	1939
„	E R Stettinius, Jr	1944	Henry L. Stimson	1940			Frank Knox	1940	Robert H Jackson	1940
„							James V Forrestal	1944	Francis Biddle	1941
Truman	James F Byrnes	1945	Robert P Patterson	1945	Frederick M Vinson	1945	„	1945	Thomas C Clark	1945
					John W Snyder	1946				

↕ Date appointed

treaties and confirm appointments.

Whatever may have been the views of the framers of the constitution and of congress, a cabinet, based on usage alone, early became a recognized part of the executive policy. Washington regarded the heads of the three executive departments and the attorney general, who was not made the head of a department until later, as his confidential advisers, though the term cabinet was not immediately applied to them. He also exercised his constitutional power of requiring opinions from the chief executive officials, and took them into his confidence in all important matters of state. By this gradual process, he welded the department heads into an executive council, and by 1793 the term cabinet was generally applied to this group of presidential advisers. Gradually, as the administrative duties increased with the expanding nation, new executive departments were created by congress and their heads became cabinet members. The three departments—state, treasury and war—were established by the first session of congress. The offices of attorney-general and postmaster-general, which were also created in 1789, did not rank as regular departments until 1870 and 1874, respectively, but the attorney-general, from the beginning, was considered a member of the cabinet and, upon the invitation of President Jackson, the postmaster-general became a member in 1829. Other department heads became members of the cabinet as follows: the navy, in 1798, the interior, in 1849, agriculture, in 1889, commerce and labor, in 1903; however, the latter department was divided in 1913 into two separate departments, that of commerce and that of labor, with separate heads.

As Prof. Munro points out in his book *The Government of the United States*, there is nothing done with the cabinet's consent which could not be done without its approval if the president should so decide. Yet it now meets regularly at stated times (usually once each week) fixed by the president. The meetings are not public, and no record is kept of transactions. Discussion is confined to whatever the president may see fit to lay before it, usually matters of importance relative to the general policy of the administration or any important piece of legislation desired by the president or by a cabinet member, and about to be submitted to congress. Cabinet members receive $15,000 per annum for their services. (*See* GOVERNMENT DEPARTMENTS.)

While the cabinet officers' nominations, usually the personal selection of the president, must be confirmed by the senate, as a matter of practice, confirmation is given promptly and without objections. Department heads are appointed for the term of the administration; however, the president may dismiss any member at pleasure. In reality, dismissals are rare but individual resignations, due to the lack of harmony, are frequent. Congressional control over the various departments is limited to its powers to create and abolish executive offices; to give or withhold appropriations; to require reports and information; and to impeachment.

Between the English and United States cabinets there is hardly a point of similarity. Members of the English cabinet must be members of one or the other branch of parliament; in the U.S. the members of the cabinet cannot be members of either house of congress, nor can they be heard from the floor. In England the cabinet assumes the function of legislative leadership; this does not belong to the cabinet in the United States. In England the cabinet is responsible to the house of commons, while in the United States the cabinet is responsible to the president alone. A list of U.S. cabinets since the begin-

Postmasters General ⇕		Secretaries of the Interior		Secretaries of Agriculture ⇕		Secretaries of Commerce and Labor ⇕		Secretaries of Commerce		Secretaries of Labor ⇕	
Aaron V. Brown	1857	Jacob Thompson	1857								
Joseph Holt	1859										
Horatio King	1861										
Montgomery Blair	1861	Caleb B. Smith	1861								
William Dennison	1864	John P. Usher	1863								
,,	1865	,,	1865								
Alex. W. Randall	1866	James Harlan	1865								
		Orville H. Browning	1866								
John A. J. Creswell	1869	Jacob D. Cox	1869								
James W. Marshall	1874	Columbus Delano	1870								
Marshall Jewell	1874	Zachariah Chandler	1875								
James N. Tyner	1876										
David McK. Key	1877	Carl Schurz	1877								
Horace Maynard	1880										
Thomas L. James	1881	Samuel J. Kirkwood	1881								
,,	1881	,,	1881								
Timothy O. Howe	1881	Henry M. Teller	1882								
Walter Q. Gresham	1883										
Frank Hatton	1884										
William F. Vilas	1885	Lucius Q. C. Lamar	1885	Norman J. Colman	1889						
Don M. Dickinson	1888	William F. Vilas	1888								
John Wanamaker	1889	John W. Noble	1889	Jeremiah M. Rusk	1889						
Wilson S. Bissel	1893	Hoke Smith	1893	J. Sterling Morton	1893						
William L. Wilson	1895	David R. Francis	1896								
James A. Gary	1897	Cornelius N. Bliss	1897	James Wilson	1897						
Charles E. Smith	1898	Ethan A. Hitchcock	1898								
,,	1901	,,	1901	James Wilson	1901	George B. Cortelyou	1903				
Henry C. Payne	1902	James R. Garfield	1907			Victor H. Metcalf	1904				
Robert J. Wynne	1904					Oscar S. Straus	1906				
George B. Cortelyou	1905										
George von L. Meyer	1907										
Frank H. Hitchcock	1909	Richard A. Ballinger	1909	,,	1909	Charles Nagel	1909				
		Walter L. Fisher	1911								
Albert S. Burleson	1913	Franklin K. Lane	1913	David F. Houston	1913			William C. Redfield	1913	William B. Wilson	1913
		John B. Payne	1920	Edw. T. Meredith	1920			Josh W. Alexander	1919		
Will H. Hays	1921	Albert B. Fall	1921	Henry C. Wallace	1921			Herbert C. Hoover	1921	James J. Davis	1921
Hubert Work	1922	Hubert Work	1923								
Harry S. New	1923										
,,	1925	,,	1925	Howard M. Gore	1924			,,	1925	,,	1925
		Roy O. West	1928	W. M. Jardine	1925			William F. Whiting	1928		
Walter F. Brown	1929	Ray Lyman Wilbur	1929	Arthur M. Hyde	1929			Robert P. Lamont	1929	,,	1929
								Roy D. Chapin	1932	William N. Doak	1930
James A. Farley	1933	Harold L. Ickes	1933	Henry A. Wallace	1933			Daniel C. Roper	1933	Miss Frances Perkins	1933
								Harry L. Hopkins	1938		
Frank C. Walker	1940			Claude R. Wickard	1940			Jesse H. Jones	1940		
Robert E. Hannegan	1945	Julius A. Krug	1946	Clinton P. Anderson	1945			Henry A. Wallace	1945	Lewis B. Schwellenbach	1945

⇕—Date appointed.

ning is found on pages 500, 501, 502 and above. Because of the slow evolution of the British cabinet (*see* above) from the old king's council, corresponding British lists from 1603 are given under MINISTRY.

CABINET, a word with various applications which may be traced to two principal meanings, (1) a small private chamber, and (2) an article of furniture containing compartments formed of drawers, shelves, etc. The word is a diminutive of "cabin" and therefore properly means a small hut or shelter. From the use both of the article of furniture and of a small chamber for the safe-keeping of a collection of valuable prints, pictures, medals or other objects, the word is frequently applied to such a collection or to objects fit for such safe-keeping. The name of *Cabinet du Roi* was given to the collection of prints prepared by the best artists of the 17th century by order of Louis XIV. A "cabinet" edition of a literary work is one of somewhat small size, and bound in such a way as would suit a tasteful collection. The term is applied also to a size of photograph of a larger size than the *carte de visite* but smaller than the "panel."

Early Cabinets.—The artificer who constructs furniture is still called a "cabinet maker," although the manufacture of cabinets, properly so-called, is now a very occasional part of his work. Cabinets can be divided into a very large number of classes according to their shape, style, period and country of origin; but their usual characteristic is that they are supported upon a stand, and that they contain a series of drawers and pigeonholes. The name is, however, now given to many pieces of furniture for the safe-keeping or exhibition of valuable objects, which really answer very little to the old conception of a cabinet. The cabinet represented an evolution brought about by the necessities of convenience, and it appealed to so many tastes and needs that it rapidly became universal in the houses of the gentle classes, and in great measure took the impress of the peoples who adopted it. It would appear to have originated in Italy, probably at the very beginning of the 16th century. In its rudimentary form it was little more than an oblong box, with or without feet, small enough to stand upon a table or chair, filled with drawers and closed with doors. In this early form its restricted dimensions permitted of its use only for the safeguard of jewels, precious stones and money.

Developments.—As the Renaissance became general these early forms gave place to larger, more elaborate and more architectural efforts, until the cabinet became one of the most sumptuous of household adornments. It was natural that the countries which were earliest and most deeply touched by the Renaissance should excel in the designing of these noble and costly pieces of furniture. The cabinets of Italy, France and the Netherlands were especially rich and monumental. Those of Italy and Flanders are often of great magnificence and of real artistic skill, though like all other furniture their style was often grievously debased, and their details incongruous and bizarre. Flanders and Burgundy were, indeed, their lands of adoption, and Antwerp added to its renown as a metropolis of art by developing consummate skill in their manufacture and adornment. The cost and importance of the finer types have ensured the preservation of innumerable examples of all but the very earliest periods; and the student never ceases to be impressed by the extraordinary variety of the work of the 16th and 17th centuries, and very often of the 18th also. The basis of the cabinet has always been wood, carved, polished or inlaid; but lavish use has been made of ivory, tortoise-shell, and those cut and polished precious stones which the Italians call *pietra dura*. In the great Flemish period of the 17th century the doors and drawers of cabinets were often painted with classical or mythological scenes. Many French and *Florentine cabinets* were also painted.

In many classes the drawers and pigeon-holes are enclosed by folding doors, carved or inlaid, and often painted on the inner sides. Perhaps the most favourite type during a great part of the 16th and 17th centuries—a type which grew so common that it became cosmopolitan—was characterized by a conceit which acquired astonishing popularity. When the folding doors are opened there is disclosed in the centre of the cabinet a tiny but palatial interior. Floored with alternate squares of ebony and ivory to imitate a black and white marble pavement, adorned with Corinthian columns or pilasters, and surrounded by mirrors, the effect, if occasionally affected and artificial, is quite as often exquisite. Although cabinets have been produced in England in considerable variety, and sometimes of very elegant and graceful form, the foreign makers on the whole produced the most elaborate and monumental examples. As we have said, Italy and the Netherlands acquired especial distinction in this kind of work. In France, which has always enjoyed a peculiar genius for assimilating modes in furniture, Flemish cabinets were so greatly in demand that Henry IV. determined to establish the industry in his own dominions. He therefore sent French workmen to the Low Countries to acquire the art of making cabinets, and especially those which were largely constructed of ebony and ivory. Among these workmen were Jean Macé and Pierre Boulle, a member of a family which was destined to acquire something approaching immortality. Many of the Flemish cabinets, so-called, which were in such high favour in France and also in England, were *armoires* (*q.v.*) consisting of two bodies superimposed, whereas the cabinet proper does not reach to the floor. Pillared and fluted, with panelled sides, and front elaborately carved with masks and human figures, these pieces which were most often in oak were exceedingly harmonious and balanced. Long before this, however, France had its own school of makers of cabinets, and some of their carved work was of the most admirable character. At a somewhat later date André Charles Boulle (*q.v.*) made many pieces to which the name of cabinet has been more or less loosely given. They were usually of massive proportions and of extreme elaboration of marquetry. The North Italian cabinets, and especially those which were made or influenced by the Florentine school, were grandiose and often gloomy. Conceived on a palatial scale, painted or carved, or incrusted with marble and *pietra dura*, they were intended for the adornment of galleries and lofty bare apartments where they were not felt to be overpowering. These North Italian cabinets were often covered with intarsia or marquetry, which by its subdued gaiety retrieved somewhat their heavy stateliness of form.

Mingled Styles.—It is, however, often difficult to ascribe a particular fashion of shape or of workmanship to a given country, since the interchange of ideas and the imports of actual pieces caused a rapid assimilation which destroyed frontiers. The close connection of centuries between Spain and the Netherlands, for instance, led to the production north and south of work that was not definitely characteristic of either. Spain, however, was more closely influenced than the Low Countries, and contains to this day numbers of cabinets which are not easily to be distinguished from the characteristic ebony, ivory and tortoise-shell work of the craftsmen whose skill was so rapidly acquired by the emissaries of Henry IV. The cabinets of southern Germany were much influenced by the models of northern Italy, but retained to a late date some of the characteristics of domestic Gothic work such as elaborately fashioned wrought-iron handles and polished steel hinges. Often, indeed, 17th-century south Germany work is a curious blend of Flemish and Italian ideas executed in oak and Hungarian ash. Such work, however interesting, necessarily lacks simplicity and repose.

A curious little detail of Flemish and Italian, and sometimes of French later 17th-century cabinets, is that the interiors of the drawers are often lined with stamped gold or silver paper, or marbled ones somewhat similar to the "end papers" of old books. The great English cabinet-makers of the 18th century were very various in their cabinets, which did not always answer strictly to their name; but as a rule they will not bear comparison with the native work of the preceding century, which was most commonly executed in richly marked walnut, frequently enriched with excellent marquetry of woods. Mahogany was the dominating timber in English furniture from the accession of George II. almost to the time of the Napoleonic wars; but many cabinets were made in lacquer or in the bright-hued foreign woods which did so much to give lightness and grace to the British style. The glass-fronted cabinet for China or glass was in high favour in the Georgian period, and for pieces of that type, for which massiveness would have been inappropriate, satin and tulip woods, and other timbers with a handsome grain taking a high polish were much used.

(J. P.-B.)

CABINET-MAKER, one skilled in furniture-making and interior wood-work finish.

(*See* FURNITURE MANUFACTURE.)

CABINET NOIR, the name given in France to the office where the letters of suspected persons were opened and read by public officials before being forwarded to their destination. This practice had been in vogue in many countries after the establishment of posts, but it was not until the reign of Louis XV that a separate office was created for the purpose, called the *cabinet du secret des postes*, or more popularly the *cabinet noir*. Although denounced at the time of the Revolution, it was used both by the revolutionary leaders and by Napoleon Bonaparte.

The *cabinet noir* as such has disappeared, but the right to open letters in cases of emergency and especially in time of war is exercised in all civilized countries.

(*See* ESPIONAGE.)

CABLE, GEORGE WASHINGTON (1844–1925), American author, was born in New Orleans, La., on Oct. 12, 1844. The son of a Virginia father and a New England mother, he became a clerk at 15, fought two years for the Confederacy as a cavalryman, engaged in surveying and newspaper work, and then entered the counting-room of a cotton house. But all this time he was absorbing the charm of the Crescent City. Like his contemporary, Lafcadio Hearn, he pored over yellowed records, wandered in the old French quarter, studied alike the great creole families and the picturesque types of the levee. His tales, based on this life, appeared first in *Scribner's Monthly*; then, in 1879, were collected in book form under the title, *Old Creole Days*. With the possible exception of *Madame Delphine* (1881), Cable's art reached its highest point in this first volume. The delicacy of his portrayal of the exotic background of the southland, the deftness of his dialogue, the bewitching grace and dignified gallantry of his characters all rank the tales high in the local colour movement of the later 19th century. *Strange True Stories of Louisiana* (1889) also partakes of this charm, which in the best of his novels *The Grandissimes* (1880) is darkened and deepened by the shadow of slavery. Old feuds between haughty clans dating back to the early days of settlement, shifting glimpses of voodoo rites and carnival balls, of thick canebrakes and the French market, of feverish gambling and busy commerce, a gallery of characters, make the book almost an epitome of Louisiana history. But as a romancer Cable fails somewhat in constructive power, this fault being even more prominent in two of his other early and somewhat distinguished novels, *Dr. Sevier* (1885), a study of the Civil War period, and *Bonaventure* (1888), a pastoral chronicle of outlying Louisiana and the "Cajun" descendants of the refugees from Grand-Pré. Although Cable continued writing until his death in St. Petersburg, Fla., on Jan. 31, 1925, his later fiction is distinctly inferior to his first books; and his studies belonging more specifically to the field of social history such as *The Creoles of Louisiana* (1884) and *The Negro Question* (1890) are not outstanding. After 1885 Cable made his home in Northampton, Mass., occupying himself with home culture clubs and with giving many readings from his works. It is not, however, as teacher or reformer, but as chronicler of the Crescent City, of the sluggish bayous and sunlit meadows of the lower Mississippi, and as portrayer of the descendants of the early French and Spanish inhabitants that his reputation is secure.

CABLE, a large rope or chain, used generally with ships, but often employed for other purposes; the term "cable" is also used for minor varieties of similar engineering or other attachments, and in the case of "electric cables" for the grouped and sheathed wires by which telegraphic and telephonic messages are transmitted. *See* TELEGRAPH and TELEPHONE.

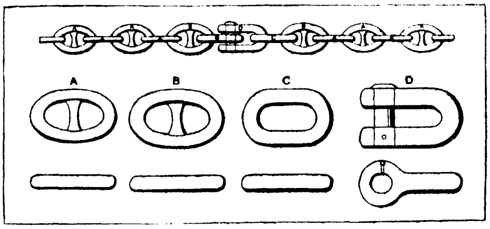


FIG. 1.—TWO LENGTHS OF CHAIN CABLE COUPLED BY A "JOINING SHACKLE"
The end links (C) are made without studs in order to take the shackle. The adjacent links (B) are made larger to take the big studless links. The shackle (D) is shown. The bolt of the shackle is secured by a steel pin and lead pellet

The cables by which ships ride at anchor are made of chain. Prior to 1811 only hempen cables were supplied to ships of the British navy; but in that year chain cables were supplied, as less liable to foul or be cut by rocks, or to be injured by enemy's shot. They are also handier and cleaner. The first patent for chain cables was by Philip White in 1634; twisted links were suggested in 1813 by Captain Brown; studs were introduced in 1816.

In manufacturing chain cables, the bars are cut to the required length of link, at an angle for forming the welds and, after heating, are bent by machinery and welded by smiths, each link being inserted in the previous one before welding.

Cables for the British navy and mercantile marine are supplied in 12½-fathom and 15-fathom lengths respectively, connected together by "joining shackles," D (fig. 1). Each length is "marked" by pieces of iron wire being twisted round the studs of the links; the wire is placed on the first studs on each side of the first shackle, on the second studs on each side of the second shackle, and so on; thus indicating the number of lengths of cable that is out. In joining the lengths together, the round end of the shackle is placed towards the anchor. The end links of each length (C.C.) are made without studs in order to take the shackle; but as studs increase the strength of a link, in a studless or open link the iron is of greater diameter. The next links (B.B.) have to be enlarged, in order to take the increased size of the links C.C. In the joining shackle (D), the bolt is oval, its greater diameter being in the direction of the strain. The bolt of a shackle, which attaches the cable to the anchor (called an "anchor shackle" to distinguish it from a joining shackle) projects and is secured by a forelock; but since any projection in a joining shackle would be liable to be injured when the cable is running out or when passing round a capstan, the bolts are made as shown (in D), and are secured by a smaller pin.

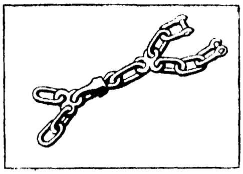
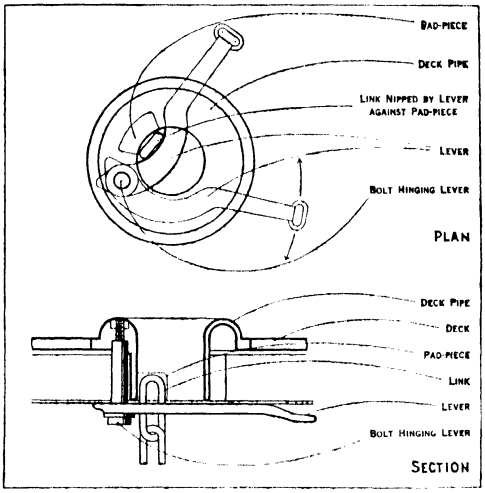


FIG. 2.—MOORING SWIVEL, PUT IN THE CABLES OF A WARSHIP WHEN SHE IS RIDING BY TWO ANCHORS, TO PREVENT THE CABLES FOULING EACH OTHER AS THE SHIP SWINGS. MOORING SWIVELS ARE SELDOM USED IN THE MERCANTILE MARINE

The inboard ends of cables are secured by a "slip" which prevents the cable's inner end from running overboard, and also enables the cable to be "slipped," or let go, in case of emergency. In the British navy, swivel pieces are fitted in the first and last lengths of cable, to prevent turns getting into the cable, caused by the ship swinging round her anchor. If a ship is moored with two anchors, the cables are secured to a mooring swivel (fig. 2), which prevents a "foul hawse," *i.e.*, the cables being entwined round each other. The cable is generally hove in by either a power-driven capstan or windlass (*see* CAPSTAN). Ships in the British navy used to ride by a compressor, a long steel arm, pivoted under the forecastle so that it can be swung across the deck pipe and jam the cable (fig. 3), but modern warships are fitted with slips just below the cable holder for this purpose. The cable-holder is used for checking cable running out. When a ship has been given the necessary cable, the compressor is "bowsed to" or the slip put on, and the brake of the cable-holder is eased up. Small vessels of the mercantile marine ride by turns round the windlass; in larger or more modern vessels fitted with a steam windlass, the friction brakes take the strain, aided, when required in bad weather, by the bitts, compressor or controller.



FROM "MANUAL OF SEAMANSHIP" BY PERMISSION OF CONTROLLER OF H.M. STATIONERY OFFICE

FIG. 3.—PLAN AND SECTION OF A COMPRESSOR SHOWING PARTS
Older ships of the British Navy are fitted to ride by a compressor but in more modern British men-o'-war a Blake slip stopper, fitted just below the cable holder, takes the place of this contrivance

See the Admiralty *Manual of Seamanship*, vol. i. (H.M. Stationery Office, London).

CABLE-HOLDER: *see* CAPSTAN.

CABLE MOULDING (sometimes called ROPE MOULDING), in architecture, a convex moulding, spirally carved, so that it resembles a rope. Its most common use is as one of the mouldings decorating recessed doorways of the Romanesque and Gothic periods. The word "cabling" designates a convex moulding sunk in the flutes of a classical column, usually in the lower portion of the shaft; this is also known as "reeding."

CABLE TRANSFERS, the immediate transfer of money from one country to another by the use of cablegram. A person in New York for instance, wishing to put in the hands of a person in London a certain sum of money at once, can do so by procuring a cable transfer from a foreign exchange banker. Upon the deposit by the transferor of the proper amount of money the New York bank will cable its London branch or correspondent to pay the designated sum at once to the payee in that city. The payee is notified, generally by the London agent, occasionally by cable by the New York bank, as to where and when to call for his funds.

The cable rate of exchange is so arranged as to be sufficient to enable the bank to procure the necessary funds and also to allow a slight profit on the transaction. It is higher than the cheque or time rate because the bank selling the cable transfer expects its correspondent to pay it at once, whereas, in the case of a cheque transfer or time transfer it may still have the use of its foreign funds for some time after the transfer is sold. Cable transfers are payable upon the arrival of the cable; between the United States and England, owing to difference in time and the interim necessary for notifying the payee, they are usually paid on the day after the sale.

CABOCHE, SIMON, Simon Lecoustellier, called "Caboche," a skinner of the Paris Boucherie. He was prominent in the seditious disturbances which broke out in Paris in April and May, 1413. When the butchers had made themselves masters of Paris, Caboche became bailiff (*huissier d'armes*) and warden of the bridge of Charenton. After the fall of the *Cabochien* party on Aug. 4, he fled to Burgundy.

See Colville, *Les Cabochiens et l'ordonnance de 1413* (1888).

CABOT, GEORGE (1751–1823), American political leader, was born in Salem, Mass., on Dec. 16, 1751. He studied at Harvard from 1766 to 1768, when he went to sea as a cabin boy. He gradually rose to become a shipowner and a successful merchant, retiring from business in 1794. Throughout his life he was much interested in politics, and exercised, as a contributor to the press and through his friendships, a powerful political influence, especially in New England. He was a member of the Massachusetts Constitutional Convention of 1779–80, of the State senate in 1782–83, of the convention which in 1788 ratified for Massachusetts the Federal Constitution, and from 1791 to 1796 of the U.S. Senate. Among the bills introduced by him in the Senate was the Fugitive Slave Act of 1793. Upon the establishment of the navy department in 1798, he was appointed and confirmed as its secretary, but he never performed the duties of the office. In 1814–15 Cabot was the president of the Hartford Convention, and as such was then and afterwards acrimoniously attacked by the Republicans throughout the country. He died in Boston on April 18, 1823.

See Henry Cabot Lodge, *Life and Letters of George Cabot* (Boston, 1877).

CABOT, JOHN (GIOVANNI CABOTO) (1450–1498), Italian navigator and explorer of North America, was born in Genoa, but in 1461 went to live in Venice, of which he became a naturalized citizen in 1476. During one of his trading voyages to the eastern Mediterranean, Cabot visited Mecca, then the greatest mart in the world for the exchange of the goods of the East for those of the West. Filled with the idea that it would be shorter and quicker to bring these goods to Europe by sea, if a route could be found, Cabot, about 1484, removed with his family to London. His plans were explained to the leading merchants of Bristol, from which port an extensive trade was already carried on with Iceland. It was decided that an attempt should be made to reach the "island of Brazil" or that of the "Seven Cities," placed on mediaeval maps to the west of Ireland, as the first halting-places on the route to Asia by the west.

To find these islands vessels were despatched from Bristol during several years, when in 1493 news reached England that another Genoese, Christopher Columbus, had reached the Indies. It was decided to forego further search for the islands and to push straight on to Asia, and letters patent for the purpose were issued on March 5, 1496 by Henry VII., granting to his "well-beloved John Cabot, citizen of Venice, to Lewis, Sebastian and Santius, sonnes of the said John, full and free authority, leave and power upon theyr own proper costs and charges, to seeke out, discover and finde whatsoever isles, countries, regions or provinces of the heathen and infidels, which before this time have been unknown to all Christians." Merchandise from the countries visited was to be entered at Bristol free of duty, but one-fifth of the net gains was to go to the king.

Armed with these powers, Cabot set sail from Bristol on Tuesday, May 2, 1497, on board a ship called the "Mathew," manned by 18 men. Rounding Ireland, they headed first north and then west. After being 52 days at sea, at five o'clock on Saturday morning, June 24, they reached the northern extremity of Cape Breton island. The royal banner was unfurled, and Cabot took possession of the country in the name of King Henry VII. The soil being found fertile and the climate temperate, Cabot was convinced he had reached the north-eastern coast of Asia, whence came the silks and precious stones he had seen at Mecca. Cape North was named Cape Discovery, and as the day was the festival of St. John the Baptist, St. Paul island, which lies opposite, was called the island of St. John. Sailing north, Cabot named Cape Ray, St. George's Cape, and christened St. Pierre and Miquelon, which then with Langley formed three separate islands, the Trinity group. Cape Race, the last land seen, was named England's Cape. On Sunday, Aug. 6, the "Mathew" dropped anchor once more in Bristol harbour. On Aug. 10 Cabot received from the king £10 for having "found the new isle." He reported that 700 leagues beyond Ireland he had reached the country of the Grand Khan. He intended on his next voyage to follow the coast southward as far as Cipangu or Japan, then placed near the equator. Once Cipangu had been reached London would become a greater centre for spices than Alexandria. Henry VII. granted Cabot a pension of £20, and promised him in the spring a fleet of ten ships with which to sail to Cipangu.

On Feb. 3, 1498, fresh letters patent were issued. Henry VII. himself also advanced considerable sums of money to various members of the expedition. In the spring Cabot visited Lisbon and Seville, to secure the services of men who had sailed along the African coast with Cam and Diaz or to the Indies with Columbus. At Lisbon he met a certain João Fernandes, called Llavrador, who about the year 1492 appears to have made his way from Iceland to Greenland. Cabot, on learning from Fernandes that part of Asia, as they supposed Greenland to be, lay so near Iceland, determined to return by way of this country. On reaching Bristol he laid his plans accordingly. Early in May the expedition, which consisted of two ships and 300 men, left Bristol. Several vessels in the habit of trading to Iceland accompanied them. Off Ireland a storm forced one of these to return, but the rest of the fleet proceeded on its way along the parallel of 58°. Each day the ships were carried northward by the Gulf Stream. Early in June Cabot reached the east coast of Greenland, and as Fernandes was the first who had told him of this country he named it the Labrador's Land.

In the hope of finding a passage Cabot proceeded northward along the coast. As he advanced, the cold became more intense and the icebergs thicker and larger. It was also noticed that the land trended eastward. On June 11, in lat. 67° 30′ the crews mutinied, and refused to proceed farther in that direction. Cabot had no alternative but to put his ships about. Rounding Cape Farewell, he explored the southern coast of Greenland and then made his way a certain distance up the west coast. Here again his progress was checked by icebergs, whereupon a course was set towards the west. Crossing Davis strait, Cabot reached our modern Baffin Land in 66°. Judging this to be the Asiatic mainland, he set off southward in search of Cipangu. South of Hudson strait a little bartering was done with the Indians, but these could offer nothing in exchange but furs. Our strait of Belle Isle was mistaken for an ordinary bay, and Newfoundland was regarded by Cabot as the main shore itself. Rounding Cape Race, he visited the region explored before and then followed the coast as far south as the 38th parallel, when the absence of all signs of eastern civilization and the low state of his stores forced him to abandon all hope of reaching Cipangu on this voyage. Accordingly, a course was set for England, where they arrived safely late in the autumn of 1498. Not long after his return John Cabot died.

His son, SEBASTIAN CABOT (*c.* 1476–1557), is not independently heard of until May 1512, when he was paid 20 shillings "for making a carde of Gascoigne and Guyenne," whither he accompanied the English army sent that year by Henry VIII. to aid his father-in-law Ferdinand of Aragon against the French. Sebastian was questioned about the Newfoundland coast by Ferdinand's councillors, and as a result was appointed a captain in the navy at a salary of 50,000 maravedis a year. Preparations were made for him to set sail in March 1516; but the death of the king in January of that year put an end to the undertaking. His services were retained by Charles V., and on Feb. 5, 1518, Cabot was named Pilot Major and official examiner of pilots.

In the winter of 1520–21 Sebastian Cabot returned to England, and while there was offered by Wolsey the command of five vessels which Henry VIII. intended to despatch to Newfoundland. Being reproached by a fellow Venetian with having done nothing for his own country, Cabot refused, and on reaching Spain secretly negotiated with the Council of Ten at Venice. On March 4, 1525 he was appointed commander of an expedition fitted out at Seville, "to discover the Moluccas, Tarsis, Ophir, Cipango and Cathay."

The three vessels set sail in April, and by June were off the coast of Brazil and on their way to the Straits of Magellan. Near the La Plata river Cabot found three Spaniards who had formed part of the De Solis expedition of 1515. These men gave such glowing accounts of the riches of the country that Cabot was induced to forego the search for Tarsis and Ophir and to enter the La Plata, which was reached in Feb. 1527. On reaching Seville in Aug. 1530, Cabot was condemned to four years' banishment to Oran in Africa, but in June 1533 he was once more reinstated in his former post of Pilot Major, which he continued to fill until he again removed to England.

As early as 1538 Cabot tried to obtain employment under Henry VIII., and it is possible he was the Sevillian pilot who was brought to London by the king in 1541. Soon after the accession of Edward VI., however, his friends induced the Privy Council to advance money for his removal to England, and on Jan. 5, 1549 the king granted him a pension of £166.13s.4d. Two applications from Spain (in 1550 and 1553), for his repatriation were refused, the first by the privy council and the second by Queen Mary herself.

On June 26, 1550 Cabot received £200 "by waie of the kinges Majesties rewarde," but it is not clear whether this was for his services in putting down the privileges of the German Merchants of the Steelyard or for founding the company of Merchant Adventurers incorporated on Dec. 18, 1551. Of this company Cabot was made governor for life. Three ships were sent out in May 1553 to search for a passage to the East by the north-east. Two of the vessels were caught in the ice near Arzina and the crews frozen to death. Chancellor's vessel alone reached the White Sea, whence her captain made his way overland to Moscow. He returned to England in the summer of 1554 and was the means of opening up a very considerable trade with Russia. Vessels were again despatched to Russia in 1555 and 1556. On the arrival of King Philip II. in England Cabot's pension was stopped on May 26, 1557, but three days later Mary had it renewed. The date of Cabot's death has not been definitely discovered. It is supposed that he died within the year.

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CABOTAGE, the French term for coasting-trade, a coast-pilotage. It is probably derived from *cabot,* a small boat, with which the name Cabot may be connected; the conjecture that the word comes from *cabo,* the Spanish for cape, and means "sailing from cape to cape," has little foundation.

CABRA, a town of southern Spain, in the province of Córdova, 28 mi. S.E. of Córdova, on the Jaén-Málaga railway. It is built on the river Cabra in the fertile valley between the Sierra de Cabra and the Sierra de Montilla. Pop. (1940) 15,172 (mun., 20,779). Cabra has a ruined Moorish castle and a parish church which was originally a mosque, and later a cathedral, when for several centuries Cabra was an episcopal see. There are marble quarries near the town, which makes bricks and pottery, coarse cloth and felt, and is the market for local grain, wine, olive oil and fruit. Cabra (Roman Baebro or Aegabro) was delivered from the Moors by Ferdinand III of Castile in 1244 and entrusted to the Order of Calatrava. Recaptured by the Muslims in 1331, it was finally reunited to Christian Spain a century later.

CABRERA, RAMON (1806–1877), Carlist general, was born at Tortosa, province of Tarragona, Spain, on Dec. 27, 1806. He took minor orders, but the bishop refused to ordain him as a priest, telling him that the army, not the church, was his vocation. Cabrera took part in Carlist conspiracies on the death of Ferdinand VII. The authorities exiled him, and he absconded to Morella to join the forces of the pretender Don Carlos. In a very short time he rose by sheer daring, fanaticism and ferocity to the front rank among the Carlist chiefs who led the bands of Don Carlos in Catalonia, Aragon and Valencia. He was many times wounded in the brilliant fights in which he again and again defeated the generals of Queen Isabella. He sullied his victories by acts of cruelty, shooting prisoners of war whose lives he had promised to spare, and not respecting the lives and property of non-combatants. The queen's generals seized his mother as a hostage, whereupon Cabrera shot several mayors and officers. Gen. Nogueras unfortunately caused the mother of Cabrera to be shot, and the Carlist leader then started upon a policy of reprisals so merciless that the people nicknamed him "The Tiger of the Maeztrazgo." He shot 1,110 prisoners of war, 100 officers, and many civilians, including the wives of four leading Isabellinos, to avenge his mother. When Marshal Espartero induced the Carlists of the north-western provinces, with Maroto at their head, to submit in accordance with the Convention of Vergara, which secured the recognition of the rank and titles of 1,000 Carlist officers, Cabrera held out in Central Spain for nearly a year. Marshals Espartero and O'Donnell, with the bulk of the Isabellino armies, had to conduct a long and bloody campaign against Cabrera before they succeeded in driving him into French territory in July 1840. The government of Louis Philippe incarcerated him for some months and then allowed him to go to England, where he quarrelled with the pretender, disapproving of his abdication in favour of the count of Montemolin In 1848 Cabrera reappeared in the mountains of Catalonia at the head of Carlist bands. These were soon dispersed and he again fled to France. He did not take a very active part in the subsequent risings of the Carlists, who, however, continued to consult him. In March 1875 Cabrera presented to Don Carlos a manifesto in which he called upon the adherents of the pretender to follow his own example and submit to the restored monarchy of Alphonso XII. Cabrera, who was ever afterwards regarded with contempt and execration by the Carlists, died in London on May 24, 1877.

CABRILLO NATIONAL MONUMENT, a tract of 1 ac. in the southern part of California, U.S.A., set apart as a Government reservation in 1913. It was at or near this point that Juan Rodriguez Cabrillo first saw the California mainland on Sept. 28, 1542. The reservation is administered by the War Department.

CABRIOLET, originally, a name given by the English to a two-wheel, horse-drawn vehicle with a hood, for gentleman's driving. In America, a name given to a horse-drawn vehicle with a coachman's seat over a panel framework (in distinction from a victoria which is similar, but of iron skeleton construction). It had a seat behind at a lower level with a collapsible leather hood and was a fashionable vehicle for ladies. *See* CAB.

CA' CANNY. Ca' canny (or "Go canny") is by origin a Scottish phrase meaning to go cautiously, or warily, or, by a slight change of meaning, to go slow. Thus, in John Galt's *The Provost,* we read "We maun ca' canny many a day yet before we think of dignities," and, in the same writer's *The Entail,* "But, Charlie and Bill, ca' canny." In modern times, the phrase has acquired a special meaning in relation to industrial strife. To "ca' canny" is to work slowly, in order to draw attention to a workshop grievance, or bring pressure to bear upon an employer. It appears to have been first used in this sense in a dispute at the Glasgow docks in 1889, when the dockers had struck for a rise in wages. Agricultural labourers were introduced as blacklegs, and the employers expressed themselves as highly satisfied with their work. When the dockers had to go back on the old terms, their leader adjured them, since the blacklegs had given satisfaction, to work like them, to ca' canny. During the following years the phrase caught on, and a pamphlet recommending it as a policy to trade unionists was published in 1805. Later, the phrase was taken up by the French Syndicalists, and identified by them with the less violent forms of *sabotage* (*q.v.*). (*See* E. Pouget, *Le Sabotage* [n.d].)

Ca' canny, as the term is used in Great Britain, is essentially an occasional practice It is not authorized by any important trade union, but is sometimes adopted spontaneously by a group of workers in some particular factory as a means of securing redress for a felt grievance. Thus, if the men think the management is unduly speeding up the pace of work, they may make a concerted effort to "speed down"; if they think piecework prices are too low they may deliberately restrict production in order to draw attention to their grievance, or they may ca' canny temporarily because of some dispute about the arrangement of work, workshop discipline, or the like. The more deliberate kind of ca' canny is sometimes known by the name of the "stay-in strike," in which the men, by a concerted arrangement, remain at work, but do as little as possible. A variant of this is the "working to rule" policy, found especially on the railways, where the men sometimes, in furtherance of a grievance, tangle up the traffic by strict obedience to all the rules laid down for them, well knowing that these are not literally workable without entire disorganization.

The term ca' canny is also known in the United States, where it has much the same sense as in Great Britain. It appears, however, to be used more often in order to describe a systematic policy, whereas the occasional practice of "go slow" methods is, in America, commonly known as "striking on the job."

As an organized practice, ca' canny is not very common. It occurs, apart from short-lived and purely spontaneous movements arising out of a particular workshop grievance, mainly where there is a long-standing bad relationship between employers and workers. It appears to have been far commoner in France, during the Syndicalist activity before the World War, and to have been also widespread in Italy. In Germany there is little sign of it. Save as an occasional method of expressing a local grievance, it is important mainly as a part of the deliberate policy of revolutionary Syndicalism in France and Italy, and industrial unionism in the English-speaking countries.

Apart from industrial disputes, the name "ca' canny" is sometimes applied to a deliberate and systematic slowing down of the pace of production, either in order to make the work last longer, or to create additional employment, or to express a general dissatisfaction with the economic system. While "going slow" may be justified as a purely temporary expedient for calling attention to a particular grievance, its systematic use is obviously more likely, by increasing the cost of production, to create unemployment than employment. (G. D. H. C.)

CACCINI, GIULIO (1558–1615?), Italian composer, also known as Giulio Romano, but to be distinguished from the painter of that name, was born at Rome about 1558, and in 1578 entered the service of the grand duke of Tuscany at Florence. He collaborated with J. Peri in the early attempts at musical drama which were the ancestors of modern opera (*Dafne*, 1594, and *Euridice*, 1000), produced at Florence by the circle of musicians and amateurs which met at the houses of G. Bardi and Corsi. He also published in 1001 *Le nuove musiche*, a collection of songs which is of great importance in the history of the art as one of the earliest essays in monodic music. He was a lyric composer rather than a dramatist like Peri, and the genuine beauty of his works makes them acceptable even to-day.

CÁCERES, a province of western Spain, formed in 1833 of districts taken from Estremadura. It is bounded on the north by Salamanca and Avila, on the east by Toledo, on the south by Badajoz, and on the west by Portugal. Pop. (1940) 511,377; area, 7,705 sq.mi. Cáceres is the largest of the Spanish provinces, after Badajoz, and one of the most thinly peopled. It consists mainly of a broad, undulating plain, rising to the Sierra de Gata and Sierra de Grédos in the north, and to lower ranges in the south and south-east. All the province, except a small area on the south-east, is drained by the river Tagus, which flows through it from east to west, and is joined by several tributaries, notably the Alagón and Tietar on the north and the Salor and Almonte on the south. The climate is temperate except in summer, when hot east winds prevail. Droughts are common in many districts and forests are confined to the north, where the cork oak is important. Much of the province is covered with thin pasture. The region north of the Tagus is more fertile than that to the south and produces fair crops of cereals, olives, peas and fruit, but agriculture everywhere is backward. As a stock-breeding province Cáceres ranks second only to Badajoz. It possesses many pigs, sheep, and more goats than any other province. It is famous for the wool, ham and red sausages, called *embutidos*, which it exports. Its mineral wealth is small but it produces all the phosphates mined in Spain and small quantities of zinc, lead and tin. Leather, coarse woollen and cork goods are produced in many towns, but owing to the general poverty, the scattered population, the lack of good roads and the backwardness of education, there is no real industrial development. The North Madrid-Lisbon railway which crosses the province from east to west is joined at Plasencia by a line from Salamanca and at Arroyo by a branch through Cáceres, the capital (pop. 1940, 27,463), to Mérida in Badajoz on the South Madrid-Lisbon line. Principal towns, in addition to Cáceres (1940 pop. figures): Valencia de Alcántara, 6,904; Trujillo, 5,771; and Alcántara, 4,404, are described in separate articles. Other towns are: Plasencia, 15,092; Arroyo de la Luz, 10,228; Miajadas, 8,302; Logrosán, 5,505; Garrovillas, 6,117, and Brozas, 5,786. The province was occupied by Nationalists early in the civil war of 1936–39. (*See* also ESTREMADURA.)

CÁCERES, capital of the Spanish province described above, about 14 mi. S. of the river Tagus, on a branch railway from Arroyo de Malpartida, on the North Madrid-Lisbon line, to Mérida on the south line. Pop. (1940) 27,463 (mun., 39,392). Cáceres, built on an eminence on a low east-west ridge, consists of two towns, an old and a new. The old, upper town, with its mediaeval palaces, turrets and massive walls, half Roman and half Arab, is dominated by the lofty tower of the Gothic church of San Mateo. The once famous monastery and college of the Jesuits is now a hospital. Steep steps lead down through four gates to the lower, modern town containing the law courts, town hall, schools and the palace of the bishops of Cória (pop. 4,141), a town on the river Alagon. Cáceres makes cork and leather goods, pottery and cloth, and exports grain, oil, live-stock, wool, sausages and phosphates from the neighbouring mines. Cáceres, of Roman origin, probably occupies the site of "Norba Caesarina."

CACHALOT: *see* SPERM-WHALE.

CACHAR or **KACHAR,** a district of British India, in the province of Assam. It occupies the upper basin of the Surma or Barak river, and is bounded on three sides by lofty hills. Its area is 3,862 sq.mi. Population (1941) 641,181. It is divided naturally between the plain and hills. The scenery is beautiful, the hills generally rising steeply and being clothed with forests, while the plain is relieved of monotony by small isolated undulations and by its rich vegetation. The Surma is the chief river, and its principal tributaries from the north are the Jiri and Jatinga, and from the south the Sonai and Dhaleswari. Several extensive fens, notably that of Chatla, which become lakes in time of flood, are characteristic of the plain. This is alluvial and bears heavy crops of rice, next to which in importance is tea. The industry connected with the latter crop employs large numbers; the tea garden population was 147,620 in 1931, when there were about 59,000 ac. under tea, with an output of nearly 21 million pounds. An oil field at Badarpur is worked by the Burma Oil company; over four and one-quarter million gallons of crude oil have been extracted annually. Manufacturing industries are otherwise slight. Reserved forests extend over nearly 1,200 sq. miles. Elephants abound in the North Cachar hills. The Assam-Bengal railway serves the district, including the headquarters town of Silchar. The plain is the most thickly-populated part of the district; in the North Cachar hills the population is sparse (16 per sq. mile). The district takes its name from the former rulers of the Kachari tribe, who settled here early in the 18th century. About the close of that century the Burmans threatened to expel the Kachari rajah and annex his territory; the British, however, intervened to prevent this, and on the death of the last rajah without heir, in 1830, they obtained the territory under treaty. A separate principality, which had been established in the North Cachar hills earlier in the century by a servant of the rajah, was taken over by the British in 1854, owing to the misconduct of its rulers. The southern part of the district was raided several times in the 19th century by the turbulent Lushai.

CACHE, a store or hiding place, generally a hole dug in the ground for concealing provisions, etc.; also the goods so hidden. A series of caches is sometimes laid on long expeditions, as in Arctic exploration, to provide stores for the return journey.

CACHIN, MARCEL (1869–), French politician, one of the principal leaders of the French Communist party, was born at Paimpol, Brittany, and adopted teaching as a profession. He was a master in a Bordeaux *lycée* when he joined the Socialist movement. His party, thanks to common action between the reactionaries and the socialists against the moderate republicans, captured the municipal government of the city, and Cachin was nominated *adjoint* to the mayor. Later, he settled in Paris, and was elected to the municipal council of the city. In May 1914 he became one of the deputies for Paris in the chamber, in which he sat continuously from that time forward. For many years he was one of the most moderate members of the Socialist group, and during World War I showed a patriotic spirit. In Dec. 1918 he accompanied Poincaré and Clemenceau to Metz and Strasbourg. But shortly his attitude underwent a sudden change. Having become director of the paper *Humanité*, he went to Moscow, and became a convert to Bolshevism. He is the principal leader in the chamber of the Communist party. In 1927 he was condemned to some months' imprisonment for inciting soldiers and sailors to revolt, and was incarcerated in the Santé prison with other deputies and Communist agitators sentenced for similar offenses. (P. B.)

CACHOEIRA, an inland commercial centre of the state of Baia, Brazil. It lies on the Paraguassú river, a short distance from its mouth at the head of the Baía de Todos os Santos, from which the state of Baia takes its name. Population of the *município* of Cachoeira (1940) 27,063. The products of the countryside are rice, cereals and tobacco. The town has a meat-preserving plant, cotton and cigar factories and potteries. It is reached by steamer from Salvador, about 48 mi. distant. It is the terminus of a short railway (28 mi.) north to Feira de Santana, and from São Félix, opposite Cachoeira across the Paraguassú river, another railway runs west to Itaeté and Contendas, both lines portions of the Baía Central railway system.

CACIQUE, name used by the Spaniards at the time of the discovery of America for a native chief or ruler. It is also applied to several species of birds of the genus *Cassicus*, of the family Icteridae, living in the tropical parts of the Americas (*see* ICTERUS).

CACODYL, a colourless liquid which is spontaneously inflammable in air, has an intolerable smell and belongs to the group of organo-arsenical compounds (*see* ARSENIC: *Organic Derivatives*).

CACTUS. This word, applied by the ancient Greeks to some prickly plant, was adopted by Linnaeus as the name of a group of curious succulent or fleshy-stemmed plants, most of them prickly and leafless, some of which produce beautiful flowers, and are now popular in gardens. As applied by Linnaeus, the name *Cactus* is almost conterminous with what is now the family Cactaceae.

The cacti may be described in general terms as plants having a woody axis, or skeleton, overlaid with thick masses of cellular tissue forming the fleshy stems. These are extremely various in character and form, being globose, cylindrical, columnar or flattened into leafy expansions of thick joint-like divisions, the surface being either ribbed like a melon, or developed into nipple-like protuberances, or variously angular, or smooth, but in the greater number of species furnished copiously with tufts of stiff, sharp spines, some of which are very horny and robust. These tufts show the position of buds, of which, however, comparatively few are developed. The leaves, if present, are generally much reduced. In *Pereskia*, however, the stems are less succulent, and the leaves, though fleshy, are developed in the usual form. The flowers are frequently large and showy, and are often attractive from their high colouring. In one group, represented by *Cereus* and related genera, they consist of a tube, elongated, on the outer surface of which, towards the base, are developed small and at first inconspicuous scales, which gradually increase in size upwards and at length become crowded, numerous and petaloid, forming a funnel-shaped blossom, the beauty of which is much enhanced by the multitude of conspicuous stamens which with the pistil occupy the centre. In another group, represented by *Opuntia*, the flowers are rotate; *i.e.*, the long tube is replaced by a very short one. At the base of the tube, in both groups, the ovary develops into a fleshy (often edible) fruit, that produced by the opuntias being known as the prickly pear or Indian fig.

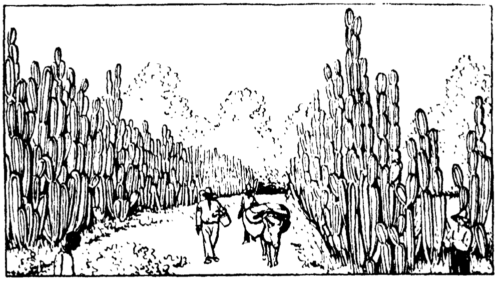
FIG. 1.—CACTUS FENCES IN SOUTHERN MEXICO

Genera with long-tubed flowers include *Echinocactus*, *Echinopsis*, *Cereus*, *Epiphyllum*, *Cephalocereus* and many others, while those with short-tubed flowers are *Rhipsalis*, *Opuntia*, *Pereskia* and several of minor importance. The Cactaceae is essentially a family characteristic of the arid and semiarid parts of America, where it is very highly developed both in genera and in species. The only representatives native of the old world are a few species of *Rhipsalis* occurring in east Africa, Madagascar, and Ceylon. However, various American species of *Opuntia* and other genera were introduced into the Mediterranean region shortly after the discovery of America, where some of them, especially species of *Opuntia*, soon became widely naturalized. Later this also happened in India, the Malayan region, and Australia. They mostly affect the hot, dry regions of tropical America, the aridity of which they are enabled to withstand in consequence of the thickness of their cuticle and the fewness and "sunk" condi-

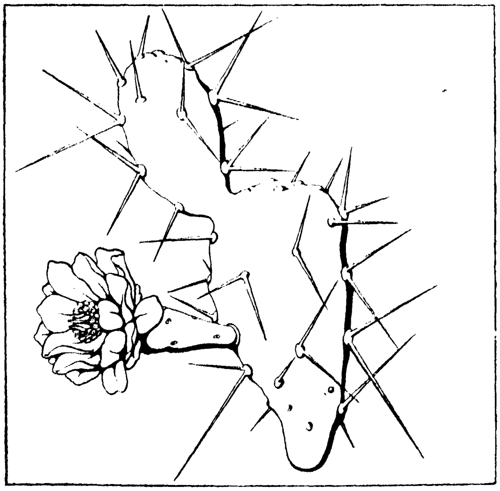
FIG. 2.—PRICKLY PEAR CACTUS (OPUNTIA)
The illustration shows the flattened branch of swollen stem which stores up water and spiny leaves which reduce transpiration

tion of the stomata with which they are furnished. The thick fleshy stems and branches contain a store of water. The succulent fruits of some kinds are not only edible but agreeable, and in fevers are freely administered as a cooling drink. The Spanish-Americans plant the opuntias and others around their houses, where they serve as impenetrable fences.

Cactus (fig. 1), the genus of melon-thistle or Turk's cap cactuses, contains about 18 species, which are found in the West Indies, Mexico, Venezuela and Colombia. The typical species, *Cactus melocactus*, of Jamaica, forms a succulent mass of ovoid form, from 1 to 2 ft. high, the surface divided into numerous furrows like the ribs of a melon, with projecting angles, which are set with a regular series of stellated spines—each bundle consisting of about five larger spines, accompanied by smaller but sharp bristles—and the top of the plant being surmounted by a cylindrical crown 3 to 5 in. high, composed of reddish-brown, needle-like bristles, closely packed with cottony wool. At the summit of this crown the small rosy-pink flowers are produced, half protruding from the mass of wool, and these are succeeded by small red or pink, elongated berries. These plants usually grow in rocky places with little or no earth to support them. The fruit of this and related species, which has an acid flavour, is eaten in the West Indies. The group is distinguished by the distinct *cephalium* or crown which bears the flowers. *Disocactus*, related genus, consists of about 7 species native to Brazil and Paraguay.

Echinocactus (fig. 3) is the genus bearing the popular name of hedgehog cactus. It comprises nine species, native of the south-western United States and Mexico. They have the fleshy stems characteristic of the family, these being either globose, oblong or cylindrical, and ribbed as in *Melocactus*, and armed with stiff sharp spines, set in little woolly cushions occupying the place of the buds. The flowers, produced near the top of the plant, are large and showy, yellow and rose being the prevailing colours. They are succeeded by succulent fruits, which are exserted, and scaly, in which respects this genus differs from *Melocactus* which has the fruits partly immersed and smooth. One of the most interesting species is *E. ingens*, in which there are 40 to 50 ridges, on which the buds and clusters of spines are sunk at intervals, the aggregate number of the spines having been computed at 50,000 on one plant. There are 27 related genera.

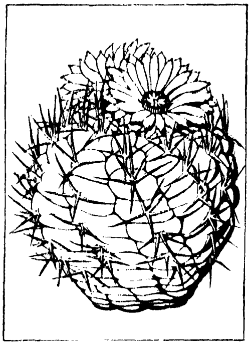

FIG. 3.—HEDGEHOG CACTUS (ECHINOCACTUS HEXAEDROPHORUS) COMMON IN THE DESERTS OF NORTH AND SOUTH AMERICA

Cereus.—This genus bears the common name of torch thistle. It comprises about 25 species, largely Mexican but scattered through South America and the West Indies. The stems are columnar or elongated, some of the latter creeping on the ground. There are many related genera. Saguaro (*Cereus giganteus* or *Carnegiea gigantea*), largest of all cacti, is a native of hot, arid, desert regions of the southwestern U.S., growing in rocky valleys and on mountain sides. The stems grow to a height of 70 ft. and have a diameter of 2 ft. often unbranched, but sometimes furnished with branches which grow out at right angles from the main stem, and then curve upwards and continue their growth parallel to it; these stems have from 12 to 20 ribs, on which, near the top at intervals of about an inch, are the buds with their thick, yellow cushions, from which issue five or six large and numerous smaller spines. The fruits, which are green oval bodies from 2 to 3 in. long, contain a crimson pulp from which the Indians prepare an excellent preserve; they also use the ripe fruit as food, gathering it with a forked stick attached to a long pole. Relatives of *Cereus* include some of our most interesting and beautiful hot-house plants. *Echinocereus pectinatus* produces a purplish fruit resembling a gooseberry, which is very good eating; and the fleshy part of the stem itself is eaten as a vegetable after removing the spines. The climbing night-blooming cacti are included in the genera *Hylocereus*, *Selenicereus* and others, many bearing very large flowers.

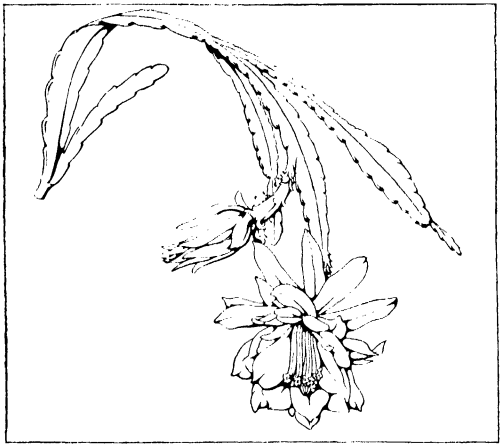

FIG. 4.—BRANCH OF THE LEAF CACTUS, A POPULAR ORNAMENTAL PLANT. THE FLOWERS OF THIS PLANT ARE 6 IN. OR MORE IN DIAMETER

Epiphyllum and **Phyllocactus** (fig. 4), the leaf cactus, comprises 17 species, found in Mexico and Central and tropical South America. They differ from all the forms already noticed in being epiphytal in habit, and in having the branches compressed and dilated so as to resemble thick fleshy leaves, with a strong median axis and woody base. The margins of these leaf-like branches are crenately notched, the notches representing buds, and from these crenatures the large flowers are produced. As cultivated plants these are among the most ornamental of the family, being of easy culture, free blooming and showy, the colour of the flowers ranging from rose-pink to creamy white. Relatives of *Epiphyllum* compose 8 other genera.

Opuntia (fig. 2), the prickly pear or Indian cactus, is a large group, comprising some 250 species, or more, found in North America, the West Indies and South America, extending as far as Chile. Some have been introduced into Australia with disastrous effects, since they overran large tracts of country; this situation was remedied by the introduction of certain insects and cactus diseases from America that destroy the plants. They are fleshy shrubs with rounded, woody stems and numerous succulent branches, composed in most of the species of separate joints or parts, which are often much compressed, elliptic or suborbicular, dotted over in spiral lines with small, fleshy, caducous leaves, in the axils of which are the areoles or tufts of barbed or hooked bristles, usually accompanied by spines. The flowers are mostly yellow or reddish yellow, and are succeeded by pear-shaped or egg-shaped fruits, having a broad scar at the top, mostly furnished on their soft, fleshy rind with tufts of small bristles. The sweet, juicy fruits of several species are much eaten under the name of prickly pears, and these are cultivated for their fruit in Southern Europe, the Canaries and northern Africa.

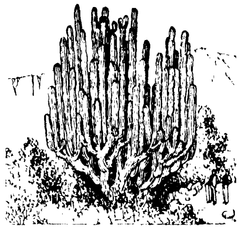

FIG. 5.—ORGAN CACTUS IN THE DESERT SOUTH OF MEXICO CITY

The cochineal (*q.v.*) insect is nurtured on the allied *Nopalea coccinellifera* and sometimes also on species of *Opuntia*. Plantations, called nopaleries, are established for rearing this insect, *Coccus cacti*, and these often contain as many as 50,000 plants. Relatives of *Opuntia* form 6 other genera. **Pereskia** differs from

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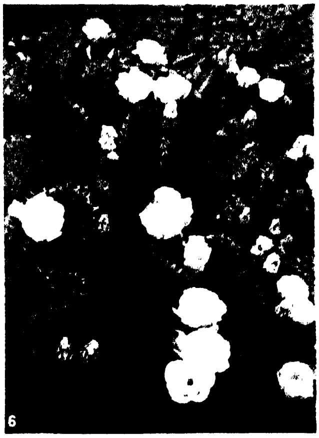
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PHOTOGRAPHS BY FRED BOND FROM PUBLIX

CACTACEAE OF NORTH AMERICA

1. Saguaro *(Cereus giganteus* or *Carnegiea gigantea)*, largest of the cacti, varying in height from 10 to 50 ft. Native to Arizona, southeastern California and northern Mexico. 2. Cholla cactus *(Opuntia imbricata)*, Colorado to Texas and central Mexico. The height is usually between 9 and 12 ft. 3. *Echinocereus coccineus;* Colorado to New Mexico and Arizona. It is globose, with individual plants from 8 to 12 in. in diameter. 4. Teddy bear cactus *(Opuntia bigelovii);* Arizona to California and Sonora, Mexico; 4 to 6 ft. high. 5. Barrel cactus *(Echinocactus grusonii)* of central Mexico. It ranges in diameter from 2 to 4½ ft. 6. *Opuntia phaeacantha;* Texas to Arizona and Chihuahua, Mexico. Only 6 to 15 in. high, the plant is prostrate and forms clumps 2 to 10 ft. in diameter. 7. *Opuntia linguiformis;* Texas; 3 to 4 ft. high

the rest in having woody stems and leaf-bearing branches, the leaves being somewhat fleshy, but otherwise of the ordinary laminate character. One species, the Barbadoes gooseberry, climbs like the blackberry (*Rubus*) by recurved thorns; the others are spiny shrubs. The flowers are subpaniculate, white or yellowish. They are frequently used as a stock on which to graft other cacti. There are about 19 species, mainly Mexican; *P. cubensis* is a peculiar little tree of eastern Cuba.

For a conservative treatment of the genera *see* F. Vaupel *Cactaceae;* Engler and Prantl, *Die Natürlichen Pflanzenfamilien*, ed. 2, 21:594–651, fig. 271–288 (1925); and for a general consideration of the entire family, N. H. Britton and J. N. Rose, *The Cactaceae,* 4 vol., Carnegie Institution Publication 248 (1919–23).

CADALSO VAZQUEZ, JOSE (1741–1782), Spanish author, born at Cadiz, entered the army and rose to the rank of colonel. He was killed at the siege of Gibraltar. Cadalso was educated in Paris, travelled widely in his youth, and spread the knowledge of French and English literature in Spain. His first published work was a rhymed tragedy, *Don Sancho Garcia, Conde de Castilla* (1771), constructed on French classical lines. His *Eruditos à la Violeta* (1772) is a prose satire on superficial knowledge. In 1773 appeared a volume of miscellaneous poems, *Ocios de mi juventud,* and after his death there was found among his mss. a series of fictitious letters in the style of the *Lettres Persanes*, which were issued in 1793 under the title of *Cartas marruecas*. His collected works appeared at Madrid in 1821, and have been supplemented by the *Obras inéditas* (Paris, 1894) published by R. Foulché-Delbosc.

CADAMOSTO or **CA DA MOSTO, ALVISE** (1432–1477), a Venetian explorer, navigator and writer, celebrated for his voyages in the Portuguese service to West Africa. In 1454 he sailed from Venice for Flanders and being detained by contrary winds off Cape St. Vincent, was enlisted by Prince Henry the Navigator among his explorers, and given command of an expedition which sailed (on March 22, 1455) for the south. He wrote an account of his voyage, *El libro de la prima navigazione per l'oceano a le terre de Nigri*, printed in 1507. Visiting the Madeira group and the Canary islands, and coasting the West Sahara, he arrived at the Senegal, whose lower course had already, as he tells us, been explored by the Portuguese 60m. up. The negro lands and tribes south of the Senegal, and especially the country and people of Budomel, a friendly chief reigning about 50m. beyond the river, are next dealt with, and Cadamosto thence proceeded towards the Gambia, which he ascended some distance, but he found the natives extremely hostile, and so returned direct to Portugal. Throughout his account he provides a wealth of interesting detail about the tribes he met, their customs and their trade. Cadamosto expressly refers to the chart he kept of this voyage. At the mouth of the Gambia he records an observation of the "Southern Chariot" (Southern Cross). Next year (1456) he went out again under the patronage of Prince Henry. Doubling Cape Blanco he was driven out to sea by contrary winds, and thus made the first known discovery of the Cape Verde islands. Having explored Boavista, and Santiago, and found them uninhabited, he returned to the African mainland, and pushed on to the Gambia, Rio Grande and Geba. Returning thence to Portugal, he seems to have remained there till 1463, when he reappeared at Venice.

Besides the accounts of his two voyages, Cadamosto left a narrative of Pedro de Cintra's explorations in 1461 (or 1462) to Sierra Leone and beyond Cape Mesurado to El Mina and the Gold Coast; all these relations first appeared in the 1507 Vicenza Collection of Voyages and Travels (the *Paesi novamente retrovati et novo mondo da Alberico Vesputio Florentino*); they have frequently since been reprinted and translated (*e.g.*, Ital. text in 1508, 1512, 1519, 1521, 1550 (Ramusio), etc. *See* also C. Schefer, *Relation des voyages . . . de Ca' da Mosto* (1895); R. H. Major, *Henry the Navigator* (1868), pp. 246–287; C. R. Beazley, *Henry the Navigator* (1895), pp. 261–288, and *Dawn of Modern Geography* (3 vols., 1897–1906); Yule Oldham, *Discovery of the Cape Verde Islands* (1892), especially pp. 4–15.

CADASTRE, a register of the real property of a country, with details of the area, the owners, and the value. A "cadastral survey" is properly, therefore, one which gives such information as the Domesday Book, but the term is sometimes used loosely of the Ordnance Survey of the British Isles, which is on sufficiently large a scale to give the area of every field or piece of ground.

CADBURY, GEORGE (1839–1922), British manufacturer and philanthropist, was born Sept. 19, 1839 at Edgbaston, Birmingham, of Quaker parents, and was brought up a member of the Society of Friends. In 1861, when he succeeded to his father's business, it gave employment to 12 workers only, but under the management of himself and his brother Richard (1835–99) it developed rapidly, and in 1879 he founded for the employees the garden village of Bournville, which served as a model for other social ventures of this kind. He became chief proprietor of *The Daily News* (London) in 1901, and his family acquired an interest in *The Star* (London) in 1909.

Cadbury died Oct. 24, 1922. *See* A. G. Gardiner *Life of George Cadbury* (1923).

CADDIS FLY and **CADDIS WORM,** the name given to a group of insects of mothlike appearance, of the order named *Trichoptera* (*q.v.*) in allusion to the hairy covering of the body and wings. Caddis flies occur in the neighbourhood of fresh water in which they lay their eggs, and their larvae (caddis worms) are aquatic. These larvae provide themselves with shelters (caddis cases) made of particles of sand, sticks, leaves, etc., held together with silk which is secreted by the insects for that purpose. Thus concealed they crawl about seeking their food. Before pupation, the larva closes the orifice of the case against intruders, and the pupa when mature, after biting its way out, rises to the surface of the water for the emergence of the perfect insect.

Where abundant, the larvae may be an important item in the diet of trout and other fishes.

CADDO. A tribe, a confederacy and a stock of American Indians west of the Mississippi river are known by this name. The Caddoan stock occupied three territories. The largest, that of the Caddo or Hasinai confederacy and their kinsmen, embraced most of the drainage of Red River plus adjacent streams, in Louisiana, Arkansas, Oklahoma and Texas. The second, in Kansas and Nebraska, and the third, on the Missouri in the Dakotas, held respectively the Pawnee and Arikara (*q.v.*). The surviving tribes or bands of the first division are the Caddo, Wichita, Kichai, Tawakoni, Waco, reduced to less than 1,000 all told. Tribes now extinct or merged were the Anadarko, Hainai, Nacogdoches, Natchitoches, Yatasi. The Caddoan groups were agricultural and lived in villages of thatched houses. In general customs they were intermediate between the settled tribes of the lower Mississippi and Gulf states and the moving bison hunters of the Plains. They became known to the Spaniards and French in the 17th century, and the usual reduction in numbers soon followed contacts.

CADE, JOHN (d. 1450), commonly called JACK CADE, captain of Kent and leader of the rising of 1450, may have been an Irishman by birth, but details of his early life are scanty. After his death the Government asserted that he had lived in Sussex, had had to flee after murdering a woman, that he had served in the French wars and settled in Kent under the false name of Aylmer or Aylesmere. How much, if any of this can be believed, is unknown. Cade himself claimed the name Mortimer; he was a man of some landed property and importance, and may quite possibly have been a distant or illegitimate relation of the duke of York. The men of Kent, when they rose in rebellion in May 1450, selected him as their leader, and under his skilled direction marched from Ashford to Blackheath, retreated, defeated the king's supporters at Sevenoaks (June 18) and returned victoriously to London, which they entered on July 3. At this time Cade was at the height of his fortunes: his army was estimated at 40,000 men, and was certainly superior to the royal forces, and the city was favourable to his complaint of maladministration, waste, corruption, and oppression, and his opposition to the Statute of Labourers. Cade executed Lord Say-and-Sele and William Crowmer, sheriff of Kent; but his attempt to exact forced contributions led to the city gates being closed against him on the withdrawal of his army to Southwark (July 5). The Government now offered concessions and pardons, through the intermediary of Chancellor Kemp, which the Kentishmen accepted, and dispersed.

Cade's pardon was in the name of Mortimer; it was consequently declared invalid, and Cade himself was hunted down with his remaining followers by Alexander Iden, the new sheriff of Kent, and killed near Heathfield (July 12). Acts were afterwards issued attainting him and annulling all measures taken during his short predominance.

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CADENABBIA, a village of Lombardy, Italy, in the province of Como, 15m. N.N.E. by steamer from Como, on the west shore of the lake of Como, and a favourite spring and autumn resort. Pop. (1936) 348. The Villa Carlotta, formerly the property of the duke of Saxe Meiningen, now belonging to the Italian Government, contains marble reliefs by Thorwaldsen, representing the triumph of Alexander, and statues by Canova.

CADENCE, a falling or sinking, especially as applied to rhythmical or musical sounds, as in the "fall" of the voice in speaking, the rhythm or measure of verses, song or dance. In music, the word is used of the closing chords of a musical phrase, which succeed one another in such a way as to produce, first a sense of expectation or suspense, and then an impression of finality. "Cadenza," the Italian form of the same word, is used of a free flourish in a vocal or instrumental composition, introduced immediately before the close of a movement or at the end of the piece. The object is to display the performer's technique, or to prevent too abrupt a contrast between two movements. Cadenzas were formerly left to the improvisation of the performer, but nowadays usually are written by the composer, or by some famous executant like Joseph Joachim who wrote the cadenza in Brahms's *violin concerto*.

CADER IDRIS ("the chair of Idris"), one of the highest mountains in North Wales, ranking next to Snowdon in popular favour. It stands south of Dolgelley and the Mawddach estuary, in Merionethshire. The main core is formed by a bare ridge some 8m. long, culminating in Pen-y-Gader (2,927ft.) and sharply defined by steep rock-walls, nearly 1,000ft. in height, to the north. The southward slopes to the Dysynni valley are grass-grown but abrupt, while the sheer drop from the knife-edge ridge to the dark tarn of Llyn-y-Cau backs one of the most remarkable cirques (*cwms*) of Britain. Beyond the narrow wall, 1,000–1,200ft. in height, in the opposing cwm, lies Llyn-y-Gader. The views from the summit are specially rich and varied on the north side; to the south-west the wide sweep of Cardigan bay is embraced. Mention of Cader Idris and its legends is frequent in Welsh literature, old and modern.

CADET, the head of a junior branch of a family, a younger son (through the Fr. from the late Lat. *capitettum*, a diminutive of *caput*, head, through the Provençal form *capdet*). Employed as a military term for an accepted candidate for a commission in the army or navy, who is undergoing training to become an officer. This latter use of the term arose in France, where it was applied to the younger sons of the *noblesse* who gained commissioned rank, not by serving in the ranks or by entering the *écoles militaires*, but by becoming attached to corps without pay but with certain privileges. "Cadet Corps," in the British service, are bodies of boys or youths organized, armed and trained on volunteer military lines. Derived from "cadet," through the Scots form "cadee," comes "caddie," a messenger-boy, and particularly one who carries clubs at golf, and also the slang word "cad," a vulgar, ill-bred person.

CADI (*qādī*), a judge in a Muhammadan court, in which decisions are rendered on the basis of the canon law of Islam (*sharī'a*). It is a general duty, according to canon law, upon a Muslim community to judge legal disputes on this basis, and it is an individual duty upon the ruler of the community to appoint a cadi to act for the community. According to Shāfi'ite law, such a cadi must be a male, free, adult Muslim, intelligent, of unassailed character, able to see, hear and write, learned in the Qur'ān, the traditions, the Agreement, the differences of the legal schools, acquainted with Arabic grammar and the exegesis of the Qur'ān. He must not sit in a mosque, except under necessity, but in some open, accessible place. He must maintain a strictly impartial attitude of body and mind, accept no presents from the people of his district, and render judgment only when he is in a normal condition mentally and physically. He may not engage in any business. On some of these points the codes differ, and the whole is to be regarded as the ideal qualification, built up theoretically by the canonists.

See Th. W. Juynboll, *Handbuch des islamischen Gesetzes* (1910); E. Sachau, *Muhammedanisches Recht* (1897).

CADILLAC (*kăd'ĭ-lăk*), a city of Michigan, U.S.A., 95 mi. N. of Grand Rapids, on Lakes Cadillac and Mitchell, which are connected by a picturesque canal 200 yd. long; the county seat of Wexford county. It is on federal highway 131, and is served by the Ann Arbor and the Pennsylvania railways. The population in 1940 was 9,855. It is the shipping centre for manufactured articles and farm produce; industrial rubber goods, furniture, castings, light machinery are some of its manufactured products. West of the city is the Caberfae winter sports area, famous for winter sports. Near by lakes and streams offer a variety of fish. Cadillac was settled in 1871, and in 1877 was chartered as a city under its present name (after Antoine de la Mothe Cadillac). It has a commission-manager form of government.

CÁDIZ, a province of southern Spain, formed in 1833 of districts taken from Seville. It is bounded on the north by Seville, east by Málaga, southeast by the Mediterranean sea, south by the Strait of Gibraltar, and west by the Atlantic ocean. Pop. (1940) 600.440; area, 2,827 sq.mi.; exclusive, in each case, of Ceuta, on the Moroccan coast, which, for administrative purposes belongs to Cádiz. The main features of the Atlantic coastline of Cádiz are the broad Guadalquivir estuary which marks the frontier of Seville, the double bay of Cádiz, outlet for the Guadalete, chief river of the north districts, and Cape Trafalgar. Farther south, the river Barbate draining the broad, marshy Laguna de la Janda, flows into the Strait of Gibraltar and Punta Marroqui, on the strait, is the southernmost promontory of the European mainland. On the east coast the rock and fortress of Gibraltar overlook Algeciras bay and the river Guadiaro, which drains the eastern highlands, enters the Mediterranean close to the frontier of Málaga. In the interior there is a striking contrast between the comparatively level western half of the province and the picturesque well-wooded mountain ranges of the east. These mountains, which form the west end of the Boetic Cordillera, attain their greatest altitudes in the Cerro de San Cristobal (5,630ft.) and the Sierra del Pinar (5,413ft.).

The climate is mild and equable, and with naturally fertile soil makes fruit, vine and olive growing one of the chief sources of wealth in the province, though severe droughts often cause great distress. Jerez de la Frontera (Xeres) is famous for the manufacture and export of sherry, and Tarifa for its oranges. Much cork is obtained from the mountain forests, and quantities of fish are caught off the coast and are salted for export. A considerable amount of salt is obtained by evaporation of sea water in pans near Cádiz bay. Railway communication is limited in the west to a line from Seville to Cádiz, with branch lines to Sanlúcar from Jerez and Puerto de Santa Maria, and from Sanlúcar a few miles north to Bonanza; and in the east to a line from Granada to Algeciras. Cádiz came under nationalist control during the civil war in 1936. The capital city is Cádiz (pop. 1940, 87.630). Other cities (1940 pops.): La Línea (35.101); Sanlúcar (28.446); the naval station of San Fernando (32,300); Algeciras (20.226); Puerto de Santa Maria (28.262); Tarifa (6.362) and Puerto Real (12,510) on the coast; Jerez de la Frontera (65,166); Arcos de la Frontera (10,919); Vejer de la Frontera (8,709); Medina Sidonia (8,361) and Chiclana (14,337) inland. These are described in separate articles. Olvera (8.478), San Roque (5.932), Jimena de la Frontera (4,979) and Grazalema, probably the Roman Lacidulermium (2,045) are lesser towns trading in farm produce, wine and leather. (*See* also **ANDALUSIA.**)

CÁDIZ, capital and principal seaport of the Spanish province described above; on Cádiz bay, an inlet of the Atlantic ocean; 94 mi. by rail south of Seville. Pop. (1940) 87,630 (mun., 87,767). Cádiz is built on the low, rocky extremity of a narrow, sandy spit projecting about 5 mi. into the sea, in a north to west direction from the Isla de León, which is separated from the mainland by a broad channel known as the Rio Santi Petri. The isthmus and headlands on the mainland to the north nearly enclose the splendid bay, over 30 mi. in circuit, to which Cádiz owes its commercial importance. The outer bay, affording extensive anchorage in from 6 to 10 fathoms of water, stretches from the promontory of Rota to the mouth of the Rio de San Pedro, a distributary of the Guadalete which enters the bay opposite Cádiz. The inner bay, guarded at its narrow entrance by the forts of Puntales and Cortadura on the isthmus, also provides good anchorage, though in rather shallower water. On its south shore is the important naval arsenal of San Fernando. The entrance to the bays is somewhat obstructed by low shelving rocks (Los Cochinos and Las Puercas) and by shifting mud banks deposited by the rivers, but the channel is well marked by illuminated buoys.

Owing to its almost insular position Cádiz enjoys a mild climate, with temperatures seldom falling below 53° F. in winter or rising above 76° F. in summer. Winter is, however, the pleasanter season, as in summer the heat is either glaring, if land winds prevail, or very oppressive when the moisture-laden *W. Virazón* sets in.

The city, only 6 to 7 mi. in circumference, is peculiarly restricted by its position, being practically hemmed in by the sea and surrounded by a wall, now largely demolished, round the harbour on the east, but with only one land exit, a gate communicating with the isthmus. In view of the uniformity and elegance of its buildings, Cádiz must certainly be ranked as one of the finest cities of Spain. The houses, three-storied or more high, have flat roofs and watch towers in the Moorish style. The marine promenades which fringe the city between the ramparts and the sea are very fine, especially that called the *Alameda,* on the eastern side overlooking the bay. The general air of cleanliness, due partly to the fact that the houses are whitewashed every year, is, however, deceptive, as the drainage of the low-lying city is quite inadequate; and refuse, thrown over the sea walls, collects in heaps along the shore. The water supply is also bad. The water, apart from that collected in cisterns from the roofs, is brought at great expense from Santa Maria on the opposite coast by an aqueduct nearly 30 mi. long. The city possesses only one fresh water spring, which rises under the high altar of the old cathedral. Several times in its history its population has been decimated by disease, but the death rate gradually decreased after the beginning of the 20th century.

Cádiz is the see of a bishop, who is suffragan to the archbishop of Seville. The old cathedral, originally erected by Alphonso X of Castile (1252–84) and rebuilt after 1596, is now only a church. The new cathedral, begun in 1722 and completed between 1832 and 1838, is chiefly remarkable for its yellow dome and vast crypt. The church of Santa Catalina, formerly attached to a Capuchin convent which is now secularized and used as a lunatic asylum, contains an unfinished picture of the marriage of St. Catherine, by Murillo, who met his death by falling from the scaffold on which he was painting it (April 3, 1682). In the centre of the town there is a watchtower, the Torre Vigía, from which the arrival and departure of vessels are signalled. Cádiz possesses three theatres and a bull ring, accommodating 11,500 spectators, and many charitable institutions, such as the large Hospico de Misericordia, the Hospico for men, the women's hospital and the foundling institution. There are many free schools and several mathematical and commercial academies, a nautical school, a school of design, a theological seminary and a flourishing medical school attached to the University of Seville. The archaeological museum contains numerous Roman and Carthaginian relics and the academy possesses a valuable collection of pictures. Most of the old fortifications have been demolished but there is a fort as well as a lighthouse on the rock of San Sebastian to the west of the city. Modern villas and bathing establishments are growing up along the isthmus.

Cádiz, in spite of its fine natural harbour and splendid geographical position, no longer ranks among the first marine cities of the world. The loss of the Spanish colonies in America, early in the 19th century following the Napoleonic wars, dealt a blow to its trade from which it never recovered. Its decline was later accelerated by the disasters of the Spanish-American War of 1898, which almost ruined local commerce with Cuba and Puerto Rico and by the decreasing demand for sherry, but above all by the lack of enterprise among its citizens, who allowed its harbour works to become out of date. After the beginning of the 20th century, however, considerable improvements were made. Moles, wharves and warehouses were constructed until the harbour had more than 2 mi. of quayage.

A free depot established in 1823, but lapsing after 1832, was successfully revived on modern lines. Industrial development is small, but important naval and mercantile shipbuilding yards and various factories exist on the mainland and there are tunny fisheries off the coast. The city is above all a commercial port, ordinarily exporting much wine, principally sherry from Jerez, salt, olives, figs, corks and salted fish, and importing coal, iron and machinery, timber, cereals, coffee and other foodstuffs. Several great shipping lines call at Cádiz and passenger traffic is important. In spite of modern improvements, however, the development of Cádiz must always be checked by the restrictions of its site and by its limited access to and from the mainland along the narrow isthmus. This accommodates only one road, a railway and an electric tramline, connecting Cádiz with San Fernando. Modern rivalry with Seville also caused a loss of local trade.

History.—Cádiz, founded, according to tradition, by Phoenician merchants from Tyre as early as 1100 B.C., had become by the 7th century the great western market for the amber and tin from the Cassiterides (*q.v.*). About 501 B.C. it was occupied by the Carthaginians, who in the 3rd century made it their base for the equipment of the armaments with which Hannibal undertook to destroy the power of Rome. At the close of the Second Punic War the city willingly surrendered to Rome and from this time its prosperity steadily increased. Its growing trade in dried fish and meat, and in all the produce of the fertile Baetis (Guadalquivir) valley, attracted many Greek settlers; while men of learning, such as Pytheas in the 4th century B.C., Polybius and Artemidorus of Ephesus in the 2nd, and Posidonius in the 1st, came to study its tides, unparalleled in the Mediterranean. C. Julius Caesar conferred the *civitas* of Rome on all its citizens in 49 B.C.; and L. Cornelius Balbus Minor built what was called the "New City," the harbour now known as Puerto Real, and the bridge still existing across the Río Santi Petri. The wealth and importance of Gades was so great at this period that under Augustus it was the residence of no fewer than 500 *equites,* and was made a *municipium* with the name of *Augusta Urbs Gaditana,* with citizenship ranking next to that of Rome. Juvenal and Martial write of *Jocosae Gades,* "Cádiz the Joyous"; and throughout the Roman world its cookery and its dancing girls were famous. In the 5th century, however, the overthrow of Roman dominion in Spain by the Visigoths involved Cádiz in destruction. A few fragments of masonry, submerged under the sea, are almost all that remains of the original city. Moorish rule over the port, which was renamed *Jezirat-Kadis,* lasted from 711 until 1262, when Cádiz was captured, rebuilt and repeopled by Alphonso X of Castile. Its renewed prosperity dated from the discovery of America in 1492. As the headquarters of the Spanish treasure fleets, it soon recovered its position as the wealthiest port of western Europe, and consequently it was a favourite point of attack for the enemies of Spain. During the 16th century it repelled a series of raids by the Barbary corsairs; in 1587 all the shipping in its harbour was burned by the English squadron under Sir Francis Drake; in 1596 the fleet of the earl of Essex and Lord Charles Howard sacked the city, and destroyed 40 merchant vessels and 13 warships. This disaster necessitated the rebuilding of Cádiz on a new plan, but it quickly recovered, and its new fortifications enabled it to repel successfully attacks by British fleets under the duke of Buckingham in 1626, Admiral Blake in 1656 and Sir George Rooke and the duke of Ormonde in 1702. During the 18th century the wealth of Cádiz became greater than ever; from 1720 to 1765, when it enjoyed a monopoly of the trade with Spanish America, the city annually imported gold and silver to the value of about £5,000,000. Its wealth at this time is said to have been greater than that of London. With the closing years of the century, however, it entered upon a period of misfortune. From February 1797 to April 1798 it was blockaded by the British fleet, and in 1800 Nelson bombarded it. In 1808 the citizens captured a French squadron imprisoned by the British fleet in the inner bay. From Feb. 1810 to Aug. 1812 it was besieged by French forces, during which time it served as the capital of all Spain not under the control of Napoleon. Here, too, the cortes met and promulgated the famous liberal constitution of March 1812. To secure a renewal of this constitution the citizens rebelled in 1820, the revolution spreading throughout Spain. Ferdinand VII was imprisoned at Cádiz until released in 1823 by a French army In the nationalist revolution in 1936 Cádiz fell into rebel hands almost at once, and served as an important port of entry for reinforcements from Spanish Morocco.

See *Sevilla y* ***Cádiz,*** *sus monumentos y artes, su naturaleza é historia*, an illustrated volume in the series "España," by P. de Madrazo (Barcelona, 1884); *Recuerdos Gaditanos*, a very full history of local affairs, by J M León y Dominguez (Cádiz, 1897); *Historia de Cádiz y de su provincia desde los remotos tiempos hasta 1824,* by A. de Castro (Cádiz, 1858); *Descripcion historico-artistica de la catedral de Cádiz,* by J. de Urrutia (Cádiz, 1843); G. W. Edwards, *Spain* (1926).

CADIZ, a municipality of the province of Negros Occidental, island of Negros, Philippine Islands, on the north coast, about 53 mi N.N.E. of Bacolod, the provincial capital. Pop. (1939) 41,905 (a gain of 19,722 since 1918), of whom 22,438 were males, and 27 were whites. Of those inhabitants aged 6 to 19, inclusive, 26% were reported as attending school, and of those 10 years old and over 41.7% were reported as literates. The vernacular is a dialect of Bisayan The number of parcels of land declared for taxation in 1938 was 1,372, of which the assessed value was 3,371,430 pesos, and the number of owners was 843. (C. S. L.)

CADMAN, CHARLES WAKEFIELD (1881–), American musical composer, was born at Johnstown (Pa.), on Dec. 24, 1881. He used American-Indian material in music. His song, "From the Land of the Sky Blue Water," has become a classic of American song literature in many countries, including Russia. Among his operas are *Shanewis* (The Robin Woman), produced at the Metropolitan Opera House on March 23, 1918, and repeated in 1919, the first American opera to live beyond a season; *The Garden of Mystery* produced in New York, March 18, 1925; and *A Witch of Salem*, produced by the Chicago Opera Company, Dec. 8, 1926. Other compositions include a cantata, *The Vision of Sir Launfal;* a piano sonata; a trio and many songs.

CADMAN, SAMUEL PARKES (1864–1936), U.S. clergyman, author and lecturer, was born in Wellington, Shropshire, England, on Dec. 18, 1864. He graduated with honours from Richmond college, Surrey, in 1889. In 1890 he went to the United States and in 1895 was appointed the leader of the forward movement in New York City Methodism. In 1901 he was called to the pastorate of the Central Congregational Church of Brooklyn. He was elected president of the Federal Council of Churches of Christ in America in 1924, and in 1928 was chosen by this council and the National Broadcasting Company of America as their official radio preacher.

He is the author of *William Owen, A Biography* (1910); *The Religious Uses of Memory* (1911); *Charles Darwin and other English Thinkers* (1911); *The Three Religious Leaders of Oxford* (1916); *Ambassadors of God* (1920); *Christianity and The State* (1924); *Imagination and Religion* (1926); and *Pro Christo* (1928).

CADMIUM, a metallic element, showing a close relationship to zinc, with which it is very frequently associated; (symbol Cd, atomic number 48, atomic weight 112·41, isotopes 114, 112, 110, 113, 111, 116). It was discovered in 1817 by F. Stromeyer in a sample of zinc carbonate yielding a yellow zinc oxide, although quite free from iron. Simultaneously Hermann discovered the new metal in a specimen of zinc oxide which had been thought to contain arsenic, since it gave a yellow sulphide in acid solution on the addition of sulphuretted hydrogen.

Cadmium does not occur naturally in the uncombined condition, and only one mineral is known which contains it in any appreciable quantity, namely, greenockite or cadmium sulphide, found at Greenock and at Bishopton in Scotland, and in Bohemia and Pennsylvania. It is, however, nearly always found associated with zinc blende, and with calamine, although only in small quantities rarely exceeding 3%.

The metal is usually obtained from the flue-dust (produced during the first three or four hours' working of a zinc distillation) which is collected in the sheet iron cones or adapters of the zinc retorts. This is mixed with small coal, and when redistilled gives an enriched dust, and by repeating the process and distilling from cast iron retorts the metal is obtained. It can be purified by solution in hydrochloric acid and subsequent precipitation by metallic zinc. This process is repeated and finally the cadmium is deposited by electrolysis.

Cadmium is a white metal, possessing a bluish tinge, and is capable of taking a high polish; on breaking, it shows a distinct fibrous fracture. By sublimation in a current of hydrogen it can be crystallized in the form of regular octahedra; it is slightly harder than tin but is softer than zinc, and, like tin emits a crackling sound when bent. It is malleable and can be rolled out into sheets. The specific gravity of the metal is 8·564, this value being slightly increased after hammering; its specific heat is 0·0548, it melts at 322° C. and boils at 778° C., forming a deep yellow vapour. The cadmium molecule, as shown by determinations of the density of its vapour, is monatomic. The metal unites with the majority of the heavy metals to form alloys; some of these, the so-called fusible alloys, find a useful application from the fact that they possess a low melting point. An alloy of lead with 10% of cadmium and 10% of tin forms a solder. It also forms amalgams with mercury, and on this account has been employed in dentistry for the purpose of stopping (or filling) teeth. The metal is quite permanent in dry air, but in moist air it becomes coated with a superficial layer of the oxide; it burns on heating to redness, forming a brown coloured oxide; and is readily soluble in mineral acids with formation of the corresponding salts. Cadmium decomposes water vapour at a red heat, with liberations of hydrogen and formation of the oxide of the metal.

Cadmium oxide, CdO, is a brown powder of specific gravity 6·5, which can be prepared by heating the metal in air or in oxygen, or by ignition of the nitrate or carbonate, or by heating the metal to a white heat in a current of oxygen, when it is obtained as a dark red crystalline sublimate. It does not melt at a white heat, and is easily reduced to the metal by heating in a current of hydrogen or with carbon. It is a basic oxide, dissolving readily in acids, with the formation of salts, somewhat analogous to those of zinc.

Cadmium hydroxide, $Cd(OH)_2$, is obtained as a white precipitate by adding potassium hydroxide to a solution of any soluble cadmium salt. It is decomposed by heat into the oxide and water, and is soluble in ammonia but not in excess of dilute potassium hydroxide; the latter property serves to distinguish it from zinc hydroxide.

The chloride, $CdCl_2$, bromide, $CdBr_2$, and iodide, CdI_2, are soluble salts; and cadmium iodide which is one of the few iodides which are soluble in alcohol, is sometimes used in photography. Cadmium chloride and iodide behave in an anomalous way in concentrated aqueous solution probably owing to the formation of complex ions $Cd(CdI_3)_2$; the abnormal behaviour diminishing as the solution becomes more dilute, until, at very high dilutions the salts are ionized in the normal manner.

Cadmium sulphate, $CdSO_4$, is known in several hydrated forms, being deposited, on spontaneous evaporation of a concentrated aqueous solution, in the form of large monosymmetric crystals of composition $3CdSO_4 8H_2O$, whilst a boiling saturated solution to which concentrated sulphuric acid has been added, deposits crystals of composition $CdSO_4 H_2O$. It is largely used for making standard electric cells, such for example as the Weston, which gives a practically constant voltage under normal conditions.

Cadmium sulphide, CdS, occurs naturally as greenockite (*q.v.*), and can be artificially prepared by passing sulphuretted hydrogen through acid solutions of soluble cadmium salts, when it is precipitated as a pale yellow amorphous solid. It is used as a pigment (cadmium yellow), for it retains its colour in an atmosphere containing sulphuretted hydrogen; it melts at a white heat, and on cooling solidifies to a lemon-yellow micaceous mass.

An enamel pigment known as fine red or cadmium red is prepared from a mixture of 80–90% of cadmium sulphide and 10–20% of selenium. The well mixed components are heated at 700° C. The product corresponds in composition to Cd_3SeS_2. In a wet process a mixture of soluble sulphides and selenides is added to a solution of cadmium salt and the precipitate is ignored.

Normal cadmium carbonate is unknown, a white precipitate of variable composition being obtained on the addition of solutions of the alkaline carbonates to soluble cadmium salts.

Cadmium nitrate, $Cd(NO_3)_2 4H_2O$, is a deliquescent salt, which may be obtained by dissolving either the metal, or its oxide or carbonate in dilute nitric acid. It crystallizes in needles and is soluble in alcohol. In the foregoing compounds cadmium is bivalent, although it differs from zinc and resembles mercury in exhibiting a tendency to become univalent in cadmous chloride, CdCl, and the corresponding hydroxide and oxide, CdOH and Cd_2O.

Cadmium salts can be recognized by the brown incrustation which is formed when they are heated on charcoal in the oxidizing flame of the blowpipe; and also by the yellow precipitate formed when sulphuretted hydrogen is passed through their acidified solutions. This precipitate is insoluble in cold dilute acids, in ammonium sulphide and in solutions of the caustic alkalis, a behaviour which distinguishes it from the yellow sulphides of arsenic and tin. Cadmium is estimated quantitatively by conversion into the oxide, being precipitated from boiling solutions by the addition of sodium carbonate, the precipitate thus formed passing into the oxide on ignition. It can also be determined as sulphide, by precipitation with sulphuretted hydrogen, the precipitated sulphide being dried at 100° C. and weighed.

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CADMUS, son of Phoenix or Agenor, king of Phoenicia and brother of Europa. After his sister had been carried off by Zeus, he was sent out to find her. Unsuccessful in his search, he came to Delphi, where he consulted the oracle. He was ordered to give up his quest and follow a cow which would meet him, and to build a town on the spot where she would lie down. The cow met him in Phocis, and guided him to Boeotia, where he founded the city of Thebes. Intending to sacrifice the cow, he sent some of his companions to a neighbouring spring for water. They were slain by a dragon, which was in turn destroyed by Cadmus, and by the instructions of Athena he sowed its teeth in the ground, from which there sprang a race of fierce armed men, called Sparti (sown). By throwing a stone among them Cadmus caused them to fall upon each other till only five survived, who assisted him to build the Cadmeia or citadel of Thebes and became the founders of the noblest families of that city (Ovid, *Metam.* iii. i. ff.; Apollodorus iii.). Cadmus, however, because of this bloodshed, had to do penance for eight years. At the expiration of this period the gods gave him to wife Harmonia (*q.v.*), daughter of Ares and Aphrodite, by whom he had a son Polydorus, and four daughters, Ino, Autonoë, Agave and Semele. At the marriage all the gods were present; Harmonia received as bridal gifts a robe worked by Athena and a necklace made by Hephaestus. Cadmus is said to have finally retired with Harmonia to Illyria, where he and his wife were changed into snakes. The origin of this story is highly doubtful.

See O. Crusius in Roscher's *Lexikon* (bibliography).

CADMUS OF MILETUS, according to some ancient authorities, the inventor of history, or simply the author of certain letters of the Greek alphabet. Suidas mentions three writers so called, one being "later" and author of a history of Attica, among other works. He may be real; but, as Dionysius of Halicarnassus (*Iudicium de Thucydide,* c. 23) distinctly states that the work current in his time under the name of Cadmus was a forgery, it is most probable that the two first are identical with the Phoenician Cadmus, who, as the reputed inventor of letters, was subsequently transformed into the Milesian and the author of an historical work.

See C. W. Müller, *Frag. Hist. Graec.* ii. 2–4; and O. Crusius in Roscher's *Lexikon der Mythologie* (article "Kadmos," 90, 91).

CADOGAN, WILLIAM CADOGAN, 1st EARL (1675–1726), British soldier, was the son of Henry Cadogan, a Dublin barrister, and grandson of Major William Cadogan (1601–61), governor of Trim. The family has been credited with a descent from Cadwgan, the old Welsh prince. Cadogan began his military career as a cornet of horse under William III. at the Boyne, and, with the regiment now known as the 5th (Royal Irish) Lancers, made the campaigns in the Low Countries. In the course of these years he attracted the notice of Marlborough. In 1701 Cadogan was employed by him as a staff officer in the complicated task of concentrating the grand army formed by contingents from multitudinous states, and Marlborough soon made the young officer his confidential staff officer and right-hand man. His services in the campaign of 1701 were rewarded with the colonelcy of the famous "Cadogan's Horse" (now the 5th Dragoon Guards). As quartermaster general, he organized the celebrated march of the allies to the Danube. At the Schellenberg he was wounded and his horse shot under him, and at Blenheim he acted as Marlborough's chief of staff. Soon after he was promoted brigadier general, and in 1705 he led "Cadogan's Horse" at the forcing of the Brabant lines between Wange and Elissem, capturing four standards. He was present at Ramillies, and immediately afterwards was sent to take Antwerp, which he did without difficulty. Becoming major general in 1706, he continued to perform the numerous duties of chief staff officer, quartermaster general and colonel of cavalry, besides which he was throughout constantly employed in delicate diplomatic missions. In the course of the campaign of 1707, when leading a foraging expedition, he fell into the hands of the enemy but was soon exchanged. In 1708 he commanded the advanced guard of the army in the operations which culminated in the victory of Oudenarde, and in the same year he was with Webb at the action of Wynendael. On Jan. 1, 1709, he was made lieutenant general. He was present at Malplaquet, and after the battle was sent off to form the siege of Mons, at which he was dangerously wounded. At the end of the year he received the appointment of lieutenant of the Tower, but he continued with the army in Flanders to the end of the war. His loyalty to the fallen Marlborough cost him, in 1712, his rank, positions and emoluments under the Crown. George I. on his accession, however, reinstated Cadogan, and, amongst other appointments, made him lieutenant of the ordnance. In 1715, as British plenipotentiary, he signed the third Barrier Treaty between Great Britain, Holland and the emperor. His last campaign was the Jacobite insurrection of 1715–16. At first as Argyle's subordinate (*see* Coxe, *Memoirs of Marlborough,* ch. cxiv.), and later as commander-in-chief, General Cadogan by his firm, energetic and skilful handling of his task restored quiet and order in Scotland. Up to the death of Marlborough he was continually employed in diplomatic posts of special trust, and in 1718 he was made Earl Cadogan, Viscount Caversham and Baron Cadogan of Oakley. In 1722 he succeeded his old chief as head of the army and master general of the ordnance, becoming at the same time colonel of the 1st or Grenadier Guards. He sat in five successive parliaments as member for Woodstock. He died at Kensington in 1726.

As a soldier, Cadogan was one of the best staff officers in the annals of the British army, and in command of detachments, and also as a commander-in-chief, he showed himself to be an able, careful and withal dashing leader.

He was succeeded, by special remainder, in the barony by his brother, General Charles Cadogan (1691–1776), who married the daughter of Sir Hans Sloane, thus beginning the association of the family with Chelsea, and died in 1776, being succeeded in turn by his son Charles Sloane (1728–1807), who in the year 1800 was created Viscount Chelsea and Earl Cadogan. His descendant George Henry, 5th Earl Cadogan (1840–1915), was lord privy seal from 1886 to 1892, and lord-lieutenant of Ireland from 1895 to 1902.

CADORNA, LUIGI, COUNT (1850–1928), Italian general, was born at Pallanza, Lake Maggiore, Sept. 4, 1850. His father was Count Raffaele Cadorna, a distinguished soldier of the wars of the Risorgimento and the Crimea. Luigi Cadorna entered the army in 1866, and served in the infantry, in the artillery and on the staff, becoming colonel in 1892. In 1905 he became lieutenant general, and a year later was chosen as an army commander in the event of war. In the manoeuvres of 1911 he opposed Carlo Caneva, who as victor was given the command in Tripoli.

In 1914, however, on the death of Gen. Pollio, chief of the general staff, Cadorna was appointed to succeed him (July 10). He found the army in a deplorable condition; moreover, within three weeks, the outbreak of World War I forced the problems of army reform to the front. Though handicapped by lack of money and by Italy's low industrial capacity, in the interval between Aug. 1914 and the entry of Italy into the war, Cadorna fashioned a weapon with which it was possible to strike, and to strike hard.

For 29 months, handicapped always by lack of means, Cadorna directed the operations against Austria-Hungary with insight, vigour and determination. Facile critics have found fault with his plan of campaign, but the more carefully and objectively this is studied, the more it justifies itself. For a year Cadorna had the full confidence of his country. The first check came with the initial success of the Austrian offensive in the Trentino-Asiago area in May 1916. As time went on, and signs of war-weariness became visible among the troops, Cadorna entered the strongest protest against the policy of the government, which, he said, permitted an antiwar propaganda which was detrimental to the morale of the army. Though these protests were largely justified, it must be admitted that a part of the responsibility for declining morale lay at Cadorna's own door, for he did not seem to have fully realized the strain of modern war upon the troops. The disaster of Caporetto led to the transfer of Cadorna in Nov. 1917, from the command of the Italian armies to the newly formed Allied Military council at Versailles. But before leaving his command he had organized the defenses on the Piave-Monte Grappa front, and thus had made a stout resistance possible.

Cadorna came to Versailles under the shadow of defeat, but his personality and military insight soon impressed his colleagues and removed the initial handicap. It was a misfortune for Italy when, in Feb. 1918, consequent upon the appointment of the Caporetto inquiry commission, it was thought necessary to remove him from Versailles. As a result of the inquiry he was placed on half pay on Aug. 29, 1918, and four days later his definite retirement was gazetted. General Cadorna died on Dec. 21, 1928.

In March 1921, Cadorna published *La Guerra alla Fronte Italiana*, which effectively answered much of the criticism that had been directed against his leadership. This work was followed by *Altre Pagine sulla Grande Guerra* (1925). On the sixth anniversary of the Italian victory (Nov. 4, 1924), the newly created rank of marshal was conferred on him. Among his writings is *Il Generale Raffaele Cadorna nel Risorgimento Italiano* (1922).

(W. K. McC.)

CADOUDAL, GEORGES (1771–1804), leader of the *Chouans* during the French Revolution, was born on Jan. 1, 1771, near Auray (Morbihan). From 1793 he organized a revolt in the Morbihan which was quickly suppressed, and he thereupon joined the army of the revolted Vendeans, taking part in the battles of Le Mans and of Savenay in Dec. 1793. Returning to Morbihan, he was arrested, but escaped from his prison at Brest. Cadoudal was one of the leaders of the Chouannerie, and was constantly fomenting trouble in Britanny, escaping, when the position was dangerous, to England. After the repression of the revolt of 1800 he came to Paris and had an interview with Napoleon, but the police suspected him of a plot to murder the latter, and he fled again to England. In Aug. 1803 Cadoudal crossed the channel for the last time, in a British cutter, armed with British government drafts to finance a rising in Paris. On Feb. 29 1804, Charles Pichegru was arrested, on March 9 Cadoudal, and shortly afterward many others. The conspirators were said to be expecting a prince, and Napoleon's police imagined the prince to be the Duc d'Enghien. Cadoudal and 19 of his companions were sentenced to death. Some of the sentences were commuted, but Cadoudal, with others, was executed on June 24. Cadoudal is popularly known as Georges.

CADRE, a framework or skeleton, particularly the permanent establishment of a military corps, regiment, etc., which can be expanded on emergency. The modern tendency is for the cadre to be largely composed of commissioned and noncommissioned officers capable of filling higher grades on mobilization, and trained as instructors so that they may train the new recruits.

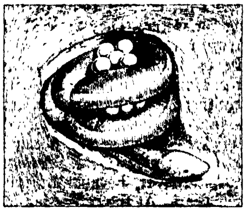
CADUCEUS (the Lat. adaptation of the Doric Gr. *καρύκειον*, Attic *κηρύκειον*), a herald's wand, and hence the staff used by messengers. The caduceus of Hermes is a familiar example. In its oldest form it was a rod ending in two prongs (probably an olive branch with two shoots, adorned with ribbons or garlands), for which, later, two serpents, with heads meeting at the top, were substituted. A pair of wings was sometimes attached to the top of the staff. In historical times the caduceus was the attribute of Hermes as the god of commerce and peace, and among the Greeks it was the distinctive mark of heralds and ambassadors, whose persons it rendered inviolable. The caduceus itself was not used by the Romans, but the derivative *caduceator* occurs in the sense of a peace commissioner.

CADUCOUS, a botanical term for "falling early," or out of season, applied, for example, to the sepals of a poppy which fall before the petals expand.

CAECILIA, VIA, an ancient highroad of Italy, which diverged from the Via Salaria at the 35th mile from Rome, and ran by Amiternum to Interamna Praetuttiorum (Teramo) and thence to the sea at Castrum Novum (Giulianova), a distance of about 148 mi. from Rome. It was probably constructed by L. Caecilius Metellus Diadematus (consul in 117 B.C.).

CAECILIAN, the best vernacular name for a group of limbless, wormlike amphibians (*see* AMPHIBIA), first described by Linnaeus as a group of snakes, but later recognized as of a distinct order of Amphibia to which the names Apoda and Gymnophiona have been given. Apoda is in general use by systematists.

The caecilians are all limbless, long-bodied Amphibia with a very short tail, the vent being nearly terminal. Their bodies are usually more or less ringed by dermal folds, which gives them the appearance of large earthworms. Within these folds there are found in several genera a series of minute scales, a structure otherwise unknown in living Amphibia. All genera are characterized by a peculiar protrusible tentacle on the side of the face near the nostril or eye, which is said to function as a tactile organ, but is radically different from such sense organs in other Amphibia. Caecilians are primitive forms apparently directly derived from the extinct Lepospondylia. They show no close affinity to other living groups, and are more primitive than other living Amphibia in having in the skull (in certain genera) a post-frontal (*Ichthyophis*, etc.), an ectopterygoid (*Hypogeophis*, etc.), a transitory spiracle cleft, a sixth gill sac, four pairs of functional thymus glands and two additional pairs of rudiments during development. In certain features of the skull the caecilians resemble a partly metamorphosed salamander, such as *Cryptobranchus*, but one highly modified for burrowing. The lidless eyes are usually indistinct and sometimes very degenerate and hidden under the bones of the skull. In spite of their primitive characters the caecilians must be considered a highly aberrant and specialized group.



AFTER SARASIN

CAECILIAN OF CEYLON (ICHTHYOPHIS GLUTINOSUS) SHOWN IN BURROW GUARDING EGGS

F. Nieden (1913) recognized 19 genera and 55 species, all referable as a whole to a single family, the Caecilidae. The primitive genera *Ichthyophis*, *Rhinatrema*, etc., have scales, exhibit the fewest fusions of skull elements, and are the least modified for burrowing. The most specialized are either degenerate burrowers, or aquatic (*Typhlonectes*). In correlation with the habitat, the structure of integument, skeleton or lungs may be modified. The caecilians inhabit the tropics. They are seldom seen except after heavy rains or when uncovered by the plow.

The life histories of several genera of caecilians are known. *Ichthyophis* lays its eggs on land in damp situations, the larvae escaping to take up an aquatic existence. The more specialized *Hypogeophis* skips over the larval stage. Other genera, including the aquatic *Typhlonectes*, give birth to living young.

Bibliography.—*See* "General Works" in bibliography under Amphibia. *See* also F. Nieden, "Gymnophiona (Amphibia apoda)," *Das Tierreich*, xxxvii (1913); H. Kuhlenbeck, "Zur Morphologie des Gymnophionen Gehirns," *Zeitschr. Nat.*, lviii, pp. 453–484 (Jena, 1922); H. Marcus, "Uber die Entwicklung von Blut und Gefässen bei Hypogeophis und Torpedo. Beitrag zur Kenntnis der Gymnophionen," ix, *Zeitschr. Anat. Entw. Gesch.*, lxxx, pp. 104–176 (1926); E. R. Dunn, "The American Caecilians," *Bull. Mus. Comp. Zool.*, xci, pp. 437–540 (1942). (G. K. N.; K. P. S.)

CAECILIUS, of Calacte in Sicily, Greek rhetorician, flourished at Rome during the reign of Augustus. Next to Dionysius of Halicarnassus, he was the most important critic and rhetorician of the Augustan age. Only fragments of his works are extant, among which may be mentioned: *On the Style of the Ten Orators; On the Sublime*, attacked by Longinus (?) in his essay on the same subject (*see* L. Martens, *De Libello* Περὶ ὕψους, 1877); *History of the Servile Wars*, or slave risings in Sicily; *On Rhetoric* and *Rhetorical Figures;* an *Alphabetical Selection of Phrases*, an Attic lexicon, mentioned by Suidas as one of his authorities; *Against the Phrygians*, probably an attack on the florid style of the Asiatic school of rhetoric.

CAECILIUS STATIUS or **STATIUS CAECILIUS,** Roman comic poet, friend of Ennius, died in 168 (or 166) B.C. He was born in the territory of the Insubrian Gauls, and was probably taken as a prisoner to Rome (*c.* 200) during the great Gallic war. Originally a slave, he assumed the name of Caecilius from his patron. He supported himself by adapting Greek plays for the Roman stage from the new comedy writers, especially Menander. Suetonius' Life of Terence states that Caecilius was ordered to hear Terence's *Andria* (exhibited 166 B.C.) read and to criticize it. Volcacius Sedigitus, the dramatic critic, places him first among the comic poets; Varro praises his plots; Horace (*Epistles*, ii, 1, 59) contrasts his dignity with the art of Terence. Quintilian (*Inst. Orat.*, x, 1, 99) speaks somewhat disparagingly of him, and Cicero (*De Optimo Genere Oratorum*, 1) considers him inferior to Terence in style and Latinity (*Ad. Att.* vii. 3). The fact that his plays could be named without any indication of the author (Cicero, *De Finibus*, ii. 7) is proof of their popularity.

The fragments of his plays are chiefly preserved in Aulus Gellius, who cites several passages from the *Plocium* (necklace) together with the original Greek of Menander. The translation, which is diffuse and by no means close, fails to reproduce the spirit of the original.

Bibliography.—Fragments in Ribbeck, *Scaenicae Romanorum Poesis Fragmenta* (1898). *See* also W. S. Teuffel, *Caecilius Statius*, etc. (1858); Mommsen, *Hist. of Rome* (Eng. tr.), bk. iii, ch. xiv; F. Skutsch in Pauly-Wissowa, *Realencyklopädie* (1897).

CAECINA, the name of a distinguished Etruscan family of Volaterrae. Graves have been discovered belonging to the family, whose name is still preserved in the river and hamlet of Cecina.

Aulus Caecina, son of Aulus Caecina, who was defended by Cicero (69 B.C.), took the side of Pompey in the civil wars and published a tirade against Caesar, for which he was banished. He recanted in a work called *Querelae*, and was pardoned at the intercession of his friends—above all, of Cicero. Caecina was regarded as an authority on the Etruscan system of divination (*Etrusca Disciplina*), which he tried to harmonize with the doctrines of the Stoics. (*See* Seneca, *Nat. Quaest.* II. 31–49, for fragments.) Cicero was probably indebted to Caecina in his treatise *De Divinatione*. Some of the correspondence is preserved in Cicero's letters (*Ad Fam.* vi, 5–8; *see* also ix and xiii, 66).

Aulus Caecina Alienus, Roman general, was quaestor of Baetica in Spain (A.D. 68). On the death of Nero he supported Galba, who appointed him to the command of a legion in upper Germany but shortly afterward ordered him to be prosecuted for embezzlement. Caecina went over to Vitellius and was sent to lead half the army into Italy, where Otho had made himself emperor. After crossing the Alps he was defeated near Cremona, but immediately afterward he was joined by Valens with the rest of the Vitellian forces and the two defeated Otho at the decisive battle of Bedriacum (Betriacum). When Vespasian's supporters invaded Italy, Caecina, who had been sent against them, turned traitor and tried to persuade his army to go over to Vespasian, but he was thrown into chains by the soldiers. After Vespasian's victory he was released and taken into favour, but in 79 he was implicated in a conspiracy against Vespasian and was put to death by order of Titus.

See Tacitus, *Histories*, i, 53, 61, 67–70, ii, 20–25, 41–44, iii, 13; Dio Cassius, lxv, 10–14, lxvi, 16; Plutarch, *Otho*, 7; Suetonius, *Titus*, 6; Zonares xi, 17.

CAEDMON, the earliest English Christian poet. His story is known to us only from Bede (*Hist. Eccl.*, iv, 24). He was (*see* Bede) a herdsman who received a divine call to poetry in a dream. One night, having quitted a company because, from want of skill, he could not comply with the demand made of each guest to sing, he dreamed that there appeared to him a stranger, who commanded him to sing of "the beginning of created things." He pleaded inability, but the stranger insisted, and he was compelled to obey. He found himself uttering "verses which he had never heard." Of Caedmon's song Bede gives a prose paraphrase, which, he says, represents the sense only, not the arrangement of the words. When Caedmon awoke he remembered the verses and added others. He related his dream to the farm bailiff under whom he worked, and was conducted by him to the monastery at Streanaeshalch (now called Whitby). The abbess Hild recognized that the illiterate herdsman had received a gift from heaven, and, to test his powers, proposed that he should render into verse a portion of sacred history which the monks explained. By the following morning he had fulfilled his task. At the request of the abbess he became an inmate of the monastery. Throughout the remainder of his life his more learned brethren expounded to him Scripture history, and all he heard he reproduced in poetry. All his poetry was on sacred themes, and its unvarying aim was to turn men from sin to righteousness. Although many among the Angles had essayed to compose religious poetry, none of them, in Bede's opinion, had approached Caedmon.

Bede's account of Caedmon's deathbed has often been quoted, and is of singular beauty. It is commonly stated that he died in 680, in the same year as Hild, but for this there is no authority. All we know of his date is that his dream took place during the period (658–680) in which Hild was abbess of Streanaeshalch, and he must have died before Bede finished his history in 731.

The hymn said to have been composed by Caedmon in his dream is extant. A copy of it, in the Northumbrian dialect, and in a handwriting of the 8th century, appears on a blank page of the Moore ms. of Bede's History; and five other Latin mss. have the poem (transliterated into a more southern dialect) as a marginal note. In the Old English version of Bede, ascribed to King Alfred, it is given in the text. Probably the Latin ms. used by the translator contained this addition. It was formerly maintained by some scholars that the extant Old English verses are not Bede's original, but a mere retranslation from his Latin prose version. The argument was that they correspond too closely with the Latin; Bede's words, "hic est sensus, non autem ordo ipse verborum," being taken to mean that he had given only a free paraphrase. But the form of the sentences in Bede's prose shows a close adherence to the parallelistic structure of Old English verse, and the alliterating words in the poem are in nearly every case the most obvious equivalents of those used by Bede. The sentence quoted above can, therefore, have been meant only as an apology for the absence of those poetic graces that disappear in translations. Even if the existing verses are a retranslation, it would still be certain that they differ very slightly from the original. It is of course possible to hold that the story of the dream is pure fiction (a similar story is told of the Icelandic poet Halebjorn

Hali), and that the lines which Bede translated were not Caedmon's at all. But there is little to justify such scepticism. As the hymn is said to have been Caedmon's first essay in verse, its lack of poetic merit is really an argument for its genuineness. There is then no reason to doubt that the nine lines are Caedmon's.

The "Caedmon Poems".—This poor fragment is all that can with confidence be affirmed to remain of the voluminous works of the man whom Bede so highly admired. A considerable body of verse was known by his name; but among modern scholars the use of the designation is merely a matter of convenience. The so-called Caedmon poems are contained in a ms. written about A.D. 1000, which was given in 1651 by Archbishop Ussher to the famous scholar Francis Junius, and is now in the Bodleian. They consist of paraphrases of parts of Genesis, Exodus and Daniel, and three separate poems, the first on the lamentations of the fallen angels, the second on the "harrowing of hell" and the third (a fragment) on the temptation. The subjects correspond so well with those of Caedmon's poetry as described by Bede that Junius unhesitatingly attributed the poems to him. The ascription was rejected in 1684 by G. Hickes, whose chief argument, based on the dialect is now known to be fallacious, as most "West Saxon" poetry is certainly of Northumbrian origin. Since, however, we learn from Bede that Caedmon had many imitators, the abstract probability is unfavourable to the assumption that a collection of poems contained in a late 10th century ms. contains any of his work. *Modern criticism* has shown that the "Caedmon ms." cannot be all by one author. Some portions of it are plainly the work of a Latin scholar. It is possible that some of the rest may be genuine; but in the absence of any basis of comparison, the internal evidence can afford no certainty. On the other hand, the mere unlikeness of any particular passage to the nine lines of the *Hymn* is no reason for denying it to Caedmon.

Genesis contains a long passage (ii, 235–851), which differs markedly in style and metre from the rest. This passage is one of the finest in all Old English poetry. In 1877 E. Sievers argued, on linguistic grounds, that it was mainly a translation from a lost poem in Old Saxon, probably by the author of the *Heliand*, a conclusion brilliantly confirmed in 1894 by the discovery in the Vatican library of a ms. containing 62 lines of the *Heliand* and the original of 28 lines of the interpolated passage of the Old English *Genesis*. The Old Saxon biblical poetry belongs to the mid 9th century; the translation is consequently later.

As *Genesis* begins with a line identical in meaning with the opening of Caedmon's *Hymn*, we may perhaps infer that the writer knew Caedmon's genuine poems, but when, after treating of the revolt of Lucifer, the paraphrast comes to the biblical part of the story, he follows the sacred text with servile fidelity. The ages of the antediluvian patriarchs, for instance, are accurately rendered into verse. In all probability *Genesis* is of Northumbrian origin. The names assigned to the wives of Noah and his three sons (Phercoba, Olla, Olliua, Olliuani) have been traced to an Irish source, and this seems to point to the influence of the Irish missionaries in Northumbria.

Exodus is a fine poem, strangely unlike anything else in Old English literature. It is full of martial spirit, yet makes no use of the phrases of the heathen epic. The condensation of the style and the peculiar vocabulary make it somewhat obscure. It is probably of southern origin, and can hardly be supposed to be even an imitation of Caedmon.

Daniel is not a great poem, but the narration is lucid and interesting. The author has borrowed some 70 lines from a poetical rendering of the Prayer of Azarias and the Song of the Three Children, of which there is a copy in the Exeter Book. The borrowed portion ends with verse 3 of the canticle, the remainder of which follows in a version for the most part independent. Elsewhere the paraphrast draws only from the canonical book of Daniel. The poem is obviously the work of a scholar.

The three other poems, designated "Book II" in the Junius ms., are characterized by considerable imaginative power and vigour of expression, but show an absence of culture and are somewhat rambling. They abound in passages of fervid religious exhortation. On the whole, they are such as we should expect in the work of the poet celebrated by Bede, and it seems just possible that we have in these pieces a comparatively little altered specimen of Caedmon's compositions.

Of poems not included in the Junius ms., the *Dream of the Rood* (*see* CYNEWULF) is the only one that has with any plausibility been ascribed to Caedmon. It was affirmed by G. Stephens that the Ruthwell cross, on which a portion of the poem is inscribed in runes, bore on its top-stone the name "Cadmon"; but the traces of runes that are still visible exclude all possibility of this reading. The poem is certainly Northumbrian and earlier than Cynewulf. It would be impossible to prove that Caedmon was not the author, though his authorship of such a work would rank among the miracles of genius. Similarities between passages in *Paradise Lost* and parts of the translation from Old Saxon have given occasion to the suggestion that some scholar may have talked to Milton about the poetry published by Junius, and that the poet may thus have gained some hints. The parallels, however, though interesting, are only such as might be expected to occur between two poets working on the same traditional material.

The name Caedmon (in the mss. of the Old English version of Bede written *Cedmon, Ceadmann*) is not explicable by means of Old English, the statement that it means "boatman" is founded on the corrupt gloss *liburnam, ced,* where *ced* is an error for *ceol*. It is most probably the British *Cadman,* intermediate between the Old Celtic *Catumanus* and the modern Welsh *Cadfan*. Possibly the poet was of British descent, though the inference is not certain, as British names may sometimes have been given to English children. The name Caedwalla was borne by a king of the West Saxons. The initial element *Caed* or *Cead* (probably adopted from British names in which it represents *catu*, war) appears combined with an Old English terminal element in the name *Caedbaed* (*cf.* the Irish name *Cathbad*), and hypocoristic forms of names containing it were borne by the English saints Ceadda (St. Chad) and his brother Cedd, called Ceadwealla in one ms. A Cadmon witnesses a Buckinghamshire charter of about A.D. 948.

The oldest edition is that of F. Junius (1655). *See* R. Wülker's re-edition of Grein's *Bibliothek*, Bd. ii (1895). This work contains also the texts of the *Hymn* and the *Dream of the Rood*. The pictorial illustrations of the Junius ms. were published in 1833 by Sir H. Ellis.

CAELIA, the name of two ancient cities in Italy. (1) In Apulia (mod. *Ceglie del Campo*), on the road to Gnatia (*q.v.*), 5 mi. S. of Barium. Coins bearing the inscription Καιλίνων prove that it was once independent. (2) In Calabria (mod. *Ceglie Messapica*), 25 mi. W. of Brundusium, and 991 ft. above sea level. There are remains of a prehistoric *enceinte* and several Messapian inscriptions and numerous tombs.

CAELIUS (MARCUS CAELIUS RUFUS) (82?–48 B.C.), Roman politician, was born at Puteoli on May 28, B.C. 82, the son of a Roman eques of the same name. (But *see* Nipperdey, *Rheinisches Museum*, xix, 290.) He was educated under the instructions of Crassus and Cicero, and was constantly with Cicero during Cicero's praetorship (66) and subsequently. In 63 he became intimate with Catiline, but according to Cicero was not involved in the conspiracy. In 61 he went to Africa as *comes* to the proconsul Q. Pompeius Rufus, and on his return in 59 successfully accused C. Antonius, who had been consul with Cicero, of complicity in the Catilinarian conspiracy, in a brilliantly savage speech which still survived in Quintilian's day (Quint. IV, ii, 123, and IX, iii, 58). About that time he was quaestor.

In 56 he was accused of violence (*vis*) at the instance of Clodia, who had been his mistress, and whom he had deserted and saddled with the nickname *quadrantaria Clytaemnestra*. Caelius is probably the Rufus whom Catullus accuses of stealing Clodia from him. Caelius spoke in his own defense and Crassus and Cicero also spoke for him. He was acquitted. In 52 he was tribune and opposed Pompey's measures for bringing Milo to trial. He was induced by Pompey, against his own judgment, not to veto the law of the ten tribunes, allowing Caesar to stand for the consulship in absence.

In 51 Cicero went to Cilicia as proconsul, and Caelius kept him supplied with news from Rome. His letters are preserved in the collection of Cicero's correspondence. One in particular (*Ad Fam.*, viii) gives a vivid account of the proceedings in the senate on the motion of Marcellus to deal with the consular provinces. In 50 he was aedile, and his letters to Cicero are dotted with requests for panthers for his games. About this time he became a supporter of Caesar. In *Ad Fam.*, viii 14, written to Cicero in Aug. 50, he foresees civil war and seems reluctantly determined to join Caesar. In 49 he supported the motion that Pompey should leave for Spain, and immediately afterward fled to Caesar's camp at Ravenna. Later that year he fought for Caesar in Liguria and Spain. In 48 he was made *praetor peregrinus*, and Caesar left for the war with Pompey. Indignant at being passed over for the urban praetorship in favour of Trebonius, and disappointed in his hopes of a proscription, which would have enabled him to pay his debts, he set up a tribunal as a counterattraction to Trebonius, who was administering Caesar's scheme for payment of debts, and introduced measures amounting to a general cancellation of debts. The senate deprived him of his office, and he left Rome to join Milo in Campania. The two of them got up a revolt and were both killed, Caelius at Thurii, by some provincial cavalry whom he was trying to bribe. Brilliant and cynical, capable of impetuous acts of kindness or savagery, he captured the imagination of antiquity, and most authorities have a good word for him. He lives more vividly than most of the men of his age, in his letters to Cicero.

CAEN, a city of northwestern France, capital of the department of Calvados, 7½ mi. from the English channel and 149 mi. W.N.W. of Paris on the Western railway to Cherbourg. Pop. (1936) 60,755. It is in the valley and on the left bank of the Orne, the right bank of which is occupied by the suburb of Vaucelles with the station of the Western railway. To the southwest of Caen, the Orne is joined by the Odon, arms of which water the "Prairie," a fine plain on which a well-known racecourse is laid out. Its wide streets, shady boulevards and public gardens enhance the attraction which the town derives from many fine churches and old houses. Hardly any remains of its once extensive ramparts and towers are to be seen, but the castle, founded by William the Conqueror and completed by Henry I, is still used as barracks, though in a greatly altered condition.

St. Pierre, the most beautiful church in Caen, stands at the northern extremity of the rue St. Jean, in the centre of town. In the main, its architecture is Gothic, but the choir and the apsidal chapels, with their elaborate interior and exterior decoration, are of Renaissance workmanship. The tower, which rises beside the southern portal to a height of 255 ft., belongs to the early 14th century. The church of St. Étienne, or l'Abbaye-aux-Hommes, in the west of the town, is an important specimen of Romanesque architecture, dating from about 1070, when it was founded by William the Conqueror. It is hemmed in by other buildings, so that a comprehensive view of it is not to be obtained. The whole building, and especially the west façade, which is flanked by two towers with lofty spires, is characterized by its simplicity. The choir, which is one of the earliest examples of the Norman Gothic style, dates from the early 13th century. In 1562 the Protestants did great damage to the building, which was skilfully restored in the early 17th century. A marble slab marks the former resting place of William the Conqueror. The abbey buildings were rebuilt in the 17th and 18th centuries, and now shelter the lycée. Matilda, wife of the Conqueror, was foundress of the church of La Trinité or l'Abbaye-aux-Dames, which is of the same date as St. Étienne. Two square unfinished towers flank the western entrance, and another rises above the transept. Queen Matilda is interred in the choir, and a fine crypt beneath it contains the remains of former abbesses. The buildings of the nunnery, reconstructed in the early 18th century, now serve as a hospital. Other interesting old churches are those of St. Sauveur, St. Michel de Vaucelles, St. Jean, St. Gilles, Notre Dame de la Gloriette, St. Étienne le Vieux and St. Nicolas, the last two now secularized.

Caen possesses many old timber houses and stone mansions, in one of which, the hôtel d'Ecoville (*c.* 1530), the exchange and the tribunal of commerce are established. The hôtel de Than, also of the 16th century, is remarkable for its graceful dormer windows. The Maison des Gens d'Armes (15th century), in the eastern outskirts of the town, has a massive tower adorned with medallions and surmounted by two figures of armed men.

The monuments at Caen include one to the natives of Calvados killed in 1870 and 1871 and one to the lawyer J. C. F. Demolombe, together with statues of Louis XIV, Élie de Beaumont, Pierre Simon, marquis de Laplace, D. F. E. Auber and François de Malherbe, the two last, natives of the town.

Caen is the seat of a court of appeal, of a court of assizes and of a prefect. It is the centre of an academy and has a university with faculties of law, science and letters and a preparatory school of medicine and pharmacy; there are also a lycée, training colleges, schools of art and music and two large hospitals.

The other chief public institutions are tribunals of first instance and commerce, an exchange, a chamber of commerce and a branch of the Bank of France. The *hôtel de ville* contains the library, with more than 100,000 volumes and the art museum with a fine collection of paintings. The town is the seat of several learned societies including the Société des Antiquaires.

Caen, despite a diversity of manufactures, is commercial rather than industrial. Its trade is due to its position in the agricultural and horse breeding district known as the *Campagne de Caen* and to its proximity to the iron mines of the Orne valley and to manufacturing towns such as Falaise, Le Mans, etc. English coal is foremost among the imports, which also include timber and grain, while iron ore, Caen stone, butter and eggs and fruit are among the exports. Important horse and cattle fairs are held in the town. In the southeast of the town there is a floating basin lined with quays and connected with the Orne and with the canal which debouches into the sea at Ouistreham 9 mi. to the N.N.E. The port, which also includes a portion of the river bed, communicates with Havre and Newhaven by a regular line of steamers; it has a considerable fishing population. The industries of Caen include timber sawing, metal founding and machine construction, cloth weaving, lacemaking, the manufacture of leather and gloves, and of oil from the colza grown in the district, furniture and other wooden goods and chemical products. Though Caen is not a town of great antiquity, the date of its foundation is unknown. It existed as early as the 9th century, and when, in 912, Neustria was ceded to the Normans by Charles the Simple, it was an important place. Under the dukes of Normandy, and particularly under William the Conqueror, it rapidly increased. It became the capital of lower Normandy, and in 1346 was besieged and taken by Edward III of England. It was again taken by the English in 1417, and was retained by them till 1450, when it capitulated to the French. The university was founded in 1436 by Henry VI of England.

During the Wars of Religion, Caen embraced the reform; in the succeeding century its prosperity was shattered by the revocation of the Edict of Nantes (1685). In 1793 the city was the focus of the Girondist movement against the Convention.

CAENOLESTID, a small South American mammal of the family Caenolestidae (*see* MARSUPIALIA), of great interest since they show some resemblance to the Australian diprotodont marsupials in that the lower first incisor tooth is greatly enlarged. There are two or three other lower incisors. Caenolestids are small shrewlike mammals, without pouches, found in the Andes mountains and on Chiloe Island, off southern Chile. Two genera are known in addition to the typical *Caenolestes*.

See W. H. Osgood, Field Mus. Nat. Hist., Zool. Ser., vol. 14 No. 1, "Monographic Study of the American Marsupial Caenolestes" pp. 1–157, and No. 2 "Review of Living Caenolestids with description of a new genus from Chile," pp. 163–172 (1924). (J. E. Hl.)

CAEN STONE, a soft cream-coloured limestone found near Caen, France. It is closely identified with the Bath oolite stone found in England. The quarries are of great antiquity, and partly because they are easily accessible to sea transportation, considerable quantities of the stone were imported into England at an early date, probably from soon after the Norman conquest down to the middle of the 15th century. It was used extensively in building churches and cathedrals, in such well-known structures as Westminster abbey, Canterbury cathedral, Buckingham palace, and the old Cathedral of St. Paul's in London. More than 400 tons were imported in 1443 to be used in building Eton college.

The stone is quarried underground, in blocks 8 or 9 ft. long and about 2 ft. thick and is brought to the surface through vertical shafts. It weighs about 165 lb. per cu.ft. It is yellowish-white in colour when first quarried, and soft, but hardens and turns white when exposed to the air. Because of its very fine texture and softness it is admirably adapted for internal decorative work, and it has been widely used for delicately carved ecclesiastical ornamentation. It is too soft and absorbent to be suitable for outdoor use in a climate like that of the United States, and it has been found that if used in New York city, the stone will not last longer than about ten years unless protected by paint.

CAEPIO, QUINTUS SERVILIUS, Roman general, consul 106 B.C. During his year of office he brought forward a law by which the jurymen were again to be chosen from the senators instead of the equites (Tacitus, *Ann.* xii, 60; but *see* Theodore Mommsen, *Römisches Staatsrecht*, iii, 531, 532). As governor of Gallia Narbonensis, he plundered the temple of the Celtic Apollo at Tolosa (Toulouse), the inhabitants of which had joined the Cimbri. In 105 Caepio suffered a defeat from the Cimbri at Arausio (Orange). In the same year he was deprived of his proconsulship and his property confiscated; later he was expelled from the senate, convicted of embezzlement and misconduct, and imprisoned. He either died during imprisonment or escaped to Smyrna.

See Livy, *Epit.* 67; Valerius Maximus, iv, 7, 3; Justin xxxii, 3; Aulus Gellius iii, 9.

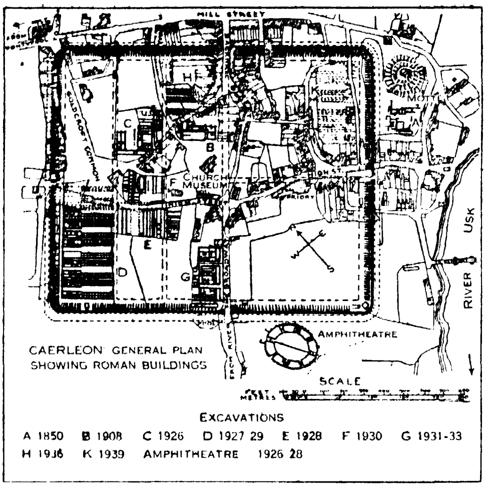
CAERE, an ancient city of Etruria (mod. Cerveteri, *i.e.*, *Caere vetus*), about 5 mi. from the seacoast and about 20 mi. N.W. of Rome, directly reached by a branch road from the Via Aurelia. Ancient writers tell us that its original Pelasgian name was Agylla, and that the Etruscans took it and called it Caere, but the former name lasted on into later times as well as Caere. It was one of the twelve cities of Etruria and had much trade through its port Pyrgos (*q.v.*). After the invasion of the Gauls in 390 B.C., the vestal virgins and the sacred objects in their custody were conveyed to Caere for safety, from which some derive the word *caerimonia*, ceremony. A treaty was made between Rome and Caere in the same year. In 353, however, Caere took up arms against Rome out of friendship for Tarquinii, but was defeated and partially incorporated in the Roman state without internal autonomy or voting rights for its members. The status is known as the *ius Caeritum*, and Caere was the first of a class of such municipalities. Under Augustus and Tiberius its prosperity was to a certain extent restored, and inscriptions speak of its municipal officials (the chief of them called *dictator*) and its town council, which had the title of *senatus*. In the middle ages, however, it sank in importance, and early in the 13th century, a part of the inhabitants founded Caere novum (mod. Ceri) 3 mi. to the east.

The town lay on a hill of tufa, running from northeast to southwest, isolated except on the northeast, and about 300 ft. above sea level. The modern town, at the western extremity, probably occupies the site of the acropolis. There seem to have been eight gates in the circuit of the city walls which was about 4 mi. in length. In the theatre many inscriptions and statues of emperors were found. The necropolis on the hill to the northwest, known as the Banditaccia, is far more imposing: it has the aspect of a veritable city of the dead, the tombs being in rows divided by paved streets. The larger tomb chambers are hewn in the rock and covered by mounds, but though many tombs have been excavated they are estimated at only 2½% of the whole. Several of them are interesting from their architectural and decorative details. The most important tomb of all, the Regolini-Galassi tomb (taking its name from its discoverers), which lies southwest of the ancient city, is a narrow rock-hewn chamber about 60 ft. long, lined with masonry, the sides converging to form the roof. The objects found in it (a chariot, a bed, silver goblets with reliefs, rich gold ornaments, etc.) are now in the Etruscan museum at the Vatican; they are attributed to about the middle of the seventh century B.C.

See Randall-MacIver, *Villanovans and Early Etruscans,* 195 *sqq.* (Oxford, 1924); *Studi Etruschi,* 145 *sqq.* (Florence, 1927).

CAERLEON, a village in the southern parliamentary division of Monmouthshire, England, on the Usk, 3 mi. N.E. of Newport. Pop. (est. 1938) 3,385. Area 5.32 sq.mi. Its claim to notice rests on its importance as the site of the Roman legionary fortress of *Isca* (not *Isca Silurum*), founded and garrisoned by *Legio II Augusta* following its campaign against the Silures. This legion had formed the right wing of the expeditionary force of 50,000 men landed in Britain by the emperor Claudius in A.D. 43. According to Tacitus (*Annals* xii, 32) it first entered south Wales in A.D. 50, and from then on was engaged in the reduction of the Silures from its base at Kingsholm, Gloucester. Under Julius Frontinus, governor in Britain A.D. 74—77-8, this task was successfully concluded and the legion moved to new quarters at Caerleon c. A.D. 75. The site, close to the tidal Usk, was chosen for its general accessibility by land and water, and for its strategic command of the approaches to the south Wales coastal plain. Together with Chester (*Deva*) it was the seat of the main Roman military power in the west for the next 200 years.

Recent Excavations.—The systematic exploration of the site was begun by the National Museum of Wales in association with the Caerleon Excavation committee in 1926, and its progress is indicated on the plan below. Finds are exhibited in the Legionary museum at Caerleon, consisting of a notable series of inscribed and sculptured stones, small bronzes, much pottery and coins. The best of the structural remains thus disclosed, the amphitheatre and the Prysg field barracks, are conserved by the Ministry of Works and Buildings.



BY PERMISSION OF THE NATIONAL MUSEUM OF WALES, CARDIFF

The Defenses.—The defenses of the fortress consisted originally of a V-shaped ditch 25 ft. wide and 8 ft. deep and a rampart of clay over 20 ft. wide revetted with timber, enclosing a rectangle of about 50 ac. *Circa* A.D. 100 the timber stockade was replaced by a stone wall 5 ft. thick and still standing in places to a height of 12 ft. The wall was built on a cobble foundation, offset on a sandstone plinth, and consisted of a rubble core faced externally with squared sandstone blocks set in yellow or pinkish mortar; the internal face was left rough as it abutted on the clay bank. The wall was probably 20 ft. high with a crenellated parapet protecting the wall walk, access to which was by small internal turrets at intervals of 50 yd. The wall was pierced by four symmetrically placed gateways, imposing structures with double-arched doorways with guardrooms in the flanking towers. The space behind the rampart, the *intervallum*, was used for cookhouses, a latrine and other buildings after the completion of the fortress; debris from the cookhouses was deposited in the turrets which were disused in the mid-2nd century.

The Interior.—(a) The street system. The planning of the interior of the fortress conformed to the normal military type. The main road, the *via principalis*, crossed between the two lateral gateways and its line can be followed approximately in the Broadway and Backhall street. It was joined mid-way at right angles by the *via praetoria* leading in from the river crossing, a bridge over the Usk. Parts of two other lateral streets are indicated on the plan, lost beneath the mediaeval and modern streets. Excavation has uncovered much of the rampart roadway, the *via sagularis*, that made a circuit of the defenses.

(b) The principal buildings. In a legionary fortress these consisted of the headquarters building (*principia*), the commander's house (*praetorium*), the hospital (*valetudinarium*), the training schools (*scholae*), the workshops (*fabricae*), the granaries (*horrei*), the armoury and stores. Not all of these have as yet been identified at Caerleon.

The headquarters building is known from excavations in 1908 and 1936 to occupy its customary position facing the central road junction, so the greater part is covered by St. Cadoc's church and churchyard. Immediately behind it, a large building (F on plan) covering more than an acre has been tentatively identified as the *quaestorium*, used for the disposal of hostages and booty. To the N.E. of this, in Jenkins' field, was the *fabrica* (C on plan) where the remains of smithies and workshops were found, and to the S.E. beneath the new council school was a large residential building, probably the commander's house.

(c) The barracks. The soldiers lived in barracks placed on the perimeter of the fortress, of which at least 24 have been located by excavation (D, H, K on plan). These buildings, which were of uniform construction, lay in pairs (*strigae*) facing inwards onto a narrow court. Each barrack was a single-storied building holding a company of 100 men (a century) and measuring 250 ft. long by 40 ft. wide. Two-thirds of it was fronted by a paved verandah and divided into 12 cubicles, in each of which eight men slept and kept their accoutrements; the other third was wider and contained a more spacious set of rooms for the centurion, the officer in charge, and his assistants (*principales*). The buildings were substantially constructed of stone throughout, with roofs of red tile made in the legionary tilery; windows were glazed and the floors paved or cemented.

The Environs.—Just outside the south gate, the *porta principalis sinistra*, stood the amphitheatre for the staging of beast fights, gladiatorial shows or other entertainment. It was an oval structure 267 ft. long by 222 ft. broad, with an arena entered by two imposing main gates on the long axis. There was seating for some 6,000 persons on wooden seats raised in tiers in the auditorium, an earthen bank buttressed and faced externally and internally by walls which gave the building the appearance of a stone structure. Access to the seats was by stairs entered through six vaulted passages. The amphitheatre was built in the late 1st century, reconstructed after partial collapse *c.* A.D. 125, and again rebuilt in the early 3rd century; it fell into final disuse at the end of that century.

The sites of three or four bath buildings are known south and east of the fortress, one of which was uncovered and destroyed in 1849. The buildings that made up the civil settlement (*Cannabae*), and the tile and pottery kilns were also probably situated in these areas, which have not yet been systematically explored. Inscriptions to Jupiter Dolichenus, Diana and Mithras are evidence of temples dedicated to these deities in the environs.

History.—The foundation of the fortress can be dated archaeologically to *c.* A.D. 75. At first buildings and defenses were constructed in timber, but in the last years of the 1st century they were rebuilt in stone. An inscription found in 1928 records the construction of the *principia* under the Emperor Trajan in the year A.D. 100, but the whole task was not completed for a decade. The full occupation of the new stone buildings was of short duration, for *c.* A.D. 120 the garrison was radically reduced to release men for the northern frontier, including work on Hadrian's Wall. The first quarter of the 3rd century saw a renewal of military activity, following 50 years' neglect, at Caerleon, as in Wales generally, due to the initiative of the Severan dynasty. An inscription records the repair of the headquarters building (A.D. ?) by Alexander Severus and his sons and some barracks and the amphitheatre were found to have been reconditioned at this time. A later rebuilding of barracks *a solo* is recorded in the joint reign of Valerian and Gallienus (A.D. 254–260).

In the later empire Caerleon declined rapidly in importance in consequence of the military reorganization of the province. Some troops are likely to have been moved to Cardiff to garrison the new type of coastal fort erected there against the Irish pirate menace, but the *Notitia Dignitatum*, a document recording the 4th–5th-century disposition of troops and officials, shows that the II Legion was stationed at Richborough (*Rutupiae*), Kent, a fort for the defense of the Saxon shore. Excavation, however, has shown that certain barracks and buildings were occupied or reoccupied at Caerleon till *c.* A.D. 350 or *c.* A.D. 375–380, but that such occupation was partial and sporadic.

Post-Roman.—No remains have been found to show that Caerleon was occupied in the dark ages, between the end of Roman rule and the Norman conquest of Gwent (A.D. 1070); but the *Urbs legionis* recorded by Gildas (*De Excidio Brit.* c. 10) as the place of martyrdom of two Romano-British saints, Aaron and Julius, is almost certainly Caerleon, and land presumably belonging to a church dedicated to these martyrs was the subject of dispute in the 9th century. (Levinson, *Antiquity*, 1941, p. 340.)

That King Arthur held court at Caerleon on Usk is highly improbable, though the green circle of the amphitheatre was long known as his "Table Round" and Lord Tennyson stayed at Caerleon while writing the *Idylls of the King*. To Giraldus Cambrensis (*c.* 1146–1220) Caerleon was recognizable as an ancient Roman city with many vestiges of its ancient splendour. (*Itinerary* I, 5.) The remains of a motte castle of the early mediaeval period stand outside the N.E. angle of the Roman fortress (*see* plan); it was mostly in Welsh ownership and was burned down in 1235. (Bradney, *A History of Mon.* III, 2, p. 186.)

See Nash-Williams, *The Roman Legionary Fort at Caerleon, Mon.* National Museum of Wales (1940); Excavation Reports, *Archaeologia Cambrensis* (1930, 1931, 1932, 1933, 1935, 1941) (Nash-Williams, Hawkes, Grimes, A. Fox); *Archaeologia* 78 (Wheeler); Nash-Williams, *Catalogue of Inscribed and Sculptured Stones*, National Museum of Wales (1935); Lee, *Isca Silurum* (1862). **(A. Fx.)**

CAERNARVON, ancient market town, municipal and contributory parliamentary borough, seaport and county town of Caernarvonshire, North Wales, 68½ mi. W. of Chester by the coastal L.M.S.R. Pop. (est. 1938), 8,697. Area, 3.40 sq.mi. It is near the S.W. end of the Menai straits, at the mouth of the Seiont. The settlement dates from mediaeval days, though only ½ mi. away is the site of the Roman Segontium. Its famous castle, begun for Edward I in 1284, though little more than a shell, is a most imposing monument, occupying some 3 ac. at the angle between the Seiont and the straits. It is now public property, under the care of a constable. The town walls (1284–85), enclosing an area to the north of the castle, are almost intact. To the southeast is Llanbeblig, the mother church of Caernarvon, with a 14th-century north chapel. From the little harbour a ferry crosses to Anglesey. The slates of the Llanberis district are exported. The town has few industries; it is best known as a tourist centre for the Snowdon country. It is an ancient parliamentary borough contributory to the Caernarvon district of boroughs, returning one member. Near the town is a wireless telegraphy station.

The county quarter sessions and assizes are held in the town, which has a separate commission of the peace, but no separate court of quarter sessions.

CAERNARVONSHIRE, a county of North Wales (Welsh Caer'narfon, for Caer yn Arfon), bounded north by the Irish sea, east by Denbigh, southeast by Merioneth, south by Cardigan bay, southwest by Caernarvon bay and west by the Menai straits. Area, 568.9 sq.mi. A small detached portion of the county on the north coast of Denbighshire stretches inland some 2½ mi. between Old Colwyn and Llanddulas. The southwest of the county, called Lleyn, projects as a peninsula separating Caernarvon and Cardigan bays.

The denuded Archaean lowland of Anglesey preserves rocks of Devonian and Carboniferous age along a low line that crosses it from northeast to southwest and along parts of the Menai straits; Carboniferous rocks are also preserved at the northeast corner of Anglesey and along the north coast east of the Conway, with the Great Orme's Head as an outstanding feature. Archaean rocks also form the west side of the south part of Lleyn from near Nevin to the point of Braich-y-Pwll, as well as the island of Bardsey beyond. The area immediately southwest of the Menai straits shows a zone of Cambrian rocks between Bangor and Bethesda on the north and stretching from Aber, near Bangor, southwestward to Clynnog; it includes a belt of Ordovician rocks and two zones of igneous rocks, all elongated in the northeast-southwest direction. The next zone is the highly characteristic mountain range which is the main feature of the county's geography and is almost unique in showing many features that elsewhere are met with only at twice the height or more. In it Ordovician grits and shales, interbedded with, and to a larger extent overlaid by, lavas, and also penetrated by intrusive rocks, occur in folds, the summit of Snowdon being structurally a syncline in the upper Ordovician volcanic rocks which dominate the lower grits and shales in the great rock wall standing above Llyn ddu Arddu. Mynydd Mawr, west of Snowdon, represents the neck of a volcano.

The northeastern end of the main range rises from Conway mountain (808 ft.) and Penmaenmawr (1,550 ft.), near the north coast, southwestward to Carnedd Llewelyn (3,484 ft.) and Carnedd Dafydd (3,426 ft.), and this section of the range is divided by the deep Ogwen pass (1,000 ft.) from the next in which are Y Glyder Fawr (3,279 ft.) and Y Glyder Fach (3,262 ft.). Elidyr Fawr (3,029 ft.) is a western outpost in this section which is bounded on the southwest by another deep zone of faults forming the pass of Llanberis (1,169 ft.). Southwest of this is Snowdon (Eryri or Yr Wyddfa, 3,560 ft.). The Snowdon mass again is separated by the pass (651 ft.) above Rhyd ddu pass from three somewhat radially arranged masses which are also separated from one another by deep lines. The most northern of these three masses is dominated by Mynydd Mawr (2,290 ft.), the median one by Garnedd Goch (2,301 ft.) and the southerly one by Moel Hebog (2,566 ft.). The median one, itself mainly of intrusive igneous rock, may be said to be followed by a series of heights, Gyrn ddu (1,712 ft.), Yr Eifl (1,849 ft.) and Garn Bodfean (918 ft.) stretching down the Lleyn peninsula.

The southeast flank of the main range is marked by another deep line, more gentle however than those cross ones which have just been named. This drains eastward to the Conway by the Gwrhyd and Llugwy, on which latter occur the Swallow falls, and southwestward by the Glaslyn which occupies Nant Gwynant and drains its two lakes, Llyn Gwynant and Llyn Dinas. After receiving a contributor (the Colwyn) from the Rhyd ddu pass on the west of Snowdon, the Glaslyn leaves the mountains by the wild gorge of Aberglaslyn emerging on to the lowland of Traeth Mawr, partly reclaimed from the sea in recent times. South and southeast of the Llugwy, Gwrhyd and Glaslyn valleys is a subordinate range, the directive lines of which are parallel to those of the valleys and are largely determined by zones of basalt, dolerite and diabase. Here are Moel Siabod (2,860 ft.) and Cynicht (2,265 ft.), the latter a very sharp peak.

The deep-cut divisions of the range are one of its most marked features and along these lines there occur numerous elongated lakes typically with a morainic dam at the lower end. Contrasting with these lakes are others higher up the mountain sides occupying deep corries or cwms, that is, glacial cirques. Cwm Glas, with its little lake on the east of Snowdon summit, and Llyn Idwal, on the north side of Y Glyder Fawr, are among the finest of these cirques with great precipices more than half surrounding the lakes. The rivers of the range are mostly swift, draining to the Irish sea and the Menai straits for the most part, with the exception of the Glaslyn already mentioned. The Ogwen, Seint (commonly Seiont), and Gwyrfai drain down the passes northwestwards to the Menai straits. The Conway, with its feeders Machno, Lledr and Llugwy (which receives the Gwrhyd), is the chief stream and runs in a remarkably straight valley from Bettws y Coed to the sea; it is navigable for about 12 mi. from the sea. This valley separates the Snowdon range with its igneous rocks from the Denbighshire plateau of Silurian rocks without igneous intrusions which, like the Welsh highland plateau generally, remains below the 2,000-foot level.

The contrast between the Welsh highland plateau, with its rounded hilltops, the remains of a peneplain, and the mountain range above the 2,000-foot contour, with its sharp cirques almost against the very heart of the mountains, is a marked feature of Wales repeated in the Cader Idris range and noticeable elsewhere in greater or less degree in West Wales where the land rises above the 2,000-foot level. On the northwest and southeast flanks of the Caernarvonshire range Cambrian rocks outcrop. Their distribution northwest of the range has been mentioned above; on the southeast of the range they occur from Blaenau Ffestiniog nearly to Criccieth and another outcrop forms the Trwyn Cilan promontory between St. Tudwals roads and Porth Neigwl. This last is doubtless a continuation of the outcrop farther east, the intervening mass having sunk under Cardigan bay, the coastline of which, low in places, has Ordovician strata with a number of igneous masses. The argillaceous Cambrian rocks were obviously subjected to intense pressure during the uprise of the folds of the mountain range and, especially towards the junctions of Cambrian and Ordovician, finely cleaved slates of economic importance are found, the chief centres being Bethesda, Llanberis and Penygroes on the northwest and Blaenau Ffestiniog on the southeast. It is usually claimed that the last important movement of land has been a downward one of post-Pleistocene date and that this has not only created the waterway of the Menai straits but has also given the Lavan and Caernarvon sands, large areas of lost land.

The prehistoric relations of Caernarvonshire suggest that the county was of some importance in megalithic times, especially perhaps the zone between Criccieth and Caernarvon. The southeastern coastal region has yielded considerable bronze finds and the native hilltop fortresses of Penmaenmawr, Tre'r Ceiri, Dinas Emrys (near Beddgelert) etc., apparently dating from Roman times at least in their present forms, as well as the Roman posts at Segontium (Caernarvon, *q.v.*) and Caerhun (Conway, *q.v.*), show the importance of the region in Roman times. As traditional ways to Ireland lay through the county and Anglesey it may be that the early importance of Caernarvonshire was partly connected with this fact. Deganwy on the fertile clay soil of the lower Conway seems to have been of importance in post-Roman times. During the early middle ages, Caernarvonshire was divided into four cantreds: Arfon, the country from the Menai straits to the heart of the mountains, and the centre of Welsh folklore; Arllechwedd from the Ogwen river in the west to Dolgarrog on the lower Conway in the east, a coastal plain with mountains behind, but also including Nant Conway; Lleyn, the southwestern peninsula, marked with old roads and hospices for pilgrims to Bardsey; and Eifionydd in the south of the county at the base of the Lleyn peninsula.

After the military conquest by Edward I (1282), the statute of Rhuddlan converted North Wales, save the lordship of Denbigh, into shire ground and the king had castles built at several places and notably around the mountain fastnesses at Caernarvon, Conway, Criccieth and Harlech. The 14th century witnessed many disturbances culminating early in the 15th century in the great effort of Owen Glendower, who made himself master of Wales and tried to develop a policy of an autonomous church and two universities, a policy which failed through military defeat. English influences spread from the castle towns as well as from the enfranchised manors of Nevin and Pwllheli, and Anglesey became strategically important in connection with Ireland, with the result that English attention was focussed on Caernarvon, and Lleyn lost its Irish links, becoming a region of survival of Welsh speech and old customs. Arfon later became to a large extent Anglican in religion while nonconformity grew strong in Eifionydd and Lleyn.

Industries.—Agriculture, especially sheep farming, is the most important occupation. The Snowdon area is the great sheep farming area, while Eifionydd is noted for its mixed farming with its market focus at Criccieth. Lleyn centres on Pwllheli and has large farms growing a little wheat and a great deal of barley. Its cattle are specially good and are exported to other areas in Wales as well as to the English midlands.

North Caernarvonshire is a region of slate and granite quarrying and claims to have the largest slate quarries in the world. The chief quarries are at Bethesda, Llanberis and Nantlle, which send their export of roofing slate and slate blocks to Penrhyn, Port Dinorwic and Caernarvon respectively. Many of the quarrymen are small farmers as well. There is also a great deal of roadstone quarrying, Pwllheli being an important centre. There are electrical power works at Dolgarrog and Cwm Dyli, with aluminum works at the former place. Catering for summer visitors is also a feature of the county both in the coast resorts and inland.

Communications.—The G.W.R. runs along the Cardigan bay coast and terminates at Pwllheli. The L.M.S.R. main line runs along the northern coast, with branches from Llandudno junction to Blaenau Ffestiniog, along the Denbighshire side of the Conway; from Menai bridge to Caernarvon (thence continuing to Llanberis, or, by another line, to Afon Wen, 4 mi. from Pwllheli). After 1920 road transport became very important, especially in Lleyn and the west of the county, where poor railway facilities were supplemented by good motorbus service. There were 267 mi. of roads in the county in 1942.

Administration.—The area of the administrative county is 568.9 sq.mi. Pop. (est. 1938) 118,590. Wartime movements caused an increase of 11% between Sept. 1939 and Feb. 1941. The county as a whole returns two members to parliament, one for the county and the other for the Caernarvon boroughs, which include the municipal boroughs of Bangor, Caernarvon, Conway and Pwllheli, the urban districts of Criccieth, Llandudno, Llanfairfechan, Penmaenmawr and the civil parish of Nevin. There are 7 urban districts, 4 rural districts and 52 civil parishes. The assizes are held at Caernarvon and are part of the North Wales circuit. Except a few parishes (in and near Llandudno) in St. Asaph diocese, Caernarvonshire is in the diocese of Bangor. The National Trust owned 690 ac. in the county in 1942.

See Edw. Breese, *Kalendar of Gwynedd* (1874); J. E. Lloyd, *The Story of Caernarvonshire*, Cambridge County Geographies.

CAERPHILLY, Glamorganshire, Wales, 7 mi. from Cardiff, and 6 mi. from Pontypridd. The origin of the name is unknown. It was formerly in the ancient parish of Eglwysilan, but from that and Bedwas, Mon., an ecclesiastical parish was formed in 1850, while the whole of the parishes of Eglwysilan and Llanfabon were in 1893 constituted into an urban district; pop. (est. 1938) 32,180. Area, 20.2 sq.mi. The ancient commote of Senghenydd (corresponding to the modern hundred of Caerphilly) comprised the mountainous district from the ridge of Cefn On on the south to Breconshire on the north, being bounded by the rivers Taff and Rhymney on the west and east. Its inhabitants, though nominally subject to the lords of Glamorgan since FitzHamon's conquest, often raided the lowlands. To keep these in check, Gilbert de Clare, during the closing years of the reign of Henry III, built the castle of Caerphilly on the southern edge of this district, in a wide plain between the two rivers. Prince Llewelyn ap Griffith laid siege to it in 1271. Subsequently completed, it became "the earliest and the most complete example in Britain of a concentric castle of the type known as 'Edwardian'." The great hall is a fine example of Decorated architecture. This and other additions are attributed to Hugh le Despenser (1318–26). It was attacked by Owen Glendower in 1403. Before the middle of the 15th century it had ceased to be a fortified residence and was used as a prison, but its ruins at the present day are extensive and imposing.

The town grew up around the castle but never received a charter or had a governing body. Its markets during the 19th century were chiefly noted for the Caerphilly cheese sold there. The district was one of the chief centres of the Methodist revival of the 18th century, the first synod of the Calvinistic Methodists being held in 1743 at Watford farm close to the town. With the development of the south Wales coal field the prosperity of Caerphilly greatly increased. In 1858 was opened the Rhymney railway from Rhymney to Caerphilly and on to Taff's Well, whence it had running powers over the Taff Vale railway to Cardiff, but in 1871, by means of the Cefn On tunnel a direct line was made to Cardiff. A branch line, 4 mi. long, was opened in 1894 to Senghenydd. The Pontypridd and Newport railway was constructed in 1887, and there is a joint station at Caerphilly for both railways. Trade depression in the 1930s had especially marked effects in this locality, 43.9% of the insured population being unemployed in May 1934.

CAESALPINUS (CESALPINO), **ANDREAS** (1519–1603), Italian botanist and physician, was born in Arezzo in Tuscany on June 6, 1519. He studied anatomy and medicine at the University of Pisa, where he took his doctor's degree in 1551, and in 1555 became professor of materia medica and director of the botanical garden. Appointed physician to Pope Clement VIII, he removed in 1592 to Rome, becoming professor at the Sapienza. He died Feb. 23, 1603. He was the most distinguished botanist of his time. His work, *De Plantis libri xvi* (Florence, 1583), was the source from which various subsequent writers, and especially Robert Morison (1620–83) derived their ideas of botanical arrangement. Linnaeus himself gratefully avowed his obligations to Caesalpinus. Caesalpinus was also distinguished as a physiologist, and it has been claimed that he had a clear idea of the circulation of the blood. His other works include *Daemonum investigatio peripatetica* (1580), *Quaestionum medicarum libri ii* (1593), *De Metallicis* (1596), and *Quaestionum peripateticarum libri v* (1571).

See L. C. Miall, *The Early Naturalists* (1912) and V. Viviani, *Vita ed Opere di Andrea Cesalpino* (Arezzo, 1922).

CAESAR, GAIUS JULIUS (IULIUS) (102?–44 B.C.), the great Roman soldier and statesman, was born on July 12, 102 B.C. (In spite of the explicit statements of Suetonius, Plutarch, and Appian that Caesar was in his 56th year at the time of his murder, it is, as Mommsen has shown, probable that he was born in 102 B.C., since he held the chief offices of state in regular order, beginning with the aedileship in 65 B.C., and the legal age for this was fixed at 37–38.) His family was of patrician rank and traced a legendary descent from Iulus, the founder of Alba Longa, son of Aeneas, and grandson of Venus and Anchises. Caesar made the most of his divine ancestry and built a temple in his forum to Venus Genetrix; but his patrician descent was of little importance in politics and disqualified Caesar from holding the tribunate, an office to which, as a leader of the popular party, he would naturally have aspired. The Iulii Caesares, however, had also acquired the new *nobilitas,* which belonged to holders of the great magistracies. Caesar's uncle was consul in 91 B.C., and his father held the praetorship. Most of the family seem to have belonged to the senatorial party (*optimates*); but Caesar himself was from the first a *popularis.* The determining factor is no doubt to be sought in his relationship with C. Marius, the husband of his aunt Iulia. Caesar was born in the year of Marius's first great victory over the Teutones, and as he grew up, inspired by the traditions of the great soldier's career, attached himself to his party and its fortunes. Of his education we know scarcely anything. His mother, Aurelia, belonged to a distinguished family, and Tacitus (*Dial. de Orat.* xxviii.) couples her name with that of Cornelia, the mother of the Gracchi, as an example of the Roman matron whose *disciplina* and *severitas* formed her son for the duties of a soldier and statesman. His tutor was M. Antonius Gnipho, a native of Gaul (by which Cisalpine Gaul may be meant), who is said to have been equally learned in Greek and Latin literature and to have set up in later years a school of rhetoric which was attended by Cicero in his praetorship 66 B.C. It is possible that Caesar may have derived from him his interest in Gaul and its people and his sympathy with the claims of the Romanized Gauls of northern Italy to political rights.

In his 16th year (87 B.C.) Caesar lost his father, and assumed the *toga virilis* as the token of manhood. The Social War (90–89 B.C.) had been brought to a close by the enfranchisement of Rome's Italian subjects; and the civil war which followed it led, after the departure of Sulla for the East, to the temporary triumph of the *populares,* led by Marius and Cinna, and the indiscriminate massacre of their political opponents, including both of Caesar's uncles. Caesar was at once marked out for high distinction, being created *flamen Dialis* or priest of Jupiter. In the following year (which saw the death of Marius) Caesar, rejecting a proposed marriage with a wealthy capitalist's heiress, sought and obtained the hand of Cornelia, the daughter of Cinna, and thus became further identified with the ruling party. His career was soon after interrupted by the triumphant return of Sulla (82 B.C.), who ordered him to divorce his wife, and on his refusal deprived him of his property and priesthood and was induced to spare his life only by the intercession of his aristocratic relatives and the college of Vestal virgins.

Released from his religious obligations, Caesar now (81 B.C.) left Rome for the East and served his first campaign under Minucius Thermus, who was engaged in stamping out the embers of resistance to Roman rule in the province of Asia, and received from him the "civic crown" for saving a fellow-soldier's life at the storm of Mytilene. In 78 B.C. he was serving under Servilius Isauricus against the Cilician pirates when the news of Sulla's death reached him and he at once returned to Rome. Refusing to entangle himself in the abortive and equivocal schemes of Lepidus to subvert the Sullan constitution, Caesar took up the only instrument of political warfare left to the opposition by prosecuting two senatorial governors, Cn. Cornelius Dolabella (in 77 B.C.) and C. Antonius (in 76 B.C.) for extortion in the provinces of Macedonia and Greece, and, though he lost both cases, probably convinced the world at large of the corruption of the senatorial tribunals. After these failures Caesar determined to take no active part in politics for a time and retraced his steps to the East in order to study rhetoric under Molon, at Rhodes. On the journey thither he was caught by pirates, whom he treated with consummate nonchalance while awaiting his ransom, threatening to return and crucify them; when released he lost no time in carrying out his threat. Whilst he was studying at Rhodes the third Mithridatic War broke out, and Caesar at once raised a corps of volunteers and helped to secure the wavering loyalty of the provincials of Asia. When Lucullus assumed the command of the Roman troops in Asia, Caesar returned to Rome, to find that he had been elected to a seat on the college of *pontifices* left vacant by the death of his uncle, C. Aurelius Cotta. He was likewise elected first of the six *tribuni militum a populo*, but we hear nothing of his service in this capacity. Suetonius tells us that he threw himself into the agitation for the restoration of the ancient powers of the tribunate curtailed by Sulla, and that he secured the passing of a law of amnesty in favour of the partisans of Sertorius. He was not, however, destined to compass the downfall of the Sullan *régime*; the crisis of the Slave War placed the senate at the mercy of Pompey and Crassus, who in 70 B.C. swept away the safeguards of senatorial ascendancy, restored the initiative in legislation to the tribunes, and replaced the Equestrian order, *i.e.*, the capitalists, in partial possession of the jury-courts. This judicial reform (or rather compromise) was the work of Caesar's uncle, L. Aurelius Cotta. Caesar himself, however, gained no accession of influence. In 69 B.C. he served as quaestor under Antistius Vetus, governor of Hither Spain, and on his way back to Rome (according to Suetonius) promoted a revolutionary agitation amongst the Transpadanes for the acquisition of full political rights, which had been denied them by Sulla's settlement.

Caesar and Pompey.—Caesar was now best known as a man of pleasure, celebrated for his debts and his intrigues; in politics he had no force behind him save that of the discredited party of the *populares*, reduced to lending a passive support to Pompey and Crassus. But as soon as the proved incompetence of the senatorial government had brought about the mission of Pompey to the East with the almost unlimited powers conferred on him by the Gabinian and Manilian laws of 67 and 66 B.C. (*see* POMPEY), Caesar plunged into a network of political intrigues which it is no longer possible to unravel. In his public acts he lost no opportunity of upholding the democratic tradition. Already in 68 B.C. he had paraded the bust of Marius at his aunt's funeral; in 65 B.C. as curule aedile, he restored the trophies of Marius to their place on the Capitol; in 64 B.C., as president of the murder commission, he brought three of Sulla's executioners to trial, and in 63 B.C. he caused the ancient procedure of trial by popular assembly to be revived against the murderer of Saturninus. By these means, and by the lavishness of his expenditure on public entertainments as aedile, he acquired such popularity with the plebs that he was elected *pontifex maximus* in 63 B.C. against such distinguished rivals as Q. Lutatius Catulus and P. Servilius Isauricus. But all this was on the surface. There can be no doubt that Caesar was cognizant of some at least of the threads of conspiracy which were woven during Pompey's absence in the East. According to one story, the *enfants perdus* of the revolutionary party—Catiline, Autronius, and others—designed to assassinate the consuls on Jan. 1, 65, and make Crassus dictator, with Caesar as master of the horse. We are also told that a public proposal was made to confer upon him an extraordinary military command in Egypt, not without a legitimate king and nominally under the protection of Rome. An equally abortive attempt to create a counterpoise to Pompey's power was made by the tribune Rullus at the close of 64 B.C. He proposed to create a land commission with very wide powers, which would in effect have been wielded by Caesar and Crassus. The bill was defeated by Cicero, consul in 63 B.C. In the same year the conspiracy associated with the name of Catiline came to a head. The charge of complicity was freely levelled at Caesar, and indeed was hinted at by Cato in the great debate in the senate. But Caesar, for party reasons, was bound to oppose the execution of the conspirators; while Crassus, who shared in the accusation, was the richest man in Rome and the least likely to further anarchist plots. Both, however, doubtless knew as much and as little as suited their convenience of the doings of the left wing of their party, which served to aggravate the embarrassments of the government.

As praetor (62 B.C.) Caesar supported proposals in Pompey's favour which brought him into violent collision with the senate. This was a master-stroke of tactics, as Pompey's return was imminent. Thus when Pompey landed in Italy and disbanded his army he found in Caesar a natural ally. After some delay, said to have been caused by the exigencies of his creditors, which were met by a loan of £200,000 from Crassus, Caesar left Rome for his province of Further Spain, where he was able to retrieve his financial position and to lay the foundations of a military reputation. He returned to Rome in 60 B.C. to find that the senate had sacrificed the support of the capitalists (which Cicero had worked so hard to secure), and had finally alienated Pompey by refusing to ratify his acts and grant lands to his soldiers. Caesar at once approached both Pompey and Crassus, who alike detested the existing system of government but were personally at variance, and succeeded in persuading them to forget their quarrel and join him in a coalition which should put an end to the rule of the oligarchy. He even made a generous, though unsuccessful, endeavour to enlist the support of Cicero. The so-called First Triumvirate was formed, and constitutional government ceased to exist save in name.

The first prize which fell to Caesar was the consulship, to secure which he forewent the triumph which he had earned in Spain. His colleague was M. Bibulus, who belonged to the straitest sect of the senatorial oligarchy and, together with his party, placed every form of constitutional obstruction in the path of Caesar's legislation. Caesar, however, overrode all opposition, mustering Pompey's veterans to drive his colleague from the forum. Bibulus became a virtual prisoner in his own house, and Caesar placed himself outside the pale of the free republic. Thus the programme of the coalition was carried through. Pompey was satisfied by the ratification of his acts in Asia, and by the assignment of the Campanian state domains to his veterans, the capitalists (with whose interests Crassus was identified) had their bargain for the farming of the Asiatic revenues cancelled, Ptolemy Auletes received the confirmation of his title to the throne of Egypt (for a consideration amounting to £1,500,000), and a fresh act was passed for preventing extortion by provincial governors.

The Gallic Wars.—It was now all-important for Caesar to secure practical irresponsibility by obtaining a military command. The senate, in virtue of its constitutional prerogative, had assigned as the *provincia* of the consuls of 59 B.C. the supervision of roads and forests in Italy. Caesar secured the passing of a legislative enactment conferring upon himself the government of Cisalpine Gaul and Illyricum for five years, and exacted from the terrorized senate the addition of Transalpine Gaul, where, as he well knew, a storm was brewing which threatened to sweep away Roman civilization beyond the Alps. The mutual jealousies of the Gallic tribes had enabled German invaders first to gain a foothold on the left bank of the Rhine, and then to obtain a predominant position in Central Gaul. In 60 B.C. the German king Ariovistus had defeated the Aedui, who were allies of Rome, and had wrested from the Sequani a large portion of their territory. Caesar must have seen that the Germans were preparing to dispute with Rome the mastery of Gaul; but it was necessary to gain time, and in 59 B.C. Ariovistus was inscribed on the roll of the friends of the Roman people. In 58 B.C. the Helvetii, a Celtic people inhabiting Switzerland, determined to migrate for the shores of the Atlantic and demanded a passage through Roman territory. According to Caesar's statement they numbered 368,000, and it was necessary at all hazards to save the Roman province from the invasion. Caesar had but one legion beyond the Alps. With this he marched to Geneva, destroyed the bridge over the Rhone, fortified the left bank of the river, and forced the Helvetii to follow the right bank. Hastening back to Italy he withdrew his three remaining legions from Aquileia, raised two more, and, crossing the Alps by forced marches, arrived in the neighbourhood of Lyons to find that three-fourths of the Helvetii had already crossed the Saône, marching westward. He destroyed their rearguard, the Tigurini, as it was about to cross, transported his army across the river in 24 hours, pursued the Helvetii in a northerly direction, and utterly defeated them at Bibracte (Mont Beuvray). Of the survivors a few were settled amongst the Aedui; the rest were sent back to Switzerland lest it should fall into German hands.

The Gallic chiefs now appealed to Caesar to deliver them from the actual or threatened tyranny of Ariovistus. He at once demanded a conference, which Ariovistus refused, and on hearing that fresh swarms were crossing the Rhine marched with all haste to Vesontio (Besançon) and thence by way of Belfort into the plain of Alsace, where he gained a decisive victory over the Germans, of whom only a few (including Ariovistus) reached the right bank of the Rhine in safety. These successes roused natural alarm in the minds of the Belgae—a confederacy of tribes in the north-west of Gaul, whose civilization was less advanced than that of the Celtae of the centre—and in the spring of 57 B.C. Caesar determined to anticipate the offensive movement which they were understood to be preparing and marched northwards into the territory of the Remi (about Reims), who alone amongst their neighbours were friendly to Rome. He successfully checked the advance of the enemy at the passage of the Aisne (between Laon and Reims) and their ill-organized force melted away as he advanced. But the Nervii and their neighbours farther to the north-west remained to be dealt with, and were crushed only after a desperate struggle on the banks of the Sambre, in which Caesar was forced to expose his person in the *mêlée*. Finally, the Aduatuci (near Namur) were compelled to submit, and were punished for their subsequent treachery by being sold wholesale into slavery. In the meantime Caesar's lieutenant, P. Crassus, received the submission of the tribes of the north-east, so that by the close of the campaign almost the whole of Gaul—except the Aquitani in the south-west—acknowledged Roman suzerainty.

In 56 B.C., however, the Veneti of Brittany threw off the yoke and detained two of Crassus's officers as hostages. Caesar, who had been hastily summoned from Illyricum, crossed the Loire and invaded Brittany, but found that he could make no headway without destroying the powerful fleet of high, flat-bottomed boats like floating castles possessed by the Veneti. A fleet was hastily constructed in the estuary of the Loire, and placed under the command of Decimus Brutus. The decisive engagement was fought (probably) in the Gulf of Morbihan and the Romans gained the victory by cutting down the enemy's rigging with sickles attached to poles. As a punishment for their treachery, Caesar put to death the senate of the Veneti and sold their people into slavery. Meanwhile Sabinus was victorious on the northern coasts, and Crassus subdued the Aquitani. At the close of the season Caesar raided the territories of the Morini and Menapii in the extreme north-west.

In 55 B.C. certain German tribes, the Usipetes and Tencteri, crossed the lower Rhine and invaded the modern Flanders. Caesar at once marched to meet them and, on the pretext that they had violated a truce, seized their leaders, who had come to parley with him, and then surprised and practically destroyed their host. His enemies in Rome accused him of treachery, and Cato even proposed that he should be handed over to the Germans. Caesar meanwhile constructed his famous bridge over the Rhine in ten days, and made a demonstration of force on the right bank. In the remaining weeks of the summer he made his first expedition to Britain, and this was followed by a second crossing in 54 B.C. On the first occasion Caesar took with him only two legions, and effected little beyond a landing on the coast of Kent. The second expedition consisted of five legions and 2,000 cavalry, and set out from the Portus Itius (Boulogne or Wissant; *see* T. Rice Holmes, *Ancient Britain and the Invasions of Julius Caesar*, 1907, later views in *Classical Review*, May 1909, and H. S. Jones, in *Eng. Hist. Rev.* xxiv., 1909, p. 115). Caesar now penetrated into Middlesex and crossed the Thames, but the British prince Cassivellaunus with his war-chariots harassed the Roman columns, and Caesar was compelled to return to Gaul after imposing a tribute which was never paid.

The next two years witnessed the final struggle of the Gauls for freedom. Just before the second crossing to Britain, Dumnorix, an Aeduan chief, had been detected in treasonable intrigues and killed in an attempt to escape from Caesar's camp. At the close of the campaign Caesar distributed his legions over a somewhat wide extent of territory. Two of their camps were treacherously attacked. At Aduatuca (near Aix-la-Chapelle) a newly-raised legion was cut to pieces by the Eburones under Ambiorix, while Quintus Cicero was besieged in the neighbourhood of Namur and only just relieved in time by Caesar, who was obliged to winter in Gaul in order to check the spread of the rebellion. Indutiomarus, indeed, chief of the Treveri (about Trèves), revolted and attacked Labienus, but was defeated and killed. The campaign of 53 B.C. was marked by a second crossing of the Rhine and by the destruction of the Eburones, whose leader Ambiorix, however, escaped. In the autumn Caesar held a conference at Durocortorum (Reims), and Acco, a chief of the Senones, was convicted of treason and flogged to death.

Early in 52 B.C. some Roman traders were massacred at Cenabum (Orleans), and on hearing the news the Arverni revolted under Vercingetorix and were quickly joined by other tribes, especially the Bituriges, whose capital was Avaricum (Bourges). Caesar hastened back from Italy, slipped past Vercingetorix and reached Agedincum (Sens), the headquarters of his legions. Vercingetorix saw that Caesar could not be met in open battle, and determined to concentrate his forces in a few strong positions. Caesar first besieged and took Avaricum, whose occupants were massacred, and then invested Gergovia (near the Puy-de-Dôme), the capital of the Arverni, but suffered a severe repulse and was forced to raise the siege. Hearing that the Roman province was threatened, he marched westward, defeated Vercingetorix near Dijon and shut him up in Alesia (Mont-Auxois), which he surrounded with lines of circumvallation. An attempt at relief by Vercassivellaunus was defeated after a desperate struggle and Vercingetorix surrendered. The struggle was over except for some isolated operations in 51 B.C., ending with the siege and capture of Uxellodunum (Puy d'Issolu), whose defenders had their hands cut off. Caesar now reduced Gaul to the form of a province, fixing the tribute at 40,000,000 sesterces (£350,000) and dealing liberally with the conquered tribes, whose cantons were not broken up.

The Civil War.—In the meantime his own position was becoming critical. In 56 B.C., at the conference of Luca (Lucca), Caesar, Pompey, and Crassus had renewed their agreement and Caesar's command in Gaul, which would have expired on March 1, 54 B.C., was renewed, probably for five years, *i.e.*, to March 1, 49 B.C., and it was enacted that the question of his successor should not be discussed until March 1, 50 B.C., by which time the provincial commands for 49 B.C., would have been assigned, so that Caesar would retain *imperium*, and thus immunity from persecution, until the end of 49 B.C. He was to be elected consul for 48 B.C., and, as the law prescribed a personal canvass, he was by special enactment dispensed from its provisions. But in 54 B.C. Iulia, the daughter of Caesar and wife of Pompey, died, and in 53 B.C., Crassus was killed at Carrhae. Pompey now drifted apart from Caesar and became the champion of the senate. In 52 B.C. he passed a fresh law *de iure magistratuum*, which cut away the ground beneath Caesar's feet by making it possible to provide a successor to the Gallic provinces before the close of 49 B.C., which meant that Caesar would become for some months a private person, and thus liable to be called to account for his unconstitutional acts. Caesar had no resource left but uncompromising obstruction, which he sustained by enormous bribes. His representative in 50 B.C., the tribune C. Scribonius Curio, served him well, and induced the lukewarm majority of the senate to refrain from extreme measures, insisting that Pompey, as well as Caesar, should resign the *imperium*. But all attempts at negotiation failed, and in Jan. 49 B.C., martial law having been proclaimed on the proposal of the consuls, the tribunes Antony and Cassius fled to Caesar, who crossed the Rubicon (the frontier of Italy) with a single legion, exclaiming "*Alea iacta est.*"

Pompey's available force consisted in two legions stationed in Campania and eight, commanded by his lieutenants, Afranius and Petreius, in Spain; both sides levied troops in Italy. Caesar was soon joined by two legions from Gaul and marched rapidly down the Adriatic coast, overtaking Pompey at Brundisium (Brindisi), but failing to prevent him from embarking with his troops for the East, where the prestige of his name was greatest. Hereupon Caesar (it is said) exclaimed "I am going to Spain to fight an army without a general, and thence to the East to fight a general without an army." He carried out the first part of this programme with marvellous rapidity. He reached Ilerda (Lerida) on June 23, and, after extricating his army from a perilous situation, outmanoeuvred Pompey's lieutenants and received their submission on Aug. 2. Returning to Rome, he held the dictatorship for 11 days, was elected consul for 48 B.C., and set sail for Epirus at Brundisium on Jan. 4. He attempted to invest Pompey's lines at Dyrrhachium (Durazzo), though his opponent's force was double that of his own, and was defeated with considerable loss. He now marched eastwards, in order if possible to intercept the reinforcements which Pompey's father-in-law, Scipio, was bringing up; but Pompey was able to effect a junction with this force and descended into the plain of Thessaly, where at the battle of Pharsalus he was decisively defeated and fled to Egypt, pursued by Caesar, who learnt of his rival's murder on landing at Alexandria. Here he remained for nine months, fascinated (if the story be true) by Cleopatra, and almost lost his life in an *émeute.* In June 47 B.C., he proceeded to the East and Asia Minor, where he "came, saw, and conquered" Pharnaces, son of Mithridates the Great, at Zela. Returning to Italy, he quelled a mutiny of the legions (including the faithful Tenth) in Campania and crossed to Africa, where a republican army of 14 legions under Scipio was cut to pieces at Thapsus (April 6, 46 B.C.). Here most of the republican leaders were killed and Cato committed suicide. On July 26–29 Caesar celebrated a fourfold triumph and received the dictatorship for ten years. In November, however, he was obliged to sail for Spain, where the sons of Pompey still held out. On March 17, 45 B.C., they were crushed at Munda. Caesar returned to Rome in September, and six months later (March 15, 44 B.C.) was murdered in the senate house at the foot of Pompey's statue.

Caesar's Dictatorship.—It was remarked by Seneca that amongst the murderers of Caesar were to be found more of his friends than of his enemies. We can account for this only by emphasizing the fact that the form of Caesar's government became as time went on more undisguised in its absolutism, while the honours conferred upon him seemed designed to raise him above the rest of humanity. It is explained elsewhere (*see* ROME: *Ancient History*) that Caesar's power was exercised under the form of the dictatorship. In the first instance (autumn of 49 B.C.) this was conferred upon him as the only solution of the constitutional deadlock created by the flight of the magistrates and senate, in order that elections (including that of Caesar himself to the consulship) might be held in due course. For this there were republican precedents. In 48 B.C. he was created dictator for the second time, probably with constituent powers and for an undefined period, according to the dangerous and unpopular precedent of Sulla. In May 46 B.C. a third dictatorship was conferred on Caesar, this time for ten years and apparently as a yearly office, so that he became Dictator IV. in May 45 B.C. Finally, before Feb. 15, 44 B.C., this was exchanged for a life-dictatorship. Not only was this a contradiction in terms, since the dictatorship was by tradition a makeshift justified only when the state had to be carried through a serious crisis, but it involved military rule in Italy and the permanent suspension of the constitutional guarantees, such as *intercessio* and *provocatio,* by which the liberties of Romans were protected. Besides the dictatorship, Caesar held the consulship in each year of his reign except 47 B.C. (when no curule magistrates were elected save for the last three months of the year); and he was, moreover, invested by special enactments with a number of other privileges and powers; of these the most important was the *tribunicia potestas,* which we may believe to have been free from the limits of place (*i.e.,* Rome) and collegiality. Thus, too, he was granted the sole right of making peace and war and of disposing of the funds in the treasury of the state.[1] Save for the title of dictator, which undoubtedly carried unpopular associations and was formally abolished on the proposal of Antony after Caesar's death, this cumulation of powers has little to distinguish it from the Principate of Augustus; and the assumption of the perpetual dictatorship would hardly by itself suffice to account for the murder of Caesar. But there are signs that in the last six months of his life he aspired not only to a monarchy in name as well as in fact, but also to a divinity which Romans should acknowledge as well as Greeks, Orientals, and barbarians. His statue was set up beside those of the seven kings of Rome, and he adopted the throne of gold, the sceptre of ivory, and the embroidered robe which tradition ascribed to them. He allowed his supporters to suggest the offer of the regal title by putting in circulation an oracle according to which it was destined for a king of Rome to subdue the Parthians, and when at the Lupercalia (Feb. 15, 44 B.C.) Antony set the diadem on his head he rejected the offer half-heartedly on account of the groans of the people. His image was carried in the *Pompa circensis* amongst those of the immortal gods, and his statue set up in the temple of Quirinus with the inscription "To the Unconquerable God." A college of Luperci, with the surname Iuliani, was instituted in his honour and *flamines* were created as priests of his godhead. This was intolerable to the aristocratic republicans, to whom it seemed becoming that victorious commanders should accept divine honours at the hands of Greek and Asiatics, but unpardonable that Romans should offer the same worship to a Roman.

Thus Caesar's work remained unfinished, and this must be borne in mind in considering his record of legislative and administrative reform. Some account of this is given elsewhere (*see* ROME: *Ancient History*), but it may be well to single out from the list of his measures (some of which, such as the restoration of exiles and the children of proscribed persons, were dictated by political expediency, while others, such as his financial proposals for the relief of debtors and the steps which he took to restore Italian agriculture, were of the nature of palliatives) those which have a permanent significance as indicating his grasp of imperial problems. The Social War had brought to the inhabitants of Italy as far as the Po the privileges of Roman citizenship; it remained to extend this gift to the Transpadane Italians, to establish a uniform system of local administration and to devise representative institutions by which at least some voice in the government of Rome might be permitted to her new citizens. This last conception lay beyond the horizon of Caesar, as of all ancient statesmen; but his first act on gaining control of Italy was to enfranchise the Transpadanes, whose claims he had consistently advocated, and in 45 B.C., he passed the *Lex Iulia Municipalis,* an act of which considerable fragments are inscribed on two bronze tables found at Heraclea near Tarentum.[1] This law deals *inter alia* with the police and the sanitary arrangements of the city of Rome, and hence it has been argued by Mommsen that it was Caesar's intention to reduce Rome to the level of a municipal town. But it is not likely that such was the case. Caesar made no far-reaching modifications in the government of the city, such as were afterwards carried out by Augustus, and the presence in the *Lex Iulia Municipalis* of the clauses referred to may be explained as an example of "tacking" (legislation *per saturam; see,* however, note [1] below). The law deals with the constitution of the local senates, for whose members qualifications of age (30 years) and military service are laid down, while persons who have suffered conviction for various specified offences, or who are insolvent, or who carry on discreditable or immoral trades are excluded. It also provides that the local magistrates shall take a census of the citizens at the same time as the census takes place in Rome and send the registers to Rome within 60 days. The existing fragments tell us little as to the decentralization of the functions of government, but from the *Lex Rubria*, which applies to the Transpadane districts enfranchised by Caesar (it must be remembered that Cisalpine Gaul remained nominally a province until 42 B.C.) we gather that considerable powers of independent jurisdiction were reserved to the municipal magistrates. But Caesar was not content with framing a uniform system of local government for Italy. He was the first to carry out on a large scale those plans of transmarine colonization whose inception was due to the Gracchi. As consul in 59 B.C. Caesar had established colonies of veterans in Campania under the *Lex Iulia Agraria*, and had even then laid down rules for the foundation of such communities. As dictator he planted numerous colonies both in the eastern and western provinces, notably at Corinth and Carthage. Mommsen interprets this policy as signifying that "the rule of the urban community of Rome over the shores of the Mediterranean was at an end," and says that the first act of the "new Mediterranean state" was "to atone for the two greatest outrages which that urban community had perpetrated on civilization." This, however, cannot be admitted. The sites of Caesar's colonies were selected for their commercial value, and that the citizens of Rome should cease to be rulers of the Mediterranean basin could never have entered into Caesar's mind. The colonists were in many cases veterans who had served under Caesar, in others members of the city proletariat. We possess the charter of the colony planted at Urso in southern Spain under the name of *Colonia Iulia Genetiva Urbanorum*. Of the two latter titles, the first is derived from the name of Venus Genetrix, the ancestress of the Julian house, the second indicates that the colonists were drawn from the *plebs urbana*. Accordingly, we find that free birth is not, as in Italy, a necessary qualification for municipal office. By such foundations Caesar began the extension to the provinces of that Roman civilization which the republic had carried to the bounds of the Italian peninsula. Lack of time alone prevented him from carrying into effect such projects as the piercing of the Isthmus of Corinth, whose object was to promote trade and intercourse throughout the Roman dominions, and we are told that at the time of his death he was contemplating the extension of the empire to its natural frontiers and was about to engage in a war with Parthia with the object of carrying Roman arms to the Euphrates. Above all, he was determined that the empire should be governed in the true sense of the word and no longer exploited by its rulers, and he kept a strict control over the *legati*, who, under the form of military subordination, were responsible to him for the administration of their provinces

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[1] The statement of Dio and Suetonius, that a *praefectura legum et morum* was conferred on Caesar in 46 B.C. is rejected by Mommsen. It is possible that it may have some foundation in the terms of the law establishing his third dictatorship. According to Dio, the censorship for life was conferred on him in 44 B.C.

[1] Since the discovery of a fragmentary municipal charter at Tarentum dating from a period shortly after the Social War, doubts have been cast on the identification of the tables of Heraclea with Caesar's municipal statute. It has been questioned whether Caesar passed such a law, since the *Lex Iulia Municipalis* mentioned in an inscription of Patavium (Padua) may have been a local charter. The most recent and on the whole the most probable theory is that the tables of Heraclea contain a number of enactments promulgated by Antony after Caesar's death under the law which authorized the ratification of Caesar's "acts" as found in his papers.

Writings and Character.—Caesar's writings are treated under LATIN LITERATURE. It is sufficient here to say that of those preserved to us, the seven books *Commentarii de bello Gallico*, appear to have been written in 51 B.C. and carry the narrative of the Gallic campaigns down to the close of the previous year (the eighth book, written by A. Hirtius, is a supplement relating the events of 51–50 B.C.), while the three books *De bello civili* record the struggle between Caesar and Pompey (49–48 B.C.). Their veracity was impeached in ancient times by Asinius Pollio and has often been called in question by modern critics. The *Gallic War*, though its publication was doubtless timed to impress on the mind of the Roman people the great services rendered by Caesar to Rome, stands the test of criticism as far as it is possible to apply it, and the accuracy of its narrative has never been seriously shaken. The *Civil War*, especially in its opening chapters is, however, not altogether free from traces of misrepresentation. With respect to the first moves made in the struggle and the negotiations for peace at the outset of hostilities, Caesar's account sometimes conflicts with the testimony of Cicero's correspondence or implies movements which cannot be reconciled with geographical facts. We have but few fragments of Caesar's other works, whether political pamphlets such as the *Anticato*, grammatical treatises (*De Analogia*), or poems. All authorities agree in describing him as a consummate orator. Cicero (*Brut.* 22) wrote: *de Caesare ita iudico, illum omnium fere oratorum Latine loqui elegantissime*, while Quintilian (x. I. 114) says that had he practised at the bar he would have been the only serious rival of Cicero.

The verdict of historians on Caesar has always been coloured by their political sympathies. All have recognized his commanding genius and few have failed to do justice to his personal charm and magnanimity, which almost won the heart of Cicero, who rarely appealed in vain to his clemency. Indeed, he was singularly tolerant of all but intellectual opposition. His private life was not free from scandal, especially in his youth, but it is difficult to believe the worst of the tales which were circulated by his opponents, *e.g.*, as to his relations with Nicomedes of Bithynia. As to his public character, however, no agreement is possible between those who regard Caesarism as a great political creation and those who hold that Caesar by destroying liberty lost a great opportunity and crushed the sense of dignity in mankind. The latter view is unfortunately confirmed by the undoubted fact that Caesar treated with scant respect the historical institutions of Rome, which with their magnificent traditions might still have been the organs of true political life. He increased the number of senators to 900 and introduced provincials into that body; but instead of making it into a grand council of the empire, representative of its various races and nationalities, he treated it with studied contempt, and Cicero writes that his own name had been set down as the proposer of decrees of which he knew nothing, conferring the title of king on potentates of whom he had never heard. A similar treatment was meted out to the ancient magistracies of the republic; and thus began the process by which the emperors undermined the self-respect of their subjects and eventually came to rule over a nation of slaves. Few men, indeed, have partaken as freely of the inspiration of genius as Julius Caesar; few have suffered more disastrously from its illusions. (*See* ROME: *Ancient History*.)

BIBLIOGRAPHY.—The principal ancient authorities for the life of Caesar are his own *Commentaries*, the biographies of Plutarch and Suetonius, letters and speeches of Cicero, the *Catiline* of Sallust, the *Pharsalia* of Lucan, and the histories of Appian, Dio Cassius, and Velleius Paterculus (that of Livy exists only in the *Epitome*). Amongst modern works may be named the exhaustive repertory of fact contained in Drumann, *Geschichte Roms*, vol. iii. (new ed. by Groebe, 1906, pp. 125–820), and the brilliant but partial panegyric of Th. Mommsen in his *History of Rome* (Eng. trans., vol. iv., est. p. 450 ff.). J. A. Froude's *Caesar; A Sketch* (2nd ed., 1896) is equally biased and much less critical. W. Warde Fowler's *Julius Caesar* (1892) gives a favourable account (*see* also his *Social Life at Rome*, 1900). On the other side *see* especially A. Holm, *History of Greece* (Eng. trans., vol. iv. p. 582 ff.), J. L. Strachan Davidson, *Cicero* (1894), p. 345 ff. and the introductory lections in Prof. Tyrrell's edition of the *Correspondence of Cicero*, particularly "Cicero's case against Caesar," vol. v. p. 13 ff. vol. ii. of G. Ferrero's *Greatness and Decline of Rome* (Eng. trans., 1907) is largely devoted to Caesar, but must be used with caution. E. Meyer, *Caesars Monarchie und das Principat des Pompeius* (2nd ed. 1919) and T. Rice Holmes, *The Roman Republic and the founder of the Empire* (1923) are both important. The Gallic campaigns have been treated by Napoleon III., *Histoire de Jules César* (1866), which is valuable as giving the result of excavations, and in English by T. Rice Holmes, *Caesar's Conquest of Gaul* (1901), in which references to earlier literature will be found. A later account is that of G. Veith, *Geschichte der Feldzüge C. Julius Caesars* (1906). For maps *see* A. von Kampen. For the Civil War *see* Colonel Stoffel (the collaborator of Napoleon III.), *Histoire de Jules César et la guerre civile* (1887). There is an interesting article, "The Likenesses of Julius Caesar," by J. C. Ropes, in *Scribner's Magazine*, Feb. 1887, with 18 plates. (H. S. J.)

MEDIAEVAL LEGENDS

In the middle ages the story of Caesar did not undergo such extraordinary transformations as befell the history of Alexander the Great and the Theban legend. Lucan was regularly read in mediaeval schools, and the general facts of Caesar's life were too well known. He was generally, by a curious error, regarded as the first emperor of Rome,[1] and representing as he did in the popular mind the glory of Rome, by an easy transition he became a pillar of the Church. Thus, in a French pseudo-historic romance *Les Faits des Romains* (*c.* 1223), he receives the honour of a bishopric. His name was not usually associated with the marvellous, and the *trouvère* of *Huon de Bordeaux* outstepped the usual sober tradition when he made Oberon the son of Julius Caesar and Morgan la Fay. About 1240 Jehan de Tuim composed a prose *Hystore de Julius Cesar* (ed. F. Settegast, Halle, 1881) based on the *Pharsalia* of Lucan, and the *Commentaries* of Caesar (on the Civil War) and his continuators (on the Alexandrine, African, and Spanish wars). The author gives a romantic description of the meeting with Cleopatra, with an interpolated dissertation on *amour courtois* as understood by the *trouvères*. The *Hystore* was turned into verse (alexandrines) by Jacot de Forest (latter part of the 13th century) under the title of *Roman de Julius César*. A prose compilation by an unknown author, *Les Faits des Romains* (*c.* 1225), has little resemblance to the last two works, although mainly derived from the same sources. It was originally intended to contain a history of the twelve Caesars, but concluded with the murder of the dictator, and in some mss. bears the title of *Li livres de César*. Its popularity is proved by the numerous mss. in which it is preserved and by three separate translations into Italian. A *Mistaire de Julius César* is said to have been represented at Amboise in 1500 before Louis XII.

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[1] Brunetto Latini, *Trésor*: *"Et ainsi Julius César fu li premiers empereres des Romains."*

See A. Graf, *Roma nella memoria e nella imaginazione del medio evo*, i. ch. 8 (1882-83); P. Meyer in *Romania*, xiv. (1885), where the *Faits des Romains* is analysed at length; A. Duval in *Histoire littéraire de la France*, xix. (1838); L. Constans in Petit de Jullevilles' *Hist. de la langue et de la litt. française*, i. (1896); H. Wesemann, *Die Cäsarfabeln des Mittelalters* (Lowenberg, 1879).

CAESAR, SIR JULIUS (1557?–1636), English judge, descended from the dukes de' Cesarini in Italy, was born near Tottenham in Middlesex. He was educated at Magdalen hall, Oxford, and afterwards at the University of Paris, where in 1581 he was made a doctor of civil law. Two years later he was admitted to the same degree at Oxford, and also became doctor of the canon law. He held many high offices during the reigns of Elizabeth and James I., including a judgeship of the admiralty court (1584), and chancellor and under treasurer of the exchequer (1606). He was knighted by King James in 1603, and in 1614 was appointed master of the rolls, an office which he held till his death on April 18, 1636. He was so remarkable for his charity that it was said of him that he seemed to be the almoner-general of the nation. His manuscripts, many of which are now in the British Museum, were sold by auction in 1757 for over £500.

See E. Lodge, *Life of Sir Julius Caesar* (1810); Wood, *Fasti Oxonienses*, ed. Bliss; Foss, *Lives of the Judges*.

CAESAREA MAZACA or KAYSERI, chief town of a vilayet of the same name in Turkey. Mazaca, the residence of the kings of Cappadocia, later called *Eusebea* (perhaps after Ariarathes Eusebes), and named *Caesarea* probably by Claudius, stood on a low spur on the north side of Erjies Dagh (*M. Argaeus*). The site, now called *Eski-shehr*, shows only a few traces of the old town. It was taken by Tigranes and destroyed by the Persian king Shapūr (Sapor) I. after his defeat of Valerian in A.D. 260. In the 4th century Basil, when bishop, established an ecclesiastical centre on the plain, about 1 mi. to the northeast, and this gradually supplanted the old town. A portion of Basil's new city was surrounded with strong walls and turned into a fortress by Justinian; and within the walls, rebuilt in the 13th and 16th centuries, lies the greater part of Kaisarieh, altitude 3,500 ft. The town was captured by the Seljuk sultan, Alp Arslan, 1064, and by the Mongols, 1243, before passing to the Osmanli Turks. The town is noted for its fruit, especially its vines; it exports tissues, carpets, hides, berries and dried fruit. Pop (1940) 52,467. It is the headquarters of the American mission in Cappadocia. It is the seat of a Greek bishop, an Armenian archbishop and a Roman Catholic bishop, and there is a Jesuit school.

CAESAREAN SECTION, in obstetrics (*q.v.*) the operation for removal of a foetus from the uterus by an abdominal incision, so called from a legend of its employment at the birth of Julius Caesar. This procedure has been practised on the dead mother since very early times; in fact it was prescribed by Roman law that every woman dying in advanced pregnancy should be so treated; and in 1608 the senate of Venice enacted that any practitioner who failed to perform this operation on a pregnant woman supposed to be dead, laid himself open to very heavy penalties. But the first recorded instance of its being performed on a living woman occurred about 1500, when a Swiss pig-gelder operated on his own wife. From this time onwards it was tried in many ways and under many conditions, but almost invariably resulted in death of the mother from sepsis or haemorrhage. Even as recently as the first half of the 19th century the recorded mortality was over 50%. Hence craniotomy—in which the life of the child is sacrificed to save that of the mother—was almost invariably preferred. The introduction of asepsis and use of an improved method of suturing the incised uterine wall have reduced the mortality to so low a point for mother and child that the operation is frequently performed. Where possible, however, induction of premature labour from the seventh month onwards is usually to be preferred.

This operation is now advised for (1) extreme degrees of pelvic contraction, (2) any malformation or tumour of the uterus, cervix or vagina, which would render birth of the child through the natural passages impossible, (3) maternal complications, as eclampsia and concealed accidental haemorrhage, and (4) at the death of the mother for the purpose of saving the child.

CAESAREA PALESTINAE, a seaport south of Carmel (mod. *Kaisūrīyeh*), built (25–13 B.C.) by Herod the Great as port of his capital Sebaste (Samaria) on a Phoenician site known to the ancients as Straton's (Astarte?) Tower. The site with its richly architectured structures (palaces, temple, amphitheatre, hippodrome, aqueducts) is described by Josephus (*Antiq.* xv. 9.6.). The harbour "free always from the waves of the sea" was constructed by reinforcing with vast stone blocks two reefs which stretched seawards. A quay encircled the whole harbour on which were arches "where the mariners dwelt." The harbour had a name and fame distinct from the town which, indeed, it partly overshadowed. Caesarea witnessed important events in the lives of Peter, Philip and Paul. It saw the first incidents in the great revolt of the Jews against the Romans (66 A.D.). There Vespasian was proclaimed emperor (69 A.D.). Under Alexander Severus it became the metropolis of Syria and its bishop in consequence the Metropolitan, an office which Eusebius held from 315 to 318. There Procopius was born and there Origen made his home. When the Moslems occupied it in 638 its sea power faded and it rapidly shrank in size and importance. Under the Crusaders it partially revived. They rebuilt and walled a part (about $\frac{1}{10}$) of the Roman city adjacent to the harbour to serve as a citadel. It was taken in 1101 by Baldwin I., on which occasion the "Holy Grail" was discovered, by Saladin (1187), by Richard I. (1191). Louis IX. strengthened its fortifications (1251) and it was finally demolished by Beibars (1265). Stones from the ruins were transported to Acre and Jaffa for building purposes during the 19th century. Turkey transferred thither a small Bosnian community in 1878. Anchorage (10 fathoms) is possible in summer $\frac{1}{2}$ m. from the shore. At Tell Barak, 6 m. inland, two 2nd century sarcophagi, finely sculptured, were discovered in 1924. They are now in the Jerusalem Museum. *See* L. Haefeli, *Caesarea am Meer. Topographie und Geschichte der Stadt nach Josephus und Apostelgeschichte* (1923).

CAESAREA PHILIPPI, anciently a city (mod. *Banias*), at the southern end of the Hermon range where from a cave issues a source of the Jordan. It was the scene of a great battle in which Palestine was won from the Ptolemies by Antiochus (Polybius, xvi. 18). A village now occupies the site. North of it is the famous "Grotto of the spring," whose well was bottomless (Josephus, *Bell. Jud.* i. 21. 3), and the actions of whose indwelling deity could be affected by casting into the waters a victim (Eusebius, vi. 18). Baal worship was no doubt practised here in early times and its identification with The Baal God of Joshua or the Baal Hermon of I Chronicles is not improbable. Baal gave way to Grecian "Pan and the Nymphs" (inscription in the grotto). The name Paneas (whence *Banias*) was applied to the whole district. Augustus presented the region to Herod who erected a temple to his benefactor and set therein the emperor's image. Philip the Tetrarch enlarged and embellished the town, naming it Caesarea after Augustus and adding Philippi to distinguish it from the Caesarea (Palestinae) of his father. Agrippa II. to honour Nero changed the name to Neronias, but the name did not endure. Jesus visited the neighbourhood and gave here the great charge to Peter (Mark viii. 27). Here Vespasian refreshed his army with a three weeks' rest before his advance into Galilee. Here, too, Titus after the downfall of Jerusalem held gladiatorial contests on a large scale.

In the 4th cent. Caesarea was erected into an episcopal see. It was taken by the crusaders (1129), the emir of Damascus (1132), and the emir of Aleppo (1137) in a three-cornered contest. It was burned by the Syrians (1157). Some broken columns and carved stones, parts of the old walls and citadel, traces of an aqueduct and some niches in the rock beside the spring are the sole reminders of a vanished glory. A fine mediaeval fortress, dismantled in the 13th cent., stands on a lofty conical hill above the spring.

CAESARIUS OF ARLES, SAINT (*c.* 470–543), bishop of Arles and ecclesiastical legislator, was born at Chalons, Burgundy. In 502 he became bishop of Arles, a town which was then of great commercial and political importance. He convoked the Council of Agde (506), of Arles (524), of Carpentras (527), of Orange and of Vaison (529), and of Marseille (533), wherein such problems as semipelagianism, ecclesiastical jurisdiction and property, and the education and support of the clergy were raised. His works, including his popular sermons, invaluable for history, and his two monastic rules were published in Migne, *Pat. Lat.* vol. lxvii.

See Malnory, *St. Césaire Évêque d'Arles* (1894), Arnold, *Caesarius v. Arelate* (Leipzig, 1894); M. Chaillon, *Saint Césaire* (1912); and K. J. Hefele, *Hist. of Councils* (Eng. trans. by W. R. Clark, 1871).

CAESARIUS OF HEISTERBACH (*c.* 1170–*c.* 1240), German preacher, was born at Cologne, joined the Cistercians and became prior of the Heisterbach house in 1228. Of his best known work, *Dialogue of Visions and Miracles*, a series of ascetical romances, the latest edition is that by J. Strange (Cologne, 1851). Of his remaining works the *Eight Books of Miracles* was edited by Meister (Rome, 1901), the more historical *Life of St. Engelbert* (d. 1225) by Gelenius (1633), the biographical list of archbishops of Cologne between 94–1238 by Cardauns in *Mon. Germ. Hist. Script. xxiv.*, his sermons in 1615, and his "*Life of St. Elizabeth of Hungary*" by Huyskens in *Annalen des Historischen Vereins*, etc. (Cologne, 1908).

See Kaufmann, *Caesarius von Heisterbach* (Cologne, 1862); Schönbach, "Studien zur Erzählungslit. des Mittelalters" in *Sitz. der k. Akad. der Wissenschaften*, No. 144 (Vienna, 1902); and E. Beitz, *C. v. Heisterbach und die bildende Kunst* (Augsburg, 1926).

CAESARIUS OF NAZIANZUS (*c.* 330–368), brother of Gregory of Nazianzus, studied at Alexandria and then became a physician. After three years in Constantinople he returned to Nazianzus in 358 and practised at the court of Constantius and of Julian the Apostate. Under the Emperor Valens he became quaestor of Bithynia. The *Dialogues* under his name in Migne's *Patr. Graeca.* 38 are probably spurious.

CAESIUM, a metal of the alkali (*q.v.*) group (symbol Cs, atomic number 55, atomic weight 132·81). Its name is derived from the Lat. *caesius*, sky-blue, from two bright blue lines of its spectrum. It was the first metal to be discovered by the aid of the spectroscope (R. Bunsen, *Pogg. Annal.*, cxiii., 337; *Berlin Acad. Ber.*, 1860), although caesium salts had undoubtedly been handled before, but had been mistaken for potassium salts. The most important mineral containing caesium is pollucite, a silicate of aluminium and caesium. This mineral contains from 31%–37% of Cs_2O and occurs in commercial quantities in Maine, U.S.A., and the Isle of Elba. In 1846 C. F. Plattner analysed the mineral and obtained as total constituents 93·75%, reckoning the Cs_2O as K_2O. He was mystified by the result which was cleared up in 1864 by F. Pisani when he found the alkali present to be caesium. Pollucite is attacked quite readily by hydrochloric or nitric acid and after the removal of the silica the caesium may be precipitated by forming the insoluble double chloride with antimony chloride or crystallizing out the fairly insoluble caesium aluminium sulphate, an alum (*q.v.*). Caesium is found in the mineral springs of Frankenhausen, Montecatini, in Val di Nievole, Tuscany, and Wheal Clifford, near Redruth, Cornwall, and, associated with rubidium, at Dürkheim; it is also found in lepidolite, leucite, petalite, triphylline and in the carnallite from Stassfurt. The separation of caesium from the minerals which contain it is an exceedingly difficult and laborious process. According to R. Bunsen, the best source of rubidium and caesium salts is the residue left after extraction of lithium salts from lepidolite. This residue consists of sodium, potassium and lithium chlorides, with small quantities of caesium and rubidium chlorides. The caesium and rubidium are separated from this by repeated fractional crystallization of their double platinum chlorides, which are much less soluble in water than those of the other alkali metals. The platinichlorides are reduced by hydrogen, and the caesium and rubidium chlorides extracted by water. W. Feit and K. Kubierschky (1892) separated rubidium and caesium from the other alkali metals by converting them into double chlorides with stannic chloride; whilst J. Redtenbacher (1865) separated them from potassium by conversion into alums, which are very slightly soluble in a solution of potash alum. In order to separate caesium from rubidium, use is made of the different solubilities of their various salts. The bitartrates $RbHC_4H_4O_6$ and $CsHC_4H_4O_6$ have been employed, as have also the alums. The double chloride of caesium and antimony $3CsCl{\cdot}2SbCl_3$ has been used, the corresponding compound not being formed by rubidium. The metal has been obtained by electrolysis of a mixture of caesium and barium cyanides, and by heating the hydroxide with magnesium or aluminium. L. Hackspill finds, however, that metallic caesium can be prepared more readily by distilling the chloride with metallic calcium. It is a silvery white metal which burns on being heated in air. It melts at 26° to 27° C and has a specific gravity of 1·88 (15° C).

Caesium hydroxide, CsOH, obtained by the decomposition of the sulphate with baryta water, is a greyish-white deliquescent solid which melts at a red heat and absorbs carbon dioxide rapidly. It readily dissolves in water, with evolution of much heat. *Caesium chloride*, CsCl, obtained by dissolving the hydroxide or carbonate in hydrochloric acid, forms small cubes which melt at a red heat and volatilize readily; it deliquesces in moist air. The *bromide*, CsBr, and *iodide*, CsI, resemble the corresponding potassium salts. Many trihaloid salts of caesium are also known such as $CsBr_3$, $CsClBr_2$, $CsBrI_2$, $CsBr_2I$, etc. (H. L. Wells and S. L. Penfield, 1892). *Caesium sulphate*, Cs_2SO_4, may be prepared by dissolving the hydroxide or carbonate in sulphuric acid. It crystallizes in short hard prisms, readily soluble in water but insoluble in alcohol. It forms caesium alum, $Cs_2SO_4{\cdot}Al_2(SO_4)_3{\cdot}24H_2O$. *Caesium nitrate*, $CsNO_3$, is obtained by dissolving the carbonate in nitric acid, and crystallizes in glittering prisms, which melt readily, and when heated evolve oxygen and leave a residue of caesium nitrite. The carbonate, Cs_2CO_3, is soluble in water and in alcohol.

Caesium compounds can be readily recognized by the two bright blue lines (of wave length 4555 and 4593) in their flame spectrum, although these are not present in the spark spectrum. The other lines include three in the green, two in the yellow, and two in the orange. Caesium has an important technical application in the manufacture of radio tubes or "valves." Its nitrate or chloride is mixed with cerium or magnesium and compressed into small tablets which are introduced into the tubes. In evacuating the tubes, these tablets are flashed, helping to secure a high vacuum.

CAESPITOSE, a botanical term for "growing in tufts," like many grasses.

CAESTUS or **CESTUS,** a gauntlet or boxing-glove used by the ancient pugilists (from Lat. *caedo*, strike). Of this there were several varieties, the simplest and least dangerous being the *meilichae* (μειλίχαι), which consisted of strips of raw hide tied under the palm, leaving the fingers bare. With these the athletes in the *palaestrae* were wont to practise, reserving for serious contests the more formidable kinds, such as the *sphaerae* (σφαῖραι), which were sewn with small metal balls covered with leather, and the terrible *murmekes* (μύρμηκες), sometimes called "limb-breakers" (γυιοτόροι), which were studded with heavy nails. The straps (*ἵμαντες*) were of different lengths, many reaching to the elbow, in order to protect the forearm when guarding heavy blows (*see* J. H. Krause, *Gymnastik und Agonistik der Hellenen*, 1841). The *caestus* is to be distinguished from *cestus* (= embroidered, from *κεντεῖν*), an adjective used as a noun in the sense of "girdle," especially the girdle of Aphrodite, which was supposed to have the power of exciting love.

CAESURA, a break within a foot (Gr. *τομη*, cutting) caused by the end of a word, with or without pause in the sense; to be distinguished from a diaeresis (*διαίρεσις*), which is a pause between feet. English examples are:

The pro|per stud|y ¦ of | mankind | is man (caesura).
And born | to write, || converse, | and live | at ease (diaeresis).

A line will often have many caesuras, as:

arma ¦ vi|rumque ¦ ca|no ¦ Tro|iae ¦ qui | primus ¦ ab| oris

which (as shown) has one in every foot except the sixth; but the term is generally employed of the *principal caesura; i.e.*, that in or about the middle of the line, in this case, the one between *cano* and *Troiae*. The parts into which such a caesura divides the verse are called cola (*κῶλα*, members). Practically every dactylic hexameter and every iambic trimeter has a caesura, the former in the third foot (penthemimeral) or in the second (trithemimeral), usually combined with one in the fourth (hephthemimeral); the latter, in the third or fourth foot. In dactyls a caesura is called *masculine* if it comes after the long syllable, *feminine* if after the first short one (*see* VERSE).

CAFETERIA. Cafeterias are popular and up-to-date restaurants which supply meals at the lowest cost by allowing the people using them to wait upon themselves. An institution of American origin and development, the cafeteria has so increasingly fixed itself in public favour that there are now thousands in the United States and many other countries.

Previous to their introduction there were no restaurants in which a light luncheon could be quickly obtained. Discouraging small orders, restaurant owners did not attract customers who desired little food. Between the high-priced and the general run of restaurants there were few attractive medium-grade eating-places where small quantities of appetizing food could be secured at slight outlay. Most of the so-called moderate-priced restaurants in cities were in cramped quarters, and too frequently their surroundings were as disagreeable as the food was unreliable.

Expected tipping of waiters was a drain upon the resources of large numbers of people working for small pay. The tipping custom became particularly irksome as the cost of living advanced out of all proportion to salaries. With but a short interval for lunch, men and women, girls and boys working in shops and offices also wanted some spare time for themselves in the noon hour. The self-service system did away with all delay. Besides the regular patrons, there is in the large cities a floating population which generally lunches at all hours. The system is practically unknown in Great Britain.

Origin of the Cafeteria.—The beginnings were somewhat crude. The Exchange Buffet was established in New York city in 1885. But its system was for men only, and consisted of customers having their orders filled at a central counter and conveying their dishes to other counters, where they ate standing. In 1891, J. R. Thompson opened a restaurant at State and Polk streets, Chicago. It combined the supplying of a variety of hot foods with the self-service plan.

In July, 1925, the *Journal of Home Economics* published the results of a questionnaire it had sent out as to the time and place of the cafeteria's inception. According to the findings, the first convincing demonstration was apparently made in Chicago, and the motive was semi-philanthropic.

Early in the '90s several social and philanthropic organizations in that city conceived the idea of assisting working girls to get cheaper meals by allowing them to wait upon themselves, and eat at tables in a congenial atmosphere. Among these pioneer cafeterias were the Ogontz club in the Pontiac building, the nearby Wildwood club maintained by Miss Kirkland's school, and the Klio Association's Noon-Day Rest, started in 1893 at No. 4 East Monroe street. These places were open only to girl members who paid a small weekly charge for luncheons. The cost was held down by renting an upper floor, by serving smaller portions than customary at the ordinary restaurant and by doing away with the need for waiters. The plan's advantages were perceived by the Young Women's Christian Association, which soon opened cafeterias in Kansas city and in other cities.

Commercial Value Established.—The commercial possibilities of the cafeteria idea shortly became evident. Experiments had shown the urgent need of such restaurants for both men and women. Mrs. Knox, one of the first managers of the Noon-Day Rest, opened and successfully managed a cafeteria opposite Marshall Field's department store in Chicago. It was, however, in Los Angeles that the cafeteria's first noted development came. Impressed by the popularity of one of the Chicago clubs, Miss H. S. Mosher, of Michigan, in May 1905, opened a cafeteria in Hill street, Los Angeles. In its first stages, a cigar box was used as a cash register and the other fittings were likewise rudimentary. But these deficiencies were overlooked in the eagerness of crowds to give their patronage where the food could be seen and selected. The novelty made such a sensation that the Los Angeles newspapers commented briskly on the spectacle of citizens balancing trays filled with savoury dishes. More cafeterias were opened in Los Angeles, then the plan spread to San Francisco and rapidly eastward to other cities.

Its Great Proportions.—The cafeteria business reached a peak in 1926, its popularity being supplanted by coffee shops, lunch-rooms, and sandwich shops. Although individually operated cafeterias declined in number, chain organizations continued to grow and prosper because they added air-conditioning, acoustical treatment, music, semi-service, luxurious surroundings and a high degree of speedy service. Most of these new chain units cost over $100,000 each and many have a capital investment of $500,000. It is not unusual for cafeterias in this group to serve upward from 10,000 to 20,000 meals a day in each unit.

The largest operators of cafeterias in 1939 were Waldorf System of Boston, Mass., with 137 shops; John R. Thompson Co. of Chicago with 115 shops; Horn & Hardart Co. of Philadelphia with 50 shops; Bickford's Inc. of New York with 95 shops.

Cafeteria operators rate as most successful of the largest newcomers in the field, the S. & W. Cafeteria Co. of Charlotte, N.C., with eight units that serve upwards of 7,000,000 meals a year, and the Forum Cafeteria Co. of Kansas City which serves 11,000,000 meals a year in six units. The most unusual cafeteria company in the United States is Clinton's Golden Rule in Los Angeles. It serves about 16,000 persons daily with an average check of 25 cents.

The food cost is about 43%, labour 27%, net profit does not exceed ½c per person served.

The most striking development of the self-service restaurant is that of the Automats, run by the Horn and Hardart Company. The name automat was adopted because the plan, which was first tried out in Germany, provided for dropping nickels in slots, thereby opening a container and releasing the food. From this original idea the company branched to the supplying of hot meals served at counters by attendants and paid for by the requisite coins dropped in slots. In its newer restaurants the automats are a combination of this mode and of the cafeteria, the lower floor devoted to coin machines, the upper to self-service from counters, with payment to a cashier.

Cafeterias in Industrial Plants.—In their welfare work for employees, beginning generally about the year 1915, many of the great industrial corporations in the United States provided cafeterias in their factories. In 1929 close to 700 corporations operated cafeterias for their employees. The business recession and the turn away from paternalism in industrial management, reduced the number of cafeterias to about 300 units.

But the trend toward cafeterias in schools and colleges has been on the increase each year. Several thousand of these units are now in operation.

Most of them are managed by women dietitians. They are operated on a non-profit basis.

The total number of cafeterias in the United States is about 21,000.

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CAFFEINE, a vegetable base, present in coffee beans, with the formula $C_8H_{10}N_4O_2$. (*See* PURINES.)

CAFFIERI, JACQUES (1678–1755), French worker in metal, the most famous member of a family several of whom distinguished themselves in plastic art, was the fifth son of Philippe Caffieri (1634–1716), a decorative sculptor, who, after serving Pope Alexander VII., entered the service of Louis XIV. in 1660. An elder son of Philippe, François Charles (1667–1721), was associated with him. As a *fondeur ciseleur*, however, the renown of the house centred in Jacques, though it is not always easy to distinguish between his own work and that of his son Philippe (1714–1777). A large proportion of his brilliant achievement as a designer and chaser in bronze and other metals was executed for the crown at Versailles, Fontainebleau, Compiègne, Choisy and La Muette. Jacques and his son Philippe undoubtedly worked together in the "Appartement du Dauphin" at Versailles, where the decorations of the marble chimney-piece in the best type of the Louis XV. style still remain. They also worked together upon the gorgeous bronze case of the famous astronomical clock made by Passement and Danthiau for Louis XV. between 1749 and 1753. The elder Caffieri was a consummate practitioner of the *style rocaille,* which he redeemed from its mannered conventionalism by the ease and mastery of his treatment. From their studio came an amazing amount of work, chiefly in the shape of those gilded bronze mounts which in the end became more insistent than the pieces of furniture which they adorned. Little of the elder's achievement was ordinary; a large proportion of it is famous. In the Wallace collection (Hertford house, London) is a commode constructed by Gaudreau with mounts from the hand of Jacques Caffieri, in which are seen the brilliance and spontaneity, the sweeping boldness and elegance of line that mark his style at its best. Also at Hertford house is the exceptionally fine lustre which was a wedding present from Louis XV. to Louise Elizabeth of France. After Jacques' death his son Philippe's style was gradually modified into that which prevailed in the third quarter of the 18th century, since by 1777, when he died, the taste for the magnificent mounts of his early days had passed away. Philippe's younger brother, Jean Jacques Caffieri (1725–1792), was a sculptor, but was sufficiently adept in the treatment of metals to design the fine *rampe d'escalier* which still adorns the Palais Royal.

See A. Michel, *À propos de quelques oeuvres de Jean Jacques Caffieri récemment entrées au Musée du Louvre,* in archives of Société de l'Histoire de l'Art français, 4 S. VIII. 251 (1916); F. de Salverté, *Les ébenistes du XVIII. siècle, leurs oeuvres et leurs marques* (1927).

CAFTAN or **KAFTAN,** a tunic or under-dress with long hanging sleeves, tied with a girdle at the waist, worn in the East by persons of both sexes. The caftan was worn by the upper and middle classes in Russia till the time of Peter the Great, when it was generally discarded.

CAGE, in mining, a contrivance in which is raised to the surface the "tub," "tram," "hutch" or "box," as the small underground truck or wagon which carries the coal or mineral from the working face to the shaft is called. The cage, which is constructed of steel, is usually of such a capacity as to permit of more than a single tub being drawn to the surface in each wind. The cages are in general use at coal mines; indeed their use is compulsory in Great Britain under Section 40 of the Coal Mines act of 1911, for the raising and lowering of persons at the mine except where there are ladders. At metalliferous mines, the mineral is usually teemed into a storage bin, at the bottom of the shaft or the level, from which it is loaded into a "skip," an iron or steel box running on wheels, which on reaching the surface automatically tips out the ore. But the nature of coal does not permit of such rough usage—from the view of both breakage and dust, it is undesirable.

Prior to the invention of the cage, coal was drawn to the surface in a large wicker-work basket, or "corf." These "corves" were woven of hazel wands. After being filled they were placed on trams which were shoved and pulled by manual labour from the face to the "crane station" where they were lifted on to a horse-trolley, conveyed to the shaft and there separately drawn to the surface by means of the iron bow or handle with which they were fitted. They were unwieldy and required a great deal of repairing; they also imposed a limit on the output. The output of a large colliery as late as 1835 working a twelve hour day, was according to Mr. George Stephenson, 300 tons (1835 *Report, 1842*). This means of conveying coal continued well into the nineteenth century.

The First Cage.—During the time this method of raising coal was in vogue the arrangements by which the miners—men and boys—were lowered and raised were also very primitive. Two men would sit each with a leg through a loop of the chain with boys (five or six) clinging to the rope above them. Attempts were made as early as 1816 at Washington colliery in the county of Durham to introduce a better method of raising coal to the surface than by wicker corves, but unsuccessfully. It rested with a mining engineer named T. Y. Hall, in the North of England, to introduce underground in 1833–1834 tubs running on wheels, and their conveyance up the shaft in a cage. Somewhat later he much improved the system by providing wooden *guide rods* in the shaft for the cage, fitted with a *shoe* at the top and bottom, to slide on, and *keeps* or *keps* for the cage to rest on on arrival at the surface whilst the process of changing the tubs (substituting empty for full tubs) was being carried out.

Cages have not undergone much change since they were first introduced, except that they are usually more capacious and carry more and larger tubs, and in most modernly equipped shafts run on steel rope guides—in place of the wooden or steel rail guides, of which there were two to each cage. These ropes, usually four to each cage, are stretched from the top of the pit-head frame and tightened by weights at the bottom of the shaft. At the pit top the guide ropes pass through crossbearers and are held by clamps. By law, guides have to be provided in the case of every working shaft over fifty yards in depth, and in the case of every shaft in course of being sunk over one hundred yards in depth; and every cage has to be provided with catches to prevent tubs falling out; and, when used for raising or lowering persons, has to be covered completely at the top and closed in at the two sides. It also has to be provided with gates or rigid fences and a rigid bar to hold on to.

The attachment of the cage to the winding rope is by means of chains, four or six, one from each corner of the cage and two "idle" chains at the sides; but intervening between the chains and the rope capping or "capel" is a safety or detaching hook—required by law in the case of vertical shafts. If the winding apparatus is used for lowering or raising persons, and in addition, if the shaft is more than 100 yards in depth, the winding engine has to have an automatic contrivance to prevent overwinding. (*See* COAL AND COAL MINING.) Every winding rope has to be recapped at intervals of not more than six months, and if used for raising or lowering persons must not be in use for more than three and a half years. All cage chains in general use have to be annealed once at least in every six months, and the detaching hook cleaned and refitted once in every three months. (R. R.)

CAGLI, a town and (with Pergola) an episcopal see of the Marches, Italy, in the province of Pesaro and Urbino, 18m. south of the latter town by rail, and 830ft. above sea-level. Pop. (1936) 2,745 (town); 12,658 (commune). The church of St. Domenico contains a good fresco (Madonna and saints) by Giovanni Santi, the father of Raphael. A tower of the citadel of the 15th century, constructed by Francesco di Giorgio Martini of Siena, is on the south-east of the modern town. Cagli occupies the site of an ancient *vicus* (village) on the Via Flaminia, which bore the name Cale, 24m. north of Helvillum (mod. *Sigillo*) and 18m. S.W. of Forum Sempronii (mod. Fossombrone). Below the town to the north is a single arched bridge of the road, the arch having a span of 15ft. Eight miles north of Cagli the Via

Flaminia, which is still the high-road, traverses the Furlo Pass, with a tunnel 42yd. long, excavated by Vespasian in A.D. 76 or 77, as an inscription at the north end records. There is another tunnel at lower level, which belongs to an earlier date; this seems to have been in use till the construction of the Roman road, which at first ran round the rock on the outside. In repairing the modern road just outside the south entrance to the tunnel, a quantity of debris belonging to the castle of Petra Pertusa, burned by the Lombards in 570 or 571, was found. Here also was found an inscription of A.D. 295, relating to the measures taken to suppress brigandage in these parts. (*See* APENNINES.)

See Journal of Roman Studies, XI., 183 *sqq.*, a brief account with reff. (1921).

CAGLIARI, the capital of Sardinia, an archiepiscopal see, and the chief town of a province (*see* also CARALES). It is 270 mi. W.S.W. of Naples, and 375 mi. south of Genoa by sea. Population (1936) 78,632 (town); 108,338 (commune). It is at the northern extremity of the Gulf of Cagliari, in the centre of the south coast of the island. The mediaeval town occupies a long narrow hill running north and south, which must have been the ancient acropolis. On each side of the town are lagoons. That of S. Gilla on the west, which produces fish in abundance, was originally an open bay. The upper town retains in part its fortifications, including the two great towers at the two extremities, called the Torre dell' Elefante (1307), and the Torre di S. Pancrazio (1305), both erected by the Pisans. On the edge of the cliffs on the east is the cathedral, which was built in 1257–1312 by the Pisans and which retains two of the original transept doors. The pulpit (now divided into two) was brought from Pisa in 1312. The church was remodelled in 1676, and the interior is baroque. The façade, in the baroque style, was added in 1703. The university is a little farther north. At the south extremity of the hill, on the site of the bastion of Caterina, a large terrace, the Passeggiata Umberto Primo, has been constructed. Below it are covered promenades, and from it steps descend to the lower town, the oldest part of which (the so-called Marina) slopes towards the sea, while the quarter of Stampace lies to the west, and beyond it again the suburb of Sant'Avendrace. East of the castle hill and the Marina is the quarter of Villanova, which contains the church of S. Saturnino, a domed church of the 8th century. The harbour is a good one; the chief exports are lead, zinc and other minerals and salt. In 1938 the harbour was much expanded; its traffic grew from 382,010 tons in 1927 to 755,208 tons in 1935. The Campidano of Cagliari, the plain which begins at the north end of the lagoon of S. Gilla, is fertile and much cultivated. The national costumes are rarely now seen in the neighbourhood of Cagliari, except at certain festivals, especially that of S. Efisio (May 1–4) at Pula. The methods of cultivation are primitive: the water wheels, made of brushwood with pots tied on to them, are turned by a blindfolded donkey. Cagliari is exposed to winds in winter, while in summer it is almost African in climate. The main line of railway runs north to Decimomannu (for Iglesias), Oristano, Macomer and Chilivani (for Terranova and Sassari); while another line (narrow-gauge) runs to Mandas (for Sorgono and Tortoli). There is also a tramway to Quarto S. Elena.

In A.D. 485 the whole of Sardinia was taken by the Vandals from Africa; but in 533 it was retaken by Justinian. In 687 Cagliari rose against the East Roman emperors, under Gialetus, one of the citizens, who made himself king of the whole island, his three brothers becoming governors of Torres (in the northwest), Arborea (in the southwest) and Gallura (in the northeast of the island). The Saracens devastated it in the 8th century, but were driven out, and the island returned to the rule of kings, until they fell in the 10th century, their place being taken by four "judges" of the four provinces, Cagliari, Torres, Arborea and Gallura. In the 12th century Musatto, a Saracen, established himself in Cagliari, but was driven out with the help of the Pisans and Genoese. The Pisans soon acquired the sovereignty over the whole island with the exception of Arborea, which continued to be independent. In 1297 Boniface VIII invested the kings of Aragon with Sardinia, and made it the seat of their government In 1348 the island was devastated by the plague described by Boccaccio. Not until 1403 were the kings of Aragon able to conquer the district of Arborea, which, under the celebrated Eleonora (whose code of laws—the so-called *Carta de Logu*—was famous), offered a heroic resistance. In 1479 the native princes were deprived of all independence. The island remained in the hands of Spain until the peace of Utrecht (1714), by which it was assigned to Austria. In 1720 it was ceded by the latter, in exchange for Sicily, to the duke of Savoy, who assumed the title of king of Sardinia (Cagliari continuing to be the seat of government), and this remained the title of the house of Savoy until 1861. Cagliari was bombarded by the French fleet in 1793, but Napoleon's attempt to take the island failed. During World War II it was bombed by the Allied air forces in May 1943.

CAGLIOSTRO, ALESSANDRO, COUNT (1743–1795), Italian alchemist, and impostor, was born at Palermo. Giuseppe Balsamo (for such was the "count's" real name) fled from Sicily to escape punishment for a series of ingenious crimes, and visited in succession Greece, Egypt, Arabia, Persia, Rhodes (where he took lessons in alchemy and the cognate sciences from the Greek Althotas) and Malta. There he presented himself to the grand master of the Maltese order as Count Cagliostro, and curried favour with him as a fellow alchemist, for the grand master's tastes lay in the same direction. From him he obtained introductions to the great houses of Rome and Naples. At Rome he married Lorenza Feliciani, with whom he travelled, under different names, through many parts of Europe. He visited London and Paris in 1771, selling love-philtres, elixirs of youth, mixtures for making ugly women beautiful, alchemistic powders, etc., and deriving large profits from his trade. After further travels on the Continent he returned to London, where he posed as the founder of a new system of freemasonry, and was well received in the best society, being adored by the ladies. He went to Germany and Holland once more, and to Russia, Poland, and then again to Paris, where, in 1785, he was implicated in the affair of the Diamond Necklace (*q.v.*); and although Cagliostro escaped conviction by the matchless impudence of his defence, he was imprisoned for other reasons in the Bastille. On his liberation he visited England once more, where he was confined for a while in the Fleet prison. Leaving England, he travelled through Europe as far as Rome, where he was arrested in 1789. He was tried and condemned to death for being a heretic, but the sentence was commuted to perpetual imprisonment, while his wife was immured in a convent. He died in the fortress prison of San Leo.

The famous *Mémoires pour servir à l'histoire du comte de Cagliostro* (*1786*) are fictitious. The best account of the life, adventures and character of Giuseppe Balsamo is contained in Carlyle's *Miscellanies*. Dumas's novel, *Memoirs of a Physician* is founded on his adventures. *See* also Sierke, *Schwärmer und Schwindler zu Ende des XVIII. Jahrhunderts* (1875); and the sketch of his life in D. Silvagni's *La Corte e la Società Romana nei secoli XVIII. e XIX.* vol. i. (Florence, 1881).

CAGNIARD DE LA TOUR, CHARLES (1777–1859), French engineer and physicist, was born in Paris on March 31, 1777, and after attending the École Polytechnique became one of the *ingénieurs géographiques*. He was made a baron in 1818, and died in Paris on July 5, 1859. He was the author of numerous inventions, including the cagniardelle, a blowing machine, which consists essentially of an Archimedean screw set obliquely in a tank of water in such a way that its lower end is completely, and its upper end partially, immersed, and operated by being rotated in the opposite direction to that required for raising water. In acoustics he invented, about 1819, the improved siren which is known by his name, using it for ascertaining the number of vibrations corresponding to a sound of any particular pitch, and he also made experiments on the mechanism of voice-production. In course of an investigation, in 1822–23, on the effects of heat and pressure on certain liquids, he found that for each there was a certain temperature above which it refused to remain liquid, but passed into the gaseous state, no matter what the amount of pressure to which it was subjected, and in the case of water he determined this critical temperature, with a remarkable approach to accuracy, to be 683·3° F.

CAGNOLA, LUIGI, Marchese (1762–1833), Italian architect, was born on June 9, 1762, in Milan, and died on Aug. 14, 1833, at Inverigo. He was sent at the age of 14 to the Clementine college at Rome, and afterwards studied law at Pavia. He spent two years in Verona and Venice, studying the architectural structures of these cities. In 1806 he was called upon to erect a triumphal arch at Milan for the marriage of Eugène Beauharnais with the princess of Bavaria. The arch was of wood, but was of such beauty that it was resolved to carry it out in marble. The result was the magnificent Arco della Pace in Milan, surpassed in dimensions only by the Arc de Triomphe in Paris. Among Cagnola's principal works are the Porta di Marengo at Milan, the campanile at Urgnano, and the chapel of Santa Marcellina in Milan.

CAGOTS, a people found in the Basque provinces, Béarn, Gascony and Brittany, first mentioned in 1288. In the 16th century they had many names, Cagots, Gahets, Gafets in France; Agotes, Gafos in Spain; and Cacons, Cahets, Caqueux and Caquins in Brittany. During the middle ages they were shunned and hated; were allotted separate quarters in towns, called *cagoteries,* and lived in wretched huts in the country distinct from the villages. Excluded from all political and social rights, they were only allowed to enter a church by a special door, and during the service a rail separated them from the other worshippers. Either they were altogether forbidden to partake of the sacrament, or the holy wafer was handed to them on the end of a stick, while a receptacle for holy water was reserved for their exclusive use. They were compelled to wear a distinctive dress, and so pestilential was their touch considered that it was a crime for them to walk the common road barefooted. The only trades allowed them were those of butcher and carpenter, and their ordinary occupation was woodcutting. Their language is merely a corrupt form of that spoken around them.

The origin of the Cagots is undecided. Teutonic descent is suggested by their fair complexions and blue eyes. Littré defines them as "a people of the Pyrenees affected with a kind of cretinism." The old mss. call them Chrétiens or Chrestians, and from this it has been argued that they were Visigoths who originally lived as Christians among the Gascon pagans. A far more probable explanation of this name is to be found in the fact that in mediaeval times all lepers were known as *pauperes Christi,* and that these Cagots were affected in the middle ages with a condition closely resembling leprosy. Thus would arise the confusion between Christians and Cretins. To-day their descendants are not more subject to goitre and cretinism than those dwelling around them, and are recognized by tradition and not by features or physical degeneracy. It was not until the French Revolution that any steps were taken to ameliorate their lot, but to-day they have ceased to form a separate class.

See Francisque Michel, *Histoire des races maudites de France et d'Espagne* (1846); *Bulletins de la société anthropologique* (1861, 1867, 1868, 1871); *Annales medico-psychologiques* (Jan. 1867); Paul Raymond, *Mœurs béarnaises* (Pau, 1872); V. de Rochas, *Les Parias de France et d'Espagne* (1877); J. Hack Tuke, *Jour. Anthropological Institute* (vol. ix., 1880).

CAGUAS is an important interior town situated on an extensive and fertile plain in the east-central part of Puerto Rico. It is about 25 mi. from San Juan, the principal city and seaport of the island, with which it is connected by a railroad and highways. The population of the town itself, by the 1930 census, was 19,791; in 1940, it was 24,377; the population of the municipal district in 1940 was 53,356.

The town is the centre of a district principally devoted to the production of sugar-cane and tobacco; some fruits and coffee are also produced. There are several important sugar centrals in the district where sugar is manufactured from the cane. In the town there are several cigar factories. The public buildings, stores and shops are attractive. It has a beautiful plaza, well-paved streets, electric lights, water-works and a sewer system. The school buildings are unusually commodious and attractive; the schools, among the best on the island. The municipality has a good hospital and a public library. The town and municipal district are regarded as among the most progressive and prosperous in the island.

CAHER (Cahir), market town in a good agricultural district, Co. Tipperary, Eire, at the foot of the east end of the Galtee mountains on the river Suir, midway between Clonmel and Tipperary on the Gt. Southern Railway. Pop. (1936) 1,638. An ancient fortress on an island in the river was called Dun-iasgach (Fortress abounding in fish). Caher derives from *Cathair,* a stone fortress. The present castle was built (1142) by O'Connor, earl of Thomond. Ardfinnan castle (Norman) stands 6 m. down the Suir; there are stalactite caverns at Mitchelstown 10 m. southwest.

CAHITA, a group of North American Indians, mainly of the Mayo and Yaqui tribes, found chiefly in Mexico, belonging to the Piman family, and numbering some 40,000.

CAHOKIA, the name of a North American Indian tribe of the Illinois confederacy, and of their mission station, near St. Louis. The "Cahokia mound" there (a model of which is in the Peabody Museum, Cambridge, Mass.) is interesting as the largest prehistoric earthwork in America (*see* North America: *Archaeology*).

CAHOKIA MOUND, THE. The largest prehistoric American earthwork north of Mexico, one of a group formerly numbering 45 considerable mounds (not including a great number of smaller ones), standing in Illinois, 6 m. east of St. Louis, Mo. The great mound is a quadrangular pyramid 998 by 721 ft., by 99 ft. in height, with a terrace, 30 ft. high, extending outward about 200 ft. from one side and with a width of 500 feet. The area of the base is over 16 acres, and its contents have been estimated at 21,690,000 cu. ft., including the terrace; hence, with the means available to prehistoric Indians, it is estimated that it would have taken 1,000 persons nearly five years to build the main earthwork alone. The mound is named from a tribe which occupied the neighbourhood in historic times.

CAHORS, a city of south-western France, capital of the department of Lot, 70m. N. of Toulouse, on the railway to Limoges. Pop. (1936), 12,271. It stands on a rocky peninsula encircled by the river Lot, and is noteworthy alike for its situation, its ancient buildings and its fine old bridge. Before the Roman conquest, Cahors, which grew up near the sacred fountain of Divona (now known as the Fontaine des Chartreux, which provides the town with water), was the capital of the Cadurci. Under the Romans it was famous for its linen cloth. Cahors appears to have had a bishop from the third century. After the fall of the empire it was occupied by the Visigoths and fell later to the Saracens. In the middle ages the town was the capital of Quercy, and its territory until after the Albigensian Crusade was a fief of the counts of Toulouse. The seignorial rights, including that of coining money, belonged to the bishops. In the 13th century Cahors became a financial centre, owing its importance to a colony of Lombard bankers, and the name *cahorsin* came to signify "banker" or "usurer." Its constant opposition to the bishops drove them, in 1316, to come to an arrangement with the French king, by which the administration of the town was placed almost entirely in the hands of royal officers, king and bishop being co-seigneurs. This arrangement survived till the Revolution. In 1331 Pope John XXII., a native of Cahors, founded there a university, which flourished till 1751, when it was united to its rival, the University of Toulouse. In the 16th century it was a Catholic stronghold and rose against Henry of Navarre who took it by assault in 1580. On his accession Henry IV. punished the town by depriving it of its privileges as a wine-market; the loss of these was the chief cause of its decline.

Cahors is divided into two portions by the Boulevard Gambetta, which runs from the Pont Louis Philippe on the south to the wall of the 14th and 15th centuries enclosing the town on the north. To the east lies the old town, with its dark narrow streets and closely-packed houses; west of the boulevard the new quarter, with spacious squares, stretches to the bank of the river. The Pont Valentré to the west of the town, is the finest mediaeval fortified bridge in France. It dates from 1308 (restored in the 19th century), and is defended at either end by high machicolated towers, another tower, less elaborate, surmounting the centre pier. The cathedral of St. Étienne (1119, but altered between 1285 and

1500) stands in the heart of the old town. Its most remarkable features are the roof of the aisle-less nave, consisting of two round cupolas, and the finely sculptured north portal (*c.* 1190) Adjoining the church are remains of a cloister (1494–1509) Near the cathedral is St. Urcisse, dating from the 12th and 13th centuries, which preserves Romanesque capitals recarved in the 14th century. Of the palace of Pope John XXII., the great Avignon pope (early 14th century), only a square tower still stands; the rest is in ruins, or unfinished. The residence of the seneschals of Quercy, mainly 14th century, known as the Château du Roi, also remains. The chief of the many old houses of Cahors, is the Maison d'Henri IV. (15th century). The Porte de Diane is a large archway of the Roman period, probably the entrance to the baths. Cahors is the seat of a bishopric, a prefect and a court of assizes. It has tribunals of first instance and of commerce. Tanning, distilling, market-gardening and the preparation of *pâté de foie gras* and other delicacies are carried on. Wine, nuts, truffles and plums are leading articles of commerce.

CAIATIA (mod. *Caiazzo*), an ancient city of Campania, on the right bank of the Volturnus, 11m. N.E. of Capua, on the road to Telesia. It was already in the hands of the Romans in 306 B.C. In the Social War it rebelled from Rome, and its territory was added to that of Capua by Sulla. In the imperial period, however, we find it once more a *municipium*. Caiatia has remains of "Cyclopean" walls, and under the Piazza del Mercato is a large Roman cistern, which still provides a good water supply. The episcopal see was founded in A.D. 966. The place is frequently confused with Calatia (*q.v.*).

CAIETAE PORTUS, an ancient harbour of *Latium adiectum,* Italy, in the territory of Formiae, from which it is 5 m. S.W. The name (originally Αἰήτη) is generally derived from the nurse of Aeneas. The coast of the gulf not only between Caietae Portus and Formiae, but east of the latter also, as far as the modern Monte Scauri, was a favourite summer resort of the Romans (*see* FORMIAE). After the destruction of Formiae in A.D. 847 it became one of the most important seaports of central Italy (*see* GAETA). In the town are scanty remains of an amphitheatre and theatre; near the church of La Trinità, higher up, are remains of a large reservoir There are also traces of an aqueduct. The promontory (548 ft.) is crowned by the tomb of Munatius Plancus, founder of Lugdunum (mod. Lyons), who died after 22 B.C.

CAILLAUX, JOSEPH MARIE AUGUSTE (1863–1944), French politician, was born March 30, 1863, at Le Mans. His father, Eugène Caillaux, was first a Deputy and later Senator; he was Minister of Public Works from 1873 to 1875 and Minister of Finance in the year 1877.

In 1888, after a brilliant academic career, Joseph Caillaux was admitted to the Ministry of Finance. Later he was appointed lecturer at the École des Sciences Politiques in Paris. In 1898 Caillaux entered the Chamber of Deputies for Mamers, which he continued to represent until 1917. In 1899, Waldeck-Rousseau made him his Minister of Finance. During his three years of office, Caillaux showed not only great financial but also great administrative ability. He inaugurated the reform of the method of taxing alcoholic drinks, the increase in the scale of the inheritance tax and the reform of the sugar laws, thus introducing into French fiscal legislation the progressive policy which characterized his subsequent work. He left office in 1902, but four years later was re-appointed by Clemenceau. During this second term of office he introduced an income tax, the first serious attempt at a just and democratic form of taxation in France.

The Agadir crisis in 1911 marked the next important stage in his career. The Monis Ministry resigned in June and Caillaux was entrusted with the formation of a new ministry, and conducted with signal ability the difficult negotiations with Germany. In 1912, however, he was obliged to retire before the hostility of the Commission of the Senate, appointed to enquire into the Franco-German Treaty. In Nov. 1913 he returned to his former post as Minister of Finance in M. Doumergue's Government. A virulent press campaign was started against him in the *Figaro,* and intimate letters which had passed between M. Caillaux and his wife before their marriage were published. The latter, deeming her honour to have been assailed, shot the editor, M. Calmette. M. Caillaux was forced to resign, and at the subsequent trial of Madame Caillaux defended her with such force and eloquence that she was acquitted.

On the outbreak of World War I he was appointed paymaster-general to the forces and some months later was entrusted with an economic mission to South America. During his absence he was accused of desiring a premature peace and of caballing in secret against the Government. He returned to France in 1915, however, and entirely ignored the accusations. In July 1917 Clemenceau led the attack upon the Ribot Government and Malvy's administration. The Government was overthrown, and Clemenceau came into power with the one idea to carry on the war, despite all obstacles. His one serious rival was Joseph Caillaux. Clemenceau, therefore, on Dec. 11, 1917, demanded the suspension of Caillaux' parliamentary immunity, moving a vote of no confidence in the Chamber. Caillaux proclaimed his innocence in one of the finest speeches ever made in the Chamber, and demanded to be heard in the Courts. His parliamentary immunity was suspended, and on Jan 4, 1918, he was arrested. Various cases of high treason were pending at this time and an attempt was made to connect these with the accusations against Caillaux. It was not until Feb. 1920 that he was brought before the Senate, sitting as the High Court of Justice, and indicted for "plotting against the security of the state abroad." After a lengthy debate the accusations fell to the ground one by one. By 213 votes to 28 the arguments of the Procureur-Général, Lescouvé, were refuted. Nevertheless, Caillaux was not completely exonerated. He was condemned to three years' imprisonment, the loss of his civic rights for ten years and to five years' residence within a zone to be indicated by the Government, as well as to pay the costs of the case amounting to about 53,000 francs. The venerable M. Demange, the senior advocate of the court, rose in his seat and said indignantly: "Remember, gentlemen, that you are condemning a man on a count on which he has not been defended." As he had already spent three years in prison Caillaux was released the next morning. He returned to Mamers and devoted his time to writing two books which appeared also in English under the titles of *My Prisons* (1921) and *Whither France? Whither Europe?* (1922).

The amnesty passed by the National Assembly in 1924 restored his political and civic rights to Caillaux. In 1925 he was asked by Painlevé to join his Government as being the one man capable of reducing French finances to order. He accepted the duty and it seemed that at last this difficult task would be accomplished He attacked first the problem of inter-allied debts. He initiated conversations in London with Churchill and in Washington with the United States Debt Commission. But political considerations proved too strong. He was accused of belonging to the Radical Socialists. Serious friction arose, with the result that Painlevé handed in the resignation of the Government on Oct. 28 and formed a new Ministry, excluding Caillaux. The latter had, in the meantime, been elected Senator and president of the council of the Sarthe. He retired from office with dignity, preferring failure to the countenancing of measures which, in his opinion, would almost certainly prove ruinous to the country. In June 1926, after another cabinet crisis, Caillaux again became Minister of Finance; but his tenure of office was brief. He sought to impose upon France a policy of financial reform—more work, increased production, reduced expenditure—and colonial development. His methods, however, were too dictatorial not to arouse Republican resentment and on July 19 the ministry fell. Caillaux was Minister of Finance in the Bouisson cabinet for a brief period in June 1935. He died Nov. 21, 1944.

CAILLAVET, ARMAN DE: *see* FLERS, ROBERT DE LA MOTTE-ANGO, MARQUIS DE.

CAILLETET, LOUIS PAUL (1832–1913), French ironmaster, was born at Châtillon-sur-Seine on Sept. 21, 1832. He worked in his father's ironworks and later was in charge of the works. He was animated by a love of scientific research. His most important work was on the liquefaction of gases. On Dec. 2, 1877, Cailletet liquefied oxygen at a pressure of 300 atmospheres and at −27° C. The oxygen was obtained in the form of a cloud, but later he repeated his experiments at the *École Normale* at Paris, when he liquefied hydrogen, nitrogen and air. This work was carried on independently of the work of Pictet on liquefaction and there was considerable discussion as to which of the two had succeeded first.

Cailletet was the author of a number of papers in *Comptes Rendus* and other French scientific periodicals on the liquefaction of gases and the production of low temperatures, on the passage of gases through metals, on manometers for measuring high pressures, on critical points and on the state of matter at low temperatures. He interested himself in aeronautics and devised an apparatus for measuring the height of an aeroplane. Cailletet was a member of the Paris Academy. He died in his native town on Jan. 5, 1913.

CAILLIÉ or **CAILLÉ, RENÉ AUGUSTE** (1799–1838), French explorer, was born at Mauzé, Poitou, on Sept. 19, 1799, the son of a baker. His first voyage, made at the age of 16, was to Senegal and Guadeloupe. In 1818 he went from Senegal to Bondu with supplies for a British expedition. In 1824 he was again in Senegal, determined to reach Timbuktu. He spent eight months with the Brakna Moors learning Arabic and being educated as a convert to Islam. Then, dressed as a Mohammedan, and giving out that he was an Arab from Egypt who wished to regain his country, he joined a Mandingo caravan going inland. Starting from Kakundi on the Rio Nunez on April 19, 1827, he travelled east along the hills of Futa Jallon, passing the head stream of the Senegal and crossing the Upper Niger at Kurussa. On reaching Timé in the Kong highlands he was detained five months by illness. In Jan. 1828 he turned north-east and reached Jenné, whence he reached Timbuktu by water. After spending a fortnight (April 20–May 4) in Timbuktu he joined a caravan crossing the Sahara to Morocco, reaching Fez on Aug. 12. From Tangier he returned to France. Major Gordon Laing had reached Timbuktu in 1826, but was murdered on leaving it, and Caillié was the first to achieve the journey in safety, for which he received the prize offered by the Geographical Society of Paris. He received the Order of the Legion of Honour, and his *Journal d'un voyage à Timbuktu et à Jenné dans l'Afrique Centrale* (ed. by E. F. Jomard) was published at public expense in three volumes in 1830. Caillié died at Badère in 1838 of a malady contracted during his travels.

See Dr. Robert Brown's *The Story of Africa*, vol. i. chap. xii. (1892); Goepp and Cordier, *Les Grands Hommes de France, Voyageurs: René Caillé* (1885); E. F. Jomard, *Notice historique sur la vie et les voyages de R. Caillié* (1839). An English version of Caillié's *Journal* was published in London in 1830 in two volumes under the title of *Travels through Central Africa to Timbuctoo etc. Le Tafitelt, d'après R. Caillié* (Renseignements Col. Afrique francaise, 1911).

CAIN was, according to Genesis iv. 1, the first-born son of Adam and Eve. The genealogy is interrupted by the story of Cain and Abel (*q.v.*), *vv.* 2–16, which cannot very well be from the same stratum of tradition as the Garden of Eden story, which precedes, for it implies the existence of a considerable population in the earth (*v.*14). It relates how Cain, a tiller of the ground, enraged because the Lord accepted the offering of his shepherd brother Abel in preference to his own, murdered Abel. For this crime he is cursed and banished from the settled country. Before he departs to the land of Nod (wandering), feeling that in his exile he will be the victim of any man who encounters him, he obtains from the Lord a sign of protection, and a promise that if he be slain despite it he shall be avenged sevenfold. The story is probably intended to explain how a certain tribe, bearing the name of Cain, came to have a certain tattoo mark, and to be noted for the plenteous vengeance it took upon any other tribe by whose hands one of its members was slain. It explains, too, from the point of view of the settled peoples, how this tribe came to live a nomad life. It has been plausibly argued, especially by Eduard Meyer (in *Die Israeliten*) that the tribe in question is the Kenites. The genealogy is resumed in iv. 17–24. In the parallel genealogy from the Priestly Source, Genesis v., the Kenan who appears fourth in the list is probably to be identified with Cain. The representation of Cain as a city-builder accords ill with the picture of Cain the nomad. Irenaeus mentions a Gnostic sect of the second century called the Cainites, who believed that Cain derived his existence from the superior, Abel from the inferior, power, and that Cain was the first of a line which included Esau, Korah, and the Sodomites; their evangel was a *Gospel of Judas*. (W. L. W.)

CAINE, SIR THOMAS HENRY HALL (1853–1931), British novelist and dramatist, was born of mixed Manx and Cumberland parentage at Runcorn, Cheshire, on May 14, 1853. He was educated with a view to becoming an architect, but turned to journalism, becoming a leader-writer on the *Liverpool Mercury*. He went to London at the suggestion of D. G. Rossetti, with whom he had had some correspondence, and lived with the poet for some time before his death. He published a volume of *Recollections of Rossetti* (1882), and also some critical work; but in 1885 he began an extremely successful career as a novelist of a melodramatic type with *The Shadow of a Crime*, followed by *The Son of Hagar* (1886), *The Deemster* (1887), *The Bondman* (1890), *The Scapegoat* (1891), *The Manxman* (1894), *The Christian* (1897), *The Eternal City* (1901), and *The Prodigal Son* (1904). His writings on Manx subjects were acknowledged by his election in 1901 to represent Ramsey in the House of Keys. *The Deemster, The Manxman* and *The Christian* had already been produced in dramatic form, when *The Eternal City* was produced with magnificent accessories by Beerbohm Tree in 1902, and in 1905 *The Prodigal Son* had a successful run at Drury Lane. Among his later works a notable novel was *The Woman of Knockaloe* (1923). He was recipient of the K.B.E. in 1918 for his services in the World War, during which he was concerned with British propaganda in the United States, and in 1922 was made a Companion of Honour. He died in 1931.

See C. F. Kenyon, *Hall Caine; The Man and the Novelist* (1901); and the novelist's autobiography, *My Story* (1908).

CAINOZOIC, more correctly KAINOZOIC, often written CENOZOIC in America (from the Gr. καινός, recent, ζωή, life); in geology, the name given to the youngest of the three great eras of geological time, the other two being the Mesozoic and Palaeozoic eras. It is equivalent to TERTIARY (*q.v.*).

ÇA IRA, a song of the French Revolution, with the refrain:

> Ah! ça ira, ça ira, ça ira!
> Les aristocrates à la lanterne.

The words, written by one Ladré, a street singer, were put to an older tune, called "Le Carillon National," and the song rivalled the "Carmagnole" (q.v.) during the Terror It was forbidden by the Directory.

CAIRD, EDWARD (1835–1908), British philosopher and theologian, brother of John Caird (*q.v.*), was born at Greenock on March 22, 1835, and educated at Glasgow university and Balliol college, Oxford. He took a first class in moderations in 1862 and in *Literae humaniores* in 1863, and was Pusey and Ellerton scholar in 1861. From 1864 to 1866 he was fellow and tutor of Merton college. In 1866 he became professor of moral philosophy in the University of Glasgow, and in 1893 succeeded Jowett as master of Balliol. With T. H. Green he founded in England a school of orthodox neo-Hegelianism, and exerted a far-reaching influence on English philosophy and theology. Owing to failing health he gave up his lectures in 1904, and in May 1906 resigned his mastership. He died on Nov. 1, 1908.

His publications include *Philosophy of Kant* (1878); *Critical Philosophy of Kant* (1880); *Religion and Social Philosophy of Comte* (1885); *Essays on Literature and Philosophy* (1892); *Evolution of Religion* (Gifford Lectures, 1891–92); *Evolution of Theology in the Greek Philosophers* (1904).

For a criticism of Dr. Caird's theology, *see* A. W. Benn, *English Rationalism in the 19th Century* (1906); Sir Henry Jones and J. H. Muirhead, *The Life and Philosophy of Edward Caird* (1921).

CAIRD, JOHN (1820–1898), Scottish divine and philosopher, was born at Greenock on Dec. 15, 1820, and died July 30, 1898. He was educated at Glasgow university, ordained in the Church of Scotland in 1845, and became professor of Divinity at Glasgow in 1862. In 1873 he was appointed vice-chancellor and principal of Glasgow university. His *Introduction to the Philosophy of Reli-*

gion (1880) is a reproduction of Hegelian teaching. His argument for the Being of God is based on the hypothesis that thought—not individual but universal—is the reality of all things, the existence of this Infinite Thought being demonstrated by the limitations of finite thought. Again his Gifford Lectures (1892–93 and 1895–96) are devoted to the proof of the truth of Christianity. Caird wrote also an excellent study of Spinoza, relating his doctrines to those of Hegel.

CAIRN, a heap of stones piled up in a conical form. In modern times cairns are often erected as landmarks; in ancient times they were erected as sepulchral monuments. Burial-cairns are either long or round, corresponding with long barrows and round barrows of earth. Meetings of the tribes were held at them, and the inauguration of a new chief took place on the cairn of one of his predecessors. Thus, in 1225, the O'Connor was inaugurated on the cairn of Fraech, the son of Fiodhach of the red hair. In mediaeval times cairns are often referred to as boundary marks. In Highland districts small cairns used to be erected at places where the coffin of a distinguished person was "rested" on its way to the churchyard. Memorial cairns are still occasionally erected; *e.g.*, the cairn raised in memory of the Prince Consort at Balmoral. (*See* Barrow.)

CAIRNES, JOHN ELLIOTT (1823–1875), British political economist of the classical school, was born at Castle Bellingham, Co Louth, Ireland, and educated at Trinity college, Dublin. He then studied law, and was called to the Irish bar. But he had little taste for the practice of law, and devoted himself to the study of political economy, and to journalism mainly on Irish social and economic questions. In 1856, through the influence of Archbishop Whateley, he was elected Whateley professor of political economy at Trinity college, Dublin. The lectures delivered in 1856 were published as *The Character and Logical Method of Political Economy.*

In 1861 Cairnes was appointed professor of political economy and jurisprudence at Queen's college, Galway, and in 1866 professor of political economy at University college, London. His health was already seriously undermined when he came to London, and he resigned in 1872. He died at Blackheath, London, on July 8, 1875.

The principal works of Prof. Cairnes, in addition to those already mentioned, were: *The Slave Power* (1862), in which he expounded the inherent disadvantages of slave labour, and gave a well-founded forecast of the probable issue of the struggle in America which influenced in a marked degree serious opinion in England on the case for the North; *Political Essays* (1873), containing his papers on Irish questions, especially on the educational system; and his largest work, *Some Principles of Political Economy, Newly Expounded* (1874). This last work does not profess to be a complete treatise; in it Cairnes expands and discusses the theories of value, cost of production, wages, labour and capital, international value, as laid down in the works of Smith, Ricardo and Mill. While Cairnes was generally in agreement with Mill, he analysed his propositions in a way which was often destructive.

Cairnes's principal contributions to the science of economics were his exposition of the province and method of political economy, his analysis of the cost of production in relation to value, his theory of the limitations imposed by the division of classes on free competition, and his defence and development of the wages fund doctrine after it had been abandoned by Mill. He regarded political economy as a science, and therefore neutral in its results with regard to social facts or systems. He was an economist of the theoretical school, and opposed those who desired to treat political economy as an integral part of social philosophy, and those who, like Jevons, sought to express economic facts in quantitative formulae. In his day he held an authority second only to that of Mill.

CAIRNGORM, a yellow or brown variety of quartz, named from Cairngorm or Cairngorum, one of the peaks of the Grampian mountains in Banffshire, Scotland. According to E. H. Cunningham-Craig, the mineral occurs in crystals lining cavities in highly-inclined veins of a fine-grained granite running through the coarser granite of the main mass. Shallow pits were formerly dug in the kaolinized granite for sake of the cairngorm, and the mineral was also found as pebbles in the bed of the river Avon. Cairngorm is a favourite ornamental stone in Scotland and is used in brooches worn with Highland costume.

CAIRNS, HUGH McCALMONT CAIRNS, 1st Earl (1819–1885), Irish statesman, and lord chancellor of England, was born at Cultra, Co. Down, Ireland, on Dec. 27, 1819, and was educated at Belfast academy and Trinity college, Dublin, graduating with a senior moderatorship in classics in 1838. In 1844 he was called to the bar at the Middle Temple, to which he had migrated from Lincoln's Inn. During his first years at the chancery bar, Cairns showed little promise of the eloquence which afterwards distinguished him. In 1852 he entered parliament as member for Belfast, and his Inn, on his becoming a Q.C. in 1856, made him a bencher.

In 1858 Cairns was appointed solicitor-general, and was knighted, and in May of that year made two of his most brilliant and best-remembered speeches in the House of Commons. In the first he defended Lord Ellenborough's public censure of Lord Canning in the India despatch, and in the other he spoke in reply o Lord John Russell for the Government—the Reform bill—winning the most cordial appreciation from Disraeli. In 1866, when Lord Derby returned to office, he was made attorney-general and in the same year after a breakdown in health he ecame a Lord Justice of Appeal. At first unable to accept a eerage for want of means, he was enabled to do so in 1867 by he assistance of a relative.

The appointment of Baron Cairns of Garmoyle as lord chan-ellor in 1868 involved the superseding of Lord Chelmsford, an ct which apparently was carried out by Disraeli with less tact han might have been expected of him. Disraeli held office on his occasion for a few months only, and when Lord Derby died n 1869, Lord Cairns became the leader of the Conservative opposition in the House of Lords. He had distinguished himself in he Commons by his resistance to the Roman Catholics' Oath bill rought in in 1865; in the Lords, his efforts on behalf of the rish Church were equally strenuous. His speech on Gladstone's uspensory bill was afterwards published as a pamphlet, but the ttitude which he and the peers who followed him had taken up, insisting on their amendments to the preamble of the bill, as one difficult to maintain, and when Lord Cairns was privately ffered concessions provided he withdrew his opposition at once, e took the responsibility of accepting, as there was no opportuity to consult his party. Not long after this, Lord Cairns resigned he leadership of his party in the upper house, but he had to esume it in 1870 and took a strong part in opposing the Irish and Bill in that year. On the Conservatives coming into power 1874, he again became lord chancellor; in 1878 he was made iscount Garmoyle and Earl Cairns; and in 1880 his party went ut of office.

After this, owing to failing health, his appearances were less requent, and he died at Bournemouth from congestion of the ungs on April 2, 1885. Cairns was the first lawyer of his time. His judgments were in the main expositions of principle, with a w decisions cited at the end as illustrations. In the legislation of he day, particularly on questions involving the Church or legal eform, his influence was great, and the harmony with which he ould work with his great friend and opponent, Lord Selborne, d to this influence being felt while he was in opposition as well s when he was in office. Among the Statutes with which he was oncerned were the Conveyancing Act 1881–82, the Settled Land ct, the Judicature Acts, and the Married Women's Property Act. f his speeches, in addition to those referred to above, his critiism of Gladstone's policy in the Transvaal after Majuba (*Times*, pril 1, 1881) is especially memorab'e.

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CAIRNS, JOHN (1818–1892), Scottish Presbyterian divine, was born at Ayton Hill, Berwickshire, on Aug. 23, 1818, the son of a shepherd. He went to school at Ayton and Oldcambus, Berwickshire, and managed with some difficulty to support himself at Edinburgh university, where he became the most distinguished student of his time, graduating M.A. in 1841, first in classics and philosophy and bracketed first in mathematics. In May 1876 he was appointed joint professor of systematic theology and apologetics with James Harper, principal of the United Presbyterian Theological college, whom he succeeded as principal in 1879. He died on March 12, 1892, at Edinburgh.

Among his principal publications are *An Examination of Ferrier's "Knowing and Being," and the Scottish Philosophy* (a work which gave him the reputation of being an independent Hamiltonian in philosophy); *Memoir of John Brown, D.D.* (1860); *Romanism and Rationalism* (1863); *Outlines of Apologetical Theology* (1867); *The Doctrine of the Presbyterian Church* (1876); *Unbelief in the 18th Century* (1881); *Doctrinal Principles of the United Presbyterian Church* (Dr. Blair's Manual, 1888).

See MacEwen, *Life and Letters of John Cairns* (1895); *John Cairns; Principal Cairns* (Famous Scot series, 1896).

CAIRNS, port on Trinity bay on N.E. coast of Queensland, Australia, stretched along the narrow lowland strip which intervenes between the Atherton plateau (1,000–4,000 ft.) and the sea. The hinterland comprises an important agricultural and sugar-growing area, with considerable possibilities for the further development of tropical fruit culture (bananas, pineapples), tropical agriculture generally, dairying, etc. The climate is tropical (mean ann. temps. 82°–68°; av. ann. rainfall 90·5 in., falling mainly in Dec.–April), and the seaward portions of the highlands are heavily clad with forests ("brush") yielding useful timber. The rocks of the Atherton highlands—Palaeozoic sediments largely metamorphosed by granitic and later igneous intrusives—are highly mineralized and Cairns is the outlet for numerous fields producing silver-lead, copper (Chillagoe, etc.) and tin (Herberton) and other minerals. The output (1925–26) was valued at *c.* £300,000. The needs of the mines and their railways lend additional importance to the Mt. Mulligan coal-field. The town has three sugar-mills, saw-mills, a (meat) freezing works, etc., and is the centre of a well-developed tram and railway system—both Government and private (mineral and sugar) lines—the many branches of which tap the mining areas and penetrate as far as Forsayth (Etheridge gold-field). The wild and heavily forested hills, the Barron river with gorge and falls, possess great scenic attractions and Cairns is growing in popularity as a tourist centre. Connection by rail (Great North Coast line) exists with all the chief eastern towns and with Brisbane (1,040 m.). The harbour is excellent and is regularly visited by coasting lines (1938–39: 789,000 tons entered). Total cargo shipped (1938–39) was *c.* 240,000 tons, exports consisting mainly of sugar, metals, maize and beef. Population was (1933) 11,993 and is increasing.

CAIRO, the capital of modern Egypt and the most populous city in Africa, on the Nile, 12m. S. of the apex of the Delta, in 30° 3′ N. and 31° 21′ E. It is 130m. S.E. of Alexandria, and 148m. W. of Suez by rail, though only 84m. from the last-named port by the overland route across the desert, in use before the opening of the Suez canal. Cairo occupies a length of 5m. on the east bank of the Nile, stretching north from the old Roman fortress of Babylon, and covers about 8 sq.m. It is built partly on the alluvial plain of the Nile valley and partly on the rocky slopes of the Mokattam hills, which rise 550ft. above the town.

The citadel, on a spur of the Mokattam hills, occupies the south-east angle of the city; the prospect from the ramparts is strikingly picturesque. Below lies the city with its ancient walls and lofty towers, its gardens and squares, its palaces and its mosques, with their delicately-carved domes and minarets covered with fantastic tracery, the broad river studded with islands, the valley of the Nile dotted with groups of trees, with the pyramids on the south horizon, and on the east the barren cliffs, backed by a waste of sand. The newer quarters of Cairo, situated near the river, are laid out in the fashion of French cities, but mediaeval Cairo can still be seen in scores of narrow, tortuous streets and busy bazaars in the eastern parts of the town.

Principal Quarters and Modern Buildings.—From the citadel a straight road runs north to the Ezbekia gardens, which form the central point of the foreign colony. About half a mile north of the gardens is the Central railway station, approached by a broad road. The Arab city and the quarters of the Copts and Jews lie east of the two streets named. West of them lies the port or riverside district, with the arsenal, foundry and railway works, a paper manufactory and the Government printing press, founded by Mohammed Ali. A little distance south-east of the Ezbekia is the Place Atabeh, the chief point of intersection of the electric tramways. From the Place Atabeh a narrow street, the Muski, with its continuation, the rue Neuve, leads east into the heart of the Arab city. Another street leads south-west to the Nile, at the point where the Kasr-en-Nil or Great Nile bridge spans the river, leading to Gezira, a large island with Ismail's palace, now turned into a hotel, polo, cricket and tennis grounds and a racecourse. Yet another street, running due south, leads to the Abdin square; and in the far south, opposite old Cairo, across a narrow arm of the river, lies Roda island, where a progressive housing policy has been carried out by the municipality.

BY COURTESY OF THE NEAR EAST RELIEF

CAIRENE FAMILY OF LOWER CLASS IN NATIVE COSTUME

The Government offices and other modern public buildings, as well as the European residential quarters, are nearly all in the western half of the city. On the south side of the Ezbekia are the post office, the courts of the Mixed Tribunals, and the opera house. On the east side are the bourse and the Crédit Lyonnais, on the north the buildings of the American Mission. On or near the west side of the gardens are most of the larger European hotels. Facing the river immediately north of the Great Nile bridge are the large barracks, called Kasr-en-Nil, and the fine Egyptian museum. South of the bridge are the Ismailia palace (a royal residence), the British residency, and other buildings. Farther removed from the river are the offices of the ministries of public works and of war—a large building surrounded by gardens—and of justice and finance. On the east side of Abdin square is Abdin palace, an unpretentious building used for official receptions. Adjoining the palace are barracks. North-east of Abdin square, in the Sharia Mehemet Ali, is the Arab museum and khedivial library. In Shari Dawarrin are the new Houses of Parliament

The Oriental City.—The eastern half of Cairo is divided into many quarters. These quarters were formerly closed at night by massive gates, of which a few remain. In addition to the Mohammedan quarters, usually called after the trade of the inhabitants or some notable building, there are the Copt or Christian quarter, the Jews' quarter, and the old "Frank" quarter in the Muski district where, since the days of Saladin, "Frank" merchants have been permitted to live and trade. Some of the principal European shops are still to be found in this street. The Copt and Jewish quarters lie north of the Muski. The modern Coptic cathedral, dedicated to St. Mark, is in the basilica style The oldest Coptic church in Cairo is, probably, the Keniset-el-Adra, or church of the Virgin, which is stated to preserve the original type of Coptic basilica. In the Copt quarter are also Armenian, Syrian, Maronite, Greek and Roman Catholic churches In the Arab city the streets as a rule are winding and narrow; but fine *sebils* or public fountains abound, and the houses of the wealthier citizens are picturesque and ample. They are built generally round an open courtyard, in a style of elaborate arabesque, the windows shaded with projecting cornices of graceful woodwork (*mushre-*

biya) and ornamented with stained glass. The principal apartment is often paved with marble; in the centre a decorated lantern is suspended over a fountain, while round the sides are richly inlaid cabinets and windows of stained glass; and in a recess is the *divan,* a low, narrow, cushioned seat. The lower storey is generally built of the soft calcareous stone of the neighbouring hills, and the upper storey, which contains the harem, of painted brick. The shops of the merchants are small and open to the street. The greater part of the trade is done, however, in the bazaars or markets, which are held in large *khans* or storehouses, of two storeys and of considerable size. Access to them is gained from the narrow lanes which usually surround them. The khans often possess fine gateways. The principal bazaar, the Khan-el-Khalil, marks the site of the tombs of the Fatimite caliphs.

The Citadel and the Mosques.—Besides the citadel, the principal edifices in the Arab quarters are the mosques and the ancient gates. The citadel or El-Kala was built by Saladin about 1177, and now contains a palace and a mosque of Oriental alabaster erected by Mohammed Ali. The dome and the two slender minarets of this mosque are among the most picturesque features of Cairo. In the centre is a well called Joseph's Well, sunk in the solid rock to the level of the Nile. There are four other mosques within the citadel walls, the chief being that which was built in A.D. 1317 by Sultan Nasir ibn Kalaun, recently renovated. The upper parts of the minarets are covered with green tiles, and crowned by bulbous cupolas. Adjoining the citadel is the mosque of Sultan Hasan, one of the finest in the city. It dates from A.D. 1357, and is celebrated for the grandeur of its porch and cornice and the delicate stalactite vaulting which adorns them Isolated from the others, the oldest mosque in the city is that of Tulun (*c.* A.D. 879) exhibiting very ancient specimens of the pointed arch. Near the west end of the Khan-el-Khalil lie the mosque, the ruined hospital and the tomb of Kalaun, a group of buildings in a style resembling the contemporaneous mediaeval work in Europe, with pointed arches in several orders At the east end of the Khan-el-Khalil is the mosque of El Hasanên, which is invested with peculiar sanctity as containing relics of Hosain and Hasan, grandsons of the Prophet. But to foreigners the most interesting of all is the mosque el-Azhar, founded in the 10th century and immediately converted into a university. And the chief theological seminary of the Islamic world it still remains, with 12,000 students from all Muslim lands Its influence on orthodox Mohammedan sentiment and policy is waning, but is yet unique. In all, Cairo contains over 260 mosques, and nearly as many *zawias* or chapels. Of the gates the finest are the Bab-en-Nasr, in the north wall of the city, and the Bab-ez-Zuwēla, the only surviving part of the southern fortifications.

Tombs of the Caliphs and Mamelukes.—Beyond the eastern wall of the city are the splendid, but decaying, mausolea erroneously known to Europeans as the tombs of the caliphs; they really are tombs of the Circassian or Burji Mamelukes, a race extinguished by Mohammed Ali. The chief tomb mosques are those of Kait Bey, the finest of its kind in Egypt; of el-Ashraf Burshey and of Sultan Barkuk, with two domes and two minarets, completed A.D. 1410. South of the citadel is another group of tomb-mosques known as the tombs of the Mamelukes. They are architecturally of less interest than those of the "caliphs." South-west of the Mameluke tombs is the much-venerated tomb-mosque of the Imam esh-Shaf'i, founder of one of the four orthodox sects of Islam; and close to it lies the family burial-place of the reigning family.

Old Cairo and Babylon.—South of the present city lie the mounds of the earlier Fostat. But the most important part of Old Cairo is the walled Roman fortress of Babylon. Several towers of this fortress remain, and in the south wall is a massive gateway, uncovered in 1901. The Nile once flowed under it, and from very early days it has been inhabited by a Christian colony. It now contains five Coptic churches, a Greek convent and two churches and a synagogue. The principal Coptic Church is that of Abu Serga (St. Sergius). The crypt dates from about the 6th century and is dedicated to Sitt Miriam (the Lady Mary), from a tradition that in the flight into Egypt the Virgin and Child rested at this spot. The wall above the high altar is faced with beautiful mosaics of marbles, blue glass and mother-of-pearl. Of the other churches in Babylon the most noteworthy is that of El Adra (the Virgin), also called El Moallaka, or The Suspended, being built in one of the towers of the Roman gateway. The other buildings in Old Cairo, or among the mounds of rubbish which adjoin it, include several fort-like *ders* or convents.

Opposite Old Cairo lies the island of Roda, where, according to Arab tradition, Pharaoh's daughter found Moses in the bulrushes. It contains a mosque built by Kait Bey, and at its southern extremity is the Nilometer, by which the Cairenes have for over a thousand years measured the rise of the river. It is a square well with an octagonal pillar marked in cubits in the centre.

Northern and Western Suburbs.—Two miles north-east of Cairo and on the edge of the desert is the suburb of Abbasia (named after the viceroy Abbas), with the military barracks where Arabi Pasha surrendered to the British on Sept. 14, 1882, the day after the battle of Tel el-Kebir. Mataria, a village 3m. farther to the north-east, is the site of the defeat of the Mamelukes by the Turks in 1517, and of the defeat of the Turks by the French under Gen. Kléber in 1800. At Mataria was a sycamore-tree, the successor of a tree which decayed in 1665, venerated as being that beneath which the Holy Family rested on their flight into Egypt. Less than a mile north-east of Mataria are the scanty remains of the ancient city of On or Heliopolis, with a fine obelisk, about 66ft. high, erected by Usertesen I. of the XIIth dynasty. A perfectly equipped residential suburb is named Heliopolis, and adjoining it is a large aerodrome, which is the chief air station in North Africa.

On the west bank of the Nile, opposite the southern end of Roda island, is the small town of Giza or Gizeh, a fortified place of considerable importance in the times of the Mamelukes. The grounds of this palace have been converted into zoological gardens. A broad, tree-bordered, macadamized road, along which run electric trams, leads south-south-west across the plain to the Pyramids of Giza, 5m. distant, built on the edge of the desert.

Inhabitants.—The inhabitants of Cairo are of many diverse races, the various nationalities being frequently distinguishable by differences in dress as well as in physiognomy and colour. The Cairenes, or native citizens, differ from the fellahin in having a much larger mixture of Arab blood, and are at once keener witted and more conservative than the peasantry. The Arabic spoken by the middle and higher classes is generally inferior in grammatical correctness and pronunciation to that of the Bedouins of Arabia, but is purer than that of Syria or the dialect spoken by the Western Arabs. Besides the Cairenes proper, who are largely engaged in trade or handicrafts, the inhabitants include Arabs, numbers of Nubians and Negroes—mostly labourers or domestics in nominal slavery—and many Levantines, there being considerable colonies of Syrians and Armenians. The higher classes of native society are largely of Turkish or semi-Turkish descent. Of other races the most numerous are Greeks, Italians, British, French and Jews. Bedouins from the desert frequent the bazaars.

At the beginning of the 19th century the population was estimated at about 200,000; in 1882 it had risen to 374,000; in 1927 it was 1,064,567, and in 1937 it was 1,312,096.

Climate and Health.—In consequence of its insanitary condition, Cairo used to have a heavy death-rate. Since the British occupation in 1882 much has been done to better this state of things, notably by a good water-supply and a proper system of drainage. New suburbs have been laid out, new bridges thrown across the Nile, and a progressive housing policy established. The hospitals have been cleaned and modernized: and a fine new ophthalmic laboratory has been built in Giza, as a gift by the British in memory of Egyptians who lost their lives in World War I. The climate in winter is dry, healthy and often cold: in summer it is hot and stifling; and though the rainfall is negligible, exhalations from the river, especially when the flood has begun to subside, render the districts near the Nile damp during September, October and November.

Commerce.—The commerce of Cairo, of considerable extent and variety, consists mainly in the transit of goods. Gum, ivory,

CAIRO

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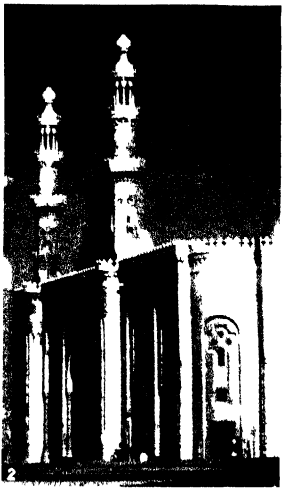
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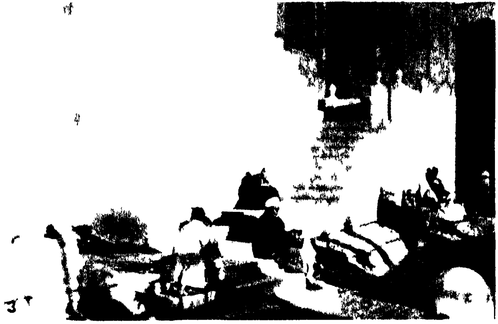
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PH N M R N W M W W

SCENES IN THE CAPITAL CITY OF EGYPT

1 General view of Cairo
2 T n e of Ha an dat ng f m 13 7
3 B gga t ng at t ta way f a m sque
4 St e t no uce A a t ef th n
5 T C t ntal Savoy h fa ng n t
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hides and ostrich feathers from the Sudan, cotton, sugar and grain from Upper Egypt, indigo and shawls from India and Persia, sheep and tobacco from Asiatic Turkey, and European manufactures, such as machinery, hardware, cutlery, glass and cotton and woollen goods, are the more important articles. The traffic in slaves ceased in 1877. The local industries include cotton factories, paper mills and a sugar refinery. Silk goods, saltpetre, gunpowder, leather, and a number of other products, are also manufactured.

Mohammedan Architecture.—Architecturally considered Cairo is still the most remarkable and characteristic of Arab cities. The outstanding feature of its architecture is its extraordinary freedom from restraint, shown in the wonderful variety of its forms, and the skill in design which has made the most intricate details to harmonize with grand outlines. Here the student may best learn the history of Arab art. Like its contemporary Gothic, it has three great periods, those of growth, maturity and decline. Of the first, the mosque of Ahmed Ibn-Tulun and the three great gates of the city, the Bab-en-Nasr, Bab-el-Futuh and Bab-Zuwela, are splendid examples. The design of these entrance gateways is extremely simple and massive, depending for their effect on the fine ashlar masonry in which they are built, the decoration being more or less confined to ornamental disks. The mosque of Tulun was built entirely in brick, and is the earliest instance of the employment of the pointed arch in Egypt. The curve of the arch turns in slightly below the springing, giving a horse-shoe shape. The stucco facing of the brick walls led to the enrichment of the archivolts and imposts with that peculiar type of conventional foliage which characterizes Mohammedan work, and which in this case was carried out by Coptic craftsmen. The second period passes to a luxuriance promising decay, as instanced in the mosque of Sultan Hasan, below the citadel, those of Muayyad and Kalaun, with the Barkukiya and the mosque of Barkuk in the cemetery of Kait Bey. The simple plain ashlar masonry still predominates, but the wall surface is broken up with sunk panels, sometimes with geometrical patterns in them. The principal characteristics of this second period are the magnificent portals, rising sometimes, as in the mosque of Sultan Hasan, to 80 or 90ft., with elaborate stalactite vaulting at the top, and the deep stalactite cornices which crown the summit of the building. The decoration of the interior consists of the casing of the walls with marble with enriched borders, and (about 20ft. above the ground) friezes 3 to 5ft. in height in which the precepts of the Koran are carved in relief, with a background of conventional foliage. Of the age of decline the finest monument is the mosque of Mohammed Bey Abu-Dahab.

After centuries of neglect efforts are now made to preserve the monuments of Arabic art, a commission with that object having been appointed in 1881; while a law of 1918 extended protection to all buildings dating from the Arab conquest to the reign of Mohammed Ali. Thus the Tulun mosque was saved, Coptic churches are being cared for, and important excavations have been made in the Roman fortress at Babylon.

Museums and Library.—The museum of Egyptian antiquities was founded at Bulak in 1863, being then housed in a mosque, by the French savant Auguste Mariette. In 1889 the collection was transferred to the Giza palace, and in 1902 was removed to its present quarters, erected at a cost of over £250,000. A statue of Mariette was unveiled in 1904. The museum is mainly devoted to antiquities of Pharaonic times, and, except in historical papyri, in which it is excelled by the British Museum, is the most valuable collection of such antiquities in existence.

The Arab museum and royal library are housed in a building erected for the purpose, at a cost of £66,000, and opened in 1903. In the museum are preserved treasures of Saracenic art, including many objects removed from the mosques for their better security. The royal library contains over 100,000 volumes, one-half being books and mss. in Arabic, Persian, Turkish, Amharic and Syriac. The Arabic section includes a unique collection of korans. The Persian section is rich in illuminated mss. The numismatic collection, as regards the period of the caliphs and later dynasties, is one of the richest in the world.

History.—Before the Arab conquest of Egypt the site of Cairo appears to have been open country. Memphis was some 12m. higher up on the opposite side of the Nile, and Heliopolis was 5 or 6m. distant on the north-east. The most ancient known settlement in the immediate neighbourhood of the present city was the town called Babylon, which is said by Strabo to have been founded by emigrants from the ancient city of the same name in 525 B.C., *i.e.*, at the time of the Persian conquest of Egypt. Here the Romans built a fortress and made it the headquarters of one of the three legions which garrisoned the country. Amr, the conqueror of Egypt for the caliph Omar, after taking the town besieged the fortress for the greater part of a year, the garrison surrendering in April A.D. 641. The town of Babylon disappeared, but the strong walls of the fortress in part remain.

Cairo itself is the fourth Mohammedan capital of Egypt; the site of one of those that had preceded it is, for the most part, included within its walls, while the other two were a little to the south. Amr founded El-Fostāt, the oldest of these, close to the fortress which he had besieged. Fostāt signifies "the tent," and the town thus built where Amr had pitched his tent is to-day, with the Roman town which preceded it, represented by Masr el-Atika, or "Old Cairo." Shortly after the overthrow of the Omayyad dynasty, and the establishment of the Abbasids, the city of El-'Askar was founded (A.D. 750) by Suleimān, the general who subjugated the country, and became the capital and the residence of the successive lieutenants of the Abbasid caliphs. Its site is now entirely desolate. The third capital, El-Katai, was founded about A.D. 873 by Ahmed Ibn Tulun, as his capital. It continued the royal residence of his successors but was sacked not long after the fall of the dynasty and rapidly decayed. A part of the present Cairo occupies its site and contains its great mosque, that of Ahmed Ibn Tulun.

Jauhar (Gōhar) el-Kaid, the conqueror of Egypt for the Fatimite caliph El-Moizz, founded a new capital, A.D. 968, which was named El-Kāhira, that is, "the Victorious," a name corrupted into Cairo. In A.D. 1176 Cairo was unsuccessfully attacked by the crusaders; shortly afterwards Saladin built the citadel on the lowest point of the mountains to the east, which immediately overlooked El-Katai, and he partly walled round the towns and large gardens within the space now called Cairo. Under the prosperous rule of the Mameluke sultans this great tract was filled with habitations; a large suburb to the north, the Hoseynia, was added: and the town of Bulak was founded. After the Turkish conquest (A.D. 1517) the metropolis decayed. In 1798 the city was captured by the French, who were driven out in 1801 by the Turkish and British forces, the city being handed over to the Turks. Mohammed Ali, originally the Turkish viceroy, by his massacre of the Mamelukes in 1811, in a narrow street leading to the citadel, made himself master of the country, and Cairo again became the capital of a virtually independent kingdom. Under Mohammed and his successors the city's western part grew. In 1882 Cairo was occupied by the British, and its history is merged in that of Egypt. It was headquarters of the British Middle East command in World War II.

CAIRO (kā'rō), a city in the southern tip of Illinois, U.S.A., at the confluence of the Ohio and Mississippi rivers, 150 mi. S.E. of St. Louis, Mo.; the county seat of Alexander county. It is on federal highways 51, 60 and 62; and is served by the Illinois Central, Missouri Pacific, Gulf, Mobile and Ohio, and the New York Central railways, and by the federal and other barge lines, operating on the Ohio and Mississippi rivers. The population in 1930 was 13.532 and in 1940 was 14,407 by the federal census. The city is built on a tongue of land between the rivers, protected by great levees, which have withstood every flood since 1858. The Ohio river rose to 59·6 ft. in 1937, and Cairo was the only city in the entire Ohio river valley that was not flooded. Its transportation facilities make it a shipping centre, not only for fertile southern Illinois (popularly called "Little Egypt") but for the entire Ohio and Mississippi river valleys and far-distant ports. There are industries, including lumber and woodworking, the manufacture of cotton-seed and soybean products, batteries (automobile and submarine), clothing and harness, with an output valued in excess of $8,000,000 a year.

At Mound City, 5 mi. N., is a national cemetery.

After abortive attempts in 1818 and in 1835, a successful settlement was made here in 1851–54, under the auspices of the New York Trust Company. The Illinois Central railroad was opened in 1856, and the city was chartered in 1857 During the Civil War it was an important strategic point, and was a military centre and depot of supplies for the federal armies in the West. At Mound City Admiral Andrew H. Foote in 1862 established a naval depot for the base of his operations on the Mississippi. Cairo is said to be the "Eden" of Charles Dickens's *Martin Chuzzlewit*.

CAIROLI, BENEDETTO (1825–1889), Italian statesman, was born in Pavia on Jan. 28, 1825. From 1848 until the completion of Italian unity in 1870, his whole activity was devoted to the Risorgimento, as Garibaldian officer, political refugee, anti-Austrian conspirator and deputy to parliament. In 1870 he conducted the negotiations with Bismarck, during which the German chancellor is alleged to have promised Italy possession of Rome and of her natural frontiers if the Democratic Party could prevent an alliance between Victor Emmanuel and Napoleon. When in 1876 the Left came into power, Cairoli became parliamentary leader of his party, and, after the fall of Depretis, Nicotera and Crispi, formed his first cabinet in March 1878 with a Francophil and Irredentist policy. General irritation was caused by his and Count Corti's policy of "clean hands" at the Berlin Congress, where Italy obtained nothing, while Austria-Hungary secured a European mandate to occupy Bosnia and the Hercegovina. The attempt of Passanante to assassinate King Humbert at Naples (Dec. 12, 1878) caused Cairoli's downfall in spite of the fact that he himself was wounded. On July 3, 1879, Cairoli returned to power, and in the following November formed with Depretis a coalition ministry, in which he retained the premiership and the Foreign Office. Confidence in French assurances, and belief that Great Britain would never permit the extension of French influence in North Africa, prevented him from foreseeing the French occupation of Tunis (May 11, 1881). In view of popular indignation he resigned. He died on Aug. 8, 1889.

See S. Cardillo Brigandi, *Benedetto Cairoli nella storia d'Italia* (1881).

CAISSON, when employed as a military term, denotes an ammunition wagon or chest; in architecture, a sunk panel or coffer in a ceiling, or in the soffit of an arch or a vault. In civil engineering, the word is used in connection with a variety of hydraulic works. An early use is as an equivalent of *camel;* a floating airtight tank, formerly constructed of timber but now always of steel, capable of being sunk to the required depth by the admission of water, which is afterwards pumped out or evacuated by air pressure, thus imparting additional buoyancy to any craft to which it may be secured. This contrivance is the prototype of the pontoon and of the floating-dock. It is employed, in various forms, in connection with salvage operations. *See* SALVAGING.

More commonly *caisson* implies a case or enclosure employed for keeping out water during the construction of foundations and other works in water-bearing strata, at the side of or under rivers and in the sea bed. There are three general types of caisson construction:—

(1) Box caissons, employed when no sinking operation through strata is required, are open at the top and closed at the bottom. The sides of the caisson, when it is sunk in position on a prepared bed, emerge above the water-level, and it serves as a shell for the building of a foundation. Such caissons are built of timber (especially in America), of steel, and of reinforced concrete or of combinations of these materials. They are often employed in building the solid superstructures of rubble mound breakwaters (*q.v.*); and, since about 1905, reinforced concrete caissons have been used in the construction of quay walls. In a few cases, *e.g.* at Dublin, they have been sunk on a dredged and levelled natural bottom, but more usually are founded on a prepared bed of rubble stone or concrete as at Marseille When sunk and filled with concrete these large boxes form monolithic masses, often considerably exceeding 1,000 tons in weight (*see* DOCKS). A large dry dock at Le Havre, opened in 1927, was built in and upon a steel box caisson framework, which was floated into position over the site of the dock, previously dredged to the required depth, and there sunk in place.

(2) Open caissons. One variety, employed for bridge foundations when little or no sinking through strata is required, is open at bottom and top and has no cutting edge. Caissons of this description, made of iron plates, were used for some of the foundation piers of the Forth bridge. Timber caissons are frequently employed in America. Another form used for sinking through strata is provided with a cutting edge at the bottom. Rectangular iron plate caissons of this description were employed in constructing the foundations of the Tower bridge, London. Cylinder caissons, consisting of a shell of masonry, concrete, wood, steel or reinforced concrete, or of composite construction, and provided with some form of cutting edge, are commonly employed for bridge (*q.v.*) foundations and in sinking shafts in alluvial strata. They are sunk to the required depth by excavating the material within the cylinder and at the same time weighting it, or using a water-jet to assist the sinking process. The internal space is, after sinking, filled with masonry or concrete. The open "well" foundations of brickwork, used for centuries in India, and the concrete well monoliths (*see* DOCKS), widely used in dock construction, and sometimes for the foundations of bridge piers, are, strictly speaking, open caissons. The monoliths are built up in tiers on a steel cutting edge or curb and have two or more open vertical wells within which excavation is carried on by grab dredging or other means.

(3) Compressed-air caissons. Where foundations have to be carried down to a considerable depth in soft, water-bearing strata, such as running sand, or where hard material is met with, which cannot be readily excavated by the means permissible in open caisson working, the use of compressed air is often resorted to. Compressed-air working can in some cases, when necessary, be applied to the sinking of caissons, started by the open method, by the addition of the necessary airtight floor, air locks and shafts. The method of compressed-air sinking consists essentially in the provision of an airtight floor in the caisson, at a height which provides room for a working chamber between it and the cutting edge, in which men can work under compressed air and carry on the necessary excavation. A shaft and air lock afford access and exit for men and materials; and the air pressure is varied in accordance with the head of water. Compressed-air caissons are employed not only for bridge foundations but in the construction of quay walls and foundations of other structures in water-bearing strata. Movable compressed-air caissons, which, after the lowest portions of the foundations have been laid, are raised by screw jacks and moved into position for constructing the next section, have been used in some instances for bridge pier foundations and dock construction.

Floating, sliding and rolling caissons built of steel are often employed for closing dry-dock entrances. They are also used, but less frequently, in place of hinged gates at the entrances to locks and docks (*q.v.*).

See C. E. Fowler, *Sub-Aqueous Foundations* (3rd ed. 1914); H. S. Jacoby and R. P. Davis, *Foundations of Bridges and Buildings* (1925).

(N. G. G.)

CAISSON DISEASE, a group of morbid changes met with in caisson workers and divers in diving dress. In order to exclude water, air pressure within a caisson used for subaqueous works must be increased by one atmosphere, or 15 lb. per sq. in. for every 33½ft. that the caisson is submerged below the surface. Hence at a depth of 100 ft. a worker in a caisson, or a diver in a diving-dress, must be subjected to a pressure of 60 lb. per sq. in. A similar condition obtains when caissons are used on land for driving tunnels. Exposure to such pressures is apt to be followed by symptoms of a very varied character, including pains in the muscles and joints (the "bends"), deafness, embarrassed breathing, vomiting, paralysis ("divers' palsy"), fainting and sometimes even sudden death. At the St. Louis bridge, where a pressure was employed equal to 4¼ atmospheres, out of 600 workmen, 119 were affected and 14 died. Symptoms do not appear while the pressure is being raised nor so long as it is continued, but only after it has been removed; they are due to effervescence of gases absorbed in the body-fluids during exposure to pressure. Experiment has proved that in animals exposed to compressed air nitrogen is dissolved in the fluids in accordance with Dalton's law, to the extent of roughly 1% for each atmosphere of pressure, and also that when the pressure is suddenly relieved the gas is liberated in bubbles throughout the body. Set free in the spinal cord, for instance, they may give rise to partial paralysis, in the labyrinth of the ear to auditory vertigo, or in the heart to stoppage of the circulation. But if the pressure is relieved gradually they are not formed, because the gas comes out of solution slowly and is removed by the lungs. To prevent caisson disease, therefore, the decompression should be slow; Leonard Hill suggests it should be at a rate of not less than 20 minutes for each atmosphere of pressure. Good ventilation of the caisson is also of great importance and long shifts should be avoided, because by fatigue the circulatory and respiratory organs are rendered less able to eliminate the absorbed gas and because a high partial pressure of oxygen acts as a general protoplasmic poison. It has been found that liability to caisson disease increases with age. Hence healthy young men alone should be employed. If the slightest symptom occurs on decompression the sufferer should be re-compressed, and then decompressed more slowly.

See Paul Bert, *La Pression barométrique* (1878); and Leonard Hill, *Recent Advances in Physiology and Biochemistry* (1906), (both these works contain bibliographies); Mummery, *British Medical Journal*, June 27th, 1908; *Diseases of Occupation*, by T. Oliver (1908); *Diseases of Workmen*, by T. Luson and R. Hyde (1908).

CAITHNESS, a county occupying the extreme north-east of Scotland, bounded west and south by Sutherlandshire, east by the North Sea, and north by the Pentland Firth. Its land area is 438,833 ac., or 685.7 sq.mi. The formation is mainly middle Old Red Sandstone, and the surface consists of barren moors, almost destitute of trees. It slopes from the north and east up to a belt of metamorphic rocks in the south and west, where the chief mountains are Morven (2,313 ft.), Scaraben (2,054 ft.) and Maiden Pap (1,587 ft.). Morven is a shapely peak of sandstones and conglomerates on a platform of quartzose rocks. The principal rivers are the Thurso ("Thor's River"), rising in Cnoc Crom Uillt (1,199 ft.) near the Sutherlandshire border, and reaching the sea in Thurso Bay; the Forss, which, emerging from Loch Shurrery, enters the sea at Crosskirk, a fine cascade about a mile from its mouth giving the river its name (*fos*, Scandinavian, "waterfall"; in English the form is *force)*; and Wick Water, which, draining Loch Watten, flows into the sea at Wick. Small lochs are numerous, the largest being Loch Watten, 2¾ m. by ¾ m., and Loch Calder, 2¼ by 1 m. So much of the land is flat and boggy that there are no glens, except in the mountainous south-west, although towards the centre of the county are Strathmore and Strathbeg (the great and little valleys). Most of the coast-line is precipitous; Dunnet Head (346 ft.) is the most northerly point of Scotland. From Berriedale at frequent intervals round the coast occur "stacks" or detached pillars of red sandstone.

Caithness is separated from the Orkneys by the Pentland Firth, a strait about 14 miles long and from 6 to 8 miles broad. The tidal wave races at a speed which varies from 6 to 12 m. an hour. At the meeting of the western and eastern currents the waves at times rise into the air like a waterspout. The breakers caused by the sunken reefs off Duncansbay Head create the Bores of Duncansbay, and eddies off St. John's Point are the origin of the Merry Men of Mey, while off the island of Stroma occurs the whirlpool of the Swalchie, and off the Orcadian Swona is the vortex of the Wells of Swona. Nevertheless, as the most direct road from Scandinavian ports to the Atlantic the Firth is used by many vessels. In the eastern entrance to the Firth lies the group of islands known as the Pentland Skerries. On Muckle Skerry, the largest, stands a lighthouse with twin towers, 100 ft. apart. The island of Stroma (pop. 1931, 193) also belongs to Caithness.

History.—Picts' houses, Norse names and Danish mounds attest that these peoples displaced each other in turn, and the number and strength of old fortified keeps point to long periods of unrest. There are a few circles of standing stones, as at Stemster Loch and Bower, and ruins of Roman Catholic chapels and places of pilgrimage occur in almost every district. The most important remains are those of Bucholie Castle, Girnigo Castle, and the tower of Keiss; and, on the south-east coast, the castles of Clyth, Swiney, Forse, Laveron, Knockinnon, Berriedale, Achastle and Dunbeath, the last of which is finely situated on a detached stack of sandstone rock. About six miles from Thurso stand the ruins of Braal Castle, the residence of the ancient bishops of Caithness. On the coast of the Pentland Firth, 1½ miles west of Duncansbay Head, is the site of John o' Groat's house.

Agriculture.—Only 23% of the total acreage was under crops and grass in 1938. The arable land (76,697 ac.) forms a broad belt along the coast, but about 72% of the county is mountains and heathland, sparsely inhabited, but used for grazing and rich in game. In spite of this poverty and a damp and windy climate, a considerable part of the acreage of large farms is successfully tilled. Small holdings predominate, however, over half being of 15 ac. or less in 1938. In 1824 James Traill of Ratter, near Dunnet, recognizing that it was impossible to expect tenants to reclaim and improve the land on a system of short leases, advocated large holdings on long terms, so that farmers might enjoy a substantial return on their capital and labour. Oats (22,630 ac. in 1938) and turnips and swedes (8,613 ac.) are the chief crops. Sheep (242,929)—chiefly Leicester and Cheviots—of which the wool is in especial request in consequence of its fine quality, cattle, horses and pigs are raised for southern markets.

Other Industries.—The great source of profit to the inhabitants is the fisheries for cod, haddock, etc., and herring. The last is the most important, particularly in summer, the centre of operations being at Wick. The fisheries give employment to a large number of coopers, curers, packers and helpers. The salmon fisheries are valuable. The Thurso is one of the best salmon streams in the north. Of manufacture there is little beyond tweeds, nets and ropes, and whisky, with sawmilling, all at Wick. The L.M.S.R. crosses the shire in a rough semicircle from a point near Altnabreac via Halkirk, to Wick, with a branch from Georgemas Junction to Thurso, and a light line from Wick to Lybster. Road motor services radiate from Wick. There is communication by steamer between Wick and Thurso and the Orkneys and Shetlands, Aberdeen and Leith.

Population and Government.—Pop. (est. 1938) 25,742. In 1931, 633 spoke Gaelic and English. Wick, a royal burgh (pop. est. 1938, 7,550), and Thurso (3,152) are the only small burghs. There are five county districts. The county returns one member to parliament with Sutherland, and unites with Orkney and Shetland, to form a sheriffdom. There is a resident sheriff-substitute at Wick, who sits also at Thurso and Lybster.

CAIUS or **GAIUS,** pope from 283 to 296, was the son of Gaius, or of Concordius, a relative of the emperor Diocletian, and became pope on Dec. 17, 283. His tomb, with the original epitaph, was discovered in the cemetery of Calixtus and in it the ring with which he used to seal his letters (*see* Arringhi, *Roma Subterr.*, l. iv. ch. xlviii. p. 426). He died in 296.

CAIUS (*Anglice*, KEES, KEYS, etc.), **JOHN** (1510–1573), English physician, and second founder of the present Gonville and Caius college, Cambridge, was born at Norwich, Oct. 6, 1510. He was admitted a student at what was then Gonville hall, Cambridge, where he seems to have studied divinity. In 1533 he visited Italy, where he studied under the celebrated Montanus and Vesalius at Padua, taking his degree in physic in 1541. After an extended tour in Europe, he practised in London, being for some years president of the College of Physicians. In 1557 he enlarged the foundation of his old college, named it "Gonville and Caius college," and endowed it with several considerable estates. In Jan. 1559 he accepted the mastership of the college, an office which he held until a month before his death on July 29, 1573. By obtaining a grant in 1564 for the college to have annually the bodies of two malefactors for dissection, Dr. Caius became a pioneer in advancing the study of anatomy.

His works, together with the *Memoir* by John Venn, have been edited by E. S. Roberts (1912).

CAJAMARCA, a department of Peru lying between the western and central Cordilleras and extending from the frontier of Ecuador south to about 7° 45′ S. lat., having the departments of Piura and Lambayeque on the west, Amazonas on the east and Libertad on the south. Its area according to official figures is 12,538 sq. mi. The upper Marañón delineates the eastern boundary of the department. The department is an elevated region, well watered with a large number of small streams, which eventually find their way through the Amazon into the Atlantic. Many of its products are of the temperate zone, and considerable attention is given to cattle-raising. Coal is found in the province of Hualgáyoc, which is also one of the rich silver-mining districts of Peru. Cajamarca is one of the most densely populated departments in Peru, with (1940 census) 568,118 inhabitants.

CAJAMARCA or **CAXAMARCA,** a city of northern Peru, capital of a department and province of the same name, 90m. E. by N. of Pacasmayo, its port on the Pacific coast. The population of the city in 1940 was 15,553. It is situated in an elevated valley between the central and western Cordilleras, 9,400 ft. above sea level, and on the Eriznejas, a small tributary of the Marañón. The streets are wide and cross at right angles; the houses are generally low and built of clay. Among the notable public buildings are the old parish church built at the expense of Charles II of Spain, the church of San Antonio, a Franciscan monastery, a nunnery and the remains of the palace of Atahualpa, the Inca ruler whom Pizarro treacherously captured and executed in this place in 1533. The hot sulphur springs of Pultamarca, called the Baños del Inca (Inca's baths), are a short distance east of the city and are still frequented. Cajamarca is an important commercial and manufacturing town, being the distributing centre for a large inland region and having long-established manufactures of woollen and linen goods and of metalwork, leather, etc. It is the seat of one of the seven superior courts of the republic and is connected with the coast by telegraph and telephone. A railway has been undertaken from Pacasmayo, on the coast, to Cajamarca, and has been completed to Chilete, 84 mi. from the coast.

CAJATAMBO or **CAXATAMBO,** a town and province of the department of Ancash, Peru, on the western slope of the Andes. The population in 1940 was 2,625. The town is 110 mi. N.E. of Lima, in 10° 30′ S., 77° 30′ west. The principal industries of the province are the raising of cattle and sheep and the cultivation of cereals. Cochineal is a product of this region. Near the town there are silver mines, in which a part of its population is employed.

CAJEPUT OIL, a volatile oil obtained by distillation from the leaves of the myrtaceous tree *Melaleuca Leucadendron.* The trees yielding the oil are found throughout the Indian Archipelago, the Malay Peninsula and over the hotter parts of the Australian continent; but the greater portion of the oil comes from Celebes. The oil is prepared from leaves which are macerated in water, and distilled after fermenting for a night. It is extremely pungent and has the odour of a mixture of turpentine and camphor. It consists mainly of cineol (*see* TERPENES), from which cajuputene having a hyacinthine odour can be obtained by distillation with phosphorus pentoxide. The drug is a typical volatile oil, and is used internally in doses of ½ to 3 minims, for the same purposes as, say, clove oil. It is frequently employed externally as a counter-irritant.

CAJETAN (GAETANUS), CARDINAL (1468–1534), was born at Gaeta in the kingdom of Naples. His proper name was Tommaso de Vio, but he adopted that of Cajetan from his birthplace. When 16 he became a Dominican, and in 1493 received his B.A. from Padua, where he was subsequently professor of metaphysics. In 1508 he was made general of his order, and for his defence of the papal claims against the Council of Pisa (1511) Leo X made him a cardinal and archbishop of Palermo in 1517. The year following he went as legate to Germany, to quiet the commotions raised by Luther. It was before him that the Reformer appeared at the diet of Augsburg; and it was he who, in 1519, helped in drawing up the bull excommunicating Luther. In April 1519 he was made bishop of Gaeta. Among other negotiations, Cajetan was able to secure the election of Adrian VI. in 1521–22. Nominated by Clement VII. a member of the committee of cardinals appointed to report on the "Nuremberg Recess," he recommended, in opposition to the majority, certain concessions to the Lutherans, notably the marriage of the clergy, as in the Greek Church, and communion in both kinds according to the decision of the council of Basel. He died on Aug. 9, 1534.

Cajetan was a zealous Thomist but reflects the humanism and the controversies against Averroism and Scotism which he had encountered at Padua. He wrote commentaries upon Aristotle's *Categories, Post. An., De Anima* and upon the *Summa* and *De Ente et Essentia* of Aquinas and also many opuscula. These have passed through a number of editions, the important commentary on the *Summa* being adjoined to the Leonine edition of Aquinas.

See Mandonnet, in *Dict. of Cath. Theol.* (1904); and T. M. Lindsay, *History of the Reformation,* vol. i. (1906).

CAKCHIQUEL, a group of Indians living in the highlands of Guatemala. Their tongue, one of the "metropolitan" Maya dialects, is spoken in the Departments of Sololá, Chimaltenango, Sacatepéquez, and Escuintla. They number about 130,000 souls.

The history of the Cakchiquel, like that of the Quiché (*q.v.*), is preserved in a manuscript written shortly after the Spanish conquest. It relates the history of the creation and their wanderings from the mysterious Tulan where all the Maya tribes once lived. It describes their varying fortunes in the almost constant wars they waged with their neighbours after settling on the shores of Lake Atitlan in Guatemala. Upon the arrival of the Spaniards (1524) the Cakchiquel made no resistance, partly through fear of Spanish arms and partly through unwillingness to ally themselves with their Quiché enemies. Hence Alvarado and his army were received in peace and the first European settlement in the country resulted. The following year, however, the Cakchiquel revolted and were defeated by the Spaniards. Like the other highland Indians, the Cakchiquel were agriculturists, who lived in cities of stone strongly fortified, on inaccessible mountain ridges. Their capital, Iximché, was particularly impregnable, as the surviving remains testify to-day. Written books, the Maya calendar, and other higher arts enjoyed by the more advanced people of Middle America were known to the Cakchiquel. A curious feature of their government was the succession of kings. This post they allotted to two families who assumed the triple canopy of State in rotation.

To-day the Cakchiquel, like their neighbours, are largely engaged in agricultural pursuits, for the most part as peons on the coffee estates. They still retain their costumes of native cotton covered with embroidery which differ from village to village. They perform various dances, sometimes of a pagan nature, but, living closer to the capital than some of the other Indians, they have been forced to assume more ostensibly Christian ways.

See Domingo Juarros, *History of the Kingdom of Guatemala* (1823); D. G. Brinton, ed., *Annals of the Cakchiquels* (Philadelphia, 1885).

CAKE-BREAKER: *see* PROCESSING MACHINERY.

CAKES AND CAKE-MAKING. There are two main classes of cakes. Cakes which contain shortening, and sponge cakes which do not contain shortening. True sponge cake is leavened solely by air beaten into eggs. Angel Food is made with only whites of eggs. Mock sponge cakes are made with baking powder and fewer eggs.

Cake Ingredients.—*Shortening* may be butter, margarine, vegetable shortening or other solid fat with a mild flavour. To measure, press shortening firmly into a standard measuring spoon or cup, pack tightly, and level off. With print butter 1 lb. equals 2 cups; ¼ lb. equals ½ cup—this simplifies the measuring. Shortening may also be measured by the water displacement method—for example if ½ cup is desired, fill the measuring cup with ½ cup of cold water, add shortening until water reaches the cup mark, making sure none of the shortening appears above the water. Drain water off thoroughly.

Sugar should be fine granulated, unless otherwise specified in the recipe. If the sugar is lumpy, sift it before measuring. In measuring brown sugar, pack it firmly in the cup—so firmly that it holds its shape when turned out.

Eggs beat up lighter and more quickly when not too cold. So take them out of the refrigerator a little ahead of time.

Flour.—While either cake or all-purpose flour may be used with excellent results in cake-making, cake flour produces a cake of particularly fine texture. In substituting all-purpose flour when a recipe calls for cake flour, decrease the amount by 2 tablespoons per cup. Always sift flour once before measuring. Then lift it lightly with a spoon into the cup and level it off with straight edge of a knife. Flour is sifted a second time with the other dry ingredients in the recipe. This insures even rising and baking and uniform distribution in the batter.

Leavening.—Baking powder is generally used in leavening "shortening" cakes made with sweet milk. Baking powders, which are composed of baking soda (sodium bicarbonate) and an acid, are classified according to their acid part as: tartrate, phosphate, alum, and combination (or sodium aluminium sulphate-phosphate) powders. While the rate at which these baking powders give off gas differs, a compromise amount of 1¼ to 1½ teaspoons of any brand of baking powder per cup of sifted flour has been found through careful tests to give excellent results, regardless of the type. Soda is used with sour milk, sour cream or molasses, usually ½ teaspoon soda to each cup.

Preparation of Pans.—Pans for "shortening" cakes should be well greased, with unsalted shortening, and lightly floured, or greased and lined with waxed paper. Pans for true sponge or angel food cakes are never greased. Use the type and size of pan called for in the recipe. In general, pans should be filled almost two-thirds full of batter.

Preparation of Oven.—The oven should be heated to the proper temperature by the time the cake is ready to be baked, to ensure the best results. A steady heat at the right temperature should be maintained throughout the baking period. Gas and electric ranges with oven heat controls eliminate guessing as to the oven temperature. If the oven has no automatic oven temperature control, a portable oven thermometer should be used and the heat controlled manually.

Mixing Cake.—Mixing by hand is a time old method of putting cakes together. Mixing with an electric beater is becoming more and more popular, however, because of the time and labour saved in producing a perfect cake. The creaming of the shortening and sugar, and the beating of the eggs are done on high speed. Low speed should be used for adding dry ingredients and liquid, using care to avoid overbeating once the flour is added. Many cake recipes give directions for mixing with the electric beater.

Baking.—Tested cake recipes indicate temperature and time needed in baking. Place pans as near the centre of the oven as possible. If cakes are baked on two racks, place them so that no pan is directly over another. Cake is baked when: (1) It has risen to its full height and has a delicate uniformly brown crust. (2) It has shrunk away slightly from the sides of the pan. (3) The surface, when pressed lightly by finger, springs back and leaves no imprint. (4) A wire cake tester or clean toothpick inserted into centre of cake comes out clean and dry.

Cooling Cakes.—Sponge and Angel Food cakes should be inverted on a wire rack and allowed to cool in the pans; then removed. Butter cakes should be allowed to stand in the pans about 5 minutes, on a cake rack, then loosened from sides of the pan with a spatula, and turned out on a rack.

CAKE RECIPES

(Use standard measuring cups and spoons, with
all measurements level.)

Two Egg Cake.—½ cup shortening, 1 cup granulated sugar, 2 eggs, ½ teaspoon salt, 2½ teaspoons baking powder, 1¾ cups sifted cake flour, ½ cup milk and ½ teaspoon vanilla extract. Cream the shortening by mashing and beating it with a spoon until it is like thick cream. Add the sugar a little at a time, creaming after each addition until the mixture is light and fluffy. Separate egg yolks and egg whites. Beat yolks until thick and lemon coloured. (Do not beat whites until ready to add.) Add beaten yolks to shortening and sugar and blend thoroughly. Add salt and baking powder to measured flour and sift. Add a little of this mixture to the shortening mixture while beating; then add a little of the milk. Continue adding first flour mixture, then milk, until all of each is added, beating each time until smooth. Add vanilla. Beat the egg whites until they are stiff enough to form peaks, but not dry. Fold them carefully into cake batter. (Whole eggs may be beaten together until very light; then add to the creamed shortening and sugar, beating thoroughly.) Pour batter into a prepared loaf pan 8″ x 8″ x 2″. Cut through the batter to break any large air bubbles, and be sure that the corners of the pan are filled. Or turn into two greased 8″ layer cake pans or into 2 doz. greased cup cake pans.

For a loaf cake, bake in a moderate oven of 350° F. for 50 to 60 minutes.

A layer cake is baked at 375° F. for 25 to 30 minutes, and cup cakes at 375° F. for 20 to 30 minutes.

Chocolate Two Egg Cake.—Follow recipe for Two Egg Cake. Melt 2 squares (2 oz.) of unsweetened cooking chocolate over hot water; cool, and add to the shortening, sugar and egg mixture. Sift ¼ teaspoon baking soda with dry ingredients. Use ¼ cup more milk.

Nut Cake.—Follow recipe for Two Egg Cake, adding 1 cup finely chopped nutmeats to the sifted dry ingredients.

Spice Cake.—Follow recipe for Two Egg Cake, sifting 2 teaspoons cinnamon, 1 teaspoon each of allspice and nutmeg, and ½ teaspoon powdered cloves with dry ingredients. Use 2 tablespoons more milk.

White Cake.—½ cup shortening, 1 cup granulated sugar, 2 cups sifted cake flour, 2 teaspoons baking powder, ½ teaspoon salt, 1 teaspoon vanilla extract, ½ cup milk and 3 egg whites. Cream the shortening thoroughly, then add the sugar gradually, creaming after each addition until the mixture is light and fluffy. Sift the dry ingredients together. Mix the flavouring with the milk, and add alternately with the dry ingredients, sifted together, to the sugar mixture. Beat with the spoon after each addition until smooth. Beat the egg whites stiff, but not dry, and fold them carefully into the cake batter. Turn into greased cake pans. Bake a loaf cake in a moderate oven of 350° F. for 50 to 60 minutes a layer cake at 375° for 25 to 30 minutes; or cup cakes at 375° F. for 20 to 30 minutes.

after each addition. Add the vinegar and flavouring, and blend. Sift the flour and salt together. Fold into the egg yolk and sugar mixture. Beat the egg whites stiff, but not dry, and fold them into the egg yolk mixture using a spoon. Bake in an ungreased 10″ tube pan in a slow oven of 320° F. for 1 hour. (D. B. Mn.)

CAKEWALK, a dance of American negro origin. The couples form a square with the men on the inside and, stepping high to a lively tune, walk in this square formation. There are several judges who consider the precision with which the corners are turned, the elegant bearing and carriage of the men and the grace and ease of their partners as they are swung about. The couples are eliminated one by one, the last being presented with a highly decorated cake, as a reward. This is the original cakewalk, as it was danced in slavery days. From it many modifying steps have been evolved all of which are called cakewalks.

CALABAR (formerly OLD CALABAR), a port of British West Africa, capital of a province of southern Nigeria, on the left bank of the Calabar river in 4° 56′ N., 8° 18′ E., 5m. above the point where the river falls into the Calabar estuary of the Gulf of Guinea, and 40m. from the sea. (Pop. about 25,000.) From the beach rise cliffs of moderate elevation, and on the sides or summits of the hills are the principal buildings. In a valley between the hills is the native quarter, called Duke Town. Here are several fine houses in bungalow style, the residences of the chiefs or wealthy natives. Among the public institutions are Government botanical gardens, primary schools and the Hope Waddell institute for technical training. Palms, mangoes and other trees give the town a picturesque setting. The trade is largely centred in the export of palm oil and palm kernels and the import of cotton goods. Vessels drawing 20ft. of water can ascend to Calabar. There is no bar in the Calabar river, which is well buoyed, but cargo has to be landed from lighters.

Calabar was the name given by the Portuguese discoverers of the 15th century to the tribes on this part of the Guinea coast at the time of their arrival. It was not till the early part of the 18th century that the Efik, owing to civil war with their kindred and the Ibibio, migrated from the neighbourhood of the Niger to the shores of the river Calabar. The native inhabitants are still mainly Efik. For several generations they were the middlemen between the white traders on the coast and the tribes of the Cross river and

Calabar district. Many of the natives are well educated, profess Christianity and dress in European fashion. A powerful bond of union among the Efik, and one that gives them considerable influence over other tribes, is the secret society known as the Egbo. The chiefs of Duke Town and other places in the neighbourhood placed themselves in 1884 under British protection.

Until 1904 Calabar was generally, and officially, known as Old Calabar, to distinguish it from New Calabar, the name of a river and port about 100m. to the east. Since the date mentioned the official style is Calabar simply. Calabar estuary is mainly formed by the Cross river (*q.v.*), but receives also the waters of the Calabar and other streams. The estuary is 10 to 12m. broad at its mouth and maintains the same breadth for about 30 miles.

CALABAR BEAN, the seed of a leguminous plant, *Physostigma venenosum,* a native of tropical Africa. The plant is a climber and attains a height of about 50ft. with a stem an inch or two in thickness. The seed pods, which contain two or three seeds or beans, are 6 or 7in. in length; and the beans are about the size of an ordinary horse bean but much thicker, with a deep chocolate-brown colour. Although highly poisonous, the bean has nothing in external aspect, taste or smell to distinguish it from any harmless leguminous seed, and disastrous effects have resulted from its being incautiously left in the way of children.

The bean usually contains a little more than 1% of alkaloids. Of these two have been identified, *calabarine*, and *physostigmine* or *eserine*. Physostigmine is used as the sulphate, which has the empirical formula of $(C_{15}H_{21}N_3O_2)_2 . H_2SO_4$, plus an unknown number of molecules of water. It occurs in small yellowish crystals, turned red by exposure to light or air, readily soluble in water or alcohol and with a bitter taste. The dose is $\frac{1}{60}$ $\frac{1}{30}$ grain, and should be administered by hypodermic injection. For the use of the oculist, it is also prepared in *lamellae* for insertion within the conjunctival sac. Each of these contains one-thousandth part of a grain of physostigmine sulphate.

Physostigmine has no action on the unbroken skin. When swallowed it causes great increase in salivary secretion, due to a direct influence on the secreting gland-cells. After a few minutes salivation is arrested owing to constriction of the blood-vessels that supply the glands. Secretion of bile, tears and sweat is also increased. Physostigmine raises the blood pressure, induces constriction of the pharynx and leads to violent vomiting and purging. It also acts upon the bladder, uterus, spleen and iris (*see* below). The terminals of the vagus nerve are also stimulated, causing the heart to beat more slowly. Later in its action, the drug depresses the intra-cardiac motor ganglia, causing prolongation of diastole and finally arrest of the heart in dilatation. The respiration is at first accelerated, but is afterwards slowed and ultimately arrested. The initial hastening is due to stimulation of the vagus terminals in the lung. The final arrest is due to paralysis of the respiratory centre in the medulla oblongata, hastened by a quasi-asthmatic contraction of the non-striped muscular tissue in the bronchial tubes, and by a "water-logging" of the lungs due to an increase in the amount of bronchial secretion. It is only in very large doses that the voluntary muscles are poisoned, there being induced in them a tremor which may simulate ordinary convulsions. The action is a direct one upon the muscular tissue (*cf.* the case of the gland-cells), since it occurs in an animal whose motor nerves have been paralysed by curare.

Consciousness is entirely unaffected by physostigmine, there being apparently no action on any part of the brain above the medulla oblongata. But the influence of the alkaloid upon the spinal cord is great. The reflex functions of the cord are abolished owing to a direct influence upon the cells in the anterior cornua. Near the termination of a fatal case there is a paralysis of the sensory columns of the cord, so that general sensibility is lowered. Calabarine on the other hand, stimulates these functions.

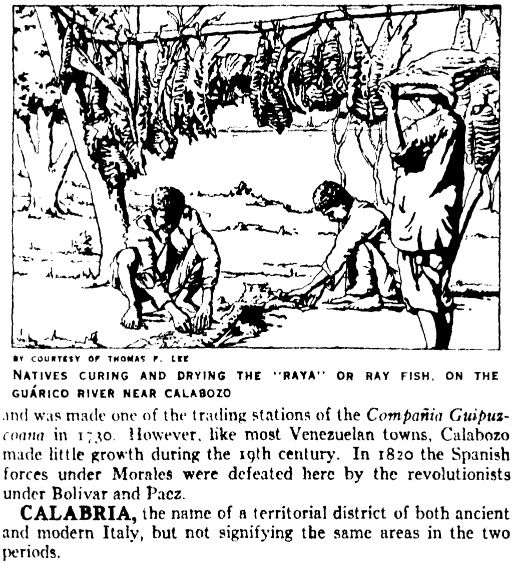
Physostigmine causes a contraction of the pupil more marked than any other known drug. Besides the *sphincter pupillae* the fibres of the ciliary muscle are stimulated. Consequently clear vision of distant objects becomes impossible. The intra-ocular tension is markedly lowered. This action is due to the extreme pupillary contraction which removes the mass of the iris from pressing upon the spaces of Fontana, through which the intra-ocular fluids normally make a very slow escape from the eye into its efferent lymphatics.

Physostigmine is used chiefly, but not exclusively, by the oculist. He uses it for at least six purposes. Its stimulant action on the iris and ciliary muscle is employed when they are weak or paralysed. It is used in all cases where one needs to reduce the intra-ocular tension, and for this and other reasons in glaucoma. It is naturally the most efficient agent in relieving the discomfort or intolerable pain of photophobia; and it is the best means of breaking down adhesions of the iris, and of preventing prolapse of the iris after injuries to the cornea.

Toxicology.—The symptoms of Calabar bean poisoning have been stated above. The obvious antidote is atropine (*q.v.*) which may often succeed; and the other measures are those usually employed to stimulate the circulation and respiration. Unfortunately the antagonism between physostigmine and atropine is not perfect; there comes a time when, if the action of the two drugs be summated, death results sooner than from either alone.

CALABASH, the shell of a gourd or pumpkin made into a vessel for holding liquids; also a vessel of similar shape made of other materials. It is the name of a tree, *Crescentia cujete* (family Bignoniaceae), of tropical America, whose gourd-like fruit is so hard that vessels made of the rind can be used over a fire many times. Tobacco pipes are made from the necks.

CALABOZO or **CALABOSO,** an inland town of Venezuela, once capital of the province of Caracas in the colonial period, and once capital of the State of Guárico. Pop. (1941) 3,720. Calabozo is situated in the midst of an extensive *llano* on the left bank of the Guárico river, 325ft. above sea-level and 123m. S.S.W. of Caracas. The plain lies slightly above the level of intersecting rivers and is frequently flooded in the rainy season; in summer the heat is most oppressive, the average temperature being 88° F. The town is regularly laid out with streets crossing at right angles, and possesses several fine old churches, a college and public school. It is also a bishop's see, and a place of considerable commercial importance because of its situation in the midst of a rich cattle-raising country. It is said to have been an Indian town originally, and was made one of the trading stations of the *Compañia Guipuzcoana* in 1730. However, like most Venezuelan towns, Calabozo made little growth during the 19th century. In 1820 the Spanish forces under Morales were defeated here by the revolutionists under Bolivar and Paez.



BY COURTESY OF THOMAS F. LEE

NATIVES CURING AND DRYING THE "RAYA" OR RAY FISH, ON THE GUÁRICO RIVER NEAR CALABOZO

CALABRIA, the name of a territorial district of both ancient and modern Italy, but not signifying the same areas in the two periods.

(1) The ancient district consisted of the peninsula at its S.E. extremity, between the Adriatic and the gulf of Tarentum, ending in the Iapygian promontory (Lat. *Promunturium Sallentinum;* the village upon it was called Leuca—Gr. Λευκά, white, from its

colour—and is still named S. Maria di Leuca) and corresponding in the main with the modern province of Lecce, Brundisium and Tarentum being its north-westerly cities, though the boundary of the latter extends somewhat farther west. It is a low terrace of limestone, the highest parts of which seldom reach 1,500 ft.; the cliffs, though not high, are steep, and it has no important rivers, but despite lack of water it was (and is) remarkably fertile. Strabo mentions its pastures and trees, and its olives, vines and fruit trees (still the principal source of prosperity) are frequently spoken of by the ancients. The wool of the good ports of Tarentum and Brundisium was also famous, and at the former place were considerable dye-works. Traces of a prehistoric population of the Stone and early Bronze Age are to be found all over Calabria. Specially noticeable are the menhirs (*pietre fitte*) and the round tower-like *specchie* or *truddhi,* which are found near Lecce, Gallipoli and Muro Leccese (and only here in Italy); they correspond to similar monuments, the *perdas fittas* and the *nuraghi,* of Sardinia; and there are also numerous dolmens. In 272–266 B.C. we find six triumphs recorded in the Roman *fasti* over the Tarentini, Sallentini and Messapii, while the name Calabria does not occur; but after the foundation of a colony at Brundisium in 244 B.C., and the final subjection of Tarentum in 209 B.C., Calabria became the general name for the peninsula (for the Iron Age in Messapia *see* APULIA: *Apulian Geometric Pottery*). Strabo says that earlier Calabria had been extremely populous and had had 13 cities, but that all except Tarentum and Brundisium had dwindled to villages. The Via Appia (*q.v.*), prolonged to Brundisium perhaps as early as 264 B.C., passed through Tarentum; the shorter route by Canusium, Barium and Gnathia was only made into a main artery of communication by Trajan. The only other roads were the two coast roads, the one from Brundisium by Lupiae, the other from Tarentum by Manduria, Neretum, Aletium (with a branch to Callipolis) and Veretum (hence a branch to Leuca), which met at Hydruntum. Augustus joined Calabria to Apulia and the territory of the Hirpini to form the second region of Italy. From the end of the second century we find Calabria for juridicial purposes associated either with Apulia or with Lucania and the district of the Bruttii, while Diocletian placed it under one *corrector* with Apulia. The loss of the name Calabria came with the Lombard conquest of this district. For the archaeology of this period *see* P. Orsi in *Boll. d'Arte* ser. 1, vol. viii. (1914) 41, 337; *Chron. Belle Arti.* i. 65; *Le Chiese Basiliane della Calabria* (1927).

(2) The modern Calabria consists of the southern extremity of Italy, bounded on the N. by the province of Potenza (Lucania) and on the other three sides by the sea. Area 5,822 sq.mi. Calabria acquired its present name in the time of the Byzantine supremacy, after the ancient Calabria had fallen into the hands of the Lombards and been lost to the Eastern empire about A.D. 668. The name is first found in the modern sense in the 8th century; the district is mainly mountainous; at the N. extremity the mountains still belong to the Apennines proper (the highest point, the Monte Pollino, 7,325 ft., is on the boundary between Lucania and Calabria), but after the plain of Sibari, traversed by the Crati (anc. Crathis, a river 58 m. long, the only considerable one in Calabria), the granite mountains of Calabria proper begin. The first group extends as far as the isthmus, about 22 m. wide, formed by the gulfs of S. Eufemia and Squillace; its highest point is the Botte Donato (6,330 ft.). It is in modern times generally called the Sila, in contradistinction to the second (southern) group, the Aspromonte (6,420 ft.); the ancients on the other hand applied the name Sila to the southern group. The rivers in both parts of the chain are short and unimportant. The mountain districts are in parts covered with forest (though less so than in ancient times), still largely government property, while in much of the rest there is good pasture. The scenery is fine, though the country is hardly at all visited by travellers. The fertile coast strip produces wine, olive-oil and fruit (oranges, lemons, figs, etc.), in abundance, especially near Reggio. The neighbourhood of Cosenza is also highly cultivated, though the methods used in many parts are still primitive. Coast fisheries are important near the straits of Messina. The climate is very hot in summer, while snow lies on the mountain-tops for at least half the year. Earthquakes have done great damage; that of the autumn of 1905 was disastrous, but was surpassed by the terrible earthquake of 1908, which destroyed Messina (*q.v.*) and ruined Reggio di Calabria. Railway communications include lines along E. and W. coasts (the latter forms part of the through route by land from Italy to Sicily, ferry-boats traversing the strait of Messina with the through trains on board) which meet at Reggio. They are connected by a branch from Paola through Corigliano (junction for Cosenza), and Spezzano Albanese (branch to Castrovillari) to Sibari, and by another from Marina di Catanzaro through Catanzaro to S. Eufemia. There are also short branches. The interior is otherwise untouched by railways; indeed many of the villages in the interior can only be approached by paths; and this is one of the causes of the economic difficulties of Calabria. Another is injudicious deforestation.

Because of the strategic location of Reggio as the chief supply point on the mainland for Sicily, it was heavily attacked by Allied bombers during World War II.

Local costumes are still much worn in the remoter districts; they vary considerably in the different villages. The population of Calabria was 1,771,651 in 1936. Colonies, founded in the 15th century by Albanians expelled by the Turks, still speak their own language, wear their national costume and worship according to Greek rite. Similar colonies exist in Sicily, notably at Piana dei Greci near Palermo.

CALAFAT, a town of Rumania in the department of Doljiu, on the Danube, opposite the Bulgarian fortress of Vidin. Pop. (1930), 7,705. Calafat is an important centre of the grain trade, and is connected by a branch line with the principal Rumanian railway system and by steam ferry with Vidin. It was founded in the 14th century by Genoese colonists, who employed large numbers of workmen (*Calfats*) in repairing ships—which industry gave its name to the place.

CALAH: *see* KALAKH.

CALAHORRA (anc. CALAGURRIS), a city of north Spain, province of Logroño; on the Bilbao-Saragossa railway and a branch line to Arnedo. Pop. (1940) 12,647 (mun., 13,199). Calahorra is built on a hill slope rising from the left bank of the river Cidacos, which enters the Ebro, 3 mi. east. It is the market for the grain, wine, oil, vegetables and fruit of the fertile Ebro valley, which it overlooks, and makes jam and artificial manures. The cathedral, dating probably from the foundation of the see of Calahorra in the 5th century, was restored in 1485, and subsequently so much altered that little of the original Gothic structure survives. The Casa Santa, annually visited by thousands of pilgrims on Aug. 31, is said to contain the bodies of the martyrs Emeterius and Celedonius, who were beheaded in the 3rd or 4th century.

Calagurris became famous in Roman times for its heroic resistance to Pompey in 76 B.C. Hunger had reduced its garrison to cannibalism before they surrendered four years later to Pompey's legate, Afranius. Under Augustus (31 B.C.–A.D. 14) Calagurris received the privileges of Roman citizenship, and later it was given the additional name of *Nassica* to distinguish it from the neighbouring town of *Calagurris Fibularensis*, the exact site of which is uncertain. The rhetorician, Quintilian, was born at Calagurris Nassica about A.D. 35. The chief Roman remains are the ruins of an aqueduct and an amphitheatre.

CALAIS, a seaport and manufacturing town of northern France, in the department of Pas-de-Calais, 22 mi. E.S.E. of Dover, and 185 mi. N. of Paris by the Northern railway. Pop. (1936) 57,349. The old town stands on an island hemmed in by the canal and the harbour basins which divide it from the much more extensive manufacturing quarter of St. Pierre, enveloping it on the east and south. The demolition of the ramparts of Old Calais was followed by the construction of a new circle of defences now obsolete. Calais was a fishing-village with a natural harbour until the end of the 10th century. It was first improved by Baldwin IV., count of Flanders, in 997, and in 1224 was regularly fortified by Philip Hurepel, count of Boulogne. It was besieged in 1346, after the battle of Crécy, by Edward III. and taken after resisting for nearly a year. The city remained in the hands of the English till 1558, when it was taken by Francis, duke of Guise, from the ill-provided English garrison. From this time the *Calaisis* or territory of Calais was known as the *Pays Reconquis*. It was held by the Spaniards from 1595 to 1598, but was restored to France by the treaty of Vervins. In the centre of the old town is the Place d'Armes, in which stands the former *hôtel-de-ville* (rebuilt in 1740, restored in 1867). It was much damaged during World War I by bombardment (1914–16). The belfry belongs to the 16th and early 17th centuries. Close by is the Tour du Guet, or watchtower, used as a lighthouse until 1848. The church of Notre Dame built during the English occupancy shows the influence of English Gothic.

A gateway flanked by turrets (14th century) is a relic of the Hôtel de Guise, built as a guild hall for the English wool staplers, and given to the duke of Guise as a reward for the recapture of Calais.

Calais is the principal port for the continental passenger and mail traffic with England carried on by the S.R. and the French railways. The principal exports are woven goods, glassware, lace and metalware Imports include petroleum, timber, raw wool, cotton yarn. The main industry is the manufacture of lace, for which it is the chief centre in France. The lace machines are driven by electrical power, a large export being to the United States. Sawmilling, boatbuilding and the manufacture of artificial ice, biscuits, **soap**, submarine and telephone cables is also carried on. Deep-sea and coast fishing for cod, herring and mackerel are also important. The tonnage of the port almost doubled between 1913 and 1918, in spite of the stoppage of civilian traffic, owing to the enormous quantity of war material that was dealt with. The port equipment was much improved to cope with military needs; a quay, 306 yds. long, was finished in 1918, and the new west dock has a depth of from 26 ft. to 30 ft. on the sill. Work on the entrance to the port was resumed in 1921, and the west jetty completed. By the construction of an elevator, canal boats of 300 tons can reach the large canal dock. The harbour is connected with the river Aa and the navigable waterways of the department.

CALAIS, a city of Washington county, Maine, U.S.A., at the head of navigation on the St. Croix river (the international boundary), 12 mi. from its mouth. It is on federal highway 1; is served by the Maine Central railroad and is connected by bridges with St. Stephens, New Brunswick, across the river. The population in 1920 was 6,084, 1,426 foreign born white; 1940, 5,161. The city stretches along the river for 14 mi., in a wide and picturesque valley. It is a port of entry, a trading centre for a wide area, and a resort for summer tourists and sportsmen. The manufacture of boots and shoes and canning of blueberries are the chief industries, replacing the lumbering and shipbuilding of former days. At Woodland, 11 mi. W., is a large paper mill. Near by are quarries of red granite, from which large shipments were made before the growth of the cement industry cut down the market.

In the winter of 1604–5 the Huguenot Pierre du Guast, sieur de Monts, came to the large island in the river on which the United States now maintains a lighthouse, to take possession of his immense grant, but the next summer the survivors of the party went to Port Royal, Nova Scotia. The first permanent settlement was made by Daniel Hill, a lumberman, in 1770. In 1789 Massachusetts sold the entire site of the present city for $4.000 to Waterman Thomas, who bought it as a speculation. The first sawmill was built in 1802 The city was chartered in 1851.

CALAÏS and **ZETES,** in Greek mythology, the winged twin sons of Boreas and Oreithyia On their arrival with the Argonauts (*q.v.*) at Salmydessus in Thrace, they liberated their sister Cleopatra, who had been thrown into prison with her two sons by her husband Phineus, the king of the country (Sophocles, *Antigone*, 906; Diod. Sic. iv. 44). According to another story, they delivered Phineus from the Harpies (*q.v.*). They were slain by Heracles near the island of Tenos, in consequence of a quarrel with Tiphys, the pilot of the Argonauts, or because they refused to wait during the search for Hylas (*q.v.*) Legend attributed the foundation of Cales in Campania to Calaïs (Silius Italicus viii. 512).

CALAMBA or **KALAMBA,** a municipality (with administrative centre and 28 barrios or districts) of the province of Laguna, Luzon, Philippine Islands, about 37 mi. from Manila; a port on the south shore of Laguna de Bay, and a junction for railways from Tayabas, Batangas and Pagsanjan. It is a centre of the sugar industry. Pop. (1939) 32,363, of whom 44 were whites. Calamba was the starting point of the Chinese revolt in 1639 and was frequently the centre of agrarian troubles. José Rizal, the national hero of the Filipinos, was born at Calamba on June 19, 1861. Tagalog is the vernacular. Of the inhabitants aged 6 to 19 inclusive, 32.3% attended school in 1939, while 58% of the population 10 years old and over were literate.

(C. S. L.)

CALAMINE. The name calamine (Ger. *Galmei*) from *lapis calaminaris* of Pliny, is a corruption of cadmia (*καδμία*), the old name for zinc ores in general, and was formerly used indiscriminately for the carbonate (*see* SMITHSONITE) and the hydrous silicate (*see* HEMIMORPHITE) of zinc; even now both species are included by miners under the same term. The two minerals often closely resemble each other in appearance, and can usually only be distinguished by chemical tests; they were first so distinguished by James Smithson in 1803. F. S. Beudant in 1832 restricted the name calamine to the hydrous silicate and proposed the name smithsonite for the carbonate, and these meanings of the terms are now adopted by Dana and many other mineralogists. Unfortunately, however, in England (following Brooke and Miller, 1852) these designations have been reversed, calamine being used for the carbonate and smithsonite for the silicate.

CALAMIS, an Athenian sculptor of the first half of the 5th century B.C. He made statues of Apollo the averter of ill, Hermes the rambearer, Aphrodite and other deities, as well as part of a chariot group for Hiero, king of Syracuse. His works are praised by ancient critics for delicacy and grace. It has been suggested that the bronze charioteer found at Delphi is by Calamis; but the evidence is not conclusive (*see* GREEK ART).

See H. Stuart Jones, *Ancient Writers on Greek Sculpture* § 78–87 (1895).

CALAMY, EDMUND, known as "the elder" (1600–1666), English Presbyterian divine, was born of Huguenot parents in Walbrook, London, in February 1600, and educated at Pembroke hall, Cambridge, where his opposition to the Arminian party, then powerful in that society, excluded him from a fellowship. Nicholas Felton, bishop of Ely, however, made him his chaplain, and gave him the living of St. Mary, Swaffham Prior, which he held till 1626. He then removed to Bury St. Edmunds, where he acted as lecturer for ten years, retiring when his bishop (Wren) insisted on the observance of certain ceremonial articles. In 1636 he was appointed rector (or perhaps only lecturer) of Rochford in Essex, and in 1630 to the perpetual curacy of St. Mary Aldermanbury in London, where he had a large following. He defended the Presbyterian cause, and had a principal share in writing *Smectymnuus*, against Bishop Joseph Hall's presentation of episcopacy. The initials of the names of the several contributors formed the name under which it was published, viz., S. Marshal, E. Calamy, T. Young, M. Newcomen and W. Spurstow. Calamy took an active part in the Westminster Assembly, and found in Presbyterianism the middle course which best suited his views of theology and Church government. He opposed the execution of Charles I., lived quietly under the Commonwealth, and was assiduous in promoting the king's return; he declined the bishopric of Coventry and Lichfield, but became one of Charles's chaplains, and vainly tried to secure the legal ratification of Charles's declaration of Oct. 25, 1660. He was ejected for Nonconformity in 1662, and died after the Great Fire on Oct. 29, 1666. His grandson, Edmund (1671–1732), a Nonconformist minister, was a prolific writer, the best known of his works being *An Account of the Ejected Ministers* (1702), and an *Autobiography* (posthumously published, 1829).

CALARASHI, the capital of the Jalomitza department of Rumania. Pop. 17,892. Situated on the left bank of the Borcea branch of the Danube, the town has considerable transport trade in wheat, linseed, hemp, timber and fish.

CALAS, JEAN (1698–1762), a Protestant merchant at Toulouse, whose legal murder is a celebrated case in French history, was born at Lacaparède, near Chartres, on March 19, 1698. His wife was an Englishwoman of French extraction. They had three sons and three daughters. His son Louis had become a Roman Catholic. In Oct. 1761 another son, Antoine, hanged himself in his father's warehouse. It was alleged that he had been strangled by the family to prevent him from changing his religion, and that this was a common practice among Protestants. The unhappy family were condemned to the rack in order to extort confession. They appealed to the parlement; but this body sentenced the old father to the torture, ordinary and extraordinary, to be broken alive upon the wheel, and then to be burnt to ashes; which decree was executed on March 9, 1762. Pierre Calas, the surviving son, was banished for life; the rest were acquitted. The distracted widow, however, found some friends, and among them Voltaire, who laid her case before the council of State at Versailles. For three years he worked indefatigably to procure justice, and made the Calas case famous throughout Europe (*see* VOLTAIRE). Finally the king and council annulled the proceeding of the parlement of Toulouse; Calas was declared to have been innocent, and a payment was made to the family, but no proceedings were taken against the magistrates or the parlement.

See Voltaire, *Sur la tolérance, à cause de la mort de Jean Calas; Causes célèbres*, tome iv.; Raoul Allier, *Voltaire et Calas, une erreur judiciaire au XVIIIe siècle* (1898); biographies of Voltaire; and F. H. Maugham, *The Case of Jean Calas* (1928).

CALASIAO, a municipality (with administrative centre and 16 *barrios* or districts) of the province of Pangasinan, Luzon, Philippine Islands, on a branch of the Agno river, about 4 mi. S. by E. of Dagupan; and on the Manila and Dagupan railway. Pop. (1939) 19,325 (a gain of 2,365 since 1918), of whom 9,404 were males and no whites. Of those inhabitants aged 6 to 19, inclusive, 44·2% were reported as attending school, and of those 10 years old and over 54·2% were reported as literates. The vernacular is Pangasinan. Hats and various woven fabrics are manufactured there. The number of parcels of land taxed in 1938 was 14,634, of which there were 7,591 owners. (C. S. L.)

CALASIO, MARIO DI (1550–1620), Italian Franciscan, was born at Calasio, in the Abruzzi. Joining the Franciscans at an early age, he devoted himself to Oriental languages and became an authority on Hebrew. He was appointed by Paul V., whose confessor he was, to the chair of Scripture at Ara Coeli, where he died on Feb. 1, 1620. Calasio is known by his *Concordantiae sacrorum Bibliorum hebraicorum* (1622), a work which is based on Nathan's *Hebrew Concordance* (Venice, 1523), and evinces great care and accuracy. All root-words are treated alphabetically, and the whole Bible has been collated for every passage containing the word, so as to explain the original idea, which is illustrated from the cognate usages of the Chaldee, Syrian, Rabbinical Hebrew and Arabic. Calasio gives under each Hebrew word the literal Latin translation, and notes any existing differences from the Vulgate and Septuagint readings. An incomplete English translation was published in London by Romaine in 1747. Calasio also wrote a Hebrew grammar, *Canones generales linguae sanctae* (1616), and the *Dictionarium hebraicum* (1617).

CALATAFIMI, a town in the province of Trapani, Sicily, 30 mi. W.S.W. of Palermo direct (51½ mi. by rail). Pop. (1936) 11,123 (town); 11,484 (commune). The name comes from the Saracenic castle of *Kalat-al-Fimi* (castle of Euphemius), which stands above it. Samuel Butler, the author of *Erewhon*, did much of his work here. The battlefield where Garibaldi won his first victory over the Neapolitans, May 15, 1860, is 2 mi. S.W.

CALATAYUD, a city of central Spain, province of Saragossa. It lies on the left bank of the river Jalón, below the entrance of the Jiloca, and is served by the Madrid-Saragossa and Calatayud-Sagunto railways. Pop. (1940) 15,116 (mun., 18,419). Calatayud consists of a lower more modern and well-built town, and an upper or Moorish town, where there are many rock-hewn dwellings inhabited by the poorer classes. Two collegiate churches are especially noteworthy. Santa Maria, originally a mosque, has a lofty red octagonal tower and a fine Renaissance doorway, added in 1528; while Santo Sepulcro, built in 1141, and restored in 1613, was long the principal church of the Spanish Knights Templar. Commercially Calatayud ranks second only to Saragossa among the Aragonese towns, for it is the central market of the exceptionally fertile valleys of the Jalón and Jiloca. About 2m. E. are the ruins of the ancient Bilbilis where the poet Martial was born (*c.* A.D. 40). This town was celebrated for its breed of horses, its armourers, its gold and its iron. Destroyed by the Arabs in the 8th century, its ruins later provided stone for the building of Calatayud, whose name is an adaptation of the Moorish *Kalat Ayub,* "Castle of Ayub."

CALATIA, an ancient town of Campania, Italy, 6m. S.E. of Capua, on the Via Appia, near the point where the Via Popillia branches off from it. The history of Calatia is practically that of its more powerful neighbour Capua, but as it lay near the point where the Via Appia turns east and enters the mountains, it had some strategic importance. In 313 B.C. it was taken by the Samnites and recaptured by the dictator Q. Fabius; the Samnites captured it again in 311, but it must have been retaken at an unknown date.

In the 3rd century we find it issuing coins with an Oscan legend, but in 211 B.C. it shared the fate of Capua. In 174 we hear of its walls being repaired by the censors. In 59 B.C. a colony was established here by Caesar.

CALBAYOG, a municipality (with administrative centre and 50 *barrios* or districts) of the province and island of Samar, Philippine Islands, on the west coast at the mouth of the Calbáyog river, about 30 mi. northwest of Catbalogan, the provincial capital. Pop. (1939) 25,786 (a gain of 406 since 1918) of whom 13,061 were males, and 8 were whites. Abacá (Manila hemp) and copra are the principal products, but the forests contain valuable hardwood timber. There are hot springs in the vicinity and a meteorological station. Of those inhabitants from 6 to 19, inclusive, 31·4% attended school, and of those 10 years old and over 39% were literates. The vernacular is Samarino, a dialect of Bisayan. The number of parcels of land taxed in 1938 was 7,320, of which there were 5,479 owners.

CALBE or KALBE, a town of Germany, on the Saale in Prussian Saxony, to be distinguished from Calbe on the Milde in the same province. Pop. (1939) 12,490. Its industries are the manufacture of cloth, paper and sugar.

CALCAR or KALCKER, **JOHN DE** (1499–*c.* 1546), Italian painter, was born at Calcar, in the duchy of Cleves, and died at Naples. He was a disciple of Titian at Venice, and perfected himself by studying Raphael. He imitated those masters so closely, especially in his portraits, as to deceive the most skilful critics.

CALCEOLARIA, a genus of shrubs and herbs belonging to the family Scrophulariaceae, containing about 250 species, chiefly natives of the South American Andes of Peru and Chile, and sometimes called slipperworts. The calceolaria of the florists has been developed into a decorative herbaceous plant. It is generally raised annually from the seed, which is sown about the end of June in a mixture of loam, leaf-mould and sand. In all stages of growth the plants are subject to the attacks of the red spider. The shrubby calceolarias, sometimes used for bedding, are propagated from cuttings planted in autumn in the cool greenhouse.

CALCHAQUIAN (Diaguitan), a group of tribes of South American Indians, somewhat doubtfully constituting an independent linguistic stock. The Calchaquis occupied a considerable territory in north-western Argentina, extending from the valley of Lerma near Salta, south and east in the foothills of the Andes and the western edge of the pampas, to the northern border of the province of Cordoba. Some recent authorities would make the stock extend westward to the Pacific coast by uniting the Calchaquis with the Atacamenan (*q.v.*). As practically all data in regard to the Calchaqui language known as "Kakan" has been lost, and the people themselves have for some time been extinct, the problem of determining their limits and affiliations is very difficult. The Calchaquis were a bold and warlike people, and successfully resisted the attacks of the Incas. Culturally their remains show clear relationship with the prehistoric culture of

Bolivia, as well as influences from the historic Inca civilization.

The Calchaquis were sedentary agriculturalists, living in villages of houses built with dry stone walls, sometimes very closely grouped to form communal dwellings somewhat resembling the pueblos of the south-western United States. They had much in the way of copper implements and ornaments, but only a little gold. Textiles were made and pottery of varied types and considerable excellence. The dead were buried and whole cemeteries of urn burials of very young children have been found, supposedly victims of infant sacrifice. In some sections large groups of small mounds associated with stone circles and alignments are found, but their purpose is unknown.

See T. A. Joyce, *South American Archaeology* (London, 1912); A. F. Chamberlain, "The Allentiacan, Bororoan and Calchaquian linguistic stocks of South America," *American Anthropologist* (n.s.), vol. xiv. pp. 499–507. The latter gives a useful bibliography. (R. B. D.)

CALCHAS, son of Thestor, the most famous soothsayer among the Greeks at the time of the Trojan war. He foretold the duration of the siege, demanded the sacrifice of Iphigeneia and the return of Chryseis; he suggested that Neoptolemus and Philoctetes should be fetched to Troy, and advised the construction of the wooden horse. It had been predicted that he should die when he met his superior in divination; and the prophecy was fulfilled in the person of Mopsus, whom Calchas met after the war, at Clarus, or at Siris in Italy. Beaten in a trial of soothsaying, Calchas died of chagrin or committed suicide.

See Roscher's *Lexikon, s.v.*

CALCINATION. Solids, when heated to a high temperature for the purpose of removing volatile substances, for the purpose of oxidizing a portion of the mass, or to render them friable, are said to be calcined. Calcination, therefore, is sometimes considered a process of purification. A typical example is the manufacture of lime from limestone. In this process the limestone, usually admixed with coke or other fuel to maintain the high temperature but sometimes treated in rotary kilns heated by gas or powdered fuel, is brought to a temperature high enough to expel the carbon dioxide, producing the lime of commerce in a highly friable or easily powdered condition. Calcination in special cases may be carried on in furnaces designed to exclude air, for which an inert gas may be substituted.

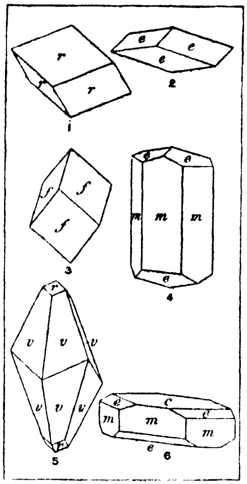
CALCITE, a mineral consisting of naturally occurring calcium carbonate ($CaCO_3$), crystallizing in the rhombohedral system. With the exception of quartz, it is the most widely distributed of minerals, while in the beautiful development and extraordinary variety of form of its crystals it is surpassed by none. In the massive condition it occurs as large rock-masses (marble, limestone, chalk) which are often of organic origin, being formed of the remains of molluscs, corals, crinoids, etc., the hard parts of which consist largely of calcite.

The name calcite (Lat. *calx, calcis,* meaning burnt lime) is of comparatively recent origin, and was first applied, in 1836, to the "barleycorn" pseudomorphs of calcium carbonate after celestine from Sangerhausen in Thuringia; it was not until about 1843 that the name was used in its present sense. The mineral had, however, long been known under the names calcareous spar and calc-spar, and the beautifully transparent variety called Iceland-spar had been much studied. The strong double refraction and perfect cleavages of Iceland-spar were described in detail by Erasmus Bartholinus in 1669 in his book *Experimenta Crystalli Islandici disdiaclastici;* the study of the same mineral led Christiaan Huygens to discover in 1690 the laws of double refraction, and E. L. Malus in 1808 the polarization of light.

An important property of calcite is the great ease with which it may be cleaved in three directions; the three perfect cleavages are parallel to the faces of the primitive rhombohedron, and the angle between them was determined by W. H. Wollaston in 1812, with the aid of his newly invented reflecting goniometer, to be 74° 55′. The cleavage is of great help in distinguishing calcite from other minerals of similar appearance. The hardness of 3 (it is readily scratched with a knife), the specific gravity of 2·72, and the fact that it effervesces briskly in contact with cold dilute acids are also characters of determinative value.

Crystals of calcite are extremely varied in form, but, as a rule, they may be referred to four distinct habits, namely: rhombohedral, prismatic, scalenohedral and tabular.

Depending on the habits of the crystals, certain trivial names have been used, such, for example, as "dog-tooth-spar" for the crystals of scalenohedral habit, so common in the Derbyshire lead mines and limestone caverns; "nail-head-spar" for crystals terminated by the obtuse rhombohedron *e,* which are common in the lead mines of Alston Moor in Cumberland; "slate-spar" (German *Schieferspat*) for crystals of tabular habit, and sometimes as thin as paper; "cannon-spar" for crystals of prismatic habit terminated by the basal plane.



FIGS. 1–6.—CALCITE CRYSTALS
1. r is primitive (cleavage) rhombohedron
2. e is flat rhombohedron
3. f is acute rhombohedron
4. prism (m) combined with rhombohedron
5. combination of scalenohedron (v) with rhombohedron (r)
6. basal pinacoid (c) prism (m) and rhombohedron (e) combined

Calcite is also remarkable for the variety and perfection of its twinned crystals. Twinned crystals, though not of infrequent occurrence, are, however, far less common than simple (untwinned) crystals.

Calcite, when pure, as in the well-known Iceland-spar, is perfectly transparent and colourless. The lustre is vitreous. Owing to the presence of various impurities, the transparency and colour may vary considerably. Crystals are often nearly white or colourless, usually with a slight yellowish tinge. The yellowish colour is in most cases due to the presence of iron, but in some cases it has been proved to be due to organic matter (such as apocrenic acid) derived from the humus overlying the rocks in which the crystals were formed. An opaque calcite of a grass-green colour, occurring as large cleavage masses in central India and known as hislopite, owes its colour to enclosed "green-earth" (glauconite and celadonite). A stalagmitic calcite of a beautiful purple colour, from Reichelsdorf in Hesse, is coloured by cobalt.

Optically, calcite is uniaxial with negative birefringence, the index of refraction for the ordinary ray being greater than for the extraordinary ray; for sodium-light the former is 1·6585 and the latter 1·4862. The difference, 0·1723, between these two indices gives a measure of the birefringence or double refraction.

Although the double refraction of some other minerals is greater than that of calcite (*e.g.,* for cinnabar it is 0·347, and for calomel 0·683), yet this phenomenon can be best demonstrated in calcite, since it is a mineral obtainable in large pieces of perfect transparency. Owing to the strong double refraction and the consequent wide separation of the two polarized rays of light traversing the crystal, an object viewed through a cleavage rhombohedron of Iceland-spar is seen double, hence the name doubly-refracting spar. Iceland-spar is extensively used in the construction of Nicol prisms for polariscopes, polarizing microscopes and saccharimeters, and of dichroscopes for testing the pleochroism of gem-stones.

Chemically, calcite has the same composition as the orthorhombic aragonite (*q.v.*), these minerals being dimorphous forms of calcium carbonate. Well-crystallized material, such as Iceland-spar, usually consists of perfectly pure calcium carbonate, but at other times the calcium may be isomorphously replaced by small amounts of magnesium, barium, strontium, manganese, cobalt, zinc or lead.

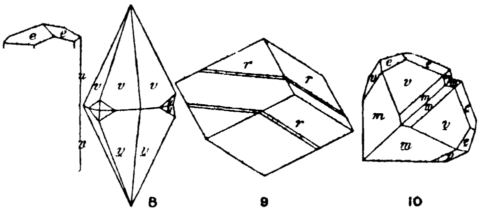
Mechanically enclosed impurities are also frequently present, and it is to these that the colour is often due. A remarkable case of enclosed impurities is presented by the so-called Fontainebleau limestone, which consists of crystals of calcite of an acute rhombohedral form enclosing 50 to 60% of quartz-sand. Similar crystals, but with the form of an acute hexagonal pyramid, and enclosing 64% of sand, have been found in large quantity over a wide area in South Dakota, Nebraska and Wyoming.

In addition to the varieties of calcite noted above, some others, depending on the state of aggregation of the material, are distinguished. A finely fibrous form is known as "satin-spar," a name also applied to fibrous gypsum: the most typical example of this is the snow-white material, often with a rosy tinge and a pronounced silky lustre, which occurs in veins in the Carboniferous shales of Alston Moor in Cumberland. Finely scaly varieties with a pearly lustre are known as argentine and aphrite (German *Schaumspat*); soft, earthy and dull white varieties as agaric mineral, rock-milk, rock-meal, etc.—these form a transition to marls, chalk, etc. Of the granular and compact forms numerous varieties are distinguished (*see* LIMESTONE and MARBLE). In the form of stalactites calcite is of extremely common occurrence.

The modes of occurrence of calcite are very varied. It is a common gangue mineral in metalliferous deposits, and in the form of crystals is often associated with ores of lead, iron, copper and silver. It is a common product of alteration in igneous rocks, and frequently occurs as well-developed crystals in association with zeolites lining the cavities of basaltic and other rocks; and it is said to be a primary constituent in certain igneous rocks. Veins and cavities in limestones are usually lined with crystals of calcite. The wide distribution, under various conditions, of crystallized calcite is readily explained by the solubility of calcium carbonate in water containing carbon dioxide, and the ease with which the material is again deposited in the crystallized state when the carbon dioxide is liberated by evaporation.

Localities at which beautifully crystallized specimens of calcite are found are extremely numerous. For beauty of crystals and variety of forms the haematite mines of the Egremont district in west Cumberland and the Furness district in north Lancashire are unsurpassed. The lead mines of Alston in Cumberland and of Derbyshire, and the silver mines of Andreasberg in the Harz and Guanajuato in Mexico have yielded many fine specimens. From the zinc mines of Joplin in Missouri enormous crystals of golden-yellow and amethystine colours have been obtained.

The quarry, which since the 17th century has supplied the famous Iceland-spar, is in a cavity in basalt, the cavity itself measuring 12 by 5yds. in area and about 10ft. in height. It is situated quite close to the farm Helgustadir, about an hour's ride from the trading station of Eskifjördur on Reydar Fjördur, on the east coast of Iceland. This cavity when first found was filled with pure crystallized masses and enormous crystals. The crystals measure up to a yard across, and are rhombohedral or scalenohedral in habit; their faces are usually dull and corroded or coated with stilbite. In recent years much of the material taken out has not been of sufficient transparency for optical purposes; this, with limited supply, has caused a rise in price. (L. J. S.)



FIGS. 7–10.—FOUR SPECIMENS OF TWINNED CRYSTALS OF CALCITE
7: Twinned prismatic crystal; 8: twinned scalenohedron; 9: cleavage rhombohedron with twin-lamellae; 10: "heart-shaped" twin

CALCIUM is a metallic element, symbol Ca, and was so named by Sir H. Davy because of its occurrence in chalk (Latin *calx*); atomic number 20, atomic weight 40·07 (two isotopes, 40 and 44, the former greatly predominating, according to F. W. Aston). It has a bright silvery appearance when freshly cut, and tarnishes rapidly and becomes yellowish on exposure to air. It does not occur naturally in the free state but is widely distributed in combination, being the fifth most abundant constituent of the earth's crust. Thus the sulphate constitutes the minerals anhydrite, alabaster, gypsum, and selenite, and the carbonate occurs as the minerals chalk, marble, calcite, and aragonite, and in combination with magnesium carbonate as dolomite. Fluorspar is the fluoride, which also occurs with the phosphate as apatite. The phosphate is the main constituent of bones, and the carbonate of egg-shells.

Extraction.—Lime was from remote ages regarded as an elementary earth, but in 1808 Sir H. Davy showed that it was an oxide of a metal which he named calcium and endeavoured to isolate. Having just obtained sodium and potassium by electrolytic methods, he tried to decompose a mixture of lime and mercuric oxide by the electric current, but he was unable to get rid of all the mercury from the resulting amalgam. Bunsen, however, met with more success in electrolysing calcium chloride moistened with hydrochloric acid, and A. Matthiessen obtained the metal by electrolysis of a mixture of fused calcium and sodium chlorides. H. Moissan obtained metal of 99% purity by electrolysing calcium iodide at a low red heat, using a nickel cathode and a graphite anode, and also by heating the iodide with excess of sodium, forming an amalgam of the product, and removing the sodium by means of absolute alcohol (which does not affect calcium, *see later*) and the mercury by distillation.

The development of electrolytic methods resulted in the commercial production of the metal. O. Ruff and W. Plato employed a mixture of the chloride and fluoride (fluorspar), which was fused in a porcelain crucible and electrolysed by a carbon anode and an iron cathode; this method did not admit of commercial application, but W. Rathenau and C. Suter achieved this object by a slight modification. A graphite vessel, which contained the fused mixture, served as the anode, and the cathode was an iron rod which could be gradually raised, and which is known as the "contact cathode." This just touches the surface of the fused mixture, and as the calcium forms at the point of contact the rod is raised, whereby the calcium is produced as a rod forming a prolongation of the iron rod. It is marketed in this form and has a purity of 98–99%. More recent methods (*e.g.*, that of Brace, *J. Inst. Metals*, 1921, xxv., p. 161) tend to revert to the electrolysis of concentrated calcium chloride solutions with a mercury cathode, and subsequent distillation of the mercury.

Properties.—A. W. Hull has shown that the crystal structure of the metal is a face-centred cube, the edge being 5·56 A.U. in length. Calcium reacts slowly with the oxygen and nitrogen of the air to form a yellow surface layer of hydroxide and nitride. It is rapidly acted upon by water, but the resulting layer of hydroxide tends to protect the metal from further attack owing to its sparing solubility. Alcohol is practically without action, and for this reason calcium is used as the best means of removing the last traces of water from alcohol. The chemical properties of calcium, strontium, and barium are very similar, showing a regular gradation throughout the series; these elements together with magnesium constitute the so-called "alkaline earths." Calcium combines directly with most elements, including nitrogen with which it forms the nitride, Ca_3N_2. Its combination with oxygen is so intense that if effected at 300°C. the heat evolved suffices to volatilise the lime produced. Its specific gravity is about 1·54, depending upon its previous treatment. It melts at 810°C., but sublimes at a lower temperature; its specific heat is 0·160 at 20°C.; it is malleable and can be drawn into wire.

Compounds.—Calcium hydride, CaH_2, obtained by heating the metal in a current of hydrogen, is known as hydrolith, and was used by the French for filling dirigibles, since it is portable and on treatment with water yields one cubic metre of hydrogen per kilo. It is stable at 600°C in a vacuum. On electrolysis in a fused (eutectic) mixture of potassium and lithium chlorides, it gives hydrogen quantitatively at the anode, a matter of great theoretical interest (D. C. Bardwell). Calcium forms the monoxide, CaO, the peroxide, CaO_2, and possibly a tetroxide, CaO_4. The monoxide and the corresponding hydroxide are lime and slaked lime. The peroxide is obtained by the addition of hydrogen peroxide to lime water, the resulting hydrate, $CaO_2,8H_2O$, losing water on being heated to 130° and giving the peroxide as a pale buff-coloured powder. *It is used to a slight extent for bleaching and antiseptic purposes. The CaO_4 is obtained by warming the foregoing hydrate* on the water-bath with concentrated hydrogen peroxide; it has a strong yellow colour.

Whereas calcium chloride, bromide, and iodide are very deliquescent soluble substances, the fluoride is insoluble in water; this constitutes a striking contrast with the silver salts for the fluoride is the only soluble one in this case. Calcium fluoride, CaF_2, occurs as fluorspar or may be prepared as an insoluble white precipitate by mixing solutions of calcium chloride and sodium fluoride; it requires about 60,000 parts of water for solution at 18°. The chloride, $CaCl_2$, occurs in many natural waters and as a by-product in many manufacturing processes. According to conditions the crystals may contain 2, 4, or 6 molecules of water; the anhydrous chloride is obtained by heating the crystals in a current of hydrogen chloride above 200°, and is used as a desiccating agent (but not for ammonia or alcohols, with which it forms compounds). It melts at about 775°. The hexahydrate dissolves in water with absorption of heat, and if mixed with three-quarters of its weight of snow, it produces a temperature of − 55°C. At 175·5°, 100 parts of water will dissolve 297 parts of $CaCl_2$, and the solution boils a few degrees higher. Concentrated solutions find a limited use for laying dust. The bromide and iodide closely resemble the chloride.

"Bleaching powder" is said to be a compound of the chloride and hypochlorite, $CaCl_2$, $Ca(OCl)_2$, but it has been shown (E. A. O'Connor, 1927) that such a compound does not exist, so that its constitution is still indefinite. It is made by exposing thin layers of slaked lime to chlorine at 30–40°C. (*see* ALKALI MANUFACTURE and BLEACHING).

Calcium carbide, CaC_2, manufactured by heating lime and carbon in the electric furnace, is of great importance since it gives rise to acetylene (*q.v.*) on reacting with water. It reacts with the nitrogen of air in the electric furnace to give calcium cyanamide (*see* CYANAMIDE).

Calcium carbonate, $CaCO_3$, occurs in minerals (above) and in natural waters, in which it is kept in solution by atmospheric carbon dioxide as the bicarbonate, $Ca(HCO_3)_2$. The loss of this carbon dioxide by evaporation or heating of the solution results in the deposition of $CaCO_3$, and hence the "hardness" of the water due to this cause is called "temporary." The chalk thus deposited is called "fur" in boilers or kettles, but if it is produced by the dripping of water in caves it forms stalactites and stalagmites. It also occurs in the skeletons of sponges and corals. The solubility in water containing the amount of carbon dioxide normally derived from the atmosphere is 1 part in 16,000 parts, but under higher pressures of the gas it is much more soluble, and under a pressure of 15 atmospheres it seems to be entirely converted into the bicarbonate. "Precipitated chalk" is prepared by mixing solutions of calcium chloride and a soluble carbonate (usually that of sodium).

Calcium nitride, Ca_3N_2, is formed by heating calcium (preferably slightly impure, for the pure metal is almost inert) in nitrogen; it is a greyish-yellow powder, and is readily decomposed by water, with formation of ammonia.

Calcium nitrate, $Ca(NO_3)_2$, is a highly deliquescent salt; from its occurrence in limestone caverns and its disintegrating action on mortar, it is variously called "lime-saltpetre" and "saltpetre-rot." The anhydrous nitrate is phosphorescent and is known as "Baldwin's phosphorus." The hydrate, $Ca(NO_3)_2{\cdot}4H_2O$, is obtained in the "flaming arc" process for "fixing" atmospheric nitrogen, and is used as an artificial manure either directly or after conversion into ammonium nitrate.

Calcium phosphide, Ca_3P_2, is obtained as a reddish substance by passing phosphorus vapour over strongly heated lime. It is used as a marine signal fire ("Holmes lights") owing to its property of giving a spontaneously inflammable hydrogen phosphide on reacting with water. It may also be prepared by direct combination of calcium metal with phosphorus vapour.

Normal calcium phosphate, $Ca_3(PO_4)_2$, is the principal inorganic constituent of bones and hence of "bone-ash" (*see* PHOSPHORUS); it occurs as the concretion known as coprolites, and also in vast masses in *Florida* and in certain Pacific Islands. It may be obtained *artificially* as a gelatinous precipitate by mixing solutions of calcium chloride, sodium phosphate, and ammonia. It is insoluble in water, but soluble in solutions of hydrochloric or nitric acids. Basic (or Thomas) slag, a by-product of the steel industry, owes its use as a fertilizer to the calcium phosphate which it conains. The acid salt, $CaH_4(PO_4)_2$, obtained by evaporating a solution of the normal salt in hydrochloric or nitric acid, is very soluble, and together with calcium sulphate constitutes the artificial manure "superphosphate of lime," which is obtained by treating ground bones or coprolites with sulphuric acid. Other phosphates occur in guano and elsewhere. It is used in medicine; as a source of phosphorus; polishing powder; ceramics; porcelain manufacture; enameling; manufacturing milk glass.

Calcium sulphide, CaS, is formed by heating the sulphate with charcoal, or by heating lime in a current of sulphuretted hydrogen; fter being heated or exposed to the sun, it shows a phosphorescence, apparently in virtue of minute traces of impurities, especially compounds of the heavy metals, which it contains; hence it is known as "Canton's phosphorus" (John Canton, 1718–1772). The hydrosulphide, $Ca(SH)_2,6H_2O$, is obtained by saturating a cold suspension of lime with sulphuretted hydrogen; it is used as a depilatory. The di- and penta-sulphides, CaS_2 and CaS_5, are formed when milk of lime is boiled with flowers of sulphur; they form the basis of Balmain's luminous paint. They are also conained in "liver of sulphur," a complex mixture prepared by heating together lime and flowers of sulphur. It is also used in medicine.

Calcium sulphide, $CaSO_3{\cdot}2H_2O$, is prepared by passing sulphur dioxide into milk of lime; excess of the former leads to a solution of "bisulphite of lime," used for bleaching wood pulp in the manufacture of paper.

Calcium sulphate, $CaSO_4$, occurs as certain minerals and in water, in which it is one of the salts causing "permanent hardness," *i.e.*, it is not removed on boiling. As a white crystalline precipitate it is obtained on mixing solutions of calcium chloride and sodium sulphate; 100 parts of water dissolve 0·24 parts at 15°C. The ordinary dihydrate is converted into a semihydrate, $CaSO_4,\frac{1}{2}H_2O$, on being heated to a suitable temperature (120—180°); this hydrate is called Plaster of Paris, having first been made from the gypsum of Montmartre.

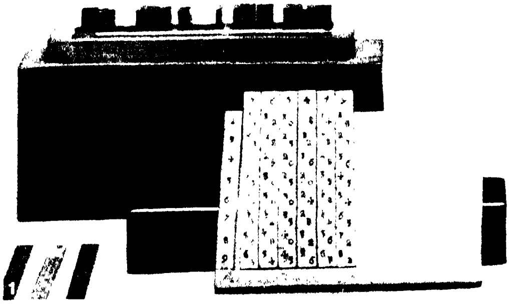
There are numerous calcium silicates in various minerals, of which the most important are zeolites and felspars. H. Le Chatelier obtained $CaSiO_3$, Ca_2SiO_4, $Ca_3Si_2O_7$, and Ca_3SiO_5 artificially.

Detection and Estimation.—Most calcium compounds impart an orange-red colour to the flame of the Bunsen burner, more especially if they are moistened by hydrochloric acid. Spectroscopically, calcium exhibits two characteristic lines—Ca_α, orange, λ 6163, and Ca_β, green, λ 4229. Calcium is not precipitated by sulphuretted hydrogen either in acid or in ammoniacal solution, but is precipitated by ammonium carbonate in the presence of ammonia. Sulphuric acid precipitates the white sulphate except from very dilute solutions; and ammonium oxalate gives the oxalate as a white precipitate, insoluble in dilute acetic acid. Calcium is usually separated in this form and subsequently dried and either converted to the oxide by heat or to the sulphate by sulphuric acid, and weighed as such.

Calcium salts are not toxic, except possibly in very large doses; deficiency of calcium in the diet leads to "rickets," owing to the lack of material for bone formation. (A. D. M.)

CALCULATING MACHINES. The evolution of numbering and of numerical calculation is embodied in that simple but great mechanical calculating instrument known as the abacus. (*See* ABACUS.) The efficiency of this instrument in expert hands has been recognized from early times, and it is still largely employed in India, China, Russia and Japan.

In 1617, John Napier of Merchiston published a description of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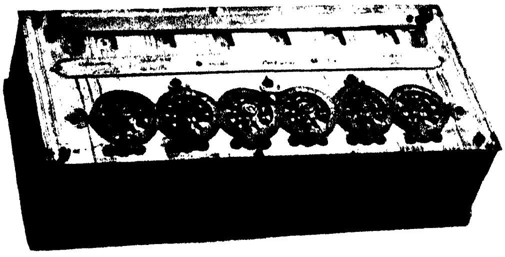
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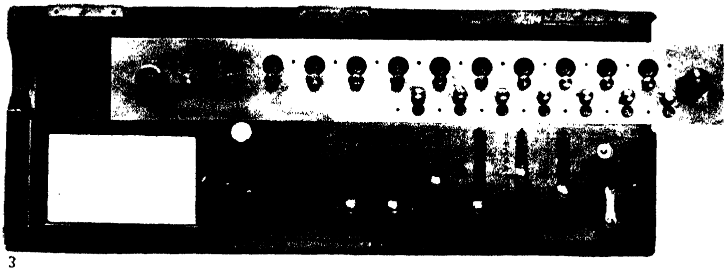
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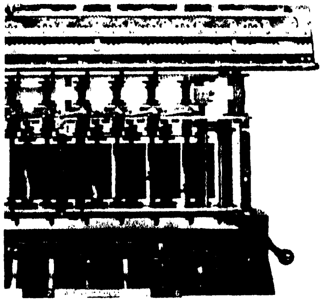

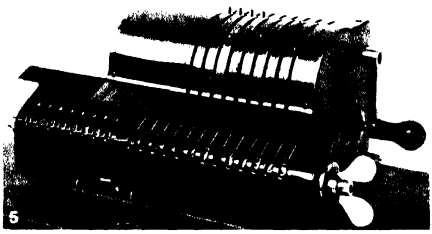
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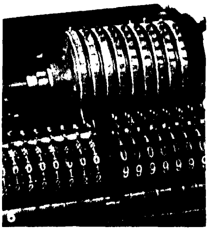

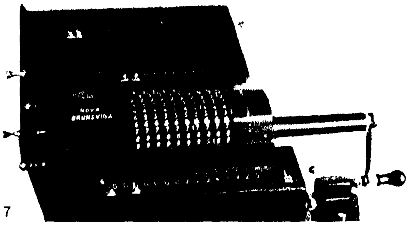
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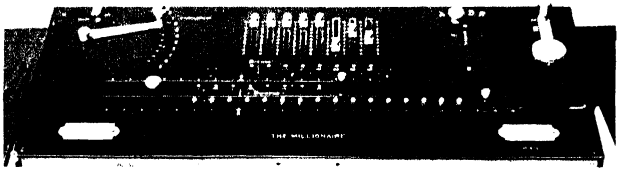

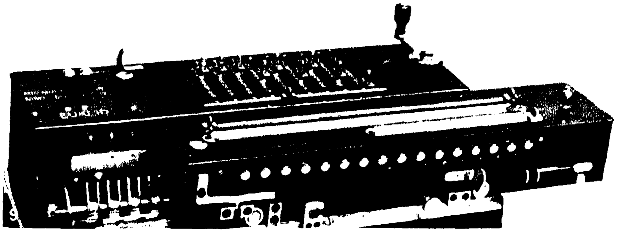
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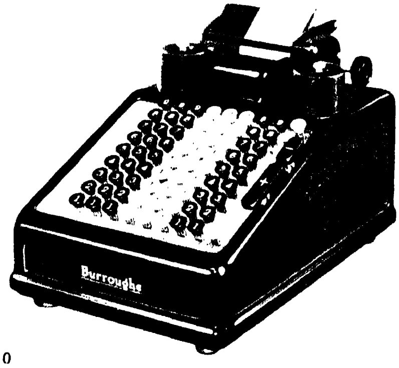

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BY COURTESY OF (1-9) THE SCIENCE MUSEUM, SOUTH KENSINGTON; (10) BURROUGHS ADDING MACHINE COMPANY

STAGES IN THE DEVELOPMENT OF CALCULATING MACHINES

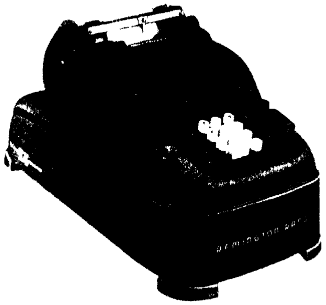
ıultiplying, showing method for multiplying
possible by reading diagonally across strips
1642. Operated by turning wheels below;

7. Later model of Brunsviga calculator
8. Millionaire calculating machine 1914, Sl
9. Me

by hand lever, showing portion of ı

perform multiplication and div

CALCULATING MACHINES



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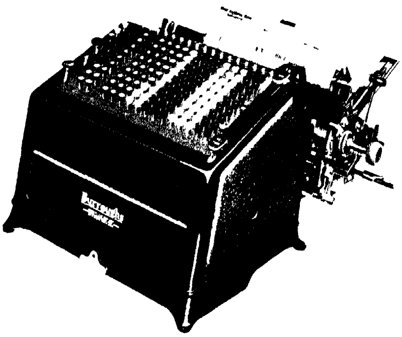

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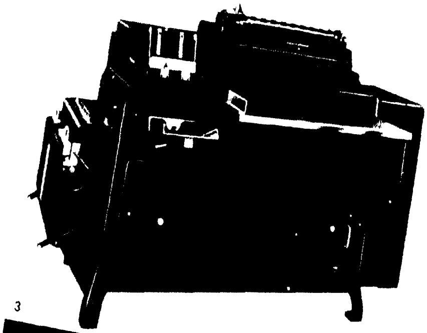

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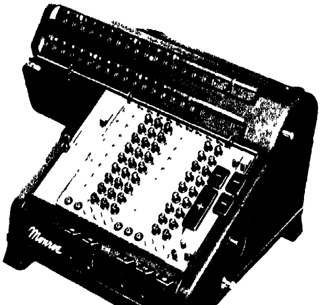

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EXAMPLES OF CALCULATING MACHINES AND SLIDE RULES

1 Remington Rand automatic printing calculator performs addition, subtraction, multiplication and automatic division with printed record

2 Burroughs high speed bank poster prints all balances except overdrafts automatically

3 International alphabetic accounting machine, an important unit of the Punched Card system

4 Monroe calculator with fully automatic positive and negative multiplication, division, short cut and carriage return

5 Slide rules: (A) Mannheim type (B) Dunlop & Jackson's log log slide rule (C) Perry's log log slide rule

his numbering rods, since known as "Napier's bones," for facilitating the multiplication of numbers. These were widely used during the 17th century, and various modifications have been made since they were introduced. The set shown in Pl. I., fig. 1, which belonged to Charles Babbage, is preserved in the Science Museum at South Kensington, where there are other sets, some of which have come from the Napier family. The strips bear the columns of numbers of the ordinary multiplication table. To multiply 765479 by any number, the strips are selected from the case and arranged as shown. The "sevens" strip bears the numbers 7, 14, 21, 28, etc., but written in the form $\boxed{/_7}$, $\boxed{^1/_4}$, $\boxed{^2/_1}$, $\boxed{^2/_8}$ etc. Horizontally opposite 6 on the index to the left, the product 6×765479 is indicated. The rule is: For units, put down the lower right-hand figure, for "tens," etc., add diagonally in pairs and we get 4592874. If the multiplier consists of several figures, the product of each with the multiplicand is read off separately, written down as in ordinary multiplication and added up. Sir Samuel Morland in 1666 invented a multiplying instrument, in which Napier's rods are replaced by rotatable disks, and the figures, instead of being in the two diagonal halves of squares, are arranged near the edge of the disk at opposite ends of diameters. For any given multiplicand, set by placing the appropriate disks on spindles, the partial products were at once indicated by means of a slot-marker, actuating the disks through a rack and pinions. Gaspard Schott in 1668 described the cylindrical form of Napier's bones, which facilitated manipulation. A similar instrument, stated to have been the property of John Napier, is preserved in the Science Museum. In 1885 M. Genaille made the further improvement of eliminating the slight but repeated mental effort required to add the pairs of adjacent figures before writing down the separate products. These ingenious devices, though in some cases embodying rudimentary mechanical arrangements, are not usually described as machines.

The First Real Calculating Machine.—This, as the term is usually understood, was invented by Blaise Pascal in 1642. Pascal made a considerable number of machines, a few of which are preserved in the Conservatoire des Arts et Métiers at Paris. Figure wheels, each bearing the numbers 0 to 9, are mounted in a box and have parallel axes; with a stylus or peg, a (Pl. I, fig. 2) horizontal wheel at the front and immediately under the cover of the machine can be advanced one-tenth to nine-tenths of a complete turn, the same movement being transmitted by pin wheel gearing to the corresponding figure-wheel. The uppermost figure of each figure-wheel is seen through a sight-hole in the cover. During the movement of the figure-wheel from 9 to 0, a "carrying" device moves the next figure-wheel to the left through one-tenth of a revolution. In machines made by Pascal for adding livres, sous and deniers, the wheels for sous and deniers were modified for recording 0 to 19 and 0 to 11 respectively In 1666 Morland invented a compact little instrument for the same purpose, measuring 3in. by 4in. by less than ¼in thick. It was operated by a stylus, but there was no tens-carrying device; the numbers to be carried were registered on small counter-disks. Viscount Charles Mahon (afterwards the 3rd Earl Stanhope) in 1780 improved Morland's instrument by providing a tens-carrying device. This acted simultaneously from the units wheel to those of higher denominations, and the addition of 1 to 999,999, for instance, was almost beyond the capacity of the instrument owing to the great force required. Dr. Roth in 1842 improved this type of stylus-driven instrument, by arranging for the successive carrying of tens. Low-priced instruments of this general type are still being made in considerable numbers.

Multiplication Machines.—Multiplication is really repeated addition. For example, 7543×634 = (7543+7543+7543+7543) + (75430 + 75430 + 75430) + (754300 + 754300 + 754300 + 754300+754300+754300). Multiplication can therefore be performed in a simple manner by all adding machines of the Pascal type, but the time occupied would be about the same as by the ordinary figuring method on paper. In the above example, for instance, there would be 52 separate operations by hand, each operation involving the placing of the stylus in its proper hole and by its means driving the figure-wheel through its proper arc.

After Pascal's invention the next great advance was due to Gottfried Wilhelm Leibniz, who in 1671 conceived the idea of a calculating machine which would perform multiplication by rapidly repeated addition. It was not until 1694 that his first complete machine was actually constructed. The figure-wheels on the fixed portion of the machine register the results of additions, rapidly repeated up to nine times of the multiplicand, which was set on a sliding portion, movable by steps into positions corresponding to units, tens, hundreds, etc. This machine was preserved in the Royal Library at Hanover, and examination has shown that the tens-transmission mechanism was never quite reliable in operation. A second machine was made in 1704, but this has disappeared.

An important unit of the machine was a stepped wheel—a cylindrical wheel or drum having on a portion of its outer surface nine teeth of increasing length, from one to nine. This element is embodied in many subsequent machines which perform multiplication by repeated addition, and is in considerable use at the present time.

During the 18th century many attempts were made by different mathematicians and mechanists to evolve a satisfactory machine which could be made commercially. Among these machines may be mentioned those of Lepine (1725), Leupold (1727), Boistessandeau (1730), Gersten (1735), Pereire (1750), Hahn (1774), Mahon (Earl Stanhope) (1775 and 1777), and Müller. The chief difficulty, however, was the high degree of accuracy necessary in the construction of the details such as wheel teeth.

The First Successful Calculating Machine Manufactured on a Commercial Scale.—This was that invented in 1820 by Charles Xavier Thomas, of Colmar in Alsace. This model forms a distinct type which has persisted up to the present day, with modifications and improvements in detail due to various makers, including Darras of Paris, successor of the original makers. By 1865, 500 machines had been made, and 1,000 more were made during the next 13 years. The example shown in Pl. I, figs. 3, 4, was made about 1866.

The mechanism may be divided into three distinct portions concerned with setting, counting and registering respectively. These are arranged in order from front to back. Any number up to 999,999 may be set by moving the pointers in one or more of the six slots in the fixed coverplate, to the numbers 0 to 9 engraved on the cover plate to the left of each slot. The movement of any of these pointers slides a small pinion with ten teeth along a square axle, underneath and to the left of which is a Leibniz stepped wheel. This is driven from the main shaft by means of a bevel wheel, and the small pinion is thus rotated by as many teeth as the cylinder bears in the transverse plane corresponding to the digit set. This amount of rotation is transferred through one of a pair of bevel wheels carried on a sleeve on the same axis, to the "results" figure-wheel on the back row on the hinged plate. This plate also carries the figure-wheel recording the number of turns of the driving crank for each position of the hinged plate. According to whether the lever at the top left-hand corner of the fixed plate is set for "Addition and Multiplication" or "Subtraction and Division," one or other of the pair of bevel wheels is placed in gear with a bevel wheel underneath a "results" figure-wheel, which is thereby rotated anticlockwise in the direction 0 to 9, or clockwise respectively. The actual operation in multiplying 3,042 by 536, for example, may be performed as follows.—First lift the hinged plate, turn and release the two milled knobs so as to bring all the figure-wheels to show zero. Lower the hinged plate in its position to the extreme left. Set the number 3,042 on the four slots on the fixed plate. Set the lever on the left to "multiplication" and turn the handle, which can be turned only in a clockwise direction, six times. Lift the hinged plate, slide it one step to the right and lower it into position. Turn the handle three times. Step the plate again one point to the right and turn the handle five times. The product 1,630,512 will then appear on the top row, and the multiplier 536 on the next row of figures

In 1878, the modern German calculating machine industry was founded by Arthur Burkhardt, who commenced the manufacture of this type of machine, under the title of "Burkhardt Arithmometer." Amongst the machines of this form constructed by other firms are—Saxonia (1895), Peerless (1904, the late keyboard models being known under the name Badenia), Gauss (1905; a small circular type, embodying a circular stepped plate in place of the Leibniz wheel), Archimedes (1906), Tim (1907, made with two slides under the name Unitas), Hermes (1911), Record (1913), Rheinmetall (1924)—in Germany; Layton (1883, known also as the "Tate"), Edmondson (1885, a circular type)—in England; Graber (1905), Austria (*c.* 1906, known in Germany as the Austro-Germania), Bunzel-Delton (1908)—in Austria; Fournier-Mang (1910)—in France; Kuhrt (1923) in Switzerland; Allen (1927) in the United States of America.

Machines of the Odhner Type.—In 1875 Frank Stephen Baldwin patented a machine in which the Leibniz stepped wheel was replaced by a wheel from the periphery of which a variable number of teeth (1 to 9) could be protruded. About the same time W. T. Odhner designed a machine embodying the same device. This type of machine has been made and developed extensively in Germany by Grimme Natalis and Company, since 1892, under the name "Brunsviga." By 1912, 20,000 machines of this type had been constructed by this firm alone. An early example made in 1892 is shown in Pl. I, figs. 5, 6.

Though the machine performs multiplication by repeated addition, as in the Thomas type, the use of the thin Odhner wheel instead of the Leibniz wheel, led to a more compact design. The Odhner wheels (nine in the example shown) fit very close together on the axle at the back. A setting lever, the end of which projects through a slot in the cylindrical portion of the cover plate, forms part of each wheel. If a lever is set against any figure (1 to 9) of its slot, a corresponding number of teeth are made to project from its wheel. When the operating handle is turned, these teeth gear with small toothed wheels of the product register, which in turn gear with the number wheels in front. The product register is mounted on a longitudinally movable carriage arranged in front of the machine, which carries also a second counter for registering the multiplier in the case of multiplication and the quotient in division. For addition and multiplication, the handle is turned in a clockwise direction; for subtraction and division, in the reverse direction, no change of gear being necessary as in machines of the Thomas type. The carriage is stepped to the right or left by pressing one or other of the projecting pieces in front. Zeroization of the product and multiplier registers is effected by turning the butterfly nuts on the ends of the carriage through a complete revolution.

Under the original Odhner patents and since these have run out, this type of machine has been made under various names by many firms in different countries. Among these machines are the Brunsviga (1892, known in France as the "Rapide"), Monopol-Duplex (1894), Berolina (1901), Triumphator (1904), Thales (1911), Teetzmann (1912, known in England as "Colt's Calculator"), Lipsia (1914), Rema (1915), Hannovera (1921), Orga (1921), Monos (1923), Gauss (1923), Mira (1924), Hamann-Manus (1925) in Germany; Dactyle (*c.* 1905), Sanders (1912), Muldivo (1924) in France; Marchant (1911), Lehigh (1919), Arrow (1921), Rapid (1923) in the United States; Original-Odhner (a model adapted for British currency is sold in England under the name "Lusid"), Facit (1918), Odhner Universal (1925), Mercur (1925) in Sweden; Demos (1923, recently sold in England under the name "Eos") in Switzerland; Calco (1921) in Denmark; and the Britannic (1922) in England.

The machine, which is made in various sizes and capacities, has been steadily modified and improved in details of construction up to the present time. In the later model by the original German makers, which was issued at the beginning of 1927 under the name Nova Brunsviga (Pl. I, fig. 7), there is a change of design. Among other new features is a device by which the result registered on the product dials can be instantly transferred to the setting levers. In a model previously introduced—the "Triplex"—giving 20-figure results, the result register can be divided into two parts, enabling multiplication of two different numbers by the same multiplier to be carried out in one operation. Another type known as the "twin" (Brunsviga, Marchant) consists of two machines coupled together for operation by a single crank.

Key-driven Machines.—The keyboard type of calculating machine, which originated and has been developed chiefly in the United States, may be divided into two distinct classes, key-driven and key-setting. In the former the energy necessary to drive the machine is provided by simply depressing the keys, without any auxiliary movements. The first key-driven adding machine which was patented in U.S.A. by D. D. Parmalee, in 1850, could add only a single column of digits at a time. Many others of this limited capacity were invented before 1887. In this year Dorr Eugene Felt patented his Comptometer, which was the first successful key-driven multiple-order calculating machine. In the first models, each key had to be operated separately so as to ensure the proper carrying of the tens. In subsequent models many improvements were made which contributed to speed, ease and accuracy of operation. In the "Duplex" model introduced in 1903, simultaneous depression of keys in every column, without interfering with the proper carrying of tens, became possible for the first time. This constituted a great advance, and an extremely high speed in operation was thereby attainable. Later, in order automatically to prevent the operator from overlooking any errors which might arise from imperfect operation, the "controlled-key" model was introduced. Interference guards at the side of the keytops prevented accidental depression of a key near the one being operated. If a key is not given its full downward stroke, the keys in all the other columns are immediately locked, and the numeral wheel in the column where the error is made shows a figure in the answer register standing out of alignment. The error can then be corrected by completing the unfinished stroke. By another automatic block device, no key can be depressed again until it has completed its up stroke. In some models, a short-pull zeroizing lever replaces the longer double-stroke lever, and at the beginning of a new calculation a clear register is indicated to the operator by visible, audible and sense-of-touch signals. In some models the power required to actuate the adding mechanism is supplied electrically when the key is depressed.

Machines of this type include: Burroughs, Comptometer in the United States; Plus in England (known as Torpedo in Germany); and Direct II in Switzerland.

Adding and Listing Machines.—In 1872 E. D. Barbour incorporated a printing device with an adding machine. Other inventions of this type were made by F. S. Baldwin (1875), H. Pottin (1883) and A. C. Ludlum (1888). The first really practical adding and listing machines were produced by D. E. Felt in 1889, and by W. S. Burroughs in 1892.

Up to the present time well over a hundred different models of the Burroughs machines have been designed and more than a million machines have been made. In one of these machines the essential element is a lever pivoted near the middle, and carrying at one end a set of type figures for printing, and at the other end a segmental rack, with which an adding wheel is alternately in and out of gear. The depression of a numeral key brings the end of a stop wire into a position which limits the possible downward travel of the rack. When the operating handle is actuated, this downward travel, during which the adding wheel is out of gear, raises the other end of the lever so as to bring the proper type figure into position for printing. After the printing is effected, the wheel comes into gear with the rack which during its ascent turns the adding wheel through a number of teeth equal to the number of the depressed key.

These machines may be grouped as follows: (*a*) Single counter adding machines, with or without direct subtraction. Where direct subtraction is provided for, the item is set up on the keyboard as if for addition, but the depression of a "subtraction" control key causes the item to be subtracted. (*b*) Duplex and multiple counter adding machines, with or without direct subtraction. The provision of two or more separate counting mechanisms enables operations to be carried out together, which on single counter machines have to be performed separately. (*c*) Billing, accounting and bookkeeping machines. These are designed to deal with such work as the preparation of invoices, reports, business forms and allied documents; in some, typewriting is combined with arithmetical computations and recording. The first practical machine of this type was the Moon-Hopkins billing machine, invented by Hubert Hopkins. This machine embodies a direct multiplication mechanism of the Bollée and Millionaire type. Machines of this class have been developed to a high degree of perfection and complexity so that very elaborate operations may be performed automatically. In some, the operations such as addition, subtraction, printing, register selection, etc., are key controlled and in others they are controlled by elaborate programing devices operated by the position of a movable printing carriage. In some models, there is an auxiliary keyboard so that new numbers may be set up while the previous ones are being processed.

In accordance with this broad classification, the groups into which the many machines made in the United States at the present time would fall are indicated in the following list (the larger firms make both hand and electrically operated machines, in various capacities): R. C. Allen (*a, c*), Allen-Wales (*a, b, c*), Barrett (*a*), Burroughs (*a, b, c*), Corona (*a*), Monroe (*a, b, c*), National (*a, b, c*), Remington (*a, c*), Swift (*a*), Underwood Sundstrand (*a, b, c*), Victor (*a*).

The most common type of keyboard is that in which there is a key for each digit of each order, the so-called "full keyboard." Another type, using only a single set of ten keys which automatically sets the different orders in succession, was employed on the Dalton in 1902 and on the Sundstrand in 1914. When equipped with a "repeat" feature, the ten-key adding machine can be used for multiplication by repeated addition since the introduction of a zero moves the number set on the keyboard to the next place. Some machines of this type (Remington-Rand, Pl. II, fig. 1) incorporate special controls for facilitating the operations of multiplication and division. The ten-key set-up is also used on some movable carriage calculators such as Friden, Mathematon, Allen (Facit).

In 1916 the design and construction of the American type of machine was also taken up in Germany, where it was considerably developed. Among these machines, made in various styles and capacities, are the Continental (1916), Adma (1919), Goerz (1921), Astra (1922), Naumann (1922), Votam (1922), Tim-Add (1923). Typewriters with adding mechanism are represented by the Urania-Vega (1920) and the Mercedes-Elektra (1924). There are also several adding mechanisms made for use in combination with a standard typewriter.

Adding mechanisms have been incorporated into numerous other commercial devices such as the addressograph which prints from plates while carrying a running total.

Cash Registers.—Of all the different types of machines embodying adding mechanisms, the cash register, used in most retail stores, is the most familiar to the general public. More than 4,000,000 cash registers have been made by the National Cash Register Co. since the pioneer firm was founded by John H. Patterson in 1884. Other standard cash registers are made by Burroughs and the Ohmer Corporation.

Though its original object was the prevention of dishonesty in retail stores, the machine has been developed so as to provide automatic records of all types of retail transactions, to issue receipts for customers, and to give detailed information to aid store management. In the most highly developed model of the "National," 27 individual totals, corresponding with the sales of each clerk or each department, may be accumulated, as well as three grand totals. The machine has also been adapted for the purposes of accounting and bookkeeping.

Since 1919 a combination type of cash register has been developed, in which a cash drawer is combined with an adding and listing machine. This possesses the advantage that the latter can be used independently when required for general purposes. When used in combination, provision is made for the automatic opening of the drawer as each item is dealt with.

Direct Multiplication Machines.—Attempts to transform Napier's rods into mechanically operative form were made in the United States by Edmund D. Barbour (1872) and Ramon Verea (1878), who patented their devices, which, however, never went beyond the first model stage. The first machine to perform multiplication successfully by a direct method, and not by repeated addition, was invented by Léon Bollée in 1887. The essential feature of the mechanism is the multiplying piece, which consists of a series of tongued plates, representing in relief the ordinary multiplication table up to "nine times." Though excellent in action, few of these machines were made, chiefly because the inventor soon became fully occupied with his work in connection with automobilism.

The "Millionaire" machine (Pl. I, fig. 8), patented by Otto Steiger in 1893, was first made and marketed by Egli in 1899. It embodies the mechanical multiplication table invented by Bollée, by the operation of which only one turn of the driving handle is required for each figure of the multiplier. The carriage, or "recorder," being moved to the extreme right, the multiplication lever is set successively to one of its positions 0 to 9 in accordance with the figures of the multiplier, starting with the figure of the highest order. At each setting of the multiplication lever, the driving crank is turned once; and during the second quarter of each turn the carriage is automatically "stepped" to the left.

The mechanism includes nine parallel toothed racks, the ends of which are in line successively with either the tens or the units group of the tongues of a tongue plate. During each rotation of the crank the tongue plates are twice thrust against the ends of the racks; during the first thrust the tens tongues operate, and the units tongues during the second thrust. In the machines as now made the slot-markers have been replaced by a keyboard.

Other Multiplication and Division Machines.—Since 1900 many improved machines which multiply by repeated addition and divide by repeated subtraction have appeared, with gradual development in speed and convenience.

The Ensign, made in Boston about 1905, had many features later generally adopted: motor-drive, keyboard set-up, multiplication keys, and self-stepping carriage. There were nine multiplication keys, and the depression of one caused the appropriate number of additions of the multiplicand set on the keyboard.

The Mercedes-Euklid (Pl. I, fig. 9) was designed by Ch. Hamann and marketed in 1910. Externally, in the general disposition of its main parts, it resembles the Thomas machine, but internally there are many innovations. The Leibniz wheel is replaced by a series of ten parallel racks, actuated from the driving handle by means of a connecting rod and proportion lever. The carriage with its mechanism slides on rollers along guides in the frame of the machine, and can be "stepped" longitudinally without the lifting which is necessary in machines of the Thomas type. The pushing of the carriage to the right stretches a spiral spring the contraction of which supplies the force for "stepping," which is controlled by the depression of a key. For division the left-hand member of the pair of levers at the top left-hand corner is placed at the bottom of its slot and the right-hand member at the top. The handle is now turned until it locks, which is the signal for reversal of the levers; the handle is turned again until it locks, when the levers are again reversed. This cycle of operations is repeated until the carriage has returned to its normal position, when the quotient is given in the front row and the remainder in the middle row of figures. Multiplication is performed as with the Thomas machine, starting with the carriage to the extreme right.

In more recent examples the slot markers are replaced by a keyboard, and both multiplication and division can be performed automatically.

The Madas, first introduced by Hans W. Egli in 1908, resembles the Thomas type. The operations of addition, multiplication and subtraction are performed in the usual way, but there is additional mechanism which enables division to be performed quite automatically, after setting the dividend and divisor. The ringing of a bell announces that the quotient and remainder are recorded.

The Monroe, incorporating previous designs by Frank S. Baldwin, was introduced in 1911 by Jay R. Monroe and Baldwin and was the first keyboard rotary machine to attain commercial success. The original model was operated by a crank as in the Odhner type. The wheels for adding are made in two coaxial parts, one with five equal teeth and the other with four, arranged in steps. The setting of a particular figure adjusts the two parts towards each other so as to enable 1, 2, . . . 9 teeth to gear with the counting wheel when the handle is turned. The machine (Pl. II fig. 4) was later motorized and numerous key-controlled features such as automatic division, motorized carriage, electric clearing, etc., incorporated.

In addition to the Marchant of the Odhner type (1911) previously mentioned, there have appeared numerous keyboard electrical models with various automatic features. The recent models contain an improved method of operating the adding wheels which permits a much higher speed (1,350 r.p.m.) in the adding operation.

The United Listing Multiplier and Calculator (see *Punched Card Machines*), which appeared in 1926 formed the product of two numbers and printed the numbers and the product.

The International Multiplier (1932) (see *Punched Card Machines*) employs an electrical multiplication table for forming partial products which are accumulated to form the complete product.

Relay and Electronic Calculators.—In all the machines described so far in this article the basic unit is an adding mechanism employing adding wheels. Among the substitutes for the adding wheel which have been tried, two are of particular interest, the electro-mechanical relay and the electronic tube.

Relay networks have been used extensively by International and by Bell Telephone Laboratories. One of the International machines contains more than 2,000 relays and performs six-digit multiplications at the rate of 12,000 per hour. The Bell Calculator which records on a teletype tape operates on the significant-figure basis instead of the fixed decimal.

The electronic tube which can operate in the order of a millionth of a second naturally recommends itself for high-speed calculators, and many such units have been built. Many of these developments were undertaken during World War II, and complete information is not yet available to the public.

Punched Card Machines.—In connection with the U.S. census of 1890, an automatic system (known as the Hollerith system) was invented for dealing analytically and statistically with the enormous mass of information obtained. This system, which was also applied to the results of the British census of 1911, has been modified and developed to meet the needs of large commercial firms.

The basis of the system is a Jacquard card on which the information is recorded by means of punched holes. The card, which is about 8 in. long and 3 in. high, is divided into vertical columns with 12 punching positions in each column. Ten of these positions indicate the digits 0 to 9 and the other two indicate operational control such as plus and minus; a letter is indicated by a combination of two holes in a column.

Once the given data has been so recorded the cards are passed through the various machines and the required operations performed automatically on each card. The operations include sorting, adding, subtracting, multiplying, reproducing, listing, collating; all the operations required in modern business. Sorting is done at the rate of 400 cards a minute, and adding (simultaneously in several counters), listing and reproducing at the rate of 100 or more.

In the International machines the cards are read by means of electrical contacts made through the holes, and the various parts of the machine such as the printing bars and the adding wheels are controlled by means of electro-magnets. The electrical impulses are routed through the machine by means of relays and plugboards similar to those in a telephone switchboard. These pluggable connections provide the operator with a quick and flexible means of controlling the operation of the machines almost at will.

The Remington Rand machines read from the cards mechanically by means of pins passing through the holes in the cards, and the operation of the various parts of the machine is accomplished through flexible cables. The multiplying machine which incorporated the United, mentioned above, reads from the cards and also from the keyboard and provides a printed record as well as the punched results.

Difference and Analytical Engines.—In 1812, Charles Babbage (1792–1871) conceived the idea of a calculating machine of a different type from those previously described. The object of the machine was to calculate and print mathematical tables such as tables of logarithms. The machine worked on the method of differences and was known as a "difference engine." The principle underlying the method may be understood by taking a table such as the table of cubes of successive numbers 1, 2, 3, etc., and subtracting each tabular number from the following one, obtaining another column of figures, called the first order of differences. Treating the numbers in this column in the same way, a column of second differences is obtained; on differencing a third time (in this particular case) a constant difference (6) is obtained. By reversal of the process, knowing the constant third difference and the numbers shown at the top of the columns, it is possible to obtain all the rest of the numbers by simple addition. It is the function of a difference engine to effect these additions successively in the proper order so as to obtain the desired series of tabular numbers automatically, once the initial numbers are set.

Babbage's difference engine was commenced in 1823 by authority and at the cost of the British government. The work was suspended in 1833, and in 1842 the government decided to abandon the machine on the ground of the estimated expense of its completion. The whole engine was intended to have 20 places of figures and six orders of differences. In 1833 a large part of the engine had been made and a small portion had been assembled in order to show the action of the mechanism.

From 1833 Babbage devoted his energies and resources to the design and construction of an "analytical engine," the object of which was to evaluate automatically any mathematical formula. Features of the difference engine were to be embodied in this new engine and the various operations were to be controlled by punched cards of the Jacquard type. The scheme proved to be too ambitious, and the machine was left unfinished when Babbage died. Portions of the machine, with all his notes, drawings and notations are preserved in the Science museum.

From 1834 to 1853 George Scheutz of Stockholm and his son Edward designed another difference engine, the first complete example being constructed by C. W. Bergström. It was exhibited in operation in Paris and London, and finally purchased for the Dudley Observatory, Albany, U.S.A. A second example was made by Bryan Donkin in 1858 for the General Register office, Somerset house, and used during the next few years for computations in connection with the preparation of the English life tables. Dr. Farr, the author of this book, states: "This volume is the result; and thus—if I may use the expression—the soul of the machine is exhibited in a series of tables which are submitted to the criticism of the consummate judges of this kind of work in England and in the world." Other engines of this type were designed and made by Martin Wiberg in Sweden, and G. B. Grant in the United States; others were designed by Léon Bollée in France, and Percy E. Ludgate in Ireland, but were not constructed.

With the development for commercial purposes of reliable adding mechanisms, the difference engine as conceived by Babbage has now become generally available in the form of multi-register bookkeeping and accounting machines. Keyboard machines, such as Burroughs and National in use at the British Nautical Almanac office, form differences and build tables from differences by means of key control; the Burroughs at the U.S. Naval observatory operates automatically under control of the movable carriage. The special International Difference Tabulator of the Columbia Statistical bureau (1928) performed these operations on the two-cycle basis envisaged by Babbage.

We have seen how Babbage's analytical engine failed because of engineering difficulties; with the development of reliable calculating units for commercial purposes, interest in the use of these units in elaborate scientific calculators grew. The International electrical punched card units were particularly well suited for the purpose since they provided not only for arithmetical operations under electrical control but for the automatic reading and recording of numbers. During the last two decades a number of special machines were built by this company in collaboration with various scientists and have been in use on a wide variety of scientific problems. The difference tabulator (1928) was used primarily on statistical work. The unit of the Thomas J. Watson Astronomical Computing bureau at Columbia university (1933) was used for general scientific calculations including the automatic numerical integration of the differential equations of planetary motion. Mathematical tables in the form of punched cards were used and sequencing was controlled by revolving disks. The IBM sequence controlled calculator at Harvard university (1943) is the largest and most completely automatic calculator in operation (1946). This machine operates automatically under the control of a sequence tape; multiplication and division with 23 significant figures are possible; mathematical tables are used in the form of punched tapes.

Non-Digital Machines.—In all the machines described so far the basic operation is that of counting discreet units; these machines are called digital machines. There is also a large class of calculators which involve measurement rather than counting; in these devices physical quantities such as length, angle, electric current, hydrostatic pressure, etc., are combined and measured. In the non-digital machines the accuracy is limited to the precision with which the quantities involved can be measured, whereas in the digital machines the accuracy may be increased to any desired limit by increasing the number of counter units. Non-digital calculators (*see* MATHEMATICAL INSTRUMENTS) include the slide rule, the planimeter, the harmonic analyzer, the differential analyzer, the network analyzer, position computers on ships and aircraft, fire-control computers used in gunnery, bomb-sight computers, devices for solving linear equations (mechanical, hydraulic, electrical and electronic), the electrical test-scoring machine, and many others. Most of these devices are designated for a special problem or group of problems; the basic slide rule, however, is an arithmetical instrument for general computation.

Slide Rules.—The logarithmic slide rule is a compact device for rapidly performing calculations with limited accuracy. The invention of logarithms in 1614 by John Napier of Merchiston, and the computation and publication of tables of logarithms, made it possible to effect multiplication and division by the more simple operations of addition and subtraction. (*See* LOGARITHMS.) In 1620 Edmund Gunter plotted logarithms on a two-foot straight line. With such scales, multiplication and division were performed by addition and subtraction of lengths by a pair of dividers.

William Oughtred, according to his own statement (1633), constructed and used as early as 1621 two of these Gunter's lines sliding by each other so as to do away with the need for dividers. The lines were used in both the straight and circular forms. In the former the scales were held against one another by the hands; in the latter, dividers were replaced by an "opening index"—really a pair of dividers fixed centrally on the circular scale. Richard Delamain in 1630 gave the first published description of a circular slide rule, both in the flat and cylindrical forms. Thomas Brown introduced the spiral logarithmic line in 1633.

The first known slide rule in which the slide worked between parts of a fixed stock was made by Robert Bissaker in 1654. Others were due to the enterprise of Seth Partridge (1657), Henry Coggeshall (1677)—a slide in a 2 ft. folding rule adapted to timber measure, and Thomas Everard (1683) for gauging purposes. The one for gauging purposes, approximated in dimensions and arrangement of scales, to the present-day 10-in. slide rule, and many thousands were made and sold during the period 1683 to 1705. The usefulness of the slide rule for rapid calculation became increasingly recognized, especially in England, during the 18th century, and the instrument was made in considerable numbers, with slight modifications.

Improvements in the direction of increased accuracy in graduation, etc., were initiated by Boulton and Watt from about 1779 in connection with calculations in the design of steam engines at their works at Soho, Birmingham. The rule evolved, which was the first designed for engineers, became known as the "Soho" rule. It was made by W. and S. Jones, Rooker, Bate and Nairne and Blunt.

The runner or cursor, though its advantages had been pointed out by Robertson (1778) and Nicholson (1787), was not added by instrument makers until Tavernier-Gravet introduced the Mannheim type of slide rule in 1850. This slide rule was much used in France and since about 1880 was imported in large numbers into other countries. Up to this period the rule had been constructed usually of boxwood and occasionally of brass or ivory but a great improvement was introduced in 1886 by Dennert and Pape in Germany by dividing the scales on white celluloid, which gave a much greater distinctness in reading. This material is now almost universally adopted, and the slide rule made by such firms as Nestler, Faber (Germany), Keuffel and Esser (U.S.A.), Tavernier-Gravet (France) and Davis (England) attain a high degree of perfection.

The disposition of the scales in the Mannheim rule (Pl. II, fig. 5a) is the arrangement still adopted in the great majority of rules made at the present time. The A and B scales are double lines as in the Everard, Coggeshall and Soho rules, but the C and D scales are single lines like the D scale of the Soho rule. At the back of the slider are scales giving the sine and tangent scales and a scale of equal parts. Applied in conjunction with the scales on the face of the stock these are used for reading the values of sines, tangents and logarithms respectively, and in computations involving these factors.

To secure an additional significant figure, the length of the logarithmic scale has to be increased ten times. To keep the dimensions of a slide rule bearing such a scale within reasonable limits four different types of design have been evolved:—(*a*) The flat spiral form. Examples have been made at various times since the invention of the slide rule, but this type has never been much used. (*b*) The cylindrical helix. Fuller's slide rule, originally designed in 1878, has been in considerable use up to the present time. Among other rules of this type are the Otis King calculator (1922) and the R.H.S. calculator. (*c*) The flat gridiron type, in which the scale is cut up into strips mounted parallel to each other; examples designed by Everett (1866), Scherer (1892), Hannyington, Rieger (1920), Gladstone and others have been in considerable use. (*d*) The cylindrical gridiron type. The parallel strips are arranged longitudinally on the surface of a cylinder; examples made and in use at the present time are those of E. Thacher (1881) and the Rouleau calculator.

In 1815 Dr. Peter M. Roget invented his "log-log" slide rule for performing the involution and evolution of numbers. The fixed scale, instead of being divided logarithmically, is divided into lengths which are proportional to the *logarithm of the logarithm* of the numbers indicated on the scale; the sliding scale is divided logarithmically. By employing this new method of graduation, the value of any expression of the form y^x may be obtained by the same mechanical process as that by which yx is obtained in the ordinary slide rule. Since $\log (y^x) = x \log y$, $\log (\log y^x) = \log x + \log (\log y)$. Hence if division 1 on the slider be set opposite y on the fixed scale, the value of y^x will be read off on the fixed scale opposite x on the slider. All problems such as those of compound interest, increase of population, etc., are solved in this manner by mere inspection. The lower log-log scale on the stock is numbered 1.0024 to 1.25, and the upper log-log scale is numbered 1.25 to 10^{10}. The log-log scale was reinvented and applied to the slide rule by Captain J. H. Thomson in 1881, and by Prof. John Perry in 1902. In Perry's log-log slide rule (Pl. II, fig. 5c) there are two log-log lines, one above and the other below the four scales of the ordinary 10-in. slide rule. The upper scale reads (left to right) from 1.1 to 10,000, and the lower one the reverse way from 0.0001 to 0.91. The scales, which are reciprocal with each other, are used in conjunction with the B scale on the slider. Lieut.-Col. H. G. Dunlop and C. S. Jackson arranged the log-log lines on a spare slider (Pl. II, fig. 5b) used with the D scale of an ordinary slide rule.

Specialized slide rules are available for many fields of science, engineering and commerce; among such rules are those for merchants, electricians, electrical engineers, radio engineers, surveyors etc. In these rules the arrangement of the scales and the indication of the quantities on them facilitate the solution of the common problems in the given field. The most common specialized rule is the circular type used by aviators for navigational computations such as those involved in correcting indicated air speed for temperature.

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CALCULI or **STONES** may occur in any hollow organ in which there is stagnation of the fluid contents together with an excess of some particular substance in solution: they may also occur in the ducts leading from glands from the same cause (*see* Plate). The chief places where stones occur are in the urinary system and in the gall bladder.

Urinary Calculi.—Calculi may be found in almost any part of the urinary system from the collecting tubules in the kidney where they are microscopic in size, to the bladder where they are known as sand, gravel or stones, according to size. In the kidney calculi are usually composed of a mixture of uric acid and water, and occasionally of calcium oxalate. There is evidence that minute concretions of these substances may form in the collecting tubules of the kidney, and pass down to the renal pelvis where they become the nucleus for the further deposit of material to form larger stones. Numerous small stones may be found in the renal pelvis, or a single large branching calculus may be formed, filling up the entire pelvis of the kidney. A small calculus may pass down the ureter into the bladder and there increase to a considerable size; in passing down the ureter, it gives rise to renal colic (*see* COLIC). If the calculus becomes impacted, usually at the upper end of the ureter, the condition known as hydronephrosis occurs and this is likely to be followed by an infective inflammation going on to suppuration and ulceration.

Calculi in the bladder may have their origin in the kidney, as already stated, or in the bladder itself; in the latter case they may occasionally form around foreign bodies introduced into the bladder, but in the majority of cases this is not so and the exact method of formation *de novo* is not yet fully understood, but may be due to the deposition of crystals on organic débris, or on a small focus of organisms. The exact nature of the crystalline material forming the stone depends almost entirely upon the chemical constituents of the urine in which they are formed. In many cases a stone is formed over a period of years, and as the urine may alter its character frequently in this time, a stone is often composed of layers very different in colour, chemical composition and hardness. Calculi may grow to a great size without causing any symptoms, if smooth, but as they are usually angular or rough on the surface, bleeding generally occurs.

Sometimes a calculus composed almost entirely of one substance is found, the substances which give rise to such a stone being uric acid, calcium oxalate, xanthin, cystin or calcium phosphate. More commonly one of these substances forms the nucleus of a larger stone, the outer layers of which may be formed of several different substances such as carbonates and phosphates. The nature of calculi varies according to their composition; uric acid calculi are hard, smooth and oval or rounded when found in the bladder, or moulded to the cavity when found in the renal pelvis. Pure calcium oxalate stones are rare, but mixed stones in which this substance forms a considerable part are common. Such stones are often formed around a nucleus of uric acid or urates and are distinguished by their dark brown colour and very rough, jagged exterior. Further deposition of other substances may convert the jagged stone into a smooth one. Phosphatic calculi are formed when the bladder is inflamed and are usually rough and often crumble easily. Cystine calculi are very rare; when they occur they are rather soft and may reach the size of a hen's egg. Xanthin calculi also are extremely rare, only a few isolated specimens having been described in medical literature.

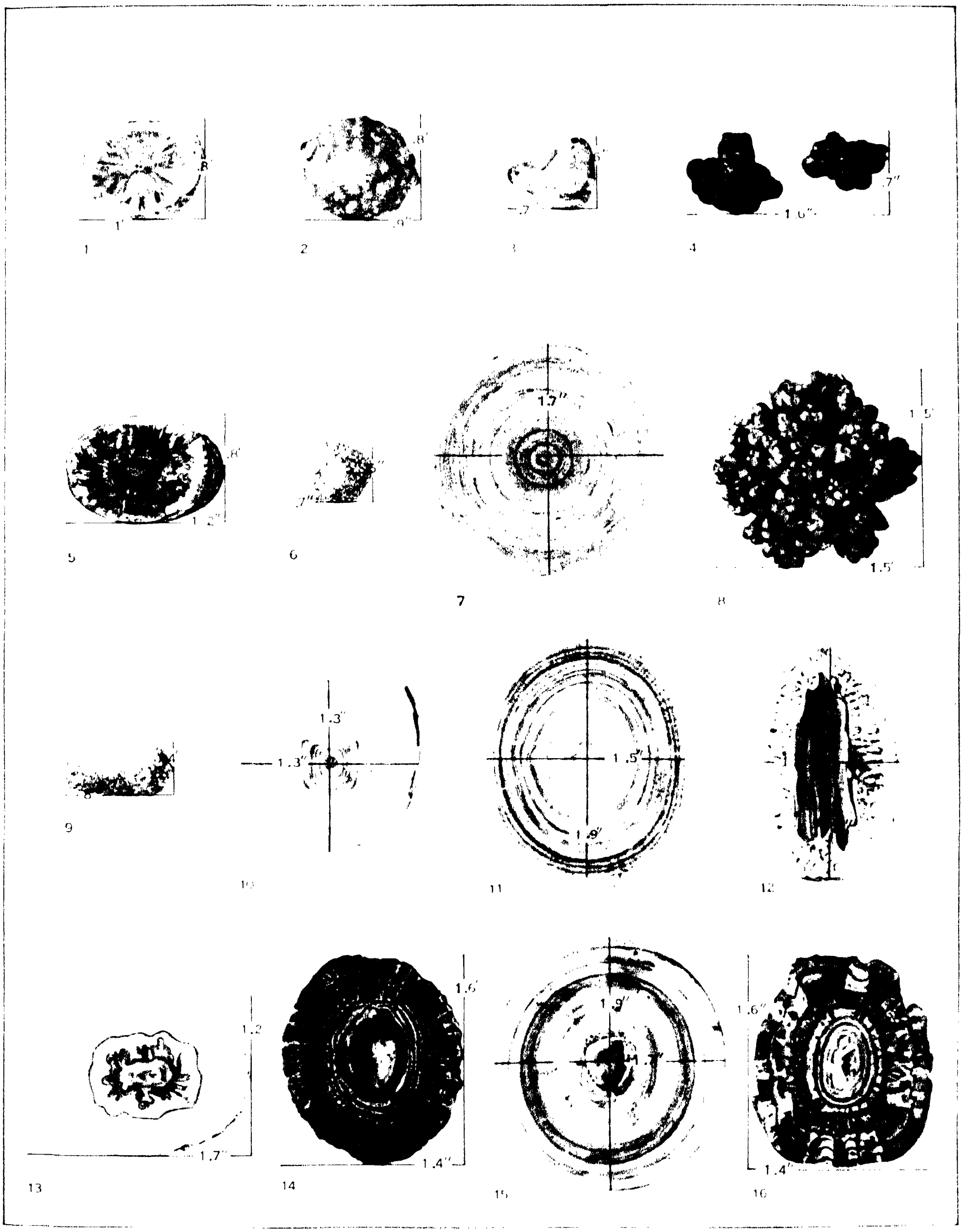
The effect of a large calculus is obstruction; so long as the stone remains loose the obstruction will be intermittent and may largely depend upon the posture of the patient. If the stone becomes impacted or large, obstruction will become complete.

Biliary Calculi or Gallstones are formed from the constituents of the bile together with a certain amount of organic material, and their formation largely depends upon stagnation of bile in the gall bladder. Their composition and shape vary in the same manner as urinary calculi, the chief constituents being cholesterol, bile pigments and lime salts. There is usually a nucleus which is commonly almost pure cholesterol. Occasionally a stone is composed of almost pure cholesterol and is quite clear and pale yellow in colour; these stones are usually oval and solitary, lying loose in the neck of the gall bladder. More often they are covered by a coloured secondary deposit. The commonest type by far is the mixed calcium-bilirubin-cholesterol stone; these may occur as single large stones or multiple smaller ones numbering many hundreds in a single case. The large single ones are oval, and the smaller multiple ones facetted. The colour varies from pure white through yellow and green to black. All gallstones contain a considerable quantity of organic matter and may contain living bacteria.

Gallstones, either single or multiple, may cause no symptoms and are often not discovered during life; on the other hand they may give rise to serious effects, partly mechanical and partly inflammatory in character. The inflammatory effects cause inflammation of the gall bladder or cholecystitis. A large stone may become impacted in the neck or the duct of the gall bladder and cause great distension, a smaller gallstone may pass out of the gall bladder and become impacted lower down the common bile duct giving rise to biliary colic and jaundice. In more chronic cases with a subsequent acute inflammation, a gallstone may ulcerate through either into the peritoneal cavity or into some portion of the gut. In the former case, peritonitis will set in, and in the latter the stone may be small enough to pass right through the bowel or may become impacted and give rise to acute intestinal obstruction. This may also be the result when the stone passes down the duct from the gall bladder into the gut. Subsequent to passage of a gallstone through the common bile duct or coincident with the presence of a gallstone in the gall bladder, localized carcinoma may develop.

Pancreatic Calculi are rare. They form in the pancreatic duct and are composed mainly of calcium carbonate and phosphate: they are usually small in size and may be numerous. In shape they are rounded or oval, and in colour whitish. If they become impacted in the duct obstruction will follow and bacteria may gain a foothold and set up an acute inflammation. When some pancreatic juice can escape, the duct becomes distended.

Salivary Calculi may occur in the ducts of the salivary glands, probably from the depositions of salts on inspissated mucus. They are uncommon, but when they occur they are rough, irregular and white: they consist chiefly of calcium phosphate and carbonate. They may occlude the duct partially or completely.



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FORMS OF CALCULI

1. Gallstone, pure cholesterin, cut section. 2 Gallstone, pure cholesterin. 3. Gallstone, mixed composition, faceted. 4. Gallstones composed almost entirely of bile pigments. 5. Gallstone of mixed composition, largely cholesterin. 6 Salivary calculus, mainly calcium phosphate and carbonate. 7. Renal calculus, smooth, chiefly salts of uric acid. 8. Renal calculus, "mulberry," chiefly oxalate of lime. 9. Renal calculus composed of cystin. uric acid nucleus, superficial laminae of calcium and ammonio-magnesium phosphates (section). 12 Bladder calculus, phosphatic nucleus of hazelwood (section). 13 Bladder calculus, phosphatic around oxalate calculus, (section). 14. Intestinal calculus, ammonio-magnesium phosphate with plumstone as nucleus (section) 15. Intestinal calculus from horse (reduced), ammonio-magnesium phosphate with pebble as nucleus (section).

causing inflammation and dilatation of the duct and atrophy of the gland. Dentists refer to tartar on teeth as salivary calculus.

Intestinal Calculi always have a nucleus of some indigestible material; in countries where oatmeal is largely eaten they are not infrequent. They may cause little or no symptoms, but if large may cause intestinal obstruction. In animals such as the horse and cow they are of relatively common occurrence and may attain to many pounds in weight; they occur chiefly in the stomach and have a nucleus of hair. Another type of concretion found in the intestine is called *Intestinal Sand* and is probably formed in the upper part of the large intestine.

Preputial Calculi are sometimes formed by the deposition of urinary salts upon the accumulated smegma under a prepuce that cannot be retracted.

Prostatic Calculi occur chiefly in the lateral lobes by the deposition of salts on the normal corpora amylacea. They may reach a considerable size and obstruct the outflow of urine.

Nasal Calculi or Rhinoliths occur around nasal secretions or blood clots, but most frequently around foreign bodies introduced into the nasal cavities; they contain a considerable amount of organic matter.

Mammary Calculi are sometimes formed in the lactiferous ducts of the breast causing a similar condition in the gland to salivary calculi.

Lung Calculi are occasionally found in the bronchi. They may be formed in the same manner as calculi in other sites, or as the result of a piece of calcified lung tissue becoming separated through suppuration. If the obstruction be complete, collapse of that portion of the lung behind the obstruction follows; if incomplete the result is bronchiectasis.

Uterine Calculi or Womb Stones sometimes occur, usually as the result of calcareous degeneration of a tumour; occasionally a foetus may die in utero and later become encapsuled and calcified, forming a large calcified mass in the cavity of the uterus known as a lithopaedion.

A considerable amount of work of different kinds has been done on calculi, especially the commoner ones. Their chemical composition is known moderately accurately; gallstones, as has been stated, may be formed round a nucleus of organisms, and if these belong to the typhoid group, the stones may be a source of danger by starting an epidemic of typhoid fever at a later date. Certain gallstones from cases of cancer of the gall bladder have been found to contain minute traces of radioactive substances. In some cases both gallstones and urinary calculi will act upon a photographic plate in the dark; this action is believed to be due to the action of hydrogen peroxide produced from turpines, or to minute traces of ammonia. The effect can be produced either at room temperature or at 37°C; at the latter temperature a few hours may suffice. (P. L.-B.)

CALCULUS, ABSOLUTE DIFFERENTIAL: *see* TENSOR ANALYSIS.

CALCULUS, BARYCENTRIC: *see* BARYCENTRIC CALCULUS.

CALCULUS, DIFFERENTIAL AND INTEGRAL.
Calculus differs from elementary algebra and geometry in that a new operation is introduced. In algebra, the operations of addition, subtraction, multiplication and division, raising to powers and extractions of roots are the only ones which are generally used. Calculus essentially differs from these subjects in that it stresses another operation, that of taking a limit. Particular examples of this operation occur in plane geometry, when one considers the area of a circle as the limit of the areas of regular inscribed polygons of $4n$ sides as the number of sides increased without bound; when one determines an expression for the perimeter of a circle or for the volume of a sphere. In algebra this operation is used when one seeks the value of a repeating decimal; while in plane analytic geometry, this concept is used in the discussion of tangents to curves.

In calculus, two limits are of especial importance; one, the *derivative* of a function, the other, the *definite integral.* Both of these concepts have a wide variety of applications and interpretations and their use has been very significant in the development of many of the modern scientific theories.

Derivative.—If y is a single valued function of the derivative of y with respect to x is defined to be

$$\lim_{\Delta x \to 0} \frac{f(x+\Delta x)-f(x)}{\Delta x} \qquad \text{if it exists.}$$

This quantity is frequently written $dy/dx = \lim\limits_{\Delta x \to 0} \Delta y/\Delta x$ where x is an arbitrary increment of x and $\Delta y = f(x+\Delta x) - f(x)$. This particular limit, the *derivative*, has many uses, especially in problems involving the determination of tangents to curves, problems involving the concepts of *maxima* and *minima*, and problems involving instantaneous rates of change. Though mathematicians usually like to think of a derivative as an abstract limit, its significance is best understood by considering its role in various problems.

Tangents.—The concept of derivative is perhaps best brought out by considering the construction of a tangent to a curve. Assuming some familiarity on the part of the reader with the graphing of curves, we will show the construction of a tangent to the curve whose equation is $y = x^2$ at the point $(2,4)$. The curve is a parabola (fig. 1).

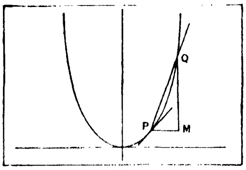

FIG. 1—TANGENTS

Let Q be any point on the parabola, distinct from the point $P(2,4)$. Let P be joined to Q by a straight line. We shall call the line PQ a *secant.* Now, let the point Q come closer and closer to P, without attaining P. As Q approaches P, the secant will rotate about P, and will tend towards coincidence with a line through P which touches the parabola at P without cutting across the parabola. This line will be called the *tangent* to the parabola at P.

The tangent at P can certainly be constructed if the angle which it makes with the X-axis is known. We shall call the angle between a line and the X-axis the *inclination* of the line. In what follows immediately, the inclination of the tangent will be found from the fact that, as the secant approaches the tangent, the inclination of the secant approaches that of the tangent. One point deserves special emphasis. We have not said that if Q comes into coincidence with P, the secant becomes a tangent. Unless Q is distinct from P, we do not have two points through which to draw a line. All that has been said is that, as Q comes closer and closer to P, the inclination of the secant comes closer and closer to that of the tangent. This fact suffices for the determination of the slope of the tangent.

By the *slope* of a line is meant the trigonometric tangent of the inclination of the line. Obviously, the slope of the secant PQ has for limit, as Q approaches P, the slope of the tangent at P. We shall first seek to make plausible, by arithmetic calculations, that the slope of the secant tends toward a limit as Q approaches P. Later, a rigorous treatment of the problem will be given.

If PM and QM are perpendicular to each other (fig. 1), the slope of PQ is

$$\frac{QM}{PM}. \tag{1}$$

Suppose that Q is the point $(3,9)$. As P is the point $(2,4)$, PM will be $3-2=1$ and QM will be $9-4=5$. Then the slope of PQ, according to (1) above, will be 5. Let Q be the point $(2.5, 6.25)$. Then $PM = 0.5$ and $QM = 2.25$, so that PQ will have for slope $2.25/0.5 = 4.5$. If Q is $(2.1, 4.41)$ the slope will be 4.1. It is thus a reasonable conjecture that, as Q approaches P, the slope of PQ approaches 4 as a limit, and that the slope of the tangent at P is 4. We will now give rigorous proof that the slope of the tangent at P is 4. We shall, for the sake of generality, deal with any point (x,y) on the parabola, rather than with the special point $(2,4)$.

Let P have the co-ordinates (x,y). Let Q be any point on the parabola distinct from P. We shall represent the measures of

PM and QM by the symbols Δx and Δy respectively. It should be noticed that Δx, for instance, is a single symbol, and does not stand for the product of two quantities, Δ and x; the symbol Δ has no meaning by itself. The co-ordinates of Q will be $x+\Delta x$ and $y+\Delta y$. The slope of PQ will be

$$\frac{\Delta y}{\Delta x}.$$

Our problem is to determine the limit of the ratio $\Delta y/\Delta x$ as Δx approaches zero.

As Δx approaches zero, that is, as Q approaches P, Δy also approaches zero. This, of course, does not mean that the quotient of Δy by Δx is small. For instance, in our calculations above, when Δx was 0.1 and Δy was 0.41, $\Delta y/\Delta x$ was 4.1. As a matter of fact, when Δx and Δy are both small, $\Delta y/\Delta x$ is very close to the slope of the tangent at P, which slope need not be a small number. *The idea contained in the last few lines is the central idea of the differential calculus.* We proceed to determine the limit of $\Delta y/\Delta x$ as Q approaches P. As Q lies on the parabola, the ordinate of Q equals the square of its abscissa, that is,

$$y+\Delta y=(x+\Delta x)^2$$

or

$$y+\Delta y=x^2+2x\cdot\Delta x+(\Delta x)^2. \qquad (2)$$

Now, as P has the co-ordinates (x, y), and as P lies on the parabola, we have $y=x^2$. Using this fact in (2), we find that

$$\Delta y=2x\cdot\Delta x+(\Delta x)^2. \qquad (3)$$

Dividing both sides of (3) by Δx, we have

$$\frac{\Delta y}{\Delta x}=2x+\Delta x. \qquad (4)$$

We now bring Q closer and closer to P, thus making Δx smaller and smaller. It is plain, from (4), that $\Delta y/\Delta x$ comes closer and closer to $2x$.

We have thus solved our problem. The tangent at any point P on the parabola has, for slope, twice the abscissa of P. Of course, this fact permits the immediate construction of the tangent at any point. When $x=2$, the slope of the tangent is 4. This is the result made reasonable above by arithmetic calculation. It should be appreciated that we have secured an exact, and not an approximate solution of the tangent problem. As Q approaches P, the slope of the secant approaches the slope of the tangent. But we have shown that the slope of the secant approaches $2x$. Hence the slope of the tangent must be identical with $2x$.

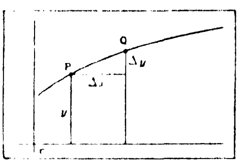

FIG 2—DERIVATIVE

Computation of Derivatives.—The solution of the tangent problem for the parabola has prepared the way for the introduction of the concept of derivative. Let $y=f(x)$ be any function of x. Let the function be graphed as in fig. 2. We choose any value for x, and keep this value fixed during the discussion. To this fixed value of x corresponds a fixed value of y. This gives a fixed point P, on the graph, of co-ordinates (x, y). We take now any point Q on the graph, distinct from P, of co-ordinates $(x+\Delta x, y+\Delta y)$. As Q approaches P, the ratio $\Delta y/\Delta x$ will, for the functions commonly met in mathematics, approach a definite limit, the slope of the tangent to the graph at P.

The limit of $\Delta y/\Delta x$ is called the *derivative* of $f(x)$ for the chosen value of x. Thus the derivative is nothing more than the slope of the tangent to the graph. We represent the derivative of the function $y=f(x)$, for any value of x, by the symbol

$$\frac{dy}{dx}.$$

Thus, when $y=x^2$,

$$\frac{dy}{dx}=2x.$$

As to each value of x there corresponds a definite value of dy/dx, the derivative is a function of x.

It cannot be emphasized too strongly that dy/dx is not a quotient. It is a number which is approached by a certain quotient, namely, $\Delta y/\Delta x$. The symbols dy and dx, as we are using them above, have no meaning by themselves. The entire symbol dy/dx represents, very expressively, the limit of $\Delta y/\Delta x$. It is true that, in one of the chapters of the calculus, "differentials" are defined, for which the symbols dy and dx are used. But the "differential" symbols are entirely distinct from the dy and dx used here.

The process of finding the derivative of a function is called *differentiation*. We have shown above how to differentiate x^2. In treatises on the calculus, it is shown how to differentiate all types of expressions.

It has been said above that the quotient $\Delta y/\Delta x$ approaches a limit for "the functions commonly met in mathematics." There exist functions, with more or less complicated definitions, for which no derivatives exist. For such functions, as Δx approaches zero, the quotient $\Delta y/\Delta x$ either becomes infinite or oscillates without approaching a limit. The subject of functions which are without their derivatives forms a chapter in the theory of functions (*q.v.*). Extensions of the concept of derivative can be made to functions which depend on several variables, and corresponding applications to problems involving surfaces, maxima and minima of functions depending on several variables, and rates of change.

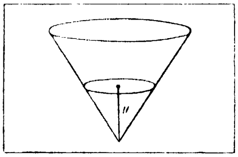

FIG 3—RATES

Rates.—With the help of a problem mentioned above, we shall now proceed to develop the concept of instantaneous rate of change of a quantity varying with the time. Let water be introduced into an inverted hollow cone (fig. 3) at the uniform rate of 1 cu. ft./sec.

Let y be the depth of the water in the cone, measured in feet, after the water has been flowing in for t seconds. Then y is a function of t. To make this situation concrete, suppose that the angle between the extreme elements of the cone, OA and OB, is 90°. Then the radius of the upper surface of the water will always be equal to y. Hence the volume of water in the cone at any instant is $\frac{1}{3}y\cdot\pi y^2=\frac{1}{3}\pi y^3$ cu. feet. But, in t seconds, t cubic feet of water have entered the tank. Hence

$$\tfrac{1}{3}\pi y^3=t,$$

or

$$y=\left(\frac{3t}{\pi}\right)^{\frac{1}{3}}.$$

What we shall do, according to the central principle of the theory of rates, is to use dy/dt for the rate of change of y. That is, the speed with which the level rises at any instant t (t seconds after the water begins to flow in) will be taken as the derivative of y at that instant. To justify this principle, let us consider any fixed instant t, and the depth y at that instant. At any later instant, $t+\Delta t$, the depth will have been increased by an amount Δy. Roughly speaking, one might say that, during the time Δt, y has increased at the "average rate" of $\Delta y/\Delta t$ ft. per sec., but we have no inherent notion of "average rate." What we are doing is to create a meaning for that term. A quantity y, increasing for Δt sec. at a uniform rate of $\Delta y/\Delta t$ ft. per sec. would increase Δy ft. That is why it is natural to take $\Delta y/\Delta t$ as an "average" in our case. Furthermore, if Δt is a very small period of time, the level of the water would appear to an observer to be rising practically uniformly, and practically at the rate $\Delta y/\Delta t$, during the time Δt.

Because $\Delta y/\Delta t$ can be used as an average speed for the period Δt, and because $\Delta y/\Delta t$ approaches dy/dt as Δt approaches zero, we define the ***instantaneous rate of change of*** y, at any instant t, to be dy/dt. Thus the instantaneous rate of change is primarily a mathematical notion.

Although the notion of instantaneous rate of change is a mathematical one, it is of the greatest utility in the applied sciences. For when a problem of applied science is to be subjected to mathematical analysis, what is done, effectively, is to replace the problem by an ideal mathematical problem, formulated in terms of the pure mathematician's concepts. To find *dy/dt* in the problem of the cone, let a represent $(3/\pi)^{\frac{1}{3}}$. Then

$$y = at^{\frac{1}{3}},$$

so that

$$y+\Delta y = a(t+\Delta t)^{\frac{1}{3}}.$$

Thus

$$\frac{\Delta y}{\Delta t} = a\frac{(t+\Delta t)^{\frac{1}{3}}-t^{\frac{1}{3}}}{\Delta t}$$

$$= a\frac{(t+\Delta t)^{\frac{1}{3}}-t^{\frac{1}{3}}}{(t+\Delta t)-t}$$

$$= \frac{a}{(t+\Delta t)^{\frac{2}{3}}+(t+\Delta t)^{\frac{1}{3}}t^{\frac{1}{3}}+t^{\frac{2}{3}}}.$$

The last step is justified by the equation

$$u-v = (u^{\frac{1}{3}}-v^{\frac{1}{3}})\cdot(u^{\frac{2}{3}}+u^{\frac{1}{3}}v^{\frac{1}{3}}+v^{\frac{2}{3}}),$$

which can be verified by multiplication. As Δt approaches zero, $t+\Delta t$ approaches t, so that $\Delta y/\Delta t$ approaches

$$\frac{a}{3t^{\frac{2}{3}}},$$

which, then, is dy/dt. For instance, when t is 8 sec., the level is rising at $a/12 = 0.08$ ft. per second.

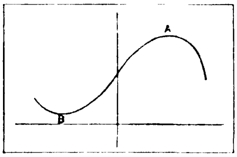

FIG 4—MAXIMA AND MINIMA

Maxima and Minima.—Consider a function $y=f(x)$ which has a derivative for every x (fig. 4). At a point such as A, at which the function is a maximum, or at a point such as B, where the function is a minimum, the tangent is horizontal, the slope of the tangent is zero.

To give rigorous proof of this fact, let the abscissa of A be a, and suppose that dy/dx is not zero for $x=a$. To fix our ideas, let us suppose that dy/dx is positive at a. When Δx is small, $\Delta y/\Delta x$ is very nearly equal to dy/dx. Hence, for a small Δx, $\Delta y/\Delta x$ is positive, like dy/dx. Then, if Δx is small and positive, Δy must be positive, for, if Δy were zero or negative, $\Delta y/\Delta x$ would be zero or negative. Hence a point on the graph somewhat to the right of A must have a greater ordinate than A, so that y cannot be a maximum for $x=a$. This absurdity shows that $dy/dx=0$ for $x=a$.

Example. Suppose that we have a square sheet of tin, 6 in. on each side, that we cut a square of side x out of each corner, and fold up the sides so as to form an open box. The altitude of the box will be x, and its base will be a square of side $6-2x$. The volume of the box, call it y, will be

$$y = x(6-2x)^2 = 4x^3-24x^2+36x.$$

We find that

$$\frac{dy}{dx} = 12x^2-48x+36,$$

so that, for a maximum,

$$12x^2-48x+36=0.$$

This equation has the roots 1 and 3; that is, if there is an x for which y is a maximum, x is either 1 or 3. From the nature of the problem, it is evident that some x makes the volume a maximum. Certainly 3 is an impossible value for x. Hence, for $x=1$, we get a box of maximum volume.

Integral Calculus: Anti-Derivatives.—There are two basic problems with which the integral calculus is concerned; one of these is the problem of finding integrals or anti-derivatives; that is, given a function, find another function which has the first function as its derivative. The other problem is the concept of a definite integral as a limit of a sum. If one function is the derivative of a second function, the second function is called an *integral* of the first. For instance, x^2 is an integral of $2x$. We say an integral, rather than the integral, because $2x$ has an infinite number of integrals. The functions x^2+2, x^2-10, in short, all functions x^2+c, with c a constant, are integrals of $2x$. This is because the derivative of a constant is zero for every x. If $F(x)$ is an integral of $f(x)$, we write

$$F(x) = \int f(x)dx.$$

(We shall explain below the origin of this rather peculiar symbolism.) Thus,

$$\int 2x\,dx = x^2+c, \text{ where } c \text{ is any constant.}$$

The fundamental question arises as to whether all integrals of a function are found by adding constants to any particular integral. The reply is affirmative. The only integrals of $2x$, for instance, are the functions x^2+c, with c a constant. To give a geometric proof of this fact, let us observe that if $F(x)$ has $2x$ for derivative, then the function $F(x)-x^2$ has a derivative which is everywhere zero. Now only a constant can have a derivative which is zero for every x, for if a function is not a constant, its graph must have points at which the tangent is not horizontal. Thus, $F(x)-x^2=c$, with c constant, so that

$$F(x) = x^2+c.$$

The process of finding the integral of a function is called *integration.* While the determination of the derivative of a function is a perfectly straightforward procedure, for which definite rules exist, there is no general method for finding the integral of a mathematical expression. Treatises on the calculus give rules for integrating large classes of functions. When these rules fail, more powerful methods can be used which do not give an expression for the integral, but which permit the value of the integral to be calculated for any value of x in which one may be interested. To find a formula for the distance through which a body falls in a given time, under the influence of gravity, let a body, initially at rest, be allowed to fall. If g is the acceleration of gravity (32 ft./sec.^{2}), the body will, in t seconds, acquire a speed of gt ft. per second. Let s be the distance through which the body falls in t seconds. Then

$$\frac{ds}{dt} = gt,$$

so that

$$s = \int gt\,dt.$$

Thus

$$s = \frac{gt^2}{2}+c.$$

To determine the constant c, we observe that $s=0$ when $t=0$. Then

$$0 = \frac{g0^2}{2}+c,$$

so that $c=0$. Hence, $s=gt^2/2$ for every t.

This problem of integration is one of those which give rise to the theory of differential equations (*see* DIFFERENTIAL EQUATIONS), and extensions of this concept have been made for functions of several variables.

Integral Calculus: Definite Integrals.—The other important limit occurring in the calculus is the definite integral, the limit of a sum. This concept is important since many quantities such as areas and arc lengths can be approximated by sums obtained by dividing the given quantity into small parts and approximating each part. The definite integral enables one to take the limits of such sums and leads to accurate instead of approximate results. The symbol $\int_a^b f(x)dx$, is read the definite integral of $f(x)dx$ from a to b, where originally the symbol $\int$, a mediaeval S, stands for *summa* (sum). It may be defined as follows: let $f(x)$ be a single valued function of x, well defined at each point on the interval $a \leq x \leq b$. Choose points x_i on the interval such that $x_0 = a, < x_1 < x_2 < \cdots < x_n = b$. Let $\Delta x_i = x_i - x_{i-1}$. Choose in each interval Δx_i a point t_i. Form the sum

$$S_n = \sum_{i=1}^{n} f(t_i)\Delta x_i = f(t_1)\Delta x_1 + f(t_2)\Delta x_2 + \cdots + f(t_n)\Delta x_n.$$

The limit of this sum, as the maximum Δx_i approaches zero (and correspondingly the number of subdivisions increases without bound), is defined to be the *definite integral* $\int_a^b f(x)dx$, if it exists. It can be shown that this integral exists if f is a continuous function for $a \leq x \leq b$. If $G(x)$ is a function whose derivative is $f(x)$, then it can be shown that $\int_a^b f(x)dx = G(b) - G(a)$. This last property enables one to evaluate many definite integrals. If such function G does not exist, or is not readily obtainable, methods of approximating the value of the integral are known.

One of the uses of definite integrals is that of finding areas bounded by certain curves. For example, consider the problem of determining the area bounded by a curve whose equation is $y = f(x)$ and the lines $x = a$, $x = b$, $y = 0$. (See fig. 5) As indicated in the last definition, subdivide the interval from $x = a$ to $x = b$ into n parts. Draw the lines $x = x_{k-1}$ and $x = x_k$. Choose on the interval a point t_k and draw the line $x = t_k$. That part of the desired area which lies between the lines $x = x_{k-1}$ and $x = x_k$ is $ABDEFG$, which can be approximated by rectangle $ACDFG$. The area of this rectangle is $(AC)(AG) = f(t_k)\Delta x_k$. Similarly for each subinterval, approximations to the actual area over this subinterval can be made by rectangles. The sum of the areas of the rectangles is

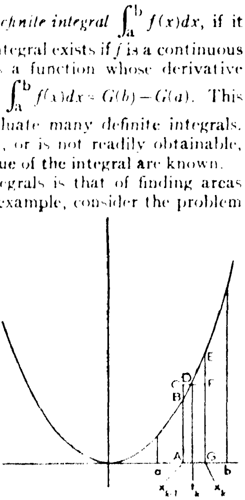

FIG. 5—AREA

$$S_n = \sum_{i=1}^{n} f(t_i)\Delta x_i.$$

As the number of subintervals increases, the length of each such interval decreasing, the approximations become more nearly equal to the area. The limit of such a sum is the actual area, and equals $\int_a^b f(x)dx$.

If $y = x^2$ and $a = 1$, $b = 4$, the area bounded by the parabola and three straight lines is $A = \int_1^4 x^2dx$. Now $G(x) = x^3/3$ is a function whose derivative is x^2. Hence, $A = \int_1^4 x^2dx = G(4) - G(1) = 64/3 - 1/3 = 63/3$.

Many other quantities such as length of arc of a curve, volumes of solids with known cross sections, centroids, and moments of inertia can be computed by definite integrals. In each case, the figure is subdivided into small parts, approximations of the desired quantity are suitably made and the corresponding limit taken. This procedure leads to accurate results. Extensions of this concept of a definite integral may be made for functions of several variables and have a wide variety of applications in mathematics and the applied sciences.

History.—The methods used by the Greeks for determining the area of a circle and of a segment of a parabola, and the volumes of the cylinder, cone and sphere, were, to the extent that they involved finding the limits of sums, akin to the method of integration. During the first half of the 17th century, methods of more or less limited scope began to appear among mathematicians for constructing tangents, determining maxima and minima, and finding areas and volumes. In particular, Fermat, Pascal, Roberval, Descartes, Huygens and others discussed ways of drawing tangents to particular curves, and finding areas bounded by certain special curves. Each problem was considered by itself and few general rules were developed, but the essential ideas of the derivative and definite integral were beginning to be formulated. With this mathematical heritage, Newton and Leibniz, working independently of each other, during the latter half of the 17th century, defined the concepts of derivatives and integrals. Leibniz used the notation dy/dx for the derivative, and also introduced the integration symbol.

Since 1700 there have been many developments in mathematics which are dependent on the calculus. That portion of mathematics called *Analysis* includes only topics which depend on calculus. Included in this category are differential and integral equations, theory of functions of real and complex variables, algebraic and elliptic functions. Use is made of this powerful tool in geometry (*see* DIFFERENTIAL GEOMETRY) and in number theory.

In the development of modern physics, the concepts developed in the calculus and its numerous extensions are continually utilized. As other sciences are put on a more mathematical basis, more uses are found for the calculus. *See* DIFFERENTIAL EQUATIONS; FUNCTIONS; SERIES.

BIBLIOGRAPHY.—Standard college texts on this subject include: Arnold Dresden, *Introduction to the Calculus*; W. A. Granville, P. F. Smith and W. R. Longley, *Elements of the Differential and Integral Calculus*; C. E. Love, *Differential and Integral Calculus*.

Books which are slightly more advanced are: W. F. Osgood, *Advanced Calculus*; E. Goursat (trans. by E. R. Hedrick), *A Course in Mathematical Analysis*, vol. i; W. B. Fite, *Advanced Calculus*.

References to books on related topics, such as differential equations or function theory may be found under the appropriate article.

(J. F. RI.; R. G. SR.)

CALCULUS OF DIFFERENCES. (THEORY OF FINITE DIFFERENCES), that branch of mathematics which deals with the successive differences of the terms of a sequence of numbers.

1. **Purposes.**—A number of important problems are dealt with in this subject. Among them the following may be mentioned:

(i.) *Summation.* A sequence being at hand, the problem in this case is to find a formula from which the sum of any specified number of its consecutive terms may be obtained. The elementary expedient of actually adding the terms may be inconvenient. At all events results so obtained By way of illustration, consider the sequence

$$1, 3, 5, 7, 9, \cdots \tag{1}$$

The sum of n terms of this sequence will be found below to be given by the formula n^2. Thus, for instance, without any elementary addition, the sum of the first 117 terms is 117^2, namely 13,689.

(ii.) *Curve fitting.* If the terms of a given sequence are the values which some continuous function $f(x)$ takes on at specific values of x, it may be required to find, exactly or approximately, the formula for $f(x)$. As an instance, consider the sequence

$$0, 2, 6, 12, 20, 30, \cdots \tag{2}$$

whose terms are respectively the values which a certain function $f(x)$ takes on when $x = 2, 3, 4, 5, 6, 7, \cdots$. From this it may be deduced, as is shown below, that the $f(x)$ in question is the function $2 - 3x + x^2$.

(iii.) *Interpolation.* If, as in the preceding case, the terms of a sequence are the values of a continuous function at specified values of the variable, it may be required to insert into this sequence other terms, intermediate to those given, in a manner which is consistent with those already at hand. As an instance, consider the sequence of numbers

$$.00000,\ .04531,\ .18232,\ .26236,\ .33647,\ \cdots, \tag{3}$$

which are the values of $\log x$ (to the base 10) respectively for $x = 1.00, 1.10, 1.20, 1.30, 1.40, \cdots$. What value is to be assigned on this basis to $\log 1.05$?

2. **Notation.**—Certain matters of conventional notation and arrangement underlie all processes of this calculus, and are requisite to the expression of the fundamental relations between sequence terms and their differences. A brief consideration of these is, therefore, an indispensable preliminary.

If a sequence which is at hand has a first term, it is customary to designate this term by the symbol u_0. The consecutively succeeding terms are then denoted in the order of their succession by $u_1, u_2, u_3, \cdots$. If the sequence is one which has no first term, the symbol u_0 may be used to designate any chosen one of the terms. The terms which follow it may then be denoted consecutively by $u_1, u_2, u_3, \cdots$, while the term preceding u_0 may be denoted by u_{-1}, that preceding u_{-1} by u_{-2}, etc. In any case the segment of $(n+1)$ terms of a sequence from the term u_k on is indicated by

$$u_k,\ u_{k+1},\ u_{k+2},\ \cdots,\ u_{k+n-1},\ u_{k+n}. \tag{4}$$

From this succession of terms a new succession or sequence, namely

$$(u_{k+1}-u_k),\ (u_{k+2}-u_{k+1}),\ (u_{k+3}-u_{k+2}),\ \cdots\ (u_{k+n}-u_{k+n-1}),$$

may be formed. In the order given, the terms of this sequence are more briefly denoted by the symbols

$$\Delta u_k,\ \Delta u_{k+1},\ \Delta u_{k+2},\ \cdots,\ \Delta u_{k+n-1}. \tag{5}$$

and are designated respectively as the first difference of u_k, the first difference of u_{k+1}, of u_{k+2}, etc. Thus, with any index r

$$\Delta u_r = u_{r+1} - u_r. \tag{6}$$

The sequence of which (5) is a segment is referred to as the sequence of first differences.

The process whereby the sequence (4) is made to yield the sequence (5) may now in turn be applied to the latter. The sequence thus generated is written as

$$\Delta^2 u_k,\ \Delta^2 u_{k+1},\ \Delta^2 u_{k+2},\ \cdots,\ \Delta^2 u_{k+n-2}, \tag{7}$$

the terms of it being given by the formula

$$\Delta^2 u_r = \Delta u_{r+1} - \Delta u_r. \tag{8}$$

This is called the *sequence of second differences*. In precisely the same manner the process may be re-applied any number of times. For any positive integer p the pth difference of u_r is thus given by the formula

$$\Delta^p u_r = \Delta^{p-1} u_{r+1} - \Delta^{p-1} u_r. \tag{9}$$

If for any sequence the differences of some particular order are the same for all terms, the differences of higher orders than this are all zero. This will be evident at once from the formula (9).

The interrelation between the terms and the various differences of a sequence are customarily and conveniently displayed in tabular form in the manner of Table I.

TABLE I

Term	1st diff.	2nd diff.	3rd diff.	4th diff.	
	. . .		. . .		. . .
. . .		. . .		. . .	
	Δu_{k-1}		. . .		. . .
u_k		$\Delta^2 u_{k-1}$		. . .	
	Δu_k		$\Delta^3 u_{k-1}$		. . .
u_{k+1}		$\Delta^2 u_k$		$\Delta^4 u_{k-1}$	
	Δu_{k+1}		$\Delta^3 u_k$		. . .
u_{k+2}		$\Delta^2 u_{k+1}$		$\Delta^4 u_k$	
	Δu_{k+2}		$\Delta^3 u_{k+1}$		. . .
. . .		$\Delta^2 u_{k+2}$		. .	
	. . .		. . .		. . .
. . .		. . .		. . .	
	Δu_{k+n-1}		$\Delta^3 u_{k+n-2}$		. . .
u_{k+n}		$\Delta^2 u_{k+n-1}$		$\Delta^4 u_{k+n-2}$	
	Δu_{k+n}		$\Delta^3 u_{k+n-1}$		. . .
u_{k+n+1}		$\Delta^2 u_{k+n}$		. . .	
	. . .		. . .		. . .
. . .		. . .		. . .	
	. . .		. . .		. . .

By way of an actual numerical example of such a table we give here Table II. The sequence to which it refers is that in which the terms are the cubes of the integers.

The reader would find it instructive to construct for himself the corresponding table in which the entries in the left-hand column are the fifth powers of the integers or one in which the sequence u_n is that which is obtained by taking $u_n = \frac{1}{n}$.

TABLE II.

u	Δu	$\Delta^2 u$	$\Delta^3 u$	$\Delta^4 u$
. . .		. . .		. . .
	. . .		. . .	
−64		. . .		. . .
	37		. . .	
−27		−18		. . .
	19		6	
−8		−12		0
	7		6	
−1		−6		0
	1		6	
0		0		0
	1		6	
1		6		0
	7		6	
8		12		. . .
	19		. . .	
27		. . .		. . .
	. . .		. . .	
. . .		. . .		. . .
	. . .			
. . .				

It should be remarked before going further that the scheme of differences thus described is only one of several which are in common use. When distinctions must be drawn, those here in question are described as *advancing differences*. Another type is described below in §8.

3. Symbols of Operation.—The difference Δu_r may be thought of as derivable from the term u_r by a certain succession of operations. Thus, there is the operation of passing from u_r to its next following term u_{r+1}, and then the operation of subtracting u_r from u_{r+1}. The first of these operations is commonly denoted by the symbol E; the second one by the familiar minus sign $-$. Accordingly we have

$$Eu_r = u_{r+1}, \tag{10}$$

and beyond this

$$\Delta u_r = Eu_r - u_r. \tag{11}$$

Clearly also the relation (6) becomes, upon transposition of the term u_r,

$$Eu_r = u_r + \Delta u_r. \tag{12}$$

It is convenient to write the right-hand members of these equations (11) and (12) in the forms $(E-1)u_r$, and $(1+\Delta)u_r$, respectively. One may abstract from them then the relations

$$\Delta = (E-1), \quad E = (1+\Delta), \tag{13}$$

these to be understood in the sense of signifying that the operation indicated by the symbol on the left yields, in the case of any term, the same result as the combination of operations specified by the symbol on the right.

By a mere change of the subscript in the relation (10) it is seen that $u_r = Eu_{r-1}$. But since the term u_{r-1} may likewise be designated by Eu_{r-2}, it follows that $u_r = E(Eu_{r-2})$, or, as this relation is more conveniently written, $u_r = E^2 u_{r-2}$. By a repetition of this process it will be found generally that for any indices r and k

$$E^r u_k = u_{k+r}. \tag{14}$$

Let it be understood now in all cases that exponents upon the operational symbols (13) are to be interpreted, as has already been done, in the sense of the formulas

$$\begin{aligned}(E-1)^r u_k &= (E-1)\{(E-1)^{r-1}u_k\},\\ (1+\Delta)^r u_k &= (1+\Delta)\{(1+\Delta)^{r-1}u_k\}.\end{aligned} \tag{15}$$

The first of these formulas, with $r=2$ indicates that $(E-1)^2 u_k$ is the same as $(E-1)\{(E-1)u_k\}$. Since by the formula (10) this is equivalent to $(E-1)\{u_{k+1}-u_k\}$, namely to $E\{u_{k+1}-u_k\}$

$\{u_{k+1}-u_k\}$, we find that it has in fact the value $\{u_{k+2}-u_{k+1}\}-\{u_{k+1}-u_k\}$. This, however, is alternatively expressible as $(E^2-2E+1)u_k$, a result which leads us to recognize that

$$(E-1)^2=(E^2-2E+1)$$

In other words, although the symbol E is not an algebraic quantity, but an operational specification, it combines in this instance by precisely the familiar algebraic law. That this is generally true of the operational symbols can be proved. It is an exceedingly fortunate fact In accordance with it the symbols $(E-1)^r$ and $(1+\Delta)^r$ may in particular be replaced by their symbolic binomial expansions In this way the following important relations may be deduced

$$\Delta^r u_k=(E-1)^r u_k$$
$$=\left\{E^r-rE^{r-1}+\frac{r(r-1)}{2!}E^{r-2}-\frac{r(r-1)(r-2)}{3!}E^{r-3}+\cdots\right\}u_k, \quad (16)$$

$$E^r u_k=(1+\Delta)^r u_k$$
$$=\left\{1+r\Delta+\frac{r(r-1)}{2!}\Delta^2+\frac{r(r-1)(r-2)}{3!}\Delta^3+\cdots\right\}u_k \quad (17)$$

The symbol $q!$ which appears here designates "factorial q", (also written $\lfloor q$), namely the product of the positive integers not greater than q. Important formulas obtainable from the rules (16) and (17) are clearly

$$\Delta^r u_k=u_{k+r}-ru_{k+r-1}+\frac{r(r-1)}{2!}u_{k+r-2}$$
$$-\frac{r(r-1)(r-2)}{3!}u_{k+r-3}+\cdots+(-1)^r u_k, \quad (18)$$

$$u_{k+r}=u_k+r\Delta u_k+\frac{r(r-1)}{2!}\Delta^2 u_k$$
$$+\frac{r(r-1)(r-2)}{3!}\Delta^3 u_k+\cdots+\Delta^r u_k \quad (19)$$

Of these the first makes possible the calculation of differences of any order without the previous calculation of those of lower order, while the second permits the calculation of any term of the sequence from the successive differences of one of them.

4 **Summation.**—With any choice of a constant C, let the sequence of values U_1, U_2, U_3, $\cdots$ be defined by the formulas

$$\begin{aligned}U_1&=C+u_0,\\U_2&=C+u_0+u_1,\\U_3&=C+u_0+u_1+u_2,\\U_4&=C+u_0+u_1+u_2+u_3,\\&\cdots\quad\cdots\quad\cdots\\&\cdots\quad\cdots\quad\cdots\end{aligned}$$

It will be seen at once that for this new sequence $\Delta U_r=u_r$, and that this will be so wholly irrespective of the choice of C. It is, therefore, consistent to extend the Table I to the left in the manner of the Table III which follows.

TABLE III.

U	u	Δu	$\Delta^2 u$	
$\cdots$		.		$\cdots$
	$\cdots$		.	
U_k		Δu_{k-1}		$\cdots$
	u_k		$\Delta^2 u_{k-1}$	
U_{k+1}		Δu_k		$\cdots$
	u_{k+1}		$\Delta^2 u_k$	
U_{k+2}		Δu_{k+1}		$\cdots$
	u_{k+2}		$\Delta^2 u_{k+1}$	
U_{k+3}		Δu_{k+2}		$\cdots$
	u_{k+3}		$\cdots$	
U_{k+4}		$\cdots$		$\cdots$
	$\cdots$		$\cdots$	
$\cdots$				
$\cdots$		$\cdots$		$\cdots$

If in this we think of u_k and $\Delta^r u_k$ as replaced by their equivalents ΔU_k and $\Delta^{r+1}U_k$, respectively, the formula (19), which in this instance appears as

$$U_{k+r}=U_k+r\Delta U_k+\frac{r(r-1)}{2!}\Delta^2 U_k+\cdots+\Delta^r U_k,$$

takes the form

$$U_{k+r}-U_k=ru_k+\frac{r(r-1)}{2!}\Delta u_k+\cdots+\Delta^{r-1}u_k. \quad (21)$$

On referring to the definitions (20), it is seen, however, that the value of the left hand member of (21) is the sum of terms $u_k+u_{k+1}+u_{k+2}+\cdots+u_{k+r-1}$. The formula (21) thus accomplishes the summation of any segment of consecutive terms of the sequence u_r.

As an application of this result, consider the particular sequence (1). In this instance, upon taking $k=0$, we have $u_0=1$, and $\Delta u_r=2$, for all r. Hence all differences of order higher than the first are zero, and the formula (21) yields the summation of n terms in the form

$$\Big[1+3+5+\cdots+(2n-1)\Big]=n+\frac{n(n-1)}{2!}2=n^2.$$

It will become clear after a moment's reflection that the formula (21) is especially advantageous if the sequence is one for which all the differences of a certain order, say the pth order, are zero. For in this case the number of terms in the right hand member of the formula totals to, at most, p, irrespective of the number r of terms which is being summed.

5 **Sequences of Functional Values.**—The most common of sources from which sequences are actually drawn in practice are tables, such as logarithmic or trigonometric tables, tables of square roots, of compound interest, of annuities, etc The terms of the sequence are in any such instance the tabulated entries. Since a table is almost invariably calculated from some appropriate formula, a sequence drawn from it naturally has such a formula behind it. Its terms, in other words, represent the values which some function, say $f(x)$, takes on at respective values x_0, x_1, x_2, x_3, $\cdots$, of the variable. These latter are usually equally spaced. It is then the problem to determine from the sequence the formula behind it in either an exact or an approximate sense. In the case of experimentally derived sequences, in which the terms are the recorded instrumental readings, the investigator quite commonly seeks to determine a function which will fit these terms. The following considerations have bearing upon this problem.

6. **The Differences of a Polynomial.**—Let $Q^{(p)}(x)$ designate any specific polynomial in x of the degree p, say

$$Q^{(p)}(x)=a_0+a_1x+a_2x^2+\cdots+a_px^p.$$

Also let the values x_0, x_1, x_2, x_3, $\cdots$, be spaced at equal intervals, so that with an appropriate value of h we have

$$x_r=x_0+rh.$$

We shall consider the sequence whose terms are given by the formula $u_r=Q^{(p)}(x_r)$. For this sequence $\Delta u_r=Q^{(p)}(x_r+h)-Q^{(p)}(x_r)$, and this is readily found to be of the form $Q^{(p-1)}(x_r)$, where $Q^{(p-1)}(x)$ is a polynomial in x of degree no higher than $(p-1)$. Since the sequence of first differences can be treated in precisely the same way, it is found that the second differences are given by a formula $\Delta^2 u_r=Q^{(p-2)}(x_r)$, in which $Q^{(p-2)}(x)$ is a polynomial of degree no higher than $(p-2)$, etc. By repeating the deduction it is found that the pth differences are the values of a polynomial of degree zero, namely they are all the same. Hence the $(p+1)$th differences are all zero. Thus, *if the terms u_r of a sequence are the values taken on by a polynomial of degree p at equally spaced values of x, then $\Delta^{p+1}u_r=0$, for all r.*

This theorem has also a converse, namely, *if for a given sequence the $(p+1)$th differences are all zero, the terms are the values which a polynomial of degree p takes on at equally spaced values of x.* To prove this it is only necessary to observe that in this case the terms after the pth one in the right hand member of the formula (10) are all zero. The formula may, therefore, be written thus,

$$u_{k+r}=u_k+r\Delta u_k+\frac{r(r-1)}{2!}\Delta^2u_k+\cdots$$
$$+\frac{r(r-1)\cdots(r-p+1)}{p!}\Delta^p u_k. \qquad (23)$$

On substituting in this the evaluations

$$r=\frac{x_{k+r}-x_k}{h}, \qquad (r-j)=\frac{x_{k+r}-x_{k+j}}{h},$$

which are forms of (22), it is clear that each term u_{k+r} is the value that the polynomial

$$Q^{(p)}(x)=u_k+\frac{x-x_k}{h}\Delta u_k+\frac{(x-x_k)(x-x_{k+1})}{h^2}\frac{\Delta^2u_k}{2!}+$$
$$\cdots+\frac{(x-x_k)(x-x_{k+1})\cdots(x-x_{k+p-1})}{h^p}\frac{\Delta^p u_k}{p!} \qquad (24)$$

takes on at the point $x=x_{k+r}$.

7. **Interpolation.**—The problem of interpolating into a table of functional values other values which are intermediate to those given, is now immediate, whenever the sequence of entries is one for which the differences of some specific order, say the $(p+1)$th, are all zero. If the interval of the variable at which the entries are made is denoted by h, the deductions of §6 show that the values in the table are those which are taken on by the polynomial (24). By calculating the value of this polynomial at any other x, the entry to be interpolated for this x is obtained. In an approximate sense the scheme described is much more widely applicable. It is an observable fact that for most tabulated functions the differences diminish rapidly in value as their orders are increased. Whenever this is the case, then when $(p+1)$ is sufficiently large the differences $\Delta^{p+1}u_r$ are all sufficiently small to permit their being replaced, in a sense of approximation, by zeros. Once this is done, the formula for interpolation becomes the polynomial (24).

As an example, consider the following values taken from a five-place table of common logarithms, with $u_r=\log\left(1+\frac{r}{10}\right)$

TABLE IV.

x	u	Δu	$\Delta^2 u$	$\Delta^3 u$
1.00	00000			
		.00531		. .
1.10	00531		−.00830	
		.08701		.00133
1.20	.18232		−.00697	
		.08004		00104
1.30	26236		−.00593	
		.07411		. . .
1.40	.33647		. . .	

In this instance $h=.1$, and if it is assumed by way of approximation that $\Delta^4u_r=0$, the value which is given by the formula (23), with $k=0$ and $x=.05$, for log 1.05 is found to be

$$Q^{(3)}(1.05)=0+\frac{.05}{.1}\Delta u_0+\frac{.05(-.05)}{(.1)^2}\frac{\Delta^2u_0}{2!}+\frac{.05(-.05)(-.15)}{(.1)^3}\frac{\Delta^3u_0}{3!}$$
$$=.04878.$$

The value given in the table for log 1.05 differs from this result only in having a 9 in the final place instead of the 8.

8. **Central Differences.**—An alternative scheme of notation for differences which is also in common use, and which permits of the compact expression of many formulas, is that in which the value $(u_{k+1}-u_k)$ is designated by $\delta u_{k+\frac{1}{2}}$. The value $(\delta u_{k+\frac{1}{2}}-\delta u_{k-\frac{1}{2}})$ is then correspondingly designated by δ^2u_k, etc. The entries of a table of *central differences* are thus designated in the manner indicated in Table V.

TABLE V.

Term	1st diff.	2nd diff.	3rd diff.	
	. . .		. . .	
. . .		. . .		. . .
	$\delta u_{k-\frac{3}{2}}$		. . .	
u_{k-2}		δ^2u_{k-2}		. . .
	$\delta u_{k-\frac{3}{2}}$		$\delta^3u_{k-\frac{3}{2}}$	
u_{k-1}		δ^2u_{k-1}		. . .
	$\delta u_{k-\frac{1}{2}}$		$\delta^3u_{k-\frac{1}{2}}$	
u_k		δ^2u_k		. . .
	$\delta u_{k+\frac{1}{2}}$		$\delta^3u_{k+\frac{1}{2}}$	
u_{k+1}		δ^2u_{k+1}		. . .
	$\delta u_{k+\frac{3}{2}}$		$\delta^3u_{k+\frac{3}{2}}$	
u_{k+2}		δ^2u_{k+2}		. . .
	. . .		. . .	
. . .		. . .		. . .

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CALCULUS OF VARIATIONS. When two points, A and B, are given in a plane, as shown in fig. 1, there is an infinity of arcs which join them. A simple problem of the calculus of variations is that of finding in this class of arcs one which has the shortest length, the solution of the problem being of course a straight line segment. But we may also seek to find in the class of arcs joining A with B one down which a particle, started with a given initial velocity v, will fall in the shortest time from A to B; or we may ask which one of these arcs, when rotated about the axis Ox, will generate a surface of revolution of smallest area. These are typical problems of the calculus of variations of the so-called simplest type.

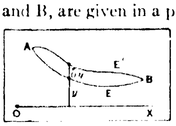

FIG 1

The notations which gave rise to the name, the calculus of variations, were originated by Joseph Louis Lagrange about the year 1762 and are still in use, though at the present time there is a tendency to replace them by others. If T represents the time of descent of a particle falling along an arc E, then to get the corresponding time for a neighbouring arc E' a correction must be added to T. This correction is called a variation of T and is designated in Lagrange's notation by δT. Similarly the vertical distances y in fig. 1 corresponding to the various points of E must be corrected by variations δy in order to get the corresponding vertical distances for E'.

The problem of finding an arc E such that the variation δT will be positive for all choices of the variations δy is the problem of the curve of quickest descent mentioned in the last paragraph. Since the time of Lagrange the theory of such problems has been called the calculus of variations.

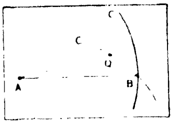

FIG 2

The Shortest Line from a Point to a Curve.—Some of the properties of minimizing arcs of the calculus of variations are well illustrated by the problem of determining the shortest line joining a fixed point A with a fixed curve C, shown in fig. 2. Evidently the solution of the problem must be a straight segment AB, and it can further readily be seen that AB must cut the fixed curve C at right angles. For if C were in the position C′ shown in fig. 2 the line AQ would evidently be shorter than AB.

It might be concluded that a straight line AB perpendicular to C is actually the shortest line joining A to C, but this is not always true. It is known that the straight lines cutting C at right angles are all tangent to a curve D, as shown in fig. 3, one of whose properties is that the length of the composite arc PQR is always equal to the length PB, whatever the position of Q at the right of P on D. This is the well-known string property of the curve D, so-called because it means that a stretched string of length PB, attached at P and allowed to wrap itself around the curve D, will describe the arc C with its movable end R. The length of the composite arc APQR is equal to that of AB, as has just been indicated, and the length of APQR will be less than that of AB when the curved arc PQ is replaced by a straight line. Evidently AB is not the shortest arc which can be drawn from A to the curve C if its point of contact P with the envelope D lies between A and B.

It is conceivable that other properties might be required of the *segment AB in order to insure its minimizing property.* But it can be proved, when the point A lies to the right of P in fig. 3, that *there is a neighbourhood of AB in which that line is shorter than* any other arc joining A with C.

The Surface of Revolution of Minimum Area.—The properties which have just been described for the shortest line AB from a point A to a curve C, namely, its straightness, its perpendicularity to C, and the absence from AB of a contact point P with the envelope D, are all analogues of properties which are possessed by minimizing arcs for other problems. There are, furthermore, sufficiency proofs, analogous to that mentioned in the last paragraph, which tell us when enough properties have been secured to insure the minimum property.

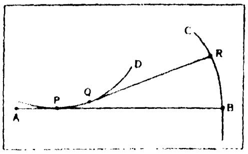

FIG 3

A circular **wire** dipped in a soap solution and then withdrawn will have a disk of **soap** film stretched across it. If a smaller circular wire is made to touch this disk and is then withdrawn to a position shown in fig. 4 a film will be stretched between the two wires which is a surface of revolution about the common axis of the two circles. It is found by experiment that when the circle B is moved away from A in the direction of the dotted axis a position is presently reached at which the film always becomes unstable. It contracts at the waist and separates into two plane disks through the two circles.

The determination of the shape of the soap film described in the last paragraph gives rise to a perfectly definite mathematical problem. It is that of finding among the arcs joining A with B, in the plane of the paper in fig. 4, one which when rotated about the dotted axis will generate a surface of revolution of smallest area. The curve which solves the problem is described by a mathematical equation, but its shape is that of a chain whose ends are fast but which otherwise hangs freely. The mathematicians call such a curve a *catenary* from the Latin word *catena* meaning a chain.

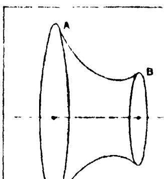

FIG. 4

The catenaries of the problem which pass through the point A have an enveloping curve D as shown in fig. 5. The critical point on one of them, beyond which its minimizing property ceases, is its point of tangency P with the envelope. A very interesting property of the curves in fig. 5 is that the surface of revolution generated by the composite arc AQP is always equal to that generated by the catenary AP whatever the position of Q below P on the envelope. This is the analogue of the string property of the envelope of the straight lines perpendicular to a curve, and an argument similar to the one described for that case shows that the area of the surface of revolution generated by a catenary arc APB can never be a minimum area since the areas of the surfaces generated by the arcs AQPB are all equal to it.

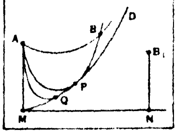

FIG. 5

When the point B lies above the envelope D there are always two catenary arcs joining it to A, as shown in fig. 5, one of which has a critical point P on it. The other is the one which can be proved to furnish a minimum area. When B lies in the position B_1, then there is no catenary arc joining the points A and B and the minimum surface of revolution consists of the two disks generated by the broken line $AMNB_1$.

When the circular wire B on fig. 4 is moved away from A the catenary arc AB varies from one to another of the catenary arcs through A shown in fig. 5. The moment when the film decomposes into two disks, like those generated by the broken line $AMNB_1$, is the moment when B reaches the enveloping curve D.

Isoperimetric and Other Problems.—The ancient Greeks proposed the problem of determining in the class of all closed arcs of a given length one which encloses the largest area. They called this the isoperimetric problem, from *ἴσος* meaning equal and *περίμετρον* meaning circumference, and were able to show in more or less rigorous fashion that the curve which solves the problem is a circle.

The isoperimetric problem of the Greeks imposes an additional property besides closure on the arcs of the class in which the minimizing arc is sought, namely, that all of them shall have the same length. Similar restrictions may be put upon the class of arcs joining the points A and B described in the first paragraph of this article.

In the class of closed surfaces enclosing a given volume the one which has a minimum surface is a sphere. This agrees with the commonly observed fact that a soap bubble, enclosing a given volume of air, has spherical form. If, on the other hand, we turn the problem around and search in the class of closed surfaces having a given area, one which encloses a maximum volume, the solution is again a sphere. Every isoperimetric problem has associated with it in this way another one of the same sort and having the same solution surface or curve.

Relation to Mechanics.—In the domain of mechanics the calculus of variations has played an important role. If a system of particles is moving subject to their own gravitational attractions, it is found that their paths will be minimizing curves for what the mathematicians call the integral of the difference between the kinetic and potential energies of the system. This is the famous principle known after its discoverer Sir William Rowan Hamilton as Hamilton's principle. Many most important trajectories of widely varying character in mechanics, astronomy and mathematical physics have similar maximum or minimum properties. The theory of the calculus of variations has been greatly enriched as a result of applications of this sort, and in turn it has been profoundly influential in shaping the mathematical interpretations of physical phenomena. Two illustrations of the 20th century are the famous relativity theory of Albert Einstein and the quantum theory of E. Schrödinger, both of which depend intimately upon portions of the theory of the calculus of variations.

The problems which have been described above are a few only of the large variety with which the calculus of variations is concerned. By the use of the devices of mathematical analysis the scope of the theory has been steadily enlarged. Great progress has been made, for example, in generalizing the character of the restrictions upon curves or surfaces of the classes in which minimizing elements are sought, as compared with the restrictions which have long been imposed for isoperimetric problems, and in generalizing the variable quantity, dependent upon the curves or surfaces, whose maximum or minimum value is to be obtained. Many of the questions which have arisen are only imperfectly answered and it is apparent to a student of the subject that the theory of the calculus of variations will always be a lively and growing one.

A Historical Sketch.—Some of the problems of the calculus of variations are very old. The isoperimetric problems of the circle and sphere were considered by Zenodorus (about 100 B.C.) and Archimedes (287?–212 B.C.). The problem of the curve of quickest descent appears somewhat vaguely in the writings of Galileo Galilei in 1630 and 1638, and was reformulated and solved by Jean (Johann, John) Bernoulli in 1696–97. The determination of the form of a hanging chain is a problem of the calculus of variations also considered by Galileo in 1638, reformulated by Jacques (Jakob, James) Bernoulli in 1690, and solved by Gottfried Wilhelm Leibniz and others in 1691. Isaac Newton determined in 1686 the characteristic property of a curve generating a surface of revolution offering minimum resistance to motion through a resisting medium in the direction of its axis.

All of these were special problems solved by special methods. The foundations for a general theory were laid by Jacques Bernoulli in his solution in 1697 of the problem of the curve of quickest descent which had been proposed by his brother Jean. Leon-hard Euler saw that the methods of Jacques Bernoulli were widely applicable and he deduced in 1744 the first general rule for the characterization of maximizing or minimizing arcs of the calculus of variations. In 1760–62 Lagrange devised the notations for variations which have given the theory its name, and greatly simplified and extended the results of Euler. In 1786 Adrien Marie Legendre studied for the first time what is called the second variation of the quantity to be minimized and found a criterion for distinguishing between maxima and minima. In his reduction of the second variation Legendre used a transformation which could not be justified in all cases. The difficulty was analysed in 1838 by Carl Gustav Jacob Jacobi, who in so doing discovered the existence of the critical point P beyond which the minimizing properties of an arc will fail.

The modern period in the development of the theory of the calculus of variations is characterized by much greater precision in the formulation of problems and in the methods and reasoning applied to their solution. It began with Karl Weierstrass, who in the decade preceding 1879 saw that one might continue indefinitely to seek for properties of minimizing arcs unless a proof could be made that a suitable set of properties would actually insure the minimum. He had himself found an important new necessary condition for a minimum which cannot easily be described here in non-technical language. He succeeded in proving in very ingenious fashion that certain characteristics of an arc are sufficient to insure its minimizing property. Between 1894 and 1898 the string property of the envelope of the normals to a curve was generalized for shortest lines on a surface by Jean Gaston Darboux, and for more general problems by E. Zermelo and Adolf Kneser. In 1899 David Hilbert stated an existence theorem which asserts that under certain circumstances a minimizing arc will surely exist. The theorem has been reproved more simply by other writers and extended by Leonida Tonelli, who in 1921–23 made it the basis for a new approach to the theory of the calculus of variations. The scope of the theory of the calculus of variations has been greatly extended by Adolf Mayer and Oskar Bolza, who formulated in 1878 and 1913, respectively, problems of very great generality to which the methods of the theory are applicable.

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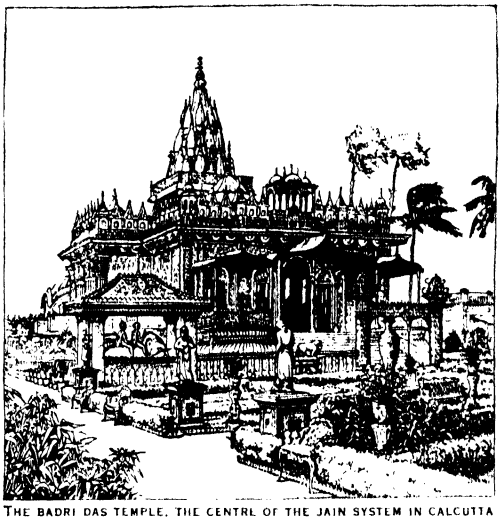
For an excellent synopsis of the development of the theory of the calculus of variations with elaborate references *see* two articles by A. Kneser; and by E. Zermelo and H Hahn, *Encyklopädie der Mathematischen Wissenschaften*, II, A 8 (1900), II, A 8a (1904). These have been translated into French and amplified importantly by Maurice Lecat, *Encyclopédie des Sciences Mathématiques,* II, 31 (1913, 1916), pp. 1–288.

Books dealing with the history of the subject are M. Cantor, *Geschichte der Mathematik,* vols. i–iv (Teubner, Leipzig, 1892–1908); and I. Todhunter, *A History of the Progress of the Calculus of Variations during the Nineteenth Century* (Macmillan, 1861), treating the period from 1760 to 1860 An interesting historical sketch is contained in Pascal, *Calcolo delle Variazioni* (Hoepli, 1897), which has also been translated into German by Adolf Schepp (*Die Variationsrechnung* (Teubner, Leipzig, 1899).

An extensive bibliography has been published by M. Lecat, *Bibliographie du Calcul des Variations, depuis les origines jusqú à 1850* (Hermann, 1916); 1850–1913 (ditto, 1913). *See* also the additions in his *Bibliographie des Séries Trigonométriques* (M. Lecat, 1921), p. 155; and in his *Bibliographie de la Relativité* (M. Lamertin, 1924), Appendix, p. 15. A bibliography of the principal treatises is given by G. A. Bliss in his first book mentioned above. Two well-known books not listed there or above are G. Vivanti, *Elementi del Calcolo delle Variazioni* (Principato, Messina, 1923); and A R Forsyth, *Calculus of Variations* (Cambridge University Press, 1927) (G. A. Bl.)

CALCUTTA, a city in British India and the capital of the province of Bengal. It is situated in 22° 34′ N and 88° 24′ E., on the left or east bank of the Hugli, about 80m. from the sea. It extends over an area of 32 sq.m. and contains a population (1941) of 2,108,891. Including Howrah on the other side of the river, which has been described as being as much a part of Calcutta as Southwark is of London, Calcutta has a total population of 2,488,183 and claims to be the second city in the British empire. It was until 1912 the seat of the Government of India, which in that year was transferred to Delhi.



THE BADRI DAS TEMPLE, THE CENTRE OF THE JAIN SYSTEM IN CALCUTTA

Buildings.—Though Calcutta has been called "the city of palaces," its modern public buildings cannot compare with those of Bombay. Its chief glory is the maidan or park, 2 sq m in area, which is large enough to embrace the area of Ft. William and a

high erected to the memory of Sir David Ochterlony, who brought the Nepalese War to a victorious conclusion South-east of the maidan stands the finest building in Calcutta, the Victoria Memorial, the conception of which was due to Lord Curzon, it was built on the site of the old gaol and opened in 1921. It is a domed marble building with a great centre dome, and contains pictures, documents, etc., illustrating Indian history. This great building dwarfs the cathedral, to the east of it, which has a spire 207ft. high. A war memorial to the lascars of Bengal and Assam has been erected near Prinsep's Ghat by the river bank Government House, which is situated near the maidan and Eden gardens, was the residence of the viceroy until 1912, since when it has been occupied by the governor of Bengal It was built by Lord Wellesley in 1799, and is a fine pile situated in grounds covering six acres. The town hall has been used for some years for meetings of the Bengal legislature pending the construction of a separate council chamber. The High Court building in its vicinity was designed on the model of the town hall at Ypres. Calcutta being a city of modern growth, there are few buildings of any considerable age. Lord Curzon restored at his own cost, the monument which formerly commemorated the massacre of the Black Hole, and a tablet let into the wall of the general post office indicates the position of the Black Hole in the north-east bastion of Ft. William, now occupied by the roadway Belvedere House, a country house of Warren Hastings and the official residence of the lieutenant-governor of Bengal from 1854 to 1921 is situated close to the zoological gardens in Alipore the southern suburb of Calcutta. Here also are Hastings House another residence of Warren Hastings, the Bengal Meteorological Observatory and cantonment Facing the maidan for a couple of miles is

Chowringhee, once a row of palatial residences, but now given up almost entirely to hotels, clubs and shops. Several magnificent buildings have been erected in the commercial quarter, including the Royal Exchange. Some areas have been almost transformed by an improvement trust which since its creation in 1912 has carried out the clearing of insanitary areas; the widening and construction of roads (the chief being the Central avenue, a fine road 100ft. wide running north and south through the heart of the city); the provision of model dwellings for families dispossessed under its schemes; and the laying out of suburban land for private building.

Commerce.—Calcutta owes its commercial prosperity to the fact that it is the natural port of north-east India, on which ocean, river and rail traffic converge. It receives the produce of the fertile river valleys of the Ganges and Brahmaputra, and being situated midway between Europe and the Far East it forms a meeting-place for the commerce of the eastern and western worlds. The port is one of the busiest in the world, and the banks of the Hooghly rival the port of London in their show of shipping. The port of Calcutta is under the control of a port trust, whose jurisdiction extends to the mouth of the Hooghly. Vessels of 10,000 tons drawing 28ft. and more ascend this great river to Calcutta; it is a dangerous river owing to mud shoals constantly forming, but is kept safe for navigation by the efforts of the port trust and the skill of the pilots. The river is also connected with eastern Bengal and Assam by a series of natural waterways and of navigable channels (some artificial) with a total length of 1,100 miles. The tonnage of vessels entering the port in 1926–27 exceeded four millions. Howrah is the terminus of two great railway systems, and is linked with Calcutta by an immense floating bridge, 1,530ft. in length, which was constructed in 1874. It was decided in 1924 to build a cantilever bridge over the river. A third large railway has its terminus at Sealdah, an eastern suburb. Docks were opened at Kidderpore to the south in 1892. Owing to the increased trade, it has been found necessary to build a new dock (King George's dock) below them.

Municipality.—The Municipal Government of Calcutta is regulated by acts of the Bengal legislature, passed in 1899 and 1923. Female suffrage was introduced by the act of 1923. The corporation consists of 85 councillors, with a mayor, deputy-mayor and aldermen elected by the council. The water-supply is derived from the river Hooghly about 16 mi. above Calcutta; an iron reservoir, said to be the second largest in the world, has been erected at Talia to the north of the city.

The drainage system consists of underground sewers, which are discharged into a natural depression to the eastward, called the Salt lake.

The University of Calcutta.—The University of Calcutta was founded, together with those of Madras and Bombay, by an Indian act in 1857, on the model of the University of London. After the report from Lord Curzon's universities' commission in 1902 it was given teaching powers by an act in 1904; and the university is still working entirely under the acts above named save for the substitution by an act of 1921 of the governor of Bengal for the governor-general as chancellor, and of the local government for the governor-general in council, as the determining authority for a number of university matters.

The university exercises control over the hundreds of secondary schools in Bengal by means of the matriculation examination, for which from 16,000 to 19,000 candidates present themselves annually; it exercises control over the "affiliated" colleges by determining the curricula and examinations in the faculties of arts, laws, teaching (education), science, medicine and engineering; and it carries on since 1909 "post-graduate" teaching in arts and science and teaching in law in the university law college. A comprehensive survey of the university work was made by the Calcutta university commission presided over by the late Sir Michael Sadler in 1917–19. Since the report was issued an area with a radius of five miles in the Dacca district and the province of Burma have been removed from the educational jurisdiction of Calcutta and the universities of Dacca (*q.v.*) and Rangoon created in 1921. In 1928 the senate adopted a resolution approving reorganization on the lines of this report. There are a number of affiliated institutions, of which the chief is Presidency college, maintained by Government. The university has a number of endowed chairs and lectureships and a very large number of benefactions for scholarships and prizes.

Population.—The population has been nearly doubled in the last half century. It is a mixture of many races and presents curious anomalies. Though a creation of British rule, Calcutta contains only 8,971 Europeans; though the capital of Bengal, only 66% of its inhabitants are Bengalis; though it is the seat of a university and the provincial centre of education, less than half can read and write.

Hardly more than one-third of its population were born in Calcutta; men outnumber women by two to one, the bulk being below the age of forty. The explanation of these peculiarities is that the trade and manufactures of the city attract an enormous number of able-bodied men, mostly illiterate workers, from outside. The day population largely exceeds that which sleeps in the city; there are 300,000 season ticket holders to the railway termini. As in other towns in Bengal, Hindus predominate, outnumbering Mohammedans by 1,033,977.

Climate.—The condition of the city was formerly very unhealthy, but it has improved greatly of recent years with modern sanitation and drainage, and it is now as healthy a place as any in the plains of Bengal. The climate is hot and damp; the quantity of vapour in the air is more than twice as great as it is in that of London. Calcutta has a pleasant cold season from the end of November to March; April, May and June are hot; and the monsoon months from June to October are distinguished by heat and humidity. The mean annual temperature is 79° F, with a range from 85° in the hot season and 83° in the rains to 72° in the cool season, a mean maximum of 102° in May and a mean minimum of 48° in January.

HISTORY

The history of Calcutta practically dates from Aug. 24, 1690, when it was founded by Job Charnock (*q.v.*) of the English East India Company. In 1596 it had obtained a brief entry as a rent-paying village in the survey of Bengal executed by command of the Emperor Akbar. In 1686 the English merchants at Hugli retreated about 26m. down the river to Sutanati, a village now within the boundaries of Calcutta. They occupied Sutanati temporarily in Dec. 1686, and permanently on Aug. 24, 1690. The new settlement soon extended itself along the river bank to the then village of Kalikata, and by degrees the cluster of neighbouring hamlets grew into the present town. In 1696 the English built the original Fort William by permission of the nawab, and in 1698 they formally purchased the three villages of Sutanati, Kalikata and Govindpur from Prince Azim, son of the Emperor Aurangzeb.

The site thus chosen had an excellent anchorage and was defended by the river from the Mahrattas, who harried the districts on the other side. The fort, subsequently rebuilt on the Vauban principle, combined with the natural position of Calcutta to render it one of the safest places for trade in India during the expiring struggles of the Mogul empire. It grew up without any fixed plan and with little regard to the sanitary arrangements required for a town. Some parts of it lay below high-water mark on the Hugli, and its low level throughout rendered its drainage a most difficult problem.

The chief event in the history of Calcutta is the sack of the town, and the capture of Fort William in 1756, by Suraj-ud-Dowlah, the nawab of Bengal. The majority of the English officials took ship and fled to the mouth of the Hugli river. The Europeans who remained were compelled, after a short resistance, to surrender. The prisoners, numbering 146 persons, were forced into the guard-room, a chamber measuring only 18ft. by 14ft. 10in., with but two small windows, where they were left for the night. It was the 20th of June; the heat was intense; and next morning only 23 were taken out alive, among them Holwell, who left an account of the awful sufferings endured in the "Black Hole." The site of the Black Hole is now covered with a black marble slab, and the incident is commemorated by a monument erected by Lord Curzon in 1902. In Jan. 1757 the expedition despatched from Madras, under the command of Admiral Watson and Colonel Clive, regained possession of the city. The battle of Plassey was fought on June 23, 1757, exactly 12 months after the capture of Calcutta. Mir Jafar, the nominee of the English, was created nawab of Bengal, and by the treaty which raised him to this position he agreed to make restitution to the Calcutta merchants for their losses. By another clause in this treaty the Company was permitted to establish a mint, the visible sign in India of territorial sovereignty, and the first coin, still bearing the name of the Delhi emperor, was issued on August 19, 1757. Modern Calcutta dates from 1757. The old fort was abandoned, and its site devoted to the custom-house and other Government offices. A new fort, the present Fort William, was begun by Clive a short distance lower down the river. At this time also the maidan, the park of Calcutta, was formed.

Up to 1707, when Calcutta was first declared a presidency, it had been dependent upon the older English settlement at Madras. From 1707 to 1773 the presidencies were maintained on a footing of equality; but in the latter year the act of parliament was passed, which provided that the presidency of Bengal should exercise a control over the other possessions of the Company; that the chief of that presidency should be styled governor general; and that a supreme court of judicature should be established at Calcutta. In the previous year, 1772, Warren Hastings had taken, under the immediate management of the Company's servants, the general administration of Bengal. The treasury was removed from Murshidabad to Calcutta which thus became the capital. In 1834 the governor general of Bengal was created governor general of India. It was not until 1854 that a separate head was appointed for Bengal. In 1912 the 1905 partition of Bengal was reversed and Calcutta was no longer the capital of India, the seat of Government being transferred to Delhi (*q.v.*). Since 1920 the harbour has been greatly extended and in internal development and foreign trade, Calcutta still leads the other large cities of Northern India. (*See* BENGAL.)

See A. K. Ray, *A Short History of Calcutta* (Indian Census, 1901); C. R. Wilson, *Early Annals of the English in Bengal* (1805); and *Old Fort William in Bengal* (1906); S. S. O'Malley, *History of Bengal, Bihar and Orissa under British Rule*, Calcutta (1925).

CALDECOTT, RANDOLPH (1846–1886), English artist and illustrator, was born at Chester on March 22, 1846, and died in Florida on Feb. 12, 1886. He was a prolific and original illustrator, gifted with a genial humorous faculty, and he succeeded also, though in less degree, as a painter and sculptor.

His most famous book illustrations are those for:—*Old Christmas* (1876) and *Bracebridge Hall* (1877), both by Washington Irving; *North Italian Folk* (1877), by Mrs. Comyns Carr; *The Harz Mountains* (1883); *Breton Folk* (1879), by Henry Blackburn; picture-books (*John Gilpin*, *The House that Jack Built*, and other children's favourites) from 1878 onwards; *Some Aesop's Fables with Modern Instances, etc.* (1883). He held a roving commission for the *Graphic*, and was an occasional contributor to *Punch*. He was a member of the Royal Institute of Painters in Water-colours. *See* Henry Blackburn, *Randolph Caldecott, Personal Memoir of his Early Life* (1886).

CALDER, SIR ROBERT, BART. (1745–1818), British admiral, was born at Elgin, in Scotland, on July 2, 1745 (o.s.), of an old family, and at the age of 14 entered the British navy as midshipman. In 1796 he was named captain of the fleet by Sir John Jervis, and took part in the great battle off Cape St. Vincent (Feb. 14, 1797). He received a baronetcy in 1798. In 1799 he became rear-admiral; and in 1801 he was despatched with a small squadron in pursuit of a French force, under Admiral Gantheaume, conveying supplies to the French in Egypt. In this pursuit he was not successful, and returning home at the peace he struck his flag. When the war again broke out he was recalled to service, was promoted vice-admiral in 1804, and was employed in the following year in the blockade of the ports of Ferrol and Corunna, in which (amongst other ports) ships were preparing for the invasion of England by Napoleon I. He held his position with a force greatly inferior to that of the enemy, and refused to be enticed out to sea. On its becoming known that the first movement directed by Napoleon was the raising of the blockade of Ferrol, Rear-Admiral Stirling was ordered to join Sir R. Calder and cruise with him to intercept the fleets of France and Spain on their passage to Brest. The approach of the enemy was concealed by a fog; but on July 22, 1805, their fleet came in sight. It still outnumbered the British force; but Sir Robert entered into action. After a combat of four hours, during which he captured two Spanish ships, he gave orders to discontinue the action. He offered battle again on the two following days, but the challenge was not accepted. The French admiral Villeneuve, however, did not pursue his voyage, but took refuge in Ferrol. In the judgment of Napoleon, his scheme of invasion was baffled by this day's action; but much indignation was felt in England at the failure of Calder to win a complete victory. In consequence of the strong feeling against him at home he demanded a court-martial. This was held on Dec. 23, and resulted in a severe reprimand of the vice-admiral for not having done his utmost to renew the engagement, at the same time acquitting him of both cowardice and disaffection. False expectations had been raised in England by the mutilation of his despatches, and of this he indignantly complained in his defence. The tide of feeling, however, turned again; and in 1815, by way of public testimony to his services, and of acquittal of the charge made against him, he was appointed commander of Portsmouth. He died at Holt, near Bishop's Waltham, Hampshire, on Aug. 31, 1818.

See *Naval Chronicle*, xvii.; James, *Naval History*, iii. 356–379 (1860).

CALDER, an ancient district of Midlothian, Scotland. It is divided into the civil parishes of Mid-Calder (pop. 1931, 2,703) and West Calder (pop. 6,817), East Calder belonging to the parish of Kirknewton. The locality owes some of its commercial importance to the mineral oil industry, which, however, has now declined. Coal is mined, sandstone and limestone are worked, and paper is made. Mid-Calder, a town on the Almond, has an ancient church, and John Spottiswood (1510–1585), the Scottish reformer, was for many years minister. The town of West Calder, within the parish of that name, is situated on Breich Water, an affluent of the Almond, 15½ mi. S.W. of Edinburgh by the L.M.S.R., and is the chief centre of the district. At Addiewell, a village about 1½ mi. S.W., the manufacture of ammonia, naphtha, paraffin oil and candles is carried on; the village dates from 1866. Oil is also refined at Pumpherston. Both these villages arose as a result of the oil workings. The district contains several tumuli, old ruined castles and a Roman camp which is in a state of comparatively good preservation.

CALDERON, GEORGE (1868–1915), British dramatist, was born in London on Dec. 2, 1868, the son of the painter Philip H. Calderon, R.A. Educated at Rugby and Trinity college, Oxford, he spent two years in St. Petersburg (Leningrad) (1805–97), and from that time onwards took a deep interest in Russian literature and in the dialects and folk-lore of the Slav peoples generally. He was for a short time an official of the British Museum. His first play, *The Fountain*, was produced by the Stage Society in 1909. His collected plays were posthumously printed in 1921–22; they included a tragedy in blank verse entitled *Cromwell: Mall o'Monks*. He wrote one volume of impressions of travel, *Tahiti*, after a visit to the South Seas in 1906. In the World War Calderon served first as an interpreter in France and then as a line officer in the Dardanelles. His name was in the wounded and missing list of June 4, 1915.

CALDERON, PHILIP HERMOGENES (1833–1898), English painter, born at Poitiers, only son of the Rev. Juan Calderon, a native of La Mancha. He was educated from his 12th year in London, where his father was professor of Spanish literature at King's college. He began his artistic studies in 1850 at Leigh's, in Newman street. When nearly 20 he went to Paris to study at the École des Beaux-Arts, under M. Picot. His most popular picture is "Broken Vows," exhibited at the Royal Academy in 1857. He became A.R.A. in 1864, R.A. in 1867. He was elected keeper of the Royal Academy in 1887, and died at Burlington House on April 30, 1898. Calderon belonged to the so-called St. John's Wood school, which excelled in genre pictures with historical interest.

CALDERÓN, RODRIGO (d. 1621), COUNT OF OLIVA AND MARQUESS DE LAS SIETE INGLESIAS, Spanish favourite and adventurer, was born at Antwerp, the son of a Spanish army officer. In 1598 he entered the service of the duke of Lerma as secretary. He was created count of Oliva, a knight of Santiago, commendador of Ocaña in the order, secretary to Philip III. and made an advantageous marriage with Ines de Vargas. As an insolent upstart he was peculiarly odious to the enemies of Lerma. Two religious persons, Juan de Santá Maria, a Franciscan, and Mariana de San José, prioress of La Encarnacion, worked on the queen Margarita, by whose influence Calderón was removed from the secretaryship in 1611. But he retained the favour of Lerma, and in 1612 he was sent on a special mission to Flanders, and on his return was made marqués de Las Siete Inglesias in 1614. When queen Margarita died in that year in childbirth Calderón was accused of having used witchcraft against her. Soon after, it became generally known that he had ordered the murder of one Francisco de Juaras. On Lerma's disgrace in 1618 he was arrested, despoiled, and on Jan. 7, 1620, was savagely tortured until he confessed to the murder of Juaras, although he steadfastly denied all the other charges. He met his fate firmly with a show of piety on Oct. 21, 1621. Lord Lytton made Rodrigo Calderón the hero of his story *Calderón the Courtier*.

See Modeste de la Fuente, *Historia General España*, vol. xv. pp. 452 *et seq.* (1850–67); Quevedo, *Obras*, vol. x. *Grandes Anales de Quince Dias* (1794). A curious contemporary French pamphlet on Calderón, *Histoire admirable et declin pitoyable advenue en la personne d'un favory de la Cour d'Espagne*, is reprinted by M. E. Fournier in *Variétes historiques*, vol. i. (1855).

CALDERÓN DE LA BARCA, PEDRO (1600–1681), Spanish dramatist and poet, was born at Madrid on Jan. 17, 1600. He was educated at the Jesuit college in Madrid with a view to accepting a family living; abandoning this project, he studied law at Salamanca, and competed with success at the literary fêtes held in honour of St. Isidore at Madrid (1620–22). From 1625–35 Calderon seems to have resided at Madrid. Early in 1629 his brother Diego was stabbed by an actor, who took sanctuary in the convent of the Trinitarian nuns; Calderón and his friends broke into the cloister and attempted to seize the offender. This violation was denounced by the fashionable preacher Hortensio Félix Paravicino in a sermon preached before Philip IV.; Calderón retorted by introducing into *El principe constante* a mocking reference (afterwards cancelled) to Paravicino's gongoristic verbiage, and was committed to prison. He was soon released, grew rapidly in reputation as a playwright, and, on the death of Lope de Vega in 1635, was recognized as the foremost Spanish dramatist of the age. A volume of his plays, edited by his brother José in 1636, contains such celebrated and diverse productions as *La Vida es sueño, El Purgatorio de San Patricio, La Devoción de la cruz, La Dama duende* and *Peor está que estaba.* In 1636–37 he was made a knight of the order of Santiago by Philip IV., who had already commissioned from him a series of spectacular plays for the royal theatre in the Buen Retiro. Calderón was almost as popular with the general public as Lope de Vega had been in his zenith; he was, moreover, in high favour at court, but this royal patronage did not help to develop the finer elements of his genius. On May 28, 1640, he joined a company of mounted cuirassiers raised by Olivares, took part in the Catalonian campaign, and distinguished himself by his gallantry at Tarragona; his health failing, he retired from the army in Nov. 1642, and three years later was awarded a special military pension in recognition of his services in the field. The history of his life during the next few years is obscure. He appears to have been profoundly affected by the death of his mistress—the mother of his son Pedro José—about the year 1648–49; his long connection with the theatre had led him into temptations, but it had not diminished his instinctive spirit of devotion, and he now sought consolation in religion. He became a tertiary of the order of St. Francis in 1650, and finally reverted to his original intention of joining the priesthood He was ordained in 1651, was presented to a living in the parish of San Salvador at Madrid, and, according to his statement made a year or two later, determined to give up writing for the stage. He did not adhere to this resolution after his preferment to a prebend at Toledo in 1653, though he confined himself as much as possible to the composition of *autos sacramentales*—allegorical pieces in which the mystery of the Eucharist was illustrated dramatically, and which were performed with great pomp on the feast of Corpus Christi and during the weeks immediately ensuing. In 1662 two of Calderón's *autos*—*Las órdenes militares* and *Mistica y real Babilonia*—were the subjects of an enquiry by the Inquisition; the former was censured; the manuscript copies were confiscated, and the condemnation was not rescinded till 1671. Calderón was appointed honorary chaplain to Philip IV. in 1663, and the royal favour was continued to him in the next reign. In his 81st year he wrote his last secular play, *Hado y Divisa de Leonido y Marfisa*, in honour of Charles II.'s marriage to Marie-Louise de Bourbon. Notwithstanding his position at court and his universal popularity throughout Spain, his closing years seem to have been passed in poverty. He died on May 25, 1681.

Like most Spanish dramatists, Calderón wrote too much and too speedily, and he was too often content to recast the productions of his predecessors. His *Saber del mal y del bien* is an adaptation of Lope de Vega's play, *Las Mudanzas de la fortuna y sucesos de Don Beltran de Aragón;* his *Selva confusa* is also adapted from a play of Lope's which bears the same title; his *Encanto sin encanto* derives from Tirso de Molina's *Amar por señas*, and, to take an extreme instance, the second act of his *Cabellos de Absalón* is transferred almost bodily from the third act of Tirso's *Venganza de Tamar.* It would be easy to add other examples of Calderón's lax methods, but it is simple justice to point out that he committed no offence against the prevailing code of literary morality. Many of his contemporaries plagiarized with equal audacity, but with far less success. Sometimes, as in *El Alcalde de Zalamea*, the bold procedure is completely justified by the result; in this case by his individual treatment he transforms one of Lope de Vega's rapid improvisations into a finished masterpiece. It was not given to him to initiate a great dramatic movement; he came at the end of a literary revolution, was compelled to accept the conventions which Lope de Vega had imposed on the Spanish stage, and he accepted them all the more readily since they were peculiarly suitable to the display of his splendid and varied gifts. Not a master of observation or an expert in invention, he showed an unexampled skill in contriving ingenious variants on existing themes; he had a keen dramatic sense, an unrivalled dexterity in manipulating the mechanical resources of the stage, and in addition to these minor indispensable talents he was endowed with a lofty philosophic imagination and a wealth of poetic diction. Naturally, he had the defects of his great qualities; his ingenuity is apt to degenerate into futile embellishment; his employment of theatrical devices is the subject of his own good-humoured satire in *No hay burlas con el amor;* his philosophic intellect is more interested in theological mysteries than in human passions; and the delicate beauty of his style is tinged with a wilful preciosity. Excelling Lope de Vega at many points, Calderón falls below his great predecessor in the delineation of character. Yet in almost every department of dramatic art Calderón has obtained a series of triumphs. In the symbolic drama he is best represented by *El Principe constante*, by *El Mágico prodigioso* (familiar to English readers in Shelley's free translation), and by *La Vida es sueño*, perhaps the most profound and original of his works. His tragedies are more remarkable for their acting qualities than for their convincing truth, and the fact that in *La Niña de Gomez Arias* he interpolates an entire act borrowed from Velez de Guevara's play of the same title seems to indicate that this kind of composition awakened no great interest in him; but in *El Médico de su honra* and *El Mayor monstruo los celos* the theme of jealousy is handled with sombre power, while *El Alcalde de Zalamea* is one of the greatest tragedies in Spanish literature. Calderón is seen to much less advantage in the spectacular plays—*dramas de tramoya*—which he wrote at the command of Philip IV.; the dramatist is subordinated to the stage-carpenter, but the graceful fancy of the poet preserves even such a mediocre piece as *Los Tres Mayores prodigios* (which won him his knighthood) from complete oblivion. A greater opportunity is afforded in the more animated *comedias palaciegas*, or melodramatic pieces destined to be played before courtly audiences in the royal palace: *La Banda y la flor* and *El Galán fantasma* are charming illustrations of Calderón's genial conception and refined artistry. His historical plays (*La Gran Cenobia, Las armas de la hermosura*, etc.) are the weakest of all his formal dramatic productions; *El Golfo de las sirenas* and *La Púrpura de la rosa* are typical *zarzuelas*, to be judged by the standard of operatic libretti; and the *entremeses* are lacking in the lively humour which should characterize these dramatic interludes. On the other hand, Calderón's faculty of ingenious stagecraft is seen at its best in his "cloak-and-sword" plays (*comedias de capa y espada*), which are invaluable pictures of contemporary society. They are conventional, no doubt, in the sense that all representations of a specially artificial society must be conventional; but they are true to life and are still as interesting as when they first appeared. In this kind *No siempre lo peor es cierto, La Dama duende, Una casa con dos puertas mala es de guardar* and *Guárdate del agua mansa* are almost unsurpassed. But it is as a writer of *autos sacramentales* that Calderón defies rivalry; his intense devotion, his subtle intelligence, his sublime lyrism, all combine to produce such marvels of allegorical poetry as *La Cena del rey Baltasar, La Viña del Senor* and *La Serpiente de metal*. The *autos* lingered on in Spain till 1765, but they may be said to have died with Calderón, for his successors merely imitated him with a tedious fidelity. Almost alone among Spanish poets, Calderón had the good fortune to be printed in a fairly correct and readable edition (1682–91), thanks to the enlightened zeal of his admirer, Juan de Vera Tassis y Villaroel, and owing to this happy accident he came to be regarded generally as the first of Spanish dramatists. The publication of the plays of Lope de Vega and of Tirso de Molina has affected the critical estimate of Calderón's work; he is seen to be inferior to Lope de Vega in creative power, and inferior to Tirso de Molina in variety of conception. But, setting aside the extravagances of his admirers, he is admittedly an exquisite poet, an expert in the dramatic form, and a typical representative of the devout, chivalrous, patriotic, and artificial society in which he moved. (J. F.-K.)

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See also E. Fitzgerald, *Six Dramas of Calderón* (1853), a free translation; F. W. V. Schmidt, *Die Schauspiele Calderon's* (Elberfeld, 1857); M. Menéndez y Pelayo, *Calderón y su teatro* (1881); E. Günthner, *Calderon und seine Werke* (Freiburg i. B. 1888); C. Pérez Pastor, *Documentos para la biografiá de D. Pedro Calderón de la Barca* (1905); S. de Madariaga, *Shelley and Calderón* (1920).

CALDERWOOD, DAVID (1575–1650), Scottish divine and historian, was educated at Edinburgh, where he took the degree of M.A. in 1593. About 1604 he became minister of Crailing, near Jedburgh, and resolutely opposed the introduction of Episcopacy. In 1617, while James was in Scotland, a Remonstrance, which had been drawn up by the Presbyterian clergy, was placed in Calderwood's hands. He was summoned to St. Andrews and examined before the king, but neither threats nor promises could make him deliver up the roll of signatures to the Remonstrance. The privy council ordered him to be banished from the kingdom for refusing to acknowledge the sentence of the High Commission. On Aug. 27, 1619, he sailed for Holland. During his residence in Holland he published his *Altare Damascenum* (1623). Calderwood appears to have returned to Scotland in 1624, and he was soon afterwards appointed minister of Pencaitland, in the county of Haddington. His last years were devoted to the preparation of a *History of the Kirk of Scotland*, the ms. of which is in the British Museum. An abridgment was published in 1678. A digest of the complete work was published by the Wodrow Society (1842–49). Calderwood died at Jedburgh on Oct. 25, 1650.

CALDERWOOD, HENRY (1830–1897), Scottish philosopher and divine, was born at Peebles on May 10, 1830. He was educated at the Royal High school and the University of Edinburgh. In 1856 he was ordained pastor of the Greyfriars church, Glasgow. He taught moral philosophy at Glasgow university until, in 1868, he became professor of moral philosophy at Edinburgh. He was made LL.D. of Glasgow in 1865. He died on Nov. 19, 1897. His first and most famous work was *The Philosophy of the Infinite* (1854) in which he attacked the statement of Sir William Hamilton that we can have no knowledge of the Infinite. Calderwood held that such knowledge can exist; that Faith implies knowledge. His moral philosophy endeavours to substantiate the doctrine of divine sanction. Beside the data of experience, the mind has pure activity of its own whereby it apprehends reality. He wrote in addition *A Handbook of Moral Philosophy* (1872); *On the Relations of Mind and Brain* (1879); *Science and Religion* (1880); *Evolution and Man's place in Nature* (1893). Among his religious works the best known is his *Parables of Our Lord* (1880), and just before his death he finished a *Life of David Hume* in the "Famous Scots" series (1896). He was the first chairman of the Edinburgh school board.

CALDWELL, a city of Idaho, U.S.A., in the fertile Boise valley, near the western boundary of the State; the county seat of Canyon county. It is on federal highway 30 and is served by the Union Pacific railway system. The population in 1940 was 7,272. It is the geographical centre of irrigated lands comprising 725,000 ac., 90% of which is under cultivation; and the home of the College of Idaho, founded in 1891.

CALDWELL, a town of Essex County, New Jersey, named in honour of a hero of the Revolution; population in 1940 was 4,932; connected by the Erie Railway and motor bus with neighbouring cities. Here Grover Cleveland, twice President of the United States, was born on March 18, 1837; Cleveland Park was named in his honour.

CALEB, in the Bible, one of the spies sent by Moses from Kadesh in South Palestine to spy out the land of Canaan. For his courage he was rewarded by the promise that he and his seed should possess it (Num. xiii. *seq.*). Later tradition includes Joshua, the hero of the conquest of the land. Subsequently Caleb settled in Kirjath-Arba (Hebron), but there are different accounts. (*a*) Caleb drove out the Anakites, giants of Hebron, and gave his daughter Achsah to Othniel, his brother, who took Kirjath-Sepher or Debir (Jos. xv. 14–19). Both are "sons" of Kenaz, an Edomite clan (Gen. xxxvi). Elsewhere (*b*) Caleb the Kenizzite reminds Joshua of the promise at Kadesh; he asks that he may have the "mountain whereof Yahweh spake," and hopes to drive out the giants from its midst. Joshua blesses him and thus Hebron becomes the inheritance of Caleb (Josh. xiv. 6–15). Further (*c*) the capture of Hebron and Debir is ascribed to Judah who gives them to Caleb (Judg. i. 10 *seq.* 20); and finally (*d*) these cities are taken by Joshua himself in the course of a great campaign against South Canaan (Josh. x. 36–39). The seat of the clan was at Carmel in South Judah, and Abigail, the wife of the Calebite Nabal, was taken by David after her husband's death (I Sam. xxv., xxx. 14). Later the small divisions of the south were united under the name Judah, and this is reflected in the genealogies of I Chron. ii., iv., where Caleb and Jerahmeel become descendants of JUDAH (*q.v.*).

CALEDON, a town of Cape Colony, South Africa, 79 miles from Capetown, 34° 14′ S., 19° 25′ E., on a spur of the Zwartberg, at an altitude of 754 feet. Pop (1941) 1,894 Europeans and about 1,327 non-Europeans. The streets conform to the irregularities of the slopes, and are lined with oaks and blue gums. The town has several mineral springs, of which six have a temperature of 118°. It used to be visited by Dutch and British officials from the East Indies and India, who are said to have derived much benefit from the baths, which are radioactive. The opening of the Suez canal diverted this traffic, but in recent years Caledon has attracted more health-seeking visitors. Sixteen baths and a hot swimming-bath have been installed.

The district of Caledon is largely devoted to pastoralism. Wool and grain are its chief products. It also has a large trade in wild flowers, especially everlastings, and many varieties of heaths. Good shooting is to be had. Caledon is also the name of a tributary of the Orange River (*q.v.*).

CALEDONIA, the Roman name of North Britain, still used for Scotland, especially in poetry. It occurs first in the poet

Lucan (A.D. 64), and then often in Roman literature. There were (1) a district Caledonia, of which the southern border must have been on or near the isthmus between the Clyde and the Forth, (2) a Caledonian Forest (possibly in Perthshire), and (3) a tribe of Caledones or Calidones, named by the geographer Ptolemy as living within boundaries which are now unascertainable. The Romans first invaded Caledonia under Agricola about A.D. 82. After a brief halt on the Forth and Clyde Isthmus, where they established a line of temporary posts, one or two of which, notably that at Barhill, have been identified through excavation they penetrated farther north and fought the decisive battle of the war, according to Tacitus on the slopes of Mons Graupius. (This, not Grampius, is the proper spelling, though Grampius was at one time commonly accepted and indeed gave rise to the modern name Grampian.) The site must have been some way beyond the Roman encampment of Inchtuthill (in the policies of Delvine, 10m. north of Perth near the union of Tay and Isla), which is the most northerly of the ascertained Roman encampments of a permanent character in Scotland and belongs to the age of Agricola. Tacitus represents the result as a victory. The home government, whether averse to expensive conquests of barren hills, or afraid of a victorious general, abruptly recalled Agricola. The old view that his northern conquests were abandoned is not borne out by the results of recent research. Rather, there is evidence to show that they were held for 20 or 30 years after his departure, though not without various vicissitudes. The abundance and richness of the relics found at Newstead, the Trimontium of Ptolemy, suggests that, on one occasion at least, the withdrawal was anything but orderly. Finally Hadrian fixed the frontier to the south of Cheviot. The next advance followed immediately. About A.D. 142, when the district up to the Firth of Forth was definitely annexed, and a rampart with forts along it, the Wall of Antoninus Pius, was drawn from sea to sea (*see* BRITAIN, *Roman;* and ANTONINUS PIUS). At the same time a few other forts such as Ardoch, north of Dunblane and Carpow near Abernethy were occupied or reoccupied. But the conquest was stubbornly disputed, and after several risings, the land north of Cheviot was lost about A.D 180–185 About A.D. 208 the emperor Septimius Severus carried out an extensive punitive expedition against the northern tribes. It is doubtful how far he penetrated, for he has left no indubitable traces of his presence save at Cramaond on the Forth, and the great temporary camps that have been recognized in the shires of Forfar, Kincardine and Aberdeen, may as easily belong to earlier campaigns as to his. It is, however, clear that after his death the Roman writ never again ran north of Cheviot Rome, indeed, is sometimes said to have recovered the whole land up to the Wall of Pius in A.D. 368 and to have established there a province, Valentia. A province with that name was certainly organized somewhere. But its site and extent are quite uncertain and its duration was exceedingly brief. Throughout, Scotland remained substantially untouched by Roman influences, and its Celtic art, though perhaps influenced by Irish, remained free from Mediterranean infusion. Even in the south of Scotland which was for a time within the empire, the occupation was military and produced little civilizing effect. Of the actual condition of the land during the period of Roman rule in Britain, we are only beginning to learn the details by excavation. The remains from the purely native settlement on Traprain Law in East Lothian, where the houses were of daub and wattle, include much Roman pottery and many Roman coins. The "brochs," the "crannoys," and the underground stone houses locally called "weems" in all three of which Roman fragments have been found, were also native forms of dwelling, etc., and some of the "Late Celtic" metal work may belong to this age. But of the political divisions, the boundaries and capitals of the tribes, and the like, we know nothing. Ptolemy gives a list of tribes and place names But hardly one can be identified with any approach to certainty, except in the extreme south. Nor has unanimity quite been reached about the ethnological problems of the population, the Aryan or non-Aryan character of the Picts and the like The name Caledonia is said to survive in the second syllable of Dunkeld and in "Schiehallion" (Sithchaillinn).

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CALEDONIAN CANAL. The chain of fresh-water lakes —Lochs Ness, Oich and Lochy—which stretch along the line of the Great Glen of Scotland in a south-west direction from Inverness, early suggested the idea of connecting the east and west coasts of Scotland by a canal which would save ships about 400 m. of coasting voyage round the north of Great Britain through the stormy Pentland firth. In 1773 James Watt was employed by the government to make a survey for such a canal, which was constructed by Thomas Telford and opened in 1822. From the northern entrance on Beauly firth to the southern, near Ft. William, the total length is about 60 m., that of the artificial portion being about 22 m. The number of locks is 28, and their lift is in general about 8 ft., but some of them are for regulating purposes only. The navigation is vested in and managed by the commissioners of the Caledonian canal, of whom the speaker of the House of Commons is *ex officio* chairman. Any profits must be expended on renewals and improvements of the canal, but parliament is occasionally called upon to make special grants. The canal is now little used owing to its small size and the increased power and range of steam fishing vessels. In the commissioners is also vested the Crinan canal (*q.v.*).

CALENBERG, the name of a district, including the town of Hanover, formerly part of the duchy of Brunswick. It received its name from a castle near Schulenburg, and is traversed by the rivers Weser and Leine, its area being about 1 050 square miles. The district was given to various cadets of the ruling house of Brunswick, one of these being Ernest Augustus, afterwards elector of Hanover, and the ancestor of the Hanoverian kings of Great Britain and Ireland.

CALENDAR, so called from the Roman Calends or Kalends a method of distributing time into certain periods adapted to the purposes of civil life, as hours, days, weeks, months, years, etc.

The *solar day* is distinguished by the daily revolution of the earth and the alternation of light and darkness. The *solar year* completes the circle of the seasons. The phases of the moon yield the *month*. The solar day, the solar year, and the lunar month, or lunation, are called the *natural* divisions of time. The hour, the week, and the civil month are conventional divisions.

Day, Week and Month.—The subdivision of the day (*q.v.*) into twenty-four parts, or hours combines a natural with a conventional division. The week, a period of seven days, having no reference whatever to the celestial motions, might have been suggested by the phases of the moon, or by the number of the planets known in ancient times, an origin which is rendered more probable from the names universally given to the different days of which it is composed.

The English names of the days are derived from the Saxon. The ancient Saxons had borrowed the week from some Eastern nation, and substituted the names of their own divinities for those of the gods of the East.

Latin	*English*	*Saxon*
Dies Solis.	Sunday.	Sun's day.
Dies Lunae.	Monday.	Moon's day.
Dies Martis.	Tuesday.	Tiw's day.
Dies Mercurii.	Wednesday.	Woden's day.
Dies Jovis.	Thursday.	Thor's day.
Dies Veneris.	Friday.	Frigg's day.
Dies Saturni.	Saturday.	Seterne's day.

Long before the exact length of the year was determined, it must have been perceived that the synodic revolution of the moon is accomplished in about 29½ days. Twelve lunations, therefore, form a period of 354 days, which differs only by about 11¼ days from the solar year. From this circumstance has arisen the practice of dividing the year into twelve months. But in the course of a few years the accumulated difference between the solar year and twelve lunar months would become considerable, and have the effect of transporting the commencement of the year to a different season. To avoid this inconvenience some peoples have abandoned the moon altogether, and regulate their year by the course of the sun. The month, however, being a convenient period of time, has retained its place in the calendars of all nations, and usually denotes an arbitrary number of days approaching to the twelfth part of a solar year.

Year.—The year is either astronomical or civil. The solar astronomical year is the period of time in which the earth performs a revolution in its orbit about the sun, or passes from any point of the ecliptic to the same point again; and consists of 365 days 5 hours 48 min. and 46 sec. of mean solar time. The civil year is that which is employed in chronology, and varies among different peoples, both in respect of the season at which it commences and of its subdivisions. When regard is had to the sun's motion alone, the regulation of the year, and the distribution of the days into months, may be effected without much trouble; but the difficulty is greatly increased when it is sought to reconcile solar and lunar periods, or to make the subdivisions of the year depend on the moon, and at the same time to preserve the correspondence between the whole year and the seasons.

In the arrangement of the civil year, two objects are sought to be accomplished—first, the equable distribution of the days among twelve months; and secondly, the preservation of the beginning of the year at the same distance from the solstices or equinoxes. Now, as the year consists of 365 days and a fraction, and 365 is a number not divisible by 12, the months can not all be of the same length and at the same time include all the days of the year. By reason also of the fractional excess of the length of the year above 365 days, the years cannot all contain the same number of days if the epoch of their commencement remains fixed; for the day and the civil year must necessarily be considered as beginning at the same instant; and therefore the extra hours cannot be included in the year till they have accumulated to a whole day. As soon as this has taken place, an additional day must be given to the year.

The civil calendar of all European countries has been borrowed from that of the Romans. At the time of Julius Caesar, the civil equinox differed from the astronomical by three months, so that the winter months were carried back into autumn and the autumnal into summer.

Caesar abolished the use of the lunar year and the intercalary month, and regulated the civil year entirely by the sun. With the advice and assistance of Sosigenes, he fixed the mean length of the year at 365¼ days, and decreed that every fourth year should have 366 days, the other years having each 365. The first Julian year commenced with the 1st of January of the 45th before the birth of Christ, and the 709th from the foundation of the city.

It may be recorded that evidence has now come to light of the existence in earlier days of a calendar based on a standard year starting from noon on our February 25th.

For many years it was imagined that Caesar readjusted the year so that the first, third, fifth, seventh, ninth and eleventh months, that is, January, March, May, July, September and November should have each thirty-one days, and the other months thirty, excepting February, which in common years should have only twenty-nine, but every fourth year thirty days. But no ancient or modern authority supports this view, which is a flat contradiction of what Macrobius says in his *Saturnalia* 1.14.7, statements that are repeated in effect in section 9. Most modern authorities are agreed that much of the suggestion about Augustan activities is unwarranted and that Augustus had nothing to do with the lengthening of the month bearing his name.

The additional day which occurred every fourth year was given to February, as being the shortest month, and this additional or intercalary day was called *bis-sexto calendas*.

Although the Julian method of intercalation is perhaps the most convenient that could be adopted, yet, as it supposes the year too long by 11 minutes 14 seconds, the real error amounts to a day in 128 years. In the course of a few centuries, however, the equinox sensibly retrogrades towards the beginning of the year. In order to restore the equinox to its former place, Pope Gregory XIII. directed ten days to be suppressed in the calendar; and as the error of the Julian intercalation was now found to amount to three days in 400 years, he ordered the intercalations to be omitted on all the centenary years excepting those which are multiples of 400.

According to modern astronomy the mean geocentric motion of the sun in longitude, from the mean equinox during a Julian year of 365·25 days, is 360° + 27″·685. Thus the mean length of the solar year is

$$\frac{360^\circ}{360^\circ + 27''\cdot685} \times 365\cdot25 = 365\cdot2422 \text{ days},$$

or 365 days 5 hours 48 min. 46 sec. Now the Gregorian rule gives 97 intercalations in 400 years; 400 years therefore contain 365×400+97, that is, 146,097 days; and consequently one year contains 365·2425 days, or 365 days 5 hours 49 min. 12 sec. This exceeds the true solar year by 26 seconds, which amount to a day in 3,323 years. It has therefore been proposed to correct the Gregorian rule by making the year 4000 and all its multiples common years. With this correction the rule of intercalation is as follows:—

Every year the number of which is divisible by 4 is a leap year, excepting the last year of each century, which is a leap year only when the number of the century is divisible by 4; but 4,000, and its multiples, 8,000, 12,000, 16,000, etc., are common years. Thus the uniformity of the intercalation, by continuing to depend on the number four, is preserved, and by the last correction the beginning of the year would not vary more than a day from its present place in two hundred centuries.

The Lunar Year.—The lunar year, consisting of twelve lunar months, contains only 354 days; its commencement consequently anticipates that of the solar year by eleven days, and passes through the whole circle of the seasons in about 34 lunar years. It being so obviously ill-adapted to the computation of time, almost all nations employ some method of intercalation, by means of which the beginning of the year is retained at nearly the same fixed place in the seasons.

Ecclesiastical Calendar.—The ecclesiastical calendar which is adopted in all the Catholic and most of the Protestant countries of Europe is luni-solar, being regulated partly by the solar, and partly by the lunar year, a circumstance which gives rise to the distinction between the movable and immovable feasts. By the 2nd century of our era, disputes had arisen among the Christians respecting the proper time of celebrating Easter, which governs all the other movable feasts. The Jews celebrated their passover on the 14th day of the *first month*, that is to say, the lunar month of which the 14th day either falls on, or next follows, the day of the vernal equinox. Most Christian sects agreed that Easter should be celebrated on a Sunday. Others followed the example of the Jews, and adhered to the 14th of the moon; but these, the minority, were accounted heretics, and received the appellation of Quartodecimans. The council of Nicaea, in the year 325, ordained that the celebration of Easter should thenceforth always take place on the Sunday which immediately follows the full moon that happens upon, or next after, the day of the vernal equinox. Should the 14th of the moon, which is regarded as the day of full moon, happen on a Sunday, the celebration of Easter was deferred to the Sunday following, in order to avoid concurrence with the Jews and the above-mentioned heretics. The observance of this rule renders it necessary to reconcile three periods which have no common measure, namely, the week, the lunar month, and the solar year; and as this can only be done approximately, and within certain limits, the determination of Easter is an affair of considerable nicety and complication.

Dominical Letter.—The first problem which the construction of the calendar presents is to connect the week with the year, or to find the day of the week corresponding to a given day of any year of the era. As the number of days in the week and the number in the year are prime to one another, two successive years cannot begin with the same day; for if a common year begins, for example, with Sunday, the following year will begin with Monday, and if a leap year begins with Sunday, the year following will begin with Tuesday. For the sake of greater generality, the days of the week are denoted by the first seven letters of the alphabet, A, B, C, D, E, F, G, which are placed in the calendar beside the days of the year, so that A stands opposite the first day of January, B opposite the second, and so on to G, which stands opposite the seventh; after which A returns to the eighth, and so on through the 365 days of the year. Now if one of the days of the week, Sunday for example, is represented by E, Monday will be represented by F, Tuesday by G, Wednesday by A, and so on; and every Sunday through the year will have the same character E, every Monday F, and so with regard to the rest. The letter which denotes Sunday is called the *Dominical Letter*, or the *Sunday Letter*; and when the dominical letter of the year is known, the letters which respectively correspond to the other days of the week become known at the same time.

Solar Cycle.—In the Julian calendar the dominical letters are readily found by means of a short cycle, in which they recur in the same order without interruption. The number of years in the intercalary period being four, and the days of the week being seven, their product is $4\times7=28$; twenty-eight years is therefore a period which includes all the possible combinations of the days of the week with the commencement of the year. This period, the *Solar Cycle*, or the *Cycle of the Sun*, restores the first day of the year to the same day of the week. At the end of the cycle the dominical letters return again in the same order on the same days of the month; hence a table of dominical letters, constructed for twenty-eight years, will serve to show the dominical letter of any given year from the commencement of the era to the Reformation. The cycle, though probably not invented before the time of the council of Nicaea, is regarded as having commenced nine years before the era, so that the year *one* was the tenth of the solar cycle. To find the year of the cycle, we have therefore the following rule:—*Add nine to the date, divide the sum by twenty-eight; the quotient is the number of cycles elapsed, and the remainder is the year of the cycle.* Should there be no remainder, the proposed year is the twenty-eighth or last of the cycle. In order to make use of the solar cycle in finding the dominical letter, it is necessary to know that the first year of the Christian era began with Saturday. The dominical letter of that year, which was the tenth of the cycle, was consequently B. The following year, or the 11th of the cycle, the letter was A; then G. The fourth year was bissextile, and the dominical letters were F, E; the following year D, and so on. In this manner it is easy to find the dominical letter belonging to each of the twenty-eight years of the cycle. But at the end of a century the order is interrupted in the Gregorian calendar by the secular suppression of the leap year; hence the cycle can only be employed during a century. In the reformed calendar the intercalary period is four hundred years, which number being multiplied by seven, gives two thousand eight hundred years as the interval in which the coincidence is restored between the days of the year and the days of the week.

Lunar Cycle and Golden Number.—In connecting the lunar month with the solar year, the framers of the ecclesiastical calendar adopted the lunar cycle, and organized the distribution of months. The lunations are supposed to consist of twenty-nine and thirty days alternately, or the lunar year of 354 days; and in order to make up nineteen solar years, six intercalary months, of thirty days each, are introduced in the course of the cycle, and one of twenty-nine days is added at the end. This gives $19\times354+6\times30+29=6{,}935$ days, to be distributed among 235 lunar months. But every leap year one day must be added to the lunar month in which the 29th of February is included. Now if leap year happens on the first, second or third year of the period, there will be five leap years in the period, but only four when the first leap year falls on the fourth. In the former case the number of days in the period becomes 6,940 and in the latter 6,939. The mean length of the cycle is therefore 6,939¾ days, agreeing exactly with nineteen Julian years.

By means of the lunar cycle the new moons of the calendar were indicated before the Reformation. As the cycle restores these phenomena to the same days of the civil month, they will fall on the same days in any two years which occupy the same place in the cycle; consequently a table of the moon's phases for 19 years will serve for any year whatever when we know its number in the cycle. This number is called the *Golden Number*, either because it was so termed by the Greeks, or because it was usual to mark it with red letters in the calendar. The golden numbers were introduced into the calendar about the year 530, but disposed as they would have been if they had been inserted at the time of the council of Nicaea. The cycle is supposed to commence with the year in which the new moon falls on the 25th of January, which took place the year preceding the commencement of our era. Hence, to find the golden number N, for any year *x*, we have $N=\left(\frac{x+1}{19}\right)_r$, which gives the following rule: *Add* 1 *to the date, divide the sum by* 19; *the quotient is the number of cycles elapsed, and the remainder is the Golden Number.* When the remainder is 0, the proposed year is of course the last or 19th of the cycle. The new moons, determined in this manner, may differ from the astronomical new moons sometimes as much as two days, because the sum of the solar and lunar inequalities, which are compensated in the whole period, may amount in certain cases to 10°, and thereby cause the new moon to arrive on the second day before or after its mean time.

Dionysian Period.—The cycle of the sun brings back the days of the month to the same day of the week; the lunar cycle restores the new moons to the same day of the month; therefore $28\times19=532$ years, includes all the variations in respect of the new moons and the dominical letters, and is consequently a period after which the new moons again occur on the same day of the month and the same day of the week. This is called the *Dionysian* Great *Paschal Period*, from its having been employed by Dionysius Exiguus, familiarly styled "Denys the Little," in determining Easter Sunday. It was, however, first proposed by Victorius of Aquitaine, who had been appointed by Pope Hilary o revise and correct the church calendar. Hence it is also called he *Victorian Period*. It continued in use till the Gregorian reformation.

Cycle of Indiction.—Besides the solar and lunar cycles, there s a third of 15 years, called the cycle of indiction, frequently mployed in the computations of chronologists. This period has reference to certain judicial acts which took place at stated epochs under the Greek emperors. Its commencement is referred to the 1st of January of the year 313 of the common era. By extending t backwards, it will be found that the first of the era was the fourth of the cycle of indiction. The number of any year in this cycle will therefore be given by the formula $\left(\frac{x+3}{15}\right)_r$, that is to say, *add* 3 *to the date, divide the sum by* 15, *and the remainder is the year of the indiction.* When the remainder is 0, the proposed year is the fifteenth of the cycle.

Julian Period.—The Julian period, proposed by the celebrated Joseph Scaliger as an universal measure of chronology, is formed by taking the continued product of the three cycles of the sun, of the moon, and of the indiction, and is consequently $28\times19\times15=7{,}980$ years. In the course of this long period no two years can be expressed by the same numbers in all the three cycles. Hence, when the number of any proposed year in each of the cycles is known, its number in the Julian period can be determined.

Reformation of the Calendar.—The ancient Church Calendar was founded on two suppositions, both erroneous, namely, that the year contains 365¼ days and that 235 lunations are exactly equal to 19 solar years. It could not therefore long continue to preserve its correspondence with the seasons, or to indicate the days of the new moons with the same accuracy. Pope Gregory XIII. issued a brief in the month of March 1582, in which he abolished the use of the ancient calendar, and substituted that which has since been received in almost all Christian countries under the name of the *Gregorian Calendar* or *New Style*. The author of the system adopted by Gregory was Aloysius Lilius, or Luigi Lilio Ghiraldi, a learned astronomer and physician of Naples, who died, however, before its introduction; but the individual who most contributed to give the ecclesiastical calendar its present form, and who was charged with all the calculations necessary for its verification, was Clavius, by whom it was completely developed and explained in a great folio treatise of 800 pages, published in 1603.

In order to restore the beginning of the year to the same place in the seasons that it had occupied at the time of the council of Nicaea, Gregory directed the day following the feast of St. Francis, that is to say the 5th of October, to be reckoned the 15th of that month. By this regulation the vernal equinox which then happened on the 11th of March was restored to the 21st. From 1582 to 1700 the difference between the old and new style continued to be ten days; but 1700 being a leap year in the Julian calendar, and a common year in the Gregorian, the difference of the styles during the 18th century was eleven days. The year 1800 was also common in the new calendar, and, consequently, the difference in the 19th century was twelve days. From 1900 to 2100 inclusive it is thirteen days.

The restoration of the equinox to its former place in the year and the correction of the intercalary period, were attended with no difficulty; but Lilius had also to adapt the lunar year to the new rule of intercalation. The lunar cycle contained 6,939 days 18 hours, whereas the exact time of 235 lunations, as we have already seen, is $235 \times 29\cdot530588 = 6,939$ days 16 hours 31 minutes. The difference, 1 hour 29 minutes, amounts to a day in 308 years, so that at the end of this time the new moons occur one day earlier than they are indicated by the golden numbers. Lilius rejected the golden numbers from the calendar, and supplied their place by another set of numbers called *Epacts*, a term of Greek origin, which, employed in the calendar, signifies the moon's age at the beginning of the year. The common solar year containing 365 days, and the lunar year only 354 days, the difference is eleven; whence, if a new moon fall on the 1st of January in any year, the moon will be eleven days old on the first day of the following year, and twenty-two days on the first of the third year. The numbers eleven and twenty-two are therefore the epacts of those years respectively. Another addition of eleven gives thirty-three for the epact of the fourth year; but in consequence of the insertion of the intercalary month in each third year of the lunar cycle, this epact is reduced to three. In like manner the epacts of all the following years of the cycle are obtained by successively adding eleven to the epact of the former year, and rejecting thirty as often as the sum exceeds that number. Two equations or corrections must be applied, one depending on the error of the Julian year, which is called the solar equation; the other on the error of the lunar cycle, which is called the lunar equation. The solar equation occurs three times in 400 years, namely, in every secular year which is not a leap year; for in this case the omission of the intercalary day causes the new moons to arrive one day later in all the following months, so that the moon's age at the end of the month is one day less than it would have been if the intercalation had been made, and the epacts must accordingly be all diminished by unity. Thus the epacts 11, 22, 3, 14, etc., become 10, 21, 2, 13, etc. On the other hand, when the time, by which the new moons anticipate the lunar cycle, amounts to a whole day, which, as we have seen, it does in 308 years, the new moons will arrive one day earlier, and the epacts must consequently be increased by unity. Thus the epacts 11, 22, 3, 14, etc., in consequence of the lunar equation, become 12, 23, 4, 15, etc. In order to preserve the uniformity of the calendar, the epacts are changed only at the commencement of a century; the correction of the error of the lunar cycle is therefore made at the end of 300 years. In the Gregorian calendar this error is assumed to amount to one day in 312½ years or eight days in 2,500 years, an assumption which requires the line of epacts to be changed seven times successively at the end of each period of 300 years, and once at the end of 400 years; and, from the manner in which the epacts were disposed at the Reformation, it was found most correct to suppose one of the periods of 2,500 years to terminate with the year 1800.

The years in which the solar equation occurs, counting from the Reformation, are 1700, 1800, 1900, 2100, 2200, 2300, 2500, etc. Those in which the lunar equation occurs are 1800, 2100, 2400, 2700, 3000, 3300, 3600, 3900, after which, 4300, 4600 and so on. When the solar equation occurs, the epacts are diminished by unity; when the lunar equation occurs, the epacts are augmented by unity; and when both equations occur together, as in 1800, 2100, 2700, etc., they compensate each other, and the epacts are not changed.

In consequence of the solar and lunar equations, it is evident that the epact or moon's age at the beginning of the year, must, in the course of centuries, have all different values from one to 30 inclusive, corresponding to the days in a full lunar month.

The use of the epacts is to show the days of the new moons, and thus the moon's age. If the last lunation of any year ends, for example, on the 2nd of December, the new moon falls on the 3rd; and the moon's age on the 31st, or at the end of the year, is twenty-nine days. The epact of the following year is therefore twenty-nine. Now, that lunation having commenced on the 3rd of December, and consisting of thirty days, will end on the 1st of January. The 2nd of January is therefore the day of the new moon, which is indicated by the epact 29. In like manner, if the new moon fell on Dec. 4 the epact of the following year would be 28, which, to indicate the day of the next new moon, must correspond to Jan. 3.

Easter.—The principal use of the calendar is to find Easter, which, according to the traditional regulation of the council of Nice, must be determined from the following conditions:—*1st*, Easter must be celebrated on a Sunday; *2nd*, this Sunday must *follow* the 14th day of the paschal moon, so that if the 14th of the paschal moon falls on a Sunday then Easter must be celebrated on the Sunday following; *3rd*, the paschal moon is that of which the 14th day falls on or next follows the day of the vernal equinox; *4th*, the equinox is fixed invariably in the calendar on the 21st of March. This regulation is to be construed according to the tabular full moon as determined from the epact, and not by the true full moon, which, in general, occurs one or two days earlier.

From these conditions it follows that the paschal full moon, or the 14th of the paschal moon, cannot happen before the 21st of March, and that Easter in consequence cannot happen before the 22nd of March. If the 14th of the moon falls on the 21st, the new moon must fall on the 8th; for $21-13=8$, and the paschal new moon cannot happen before the 8th; for suppose the new moon to fall on the 7th, then the full moon would arrive on the 20th, or the day before the equinox. The following moon would be the paschal moon. But the fourteenth of this moon falls at the latest on the 18th of April, or 29 days after the 20th of March; for by reason of the double epact that occurs at the 4th and 5th of April, this lunation has only 29 days. Now, if in this case the 18th of April is Sunday, then Easter must be celebrated on the following Sunday, or the 25th of April. Hence Easter Sunday cannot happen earlier than the 22nd of March, or later than the 25th of April.

The complicated, though highly ingenious method, invented by Lilius, for the determination of Easter and the other movable feasts, is entirely independent of astronomical tables, or indeed of any celestial phenomena whatever; so that all chances of disagreement arising from the inevitable errors of tables, or the uncertainty of observation, are avoided, and Easter determined without the possibility of mistake. But this advantage is only procured by the sacrifice of some accuracy; for the conditions of the problem are not always exactly satisfied, nor can they be always satisfied by any similar method of proceeding. The equinox is fixed on the 21st of March, though the sun enters Aries generally on the 20th of that month, sometimes even on the 19th. A full moon may therefore arrive after the true equinox, and yet precede the 21st of March. This would not be the paschal moon of the calendar, though it undoubtedly ought to be so if the intention of the council of Nice were rigidly followed. The new moons indicated by the epacts also differ from the astronomical new moons, and even from the mean new moons, in genral by one or two days. In imitation of the Jews, who counted he time of the new moon, not from the moment of the actual phase, but from the time the moon first became visible after the conjunction, the fourteenth day of the moon is regarded as the full moon. But the moon is in opposition generally on the 16th day; therefore, when the new moons of the calendar nearly concur with the true new moons, the full moons are considerably in error. The epacts are also placed so as to indicate the full moons generally one or two days after the true full moons; but this was done to avoid the chance of concurring with the Jewish passover, which the framers of the calendar seem to have considered a greater evil than that of celebrating Easter a week too late.

Perpetual Table, Showing Easter

Epact.	Dominical Letter *For Leap Years use the* SECOND *Letter*						
	A	B	C	D	E	F	G
*	Apr. 16	Apr. 17	Apr. 18	Apr. 19	Apr. 20	Apr. 14	Apr 15
1	,, 16	,, 17	,, 18	,, 19	,, 13	,, 14	,, 15
2	,, 16	,, 17	,, 18	,, 12	,, 13	,, 14	,, 15
3	,, 16	,, 17	,, 11	,, 12	,, 13	,, 14	,, 15
4	,, 16	,, 10	,, 11	,, 12	,, 13	,, 14	,, 15
5	,, 9	,, 10	,, 11	,, 12	,, 13	,, 14	,, 15
6	,, 9	,, 10	,, 11	,, 12	,, 13	,, 14	,, 8
7	,, 9	,, 10	,, 11	,, 12	,, 13	,, 7	,, 8
8	,, 9	,, 10	,, 11	,, 12	,, 6	,, 7	,, 8
9	,, 9	,, 10	,, 11	,, 5	,, 6	,, 7	,, 8
10	,, 9	,, 10	,, 4	,, 5	,, 6	,, 7	,, 8
11	,, 9	,, 3	,, 4	,, 5	,, 6	,, 7	,, 8
12	,, 2	,, 3	,, 4	,, 5	,, 6	,, 7	,, 8
13	,, 2	,, 3	,, 4	,, 5	,, 6	,, 7	,, 1
14	,, 2	,, 3	,, 4	,, 5	,, 6	Mar. 31	,, 1
15	,, 2	,, 3	,, 4	,, 5	Mar. 30	,, 31	,, 1
16	,, 2	,, 3	,, 4	Mar 29	,, 30	,, 31	,, 1
17	,, 2	,, 3	Mar. 28	,, 29	,, 30	,, 31	,, 1
18	,, 2	Mar 27	,, 28	,, 29	,, 30	,, 31	,, 1
19	Mar. 26	,, 27	,, 28	,, 29	,, 30	,, 31	,, 1
20	,, 26	,, 27	,, 28	,, 29	,, 30	,, 31	Mar. 25
21	,, 26	,, 27	,, 28	,, 29	,, 30	,, 24	,, 25
22	,, 26	,, 27	,, 28	,, 29	,, 23	,, 24	,, 25
23	,, 26	,, 27	,, 28	,, 22	,, 23	,, 24	,, 25
24	Apr. 23	Apr. 24	Apr. 25	Apr. 19	Apr 20	Apr. 21	Apr. 22
25	,, 23	,, 24	,, 25	,, 19	,, 20	,, 21	,, 22
26	,, 23	,, 24	,, 18	,, 19	,, 20	,, 21	,, 22
27	,, 23	,, 17	,, 18	,, 19	,, 20	,, 21	,, 22
28	,, 16	,, 17	,, 18	,, 19	,, 20	,, 21	,, 22
29	,, 16	,, 17	,, 18	,, 19	,, 20	,, 21	,, 15

In 1923 a committee was appointed by the League of Nations to consider the reform of the Calendar and the establishment of a fixed Easter. No evidence was discovered of a wide desire to alter the calendar, but there was much secular support and a certain sympathy from some religious authorities in favour of a fixed Easter. In 1928 a private member's bill was introduced into the British parliament, and duly passed in August (the Easter Act); it provided that, from a date to be fixed by an Order in Council, Easter day shall be the first Sunday following the second Saturday in April. This Order in Council may not be made, however, until a draft of the order has been approved by parliament—a safeguard intended to ensure uniform action with other countries, and to prevent the taking of any definite step before being assured of the acknowledged support of the religious denominations.

The principal church feasts depending on Easter, and the times of their celebration are as follows:—

Septuagesima Sunday	is	9 weeks	before Easter.
First Sunday in Lent		6 weeks	
Ash Wednesday		46 days	
Rogation Sunday	is	5 weeks	after Easter.
Ascension Day or Holy Thursday		39 days	
Pentecost or Whitsunday		7 weeks	
Trinity Sunday		8 weeks	

The Gregorian calendar was introduced into Spain, Portugal and part of Italy the same day as at Rome. In France it was received in the same year in the month of December, and by the Catholic states of Germany the year following. In the Protestant states of Germany the Julian calendar was adhered to till the year 1700, when it was decreed by the diet of Regensburg that the new style and the Gregorian correction of the intercalation should be adopted. Instead, however, of employing the golden numbers and epacts for the determination of Easter and the movable feasts, it was resolved that the equinox and the paschal moon should be found by astronomical computation from the Rudolphine tables. But this method was abandoned in 1774 at the instance of Frederick II., king of Prussia. In Denmark and Sweden the reformed calendar was received about the same time as in the Protestant states of Germany. Russia adhered to the Julian reckoning, until it was superseded by the Soviet Government, which introduced the Gregorian reckoning.

In Great Britain the Calendar (New Style) Act 1750 was passed for the adoption of the new style in all public and legal transactions. The difference of the two styles, which then amounted to eleven days, was removed by ordering the day following the 2nd of September of the year 1752 to be accounted the 14th of that month; and in order to preserve uniformity in future, the Gregorian rule of intercalation respecting the secular years was adopted. At the same time, the commencement of the legal year was changed from the 25th of March to the 1st of January. In Scotland, January 1st was adopted for New Year's Day from 1600, according to an act of the privy council in December 1599. This fact is of importance with reference to the date of legal deeds executed in Scotland between that period and 1751, when the change was effected in England. With respect to the movable feasts, Easter is determined by the rule laid down by the council of Nice; but instead of employing the new moons and epacts, the golden numbers are prefixed to the days of the *full* moons. In those years in which the line of epacts is changed in the Gregorian calendar, the golden numbers are removed to different days, and of course a new table is required whenever the solar or lunar equation occurs. The golden numbers have been placed so that Easter may fall on the same day as in the Gregorian calendar. The calendar of the Church of England is therefore from century to century the same in form as the old Roman calendar, excepting that the golden numbers indicate the full moons instead of the new moons. The Orthodox Church in Greece has adopted a modified Gregorian calendar, with a 900 year cycle. The Orthodox Church in Greece has also adopted the Gregorian system presumably in this form. Easter is computed by the actual, not the simplified ecclesiastical moon. The meridian for calculations is that of Jerusalem.

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PRIMITIVE

The calendar of the modern civilized world is a system of time-reckoning which consists of units or divisions and subdivisions which have a strictly limited duration: years, months, days, hours, minutes, and seconds. To define a certain point or space in the lapse of time these units are simply numbered. They serve not only for the indication and reckoning of time but also for its measurement. Consequently units of the same order ought always to have the same length, but here natural causes and tradition create certain exceptions such as months of 31, 30, 29 and 28 days respectively, and, in the lunisolar calendar, years of alternately 12 and 13 months. Primitive man clings always to the concrete. In his experience certain natural phenomena constantly recur, *e.g.,* the sun and the new moon, and certain phenomena recur in the same order, *e.g.,* snow, the sprouting of the leaves, the ripening of certain fruits, and the falling of the leaves, etc. By reference to such concrete phenomena he is able to indicate a certain time. Time indications of primitive man are not durational like the unit of any system of time-reckoning, but indefinite.

Again, the phenomena referred to are often of unequal or indeterminate duration; they overlap or leave gaps, and cannot be numerically grouped together. Consequently we have to deal with a time-reckoning by time-indications only, or briefly, a *discontinuous time-reckoning.* A definite and constantly-recurring phenomenon, *e.g.,* a certain day, a certain month, a certain year, is indicated by referring to a certain event or natural phenomenon connected with it as, for instance, the day of the waning of the moon, the month in which the leaves fall, the year of the cattle disease, etc. It is possible to count time by reckoning a single phenomenon, recurring constantly within a certain unit, which has not yet been conceived as such. The child who has seen ten snows or ten harvests is ten years old. Nine new moons appear before the woman bears her child. This mode of counting time may be called the *pars-pro-toto* method. Presuming that the indication of concrete phenomena following one another in the regular succession of Nature has preceded the abstract numerical indication of time, the origin of time-reckoning is to be found, not in any system, however simple, but in the time-indications referring to concrete phenomena and in the *pars-pro-toto* method of counting time referring to these concrete phenomena.

Celestial phenomena are of outstanding importance. The units of time-reckoning depend on the motions of the heavenly bodies, and the more intimately these enter into the life of man, the more important they are for the calendar. The (solar) day of 24 hours is determined by the rotation of the earth on its axis. The year is the period of a revolution of the earth about the sun. The varying height of the sun and duration of its appearance are ultimately the causes of the seasonal variations of the climate and the life of Nature. By the term "months," the lunar or moon-month is understood, unless expressly stated otherwise. Our months have nothing to do with the moon but are simply subdivisions of the solar year, the length of which comes near that of a lunar month. The lunar month is the interval between two consecutive new moons, and comprises slightly more than 29½ days.

Primitive man knows the stars and notes their appearances. It can be observed that some constellations appear in the heavens in the winter, others in the summer. The sun seems to move more slowly than the stars owing to the motion of the earth, and in the course of a year the sun runs through the zodiac backwards. The stars gain every day 3 min. 56 secs. on the sun, *i.e.,* a particular star culminates every day that much earlier than the sun. Primitive man rises and goes to bed with the sun. At dawn he notices the stars that are shining in the east and are soon to vanish before the light of the sun. In the same way he observes at evening, before he goes to rest, the stars on the western horizon which soon afterwards set there. The star of which he is just able to catch a glimpse in the east in the morning twilight, will stand a little higher next morning, and it will rise earlier every morning until after about half a year its rising will take place in the evening twilight. The first visible appearance of a star in the morning twilight is termed its *heliacal rising,* and the last visible setting of a star in the evening twilight is called its *heliacal setting.* The observation of the stars provides a means of determining the time from quite regular phenomena, whereas the variations of the seasons in different years may be considerable.

The Day.—The notion of the day of 24 hours, comprising a day and a night, is a late development, so late indeed that most languages lack a proper word for it. Some primitive peoples use such expressions as "light and darkness," "sun-darkness" to describe it. But this is rare. The days are counted according to the *pars-pro-toto* method in "suns," "nights," "sleeps," "dawns" (Homer); whoever has slept six nights on the way has undertaken a six days' journey. The counting in nights was especially favoured by the old Teutonic peoples (*cf.* the expressions "fortnight," "sennight"). For the indication of a point of time within the day, reference to the course of the sun is very common, and this indication can be given by a gesture. More rarely the position or the length of the shadow is referred to, and still more rarely a staff is used as a sun-dial. In Iceland and the northern parts of Scandinavia the time of the day was determined by mountain peaks or stone heaps above which the sun stood at a certain time of the day. The names of the divisions of the day are derived from natural phenomena, *e.g.,* day-break, twilight, sun-rise, morning, noon, etc., and from the common daily occupations. Examples of these are the Homeric description of evening as "the time when the oxen are unyoked," and the Irish *imbuarach* (morning), "at the yoking of the oxen." Many primitive peoples have elaborate series of expressions of this kind. The night is the time of complete darkness and rest, and time indications are therefore scanty. The cock-crow sometimes serves this purpose and, more rarely, the stars are used by peoples who have studied them to determine the lapse of the night, because the position of the stars in the night-sky change every day. These indications do not imply a strictly limited duration as our "hours" do. To indicate a definite time-limit, some activity, the duration of which is known, is referred to, *e.g.,* "the time in which one can cook a handful of vegetables," *i.e.,* an hour, "the frying of a locust," *i.e.,* a moment. Very often duration of time is indicated by reference to the time needed to traverse a well-known piece of road.

The Seasons.—The seasons are sometimes used to determine time within the year, but every seasonal occurrence, *e.g.,* the sowing, is used thus, and as these have a short duration, they are better suited to indicate time and much more widely used for this purpose. Thus in the classical examples in Hesiod, the cry of the migrating cranes shows the time of ploughing and sowing; when the snail climbs up the plants there should be no more digging in the vineyards; when the thistle blossoms summer has come; the sea can be navigated when the fig-tree sprouts, etc. Similar time-indications are still used by peasants. Among primitive peoples they are common, and not only among the agricultural ones. The main seasons differ according to the zones. In the tropics there are dry and rainy seasons, sometimes two of each; the trade-winds and the monsoons and the intervening calms. Although the seasons recur more regularly in the tropics and the sub-tropical regions than in northern climates, they are of varying length, and there are greater and smaller seasons and seasonal points, which overlap. Consequently their number is varying and indefinite. We may, *e.g.,* speak of the year as consisting of winter and summer or of spring, summer, harvest and winter. The old Teutons are said to have had only three seasons: winter, spring, and summer. The climatic conditions of the country are of paramount importance. The seasons are seldom adapted for true calendrical purposes, as only with some violence can they be systematized into periods of a definite number of days as the early Scandinavians did with the winter and summer.

The Year.—A cycle of seasons make up a year, and while all peoples have an idea of the year in the sense that the same cycle of seasons always recurs in a certain order, they seldom consciously unite the different seasons into a year. The notion of the year is a comparatively late and gradual development acquired by means of selection, regulation and systemization of the seasons. Some peoples reckon in half-years—two seasons—without joining them together, as in East Africa where there are two rainy seasons, and in the East Indian Archipelago, where the south-west and the north-east monsoons each blow for about half a year. Some peoples count one dry and one rainy season without combining them into a year. An incomplete year consisting of about ten months is found especially among some agricultural peoples, but is in reality the vegetation year, from the commencement of agricultural work to its end, when the harvest is housed; the vacant period is simply passed over. Such reckonings are known to be made in north-east Asia, the East Indian Archipelago and Central Africa. If the vacant period were added to this cycle, the natural year would be attained, but its length is indefinite and may vary according to the accidental variations of the climate. A calendrical year is attained only by the aid of the stars or the months. For the counting of years, the *pars-pro-toto* method is employed. The Hottentots reckon the age of their cattle and sheep by the calving and lambing periods The Algonquin and the old Scandinavians counted by winters, the fellahs of Palestina and the Inca people by harvests, etc.

Primitive peoples are primarily concerned with the age of a man in relation to his fellows, that is, whether he be older or younger than another, and from this the counting in generations is evolved. Years are not numbered but designated by reference to some well-known event which took place in a certain year, *e.g.*, a plague, cattle disease, war, migration, unusual snowfall, etc. Long lists of such designations of years are quoted from the Herero and some North American Indians The same method was employed in Babylonia and in pre-Mohammedan Arabia. Higher civilized peoples refer to their chiefs or kings and the years of their reign. If the highest authority is changed annually, the years are designated by their names: thus, in Rome, the year was known by the name of the consul and in Greece by that of the archon This method is unwieldy, for a long series of names must be kept in mind in correct order.

The Stars.—Time indications by seasons are inexact because the phenomena to which they are related are fluctuating. Observation of the stars provides a means of indicating time within the year with greater precision. Most primitive peoples know the stars well, and some extremely well, *e.g.*, the South American Indians, the Polynesians and Melanesians. Hesiod and many classical authors indicate time by the rising and setting of certain stars: the vines should be pruned before the evening rising of Arcturus; the morning setting of the Pleiades is the time of sowing and of the autumn storms. Counting by the stars, particularly by the Pleiades, is still practised by certain primitive peoples. The appearance of certain stars is connected with seasonal phenomena and used for determining agricultural occupations. Finally, a true notion of the year is formed by a few peoples when the period between a certain appearance of a star or constellation (principally the Pleiades) and its next appearance of the same kind, *e.g.*, the heliacal rising, is noticed. The inhabitants of the Marquesas and some South American Indians call the year and the Pleiades by the same name. In this manner, by observing the heliacal rising of Sirius, the old Egyptians established the solar year, and from them it was adopted by Julius Caesar.

The Moon.—The course of the moon forms a shorter unit which steps in between day and year. The shorter period of time defined by it is easily kept in mind and noted at a glance. It has in itself nothing to do with the natural phases conditioned by the course of the sun. Time-reckoning according to the moon is by its nature continuous and strictly limited. The month is by its nature a definite and limited unit of time. One moon follows another with a brief interruption of only one or two days in which the moon is invisible. The phases of the moon represent a gradual waxing and waning, a continuous development. The principle of continuous time-reckoning is suggested by the moon. The days of the month are originally not counted but designated with reference to the shape of the moon and its position in the sky. The new moon and the full moon have a special prominence and are often hailed with rejoicing and feasting. Then the crescent of the waning moon is added. Many peoples distinguish the three phases of the waxing, the full and the waning moon; then further phases and the absence of the moon, "when it has gone to sleep," are added. The Polynesians and Micronesians have developed a system by which every day of the month has a name taken from the shape or the position of the moon. Other peoples, *e.g.*, the Masai, the Hindus, etc., count the days of the light and the dark halves of the moon. The Greeks counted in decades after the three principal phases, but there are also traces of a division of the month into two parts. A division into four parts is but rarely found.

The Month.—The months are seldom counted, and then principally in regard to the months of pregnancy; but a month is designated by a natural phenomenon or seasonal occupation occurring in it, *e.g.*, the blackberry month, sowing month, lambing month, etc. This naming was originally accidental. Sharp distinctions were not made, indeed were not possible. There was much overlapping, but from this material, by a kind of natural selection, a series of month-names came into being covering the course of the natural year. A number of such series have been found in all parts of the world except South America and Australia. A year of 13 months is reckoned by quite as many peoples as reckon 12 months.

Inter- or Extra-calation.—Here a fundamental difficulty appears, for the solar year has 365¼ days; 12 months make 354 days, *i.e.*, 10 days too little, 13 months 384 days, *i.e.*, 19 days too much. So long as the month-names are accidental, or only some of the months are named and the two or three months not associated with definite occupations are neglected, the difficulty is passed over. But once a fixed series of months has arisen they soon cease to coincide with the natural phenomena and occupations after which they are named. If the series has 12 months, a month will come earlier than the natural phenomenon after which it is named. If the series has 13 months it will soon come after this phenomenon is over. The Dakota often had heated debates as to the existing month and the Pawnees sometimes became inextricably involved in their reckoning. The obvious remedy is to correct the reckoning after the occurrence of the natural phenomenon. In a 12-month series, for instance, the harvest month which came before the corn was ripe, is repeated; the first harvest month is then said to have been "lost" or "forgotten." In the 13-month series the month which came after the natural phenomenon is simply left out, and the following month in the series is reckoned. The means resorted to in the former case was the intercalation of a month and in the latter the extracalation of a month to restore the months to their relative position in the seasons, *i.e.*, the solar year, indicated by their names. Thus came into existence the lunisolar year which follows both the sun and the moon, and consequently must have alternately 12 and 13 months. A still more exact means of detecting the deviation of the months and correcting it was attained by naming some or all of the months after the appearances of certain stars as, for instance, is the practice in north-west America, Polynesia and Melanesia. In Babylonia, before the middle of the third millennium B.C., the list of months had been fixed and a certain month had been singled out as the intercalary month. (From about 2000 B.C. it was one of the two months *Adarru* or *Ululu.*) The lunisolar year was regulated by empirical intercalation, which continued down to the Persian times. From Babylonia the Greeks took over the lunisolar year, but in the 7th century B.C. introduced a cyclical intercalation, the *octaëteris*, thus setting the problem of the scientific regulation of the calendar.

The natural year, being an ever-recurring cycle, has no proper new year, *i.e.*, a point from which the year commences; the beginning of the year or of the list of month-names varies greatly therefore. But the agricultural year has a definite commencement and end. This end of the agricultural occupations is often celebrated by festivals. It forms the turning point of the year; a new period is entered upon. The European calendrical new year has its origin in the term at which the Roman Consul, after whom the year was named, entered upon his office.

Solstices and Equinoxes.—While the stars were often used for more accurately defining the time within the year, certain points in the course of the sun may be referred to, namely, the solstices and equinoxes (*q.v.*). This is, however, a more complicated observation which requires a fixed standing point and certain landmarks touched by the sun in its travel from north to south and inversely. In this manner the Eskimos, the Indians of Arizona, the Amazulu, etc., observe the most northern and southern points reached by the sun, its "houses" or "turning points." They were also known to Homer and Hesiod. The observation of the equinoxes is still more difficult; for this purpose the Incas had erected towers as artificial marks at Cuzco. Certain gifted and advanced peoples, the Eskimos, the Northern Scandinavians, the Polynesians and Melanesians, have made still more refined observations of the course of the sun, but on the whole even the simplest observations of this nature, viz., those of the solstices, play no important part in primitive time-reckoning.

The Market-week.—There is a wholly artificial period of fairly frequent occurrence among peoples who have sufficiently advanced in civilization to have a regular trade. This is the market-week, or the fixed period of days in which a market is held. It varies in length and lasts three days among the Muysca in Bogota, four among many West African tribes, five in Central America, the East Indian Archipelago and old Assyria, six among a tribe in Togo, eight among the ancient Romans (the *nundinae*), and ten among the Inca people. On the market day, especially in Africa, work is often forbidden, certain taboos are imposed, and religious ceremonies performed. The hypothesis has therefore been advanced that the Israelitish sabbath was by origin a market day, although the prohibition of work has been extended also to its original purpose of commerce.

Methods of Reckoning.—Finally many peoples use a tally or other device for counting days, moons, and years, and where a more refined science of time-reckoning is evolved it is in the hands of a special class, particularly the priests, who preserve this knowledge and regulate the calendar. Hence the close connection between the religious system and the calendar, for the celebration of the festivals and ceremonies at the right times as indicated by the calendar is the chief duty of the priests, who gathered great knowledge of times and seasons, of the holy days and the work days, of the links between man and the sun, the moon, and the stars. These and the seasons and the cycle of Nature are the material from which by long, hard thought, by patient observation, by ever subtler and more accurate calculation, modern systems of time-reckoning have been developed.

See Martin P. Nilsson, *Primitive Time-Reckoning* (1920).

(M. P. N.)

CHINESE

For chronological purposes, the Chinese people, as elsewhere in the east of Asia, employ cycles of sixty to reckon their days, moons and years. The days are distributed in the calendar into cycles of sixty, in the same manner as ours are distributed into weeks, or cycles of seven. Each day of the cycle has a particular name, and as it is usual in mentioning dates, to give the name of the day along with that of the moon and the year, it is easy to verify the epochs of Chinese chronology. The order of the days in the cycle is never interrupted by any intercalation used to adjust the months or years. The moons of the civil year are also distinguished by their place in the cycle of sixty; and as the intercalary moons are not reckoned, because during one of these lunations the sun enters into no new sign, there are only twelve regular moons in a year, so that the cycle is renewed every five years. The cycle of sixty is formed of two subordinate cycles or series of characters, one of ten and the other of twelve, which are joined together so as to afford sixty different combinations. The names of the characters in the cycle of ten, which are called *celestial* signs, are:

1. Kia; 2. I; 3. Ping; 4. Ting; 5 Wu;
6. Ki; 7. Kêng; 8. Hsin; 9. Jên; 10. Kuei;

and in the series of 12, denominated *terrestrial* signs,

1. Tzŭ; 2. Chou; 3. Yin; 4. Mao; 5. Shin; 6. Ssŭ;
7. Wu; 8. We; 9. Shin; 10. Yu; 11. Hsü; 12. Hai.

The name of the first year, or of the first day, in the sexagenary cycle is formed by combining the first words in each of the above series; the second is formed by combining the second of each series, and so on to the tenth. For the next year the first word of the first series is combined with the eleventh of the second, then the second of the first series with the twelfth of the second, after this the third of the first series with the first of the second, and so on till the sixtieth combination, when the last of the first series concurs with the last of the second.

In the Chinese history translated into the Tatar dialect by order of the emperor K'ang-hi (d. 1721), the characters of the cycle begin to appear at the year 2357 B.C. From this it has been inferred that the Chinese empire was established previous to that epoch; but as the cycles can be extended backwards indefinitely, the inference can have very little weight. The characters given to that year 2357 B.C., are Keă-shin, which denote the 41st of the cycle. We must, therefore, suppose the cycle to have begun 2397 B.C., or forty years before the reign of Yao. This is the epoch assumed by the authors of *L'art de vérifier les dates*. The mathematical tribunal has, however, from time immemorial counted the first year of the first cycle from the eighty-first of Yao, that is to say, from the year 2277 B.C.

Since the year 163 B.C. Chinese writers date the year from the accession of the reigning emperor. An emperor, on succeeding to the throne, gives a name to the years of his reign. The periods thus formed are called by the Chinese *Nien-hao* (year-name). According to this method of dating the years a new era commences with every reign; and the year corresponding to a Chinese date can only be found when we have before us a catalogue of the Nien-hao, with their relation to the years of our era. In modern China the native calendar is used side by side with the western one (*Hsi-li* or western reckoning). (X.)

EGYPTIAN

A solar year, a lunar month and a day unfortunately are incommensurable units of time, for a year contains roughly 365¼ days and a month roughly 29½ days. From this fact arise the difficulties with which early constructors of calendars were confronted. The Egyptians appear to have begun with a lunar calendar. We have no contemporary evidence of this, but the writing of the word "month" with the moon-sign, the importance of the monthly and half-monthly festivals in later times, and the adoption of the month as a unit in the later calendar place it beyond doubt.

At a very early date, however, the Egyptians had begun to observe what is known as the heliacal rising of the star Sirius or Sothis, a conspicuous object in the Egyptian sky. A star is said to rise heliacally on the day on which it first appears again in the sky just before sunrise after being for some time invisible. The Egyptians noted that this rising corresponded very closely with the rise of the Nile, on which the agricultural welfare of the country depended. Small wonder then that they chose this for the first day of the year, and took the period between two such observed risings to form a unit of time which was convenient not only as being much longer than the old month, but as including a whole round of the seasons.

The next step was to subdivide the new unit, and here use was made both of the old months and of the changing seasons. Twelve nominal months of 30 days each gave 360 days, and the missing 5 days were added on at the end under the name of "days additional to the year." The months were grouped into three sets of four, the first four forming the inundation season, the second four the winter or sowing-time and the third four the summer or harvest.

Unfortunately the constructors of this calendar either overlooked or ignored the fact that every four years, as observation must have shown, Sothis rose a day later, *i.e.*, after a lapse of 366 and not 365 days, the reason being as we now know, that the star-year, which is virtually identical with the solar year, measures about 365¼ days. This error of theirs meant that their calendar got out of gear with the solar year, and consequently with the seasons, to the extent of one day every four years, and the error became greater and greater until eventually, after 1,460 (365×4) solar years, known as a Sothic Period, the calendrical New Year's Day had worked right round the seasons and come back to its correct place again. The Egyptians were not unaware of this absurdity, but it was not until quite late times that they sought to correct it by the insertion of an extra day every four years (Leap Year), and even then the attempt failed

We know from the Latin writer Censorinus that the first day of the Egyptian calendar year coincided with the rising of Sothis in A.D. 130, and it must therefore have done the same thing 1,460 solar years earlier and so on, *i.e.*, in 1321 B.C., 2781 B.C., 4241 B.C., 5701 B.C., etc. Obviously it was at one of these moments that the calendar was introduced. Now the religious texts inscribed in the pyramids of the Fifth and Sixth Dynasties show that the calendar with its five extra days was then already in existence. Egyptologists consequently date the introduction of the calendar to 4241 B.C. or to 2781 B.C., according as they believe the pyramids to be earlier or later than the latter date. A still higher date, *e.g.*, 5701 B.C., is hardly likely.

The Egyptians used no unit of time longer than a year. Consequently they had no dating by eras in the modern sense. In very early times each year was named after some important event in it, *e.g.*, "The year of the first smiting of the East," and was at the same time connected with the reigning king Later, under the Fifth and Sixth Dynasties, the biennial cattle census was used for time reckoning, and the years of a king's reign were numbered alternately "The Year of the first (second, third, etc.), census" and "The Year after the first (second, third, etc.), census." Later still the years of the reign were numbered straightforwardly 1, 2, 3 and so on.

In early Egyptian documents the months bear no special names, being written merely as the first, second, third or fourth month of such and such a season. In the Persian period, however (6th cent. B.C.) there began to appear month names drawn from festivals which took place during the month; these names may of course have been in use in speech earlier, though they were never written. Considerable uncertainty surrounds the origin of some of them, and the question is complicated by the fact that at some date in or before the Ramesside Age the whole of the names seem to have been thrown one month back in the year.

The week of seven days was totally unknown to the early Egyptians and the evidence brought forward for its existence in very late times is far from convincing.

The day and the night were each divided into 12 hours, but as the day was measured sometimes from sunrise to sunset and sometimes from the appearance of daylight to its disappearance, the length of day and of night varied through the year. Consequently the Egyptians cannot claim to have established the hour as a fixed unit of time. (T. E. P.)

BABYLONIAN AND ASSYRIAN

Babylonian, from 2000 B.C. Onwards.—The Babylonian calendar imposed by the kings of the First Dynasty of Babylon, on all the cities immediately under their rule, was adopted by the Assyrians at the end of the second millennium B.C., was used by the Jews on their return from exile, and was widely used in the Christian era. This calendar was equated with the Sumerian calendar in use at Nippur at the time of the Third Dynasty of Ur (about 2300–2150 B.C.) in the following manner:

Bab.		Sum.	Bab.		Sum.
Nisan		Bar. Zag. Ga.	Tashritum	–	Du. Ku.
Aiaru	–	Gud. Si. Di.	Arakhsamna	=	Apin. Du. A.
Simanu	-	Šeg. Ga.	Kislimu	=	Gan. Gan. Na.
Du'uzu	-	Šu. Numun. Na.	Tebitum	–	Ab. Ba. E.
Abu	=	Ne. Ne. Gar.	Shabat	=	Aš. Am.
Ululu	=	Kin. Innin. Na.	Addaru	–	Še. Gur. Kud.

These were lunar months, and in general their length was 30 days; in historical times regular watch was kept for the new moon, and if that fell on the 30th of a month, then the day automatically became the first of the next month, and all officials were apprised of the fact. In order to prevent too serious a derangement of the seasons owing to the discrepancy between 12 lunar months and the solar year, a month was intercalated; the intercalary month might be a second Elul (Ululu) or a second Adar. Such intercalations were, in the late period, regularly devised within a cycle; in the Seleucid period and earlier, from 382 B.C., the cycle was 19 years, from 504–383 it was 27 years, from 528–505 it was eight years. Before the reign of Darius the intercalation was not based on any fixed cycle, but was inserted when the astronomers advised the king that it was necessary, the object being, it has been suggested, that the first of Nisan, with which the year always began, should not fall over a month later than the spring equinox, and not more than a month before it. It has been calculated that the actual variation in terms of the Julian calendar amounts to about 27 days. Nisan is therefore roughly March–April, but in certain extreme cases April–May.

The meanings of the names of the months cannot be ascertained with certainty. *Nisannu* seems to mean "sacrifice," *Aiaru* "blossom," *Simanu* "the fixed, appointed time," whether in relation to some ritual observance is not clear, *Du'uzu* is a form of Tammuz due to sound changes and the month was so named because vegetation had left the parched earth then, *Arakhsamna* is "the eighth" month. Since these names belong to the Akkadian language, it is probable that they arose in Babylonia, but it is conceivable that they were already known to the earliest people of Semitic speech before they entered the Euphrates valley.

The month was divided into unequal periods by days with special names, the first, *arhu*, the seventh, *sibutu*, the 15th, *šabattu*, the 28th, *bubbulu*, and the 3rd., 7th., 16th., *nubattu*, "rest"; but there was no system of continuous reckoning in weeks of seven or any other number of days. The day was divided into six watches, three for the day, three for the night, the first being called "sunrise," *napakh Shamshi*, "siesta," *muslalu*, and "sunset," *ereb Shamshi*, or "evening," *lilati;* the second "peeping (of the stars)," *bararitu*, "middle," *qablitu*, and "the time of dawn," *šat urri*. Time was reckoned in double hours, 12 to the day, and it is probable that the astronomers, if not all others, reckoned day as beginning with sunset. The hours consisted of 30 smaller divisions. Exact reckoning was secured by measuring weights of water passing through a pierced bowl—a water clock.

Other calendars were in use in the seventh century within the Assyrian empire. Thus a month Kanun, which was probably derived from a Syrian calendar, is testified to by a man's name. The Elamites had a calendar of their own occasionally used in Assyria.

Early Assyrian, Before 1000 B.C.—The calendar regularly used in Assyria before the tenth century, and even after that date occasionally, was not derived from Babylonia. The month names are: (1) Qarrate, (2) Tan(?)marte, (3) Sin, (4) Kuzalli, (5) Allanate, (6) Belti-ekallim, (7) Sarate, (8) Kinate, (9) Mukhur ili, (10) Ab sharrani (11) Khibur, (12) Sippim. These months are differently equated by cuneiform scribes with Babylonian months; one list makes Qarrate equivalent to Addaru, the other to Shabatu, *i.e.*, either Feb.–March, or Jan.–Feb. The difference may perhaps have arisen from the lack of intercalation in the Assyrian calendar over a long space of time. It is to be noted that there is no certain occurrence of *an intercalary month in* this Assyrian calendar.

The meanings of the names are in this instance also known in a few cases. The first month derived its name from a festival in which the *limmu* or eponymous officer of the year took part, perhaps connected with the drawing of lots. The second, Tanmarte, if correctly read, is the month of "shining forth," the third is the month of the moon-god, the fourth perhaps "of gourds," the fifth, "of terebinths," the sixth is named after a form of Ishtar called "the Lady of the Palace," the ninth is named after a special offering made to gods when entering holy buildings. The origin of this calendar must lie in the times before the Assyrians entered the Tigris valley. It was not the Subaraean calendar, for the three known Subaraean month-names were *Ari*, and "the month of Adad" and "the month of Nergal." This Assyrian calendar was used over an extensive area at the time of the Third Dynasty of Ur, for it occurs on the tablets from Caesarea (Mazaca) at that time, together with other month names, Kiratim, "of gardens," Tinatim, "of figs," and Narmak-Ashur, "the libation of Ashur." This last month was the same as Kinatim, and was only temporarily used, the other two also may represent a change in nomenclature. But it had no currency in the middle Euphrates, for in the kingdom of Khana, immediately north of Babylonia, still another calendar was used, including the names Kinunu, "stove" (the later Kanun), Birissaru, Teritum, Belitbiri, "the lady of vision," Igi-kurra (a divine title); the order of these months is unknown, and it is uncertain whether this calendar was used outside Khana. Still other month names must have been used elsewhere, for on documents of the First Dynasty of Babylon there occur the names Tiru, Nabru, Sibutu, Rabutu (equivalent to Nisan), Mamitu, and Isin-Abi

The most striking feature of the Assyrian calendar is its commencement, not at the spring equinox, but one or even two months before. This feature proves a complete independence of any astronomical observation when the calendar was first formed, but its exact cause cannot be defined. The general meanings of the month-names, with the exception of the third and sixth, seem to show that this was an agricultural calendar, based simply on the farming year; the month names closely connected with ritual observances may have been adopted long after the origin of the actual calendar itself.

Sumerian Calendars.—The calendar used by the kings of the Third Dynasty of Ur (*see* above), and always subsequently kept as "ideograms" for the later month names, seems to have originated as the local calendar of the city of Nippur at a time when various other city-calendars were in use. The meanings of these month names may be roughly as follows: (1) "month of the dweller of the sanctuary," (2) "month of the leading out of the oxen," (3) "month of brick-making," (4) uncertain, (5) "month of setting the fire," (6) "month of a (certain) festival of Ishtar," (7) "month of the sacred place" *duku*, (8) "month of opening the irrigation canals," (9) "month of ploughing (?)," (10) named after a religious festival, (11) "month of emmer-grain," (12) "month of corn-harvest." An intercalary month DIR.ŠE.GUR-KUD. was inserted, but no fixed principle can be observed.

The Nippur calendar was not used at Lagash, Umma or the ancient town which occupied the site of the modern Duraihim, under the Third Dynasty of Ur, *i.e.*, about 2300–2150 B.C. The month names at Lagash in use at the time of Sargon of Agade, *i.e.*, before 2500 B.C., number about 25, but not all these names belonged to a calendar; some are merely descriptions of a month as that in which sheep-shearing took place, or when men arrived from a certain place. The fixed month-names at Lagash, Umma, and Duraihim, where two calendars were in use at the same time, for the Third Dynasty of Ur period were:—

Lagash.	Umma.	Ur.	Duraihim.
Gan. Maš.	Še. Gur. Kud.	Še. Gur. Kud.	Maš. Du. Ku.
Har. Ra. Ne. Mu. Mu.	Sig. I. Šub. Ba. Gar.	(Dir. Še. Gur. Kud.)	Šeš. Da. Ku.
Ezen ^{d}Ne. Šu	Še. Kar. Gal. La.	Maš. Ku. Ku.	U. Ne. Ku
Šu. Kul.	..	Šeš. Da. Ku.	Ki. Sig. Nin. A. Zu.
Dim. Ku.	..	U. Ne. Ku.	Ezen. Nin. A. Zu.
Ezen ^{d}Dumu Zi.	Šu. Numun.	Ki. Sig. Nin. A. Zu.	A. Ki. Ti.
Ezen ^{d}Šul. Gi.	Min. Ab.	Ezen. Nin. A. Zu.	Ezen ^{d}Šul. Gi.
Ezen ^{d}Ba. U.	E. Itu. Aš.	A. Ki. Ti.	Su. Ešh. Ša.
Mu. Su. Du.	^{d}Ne. Gun.	Ezen ^{d}Šul. Gi.	Ezen. Makh.
Amar. A. A. Si.	Ezen. ^{d}Shul. Gi.	Šu. Eš. Ša.	Ezen. An. Na.
Še. Gur. Kud.	Kur. U. E.	Ezen. ^{d}Makh.	Ezen. Me. Ki. Gal.
(Dir. Še. Gur. Kud.)	^{d}Dumu Zi.	Ezen. An. Na.	Še. Gur. Kud.
Še. Il. La.	(Dirig.)	Ezen. Me. Ki. Gal.	

Those names enclosed in brackets are the names of the intercalary months marking the position in the calendar when intercalated. All, or nearly all, these names are derived from specific festivals and ritual acts. The lists are sufficient to prove three points: (1) names were borrowed by one local calendar from another at this time, (2) the time of the festivals in the different cities must have varied, for it is inconceivable that the festival of Shulgi, the second king of the Third Dynasty of Ur, could ever have been in the same month at Umma and Lagash, (3) that the intercalation in different towns was independent. We are not in a position to explain the complicated calendar of this period by the position at an earlier date; the earliest month names, from the pre-Sargonic or early Sumerian period offer even greater difficulties, and are also connected with religious festivals and ritual acts. Of all the Sumerian calendars, that of Nippur, which is derived from agricultural habits, looks the most primitive, but the point must remain quite obscure. Some local Sumerian month-names survived until the period of the First Dynasty of Babylon, and the reduction of the confusion in this matter to comparative order was probably due to Hammurabi. (S. SM.)

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HINDU

From very early times Hindus have employed luni-solar cycles made by the combination of solar years and lunar years so treated as to keep the beginning of the lunar year near that of the solar year. The detailed arrangement of the earliest form of Hindu calendar is still a subject of research but, from about A.D. 400, under the influence of the Greek astronomy, developed the Hindu calendar as known to-day.

For civil purposes, solar years are used in Bengal, Orissa and in the Tamil and Malayālam districts of Madras; elsewhere lunar years. But everywhere the general religious rites and festivals are regulated by the lunar year and the details of private and domestic life (auspicious occasions for marriages, undertaking journeys, etc.), are based upon the lunar calendar. Even almanacs showing the solar year give details of the lunar year. The civil solar year is determined by the astronomical solar year, beginning with an artificial nominal equinox instead of with the true one.

The Solar Month.—The solar year is divided into 12 months, in accordance with the successive *saṁkrāntis* or entrances of the sun into the (sidereal) signs of the zodiac, which, as with us, are 12 in number. The names of the signs in Sanskrit are as follows: Mēsha, the ram (Aries); Vṛishabha, the bull (Taurus); Mithuna, the pair, the twins (Gemini); Karka, Karkaṭa, Karkaṭaka, the crab (Cancer); Siṁha, the lion (Leo); Kanyā, the maiden (Virgo); Tulā, the scales (Libra); Vṛischika, the scorpion (Scorpio); Dhanus, the bow (Sagittarius); Makara, the sea-monster (Capricornus); Kumbha, the water-pot (Aquarius); and Mīna, the fishes (Pisces). The solar months are known in some parts by the names of the signs or by corrupted forms of them; and these are the best names for them for general use, because they lead to no confusion. But they have elsewhere another set of names, preserving the connection of them with the lunar months: the Sanskṛit forms of these names are Chaitra, Vaiśākha, Jyaishṭha, Ashāḍha, Śrāvaṇa, Bhādrapada, Āśvina or Āśvayuja, Kārttika, Mārgaśira or Mārgaśīrsha (also known as Agrahāyaṇa), Pausha, Māgha, and Phālguna: in some localities these names are used in corrupted forms, and in others vernacular names are substituted for some of them; and, while in some parts the name Chaitra is attached to the month Mēsha, in other parts it is attached to the month Mīna, and so on throughout the series in each case The astronomical solar month runs from the moment of one *saṁkranti* of the sun to the moment of the next *saṁkrānti*; and, as the signs of the Hindu zodiac are all of equal length, 30 degrees, as with us, while the speed of the sun (the motion of the earth in its orbit round the sun) varies according to the time of the year, the length of the month is variable: the shortest month is Dhanus; the longest is Mithuna

The Civil Day.—The civil days of the solar month begin at sunrise. They are numbered 1, 2, 3, etc., in unbroken succession to the end of the month; the length of the month being variable, the number of civil days may range from 29 to 32.

The civil days are named after the weekdays, of which the usual appellations (there are various synonyms in each case, and some of the names are used in corrupted forms) are in Sanskṛit Ādityavāra or Ravivāra, the day of the sun, sometimes called Ādivāra, the beginning-day (Sunday); Sōmavāra, the day of the moon (Monday); Maṅgalavāra, the day of Mars (Tuesday); Budhavāra, the day of Mercury (Wednesday); Bṛihaspativāra or Guruvāra, the day of Jupiter (Thursday); Śukravāra, the day of Venus (Friday); and Śanivāra, the day of Saturn (Saturday). While some of the astronomical books perhaps postulate an earlier knowledge of the "lords of the days," and other writings indicate a still earlier use of the period of seven days, the first proved instance of the use of the name of a weekday is of the year A.D. 484, and is furnished by an inscription in the Saugor district, Central India.

The main divisions of the civil day are 60 *vipalas* = 1 *pala* = 24 seconds; 60 *palas* = 1 *ghaṭikā* = 24 minutes; 60 *ghaṭikās* = 24 hours = 1 day. There is also the *muhūrta* = 2 *ghaṭikās* = 48 minutes: this is the nearest approach to the "hour." The comparative value of these measures of time may perhaps be best illustrated thus: 2½ *muhūrtas* = 2 hours; 2½ *ghaṭikās* = 1 hour; 2½ *palas* = 1 minute; 2½ *vipalas* = 1 second

As their civil day begins at sunrise, the Hindus naturally count all their times, in *ghaṭikās* and *palas*, from that moment. But the moment is a varying one, though less in India than in European latitudes; and Hindus have recognized the necessity, in connection with their lunar calendar, of a convenient means of referring their own times to the time which prevails officially. Consequently, many almanacs have adopted the European practice of showing the time of sunrise, in hours and minutes, from midnight; and some of them add the time of sunset from noon.

The lunar year consists primarily of 12 lunations or lunar months, of which the present Sanskrit names, generally used in more or less corrupted forms, are Chaitra, Vaiśākha, etc., to Phālguna, as given above in connection with the solar months. It is of two principal varieties, according as it begins with a certain day in the month Chaitra, or with the corresponding day in Kārttika: the former variety is conveniently known as the Chaitrādi year; the latter as the Kārttikādi year. For religious purposes the lunar year begins with its first lunar day: for civil purposes it begins with its first civil day, the relation of which to the lunar day will be explained below. Owing to the manner in which the beginning of the lunar year is always shifting backwards and forwards, it is not practicable to lay down any close equivalents for comparison: but an indication may be given as follows. The first civil day of the Chaitrādi year is the day after the new-moon conjunction which occurs next after the entrance of the sun into Mīna, and it now falls from about March 13 to about April 11; the first civil day of the Kārttikādi year is the first day after the new-moon conjunction which occurs next after the entrance of the sun into Tulā, and it now falls from about Oct. 17 to about Nov 15.

The present names of the lunar months, indicated above, were derived from the *nakshatras*, which are certain conspicuous stars and groups of stars lying more or less along the neighbourhood of the ecliptic. The *nakshatras* are regarded sometimes as 27 in number, sometimes as 28, and are grouped in 12 sets of two or three each, beginning, according to the earlier arrangement of the list, with the pair Kṛittikā and Rohiṇī, and including in the sixth place Chitrā and Svāti, and ending with the triplet Rēvatī, Aśvinī and Bharaṇī. They are sometimes styled lunar mansions, and are sometimes spoken of as the signs of the lunar zodiac; and it is, no doubt, chiefly in connection with the moon that they are now taken into consideration. But they mark divisions of the ecliptic: according to one system, 27 divisions, each of 13 degrees 20 minutes; according to two other systems, 27 or 28 unequal divisions, which we need not explain here. The almanacs show the course of the sun through them, as well as the course of the moon; and the course of the sun was marked by them only, before the time when the Hindus began to use the 12 signs of the solar zodiac. So there is nothing exclusively lunar about them. The present names of the lunar months were derived from the *nakshatras* in the following manner: the full-moon which occurred when the moon was in conjunction with Chitrā (the star α Virginis) was named Chaitrī, and the lunar month, which contained the Chaitrī full-moon, was named Chaitra; and so on with the others. The present names have superseded another set of names which were at one time in use concurrently with them; these other names are Madhu (= Chaitra), Mādhava, Śukra, Śuchi, Nabhas, Nabhasya, Isha, Ūrja (= Kārttika), Sahas, Sahasya, Tapas, and Tapasya (= Phālguna): they seem to have marked originally solar season-months of the solar year, rather than lunar months of the lunar year.

A lunar month may be regarded as ending either with the new-moon, which is called *amāvāsyā*, or with the full-moon, which is called *pūrṇamāsī*, *pūrṇimā*: a month of the former kind is termed *amānta*, "ending with the new-moon," or *śuklādi*, "beginning with the bright fortnight"; a month of the latter kind is termed *pūrṇimānta*, "ending with the full-moon," or *kṛishṇādi*, "beginning with the dark fortnight." For all purposes of the calendar, the *amānta* month is used in Southern India, and the *pūrṇimānta* month in Northern India. But only the *amānta* month, the period of the synodic revolution of the moon, is recognized in Hindu astronomy, and for the purpose of naming the lunations and adjusting the lunar to the solar year by the intercalation and suppression of lunar months; and the rule is that the lunar Chaitra is the *amānta* or synodic month at the first moment of which the sun is in the sign Mīna, and in the course of which the sun enters Mēsha: the other months follow in the same way; and the lunar Kārttika is the *amānta* month at the first moment of which the sun is in Tulā, and in the course of which the sun enters Vṛiśchika. The connection between the lunar and the solar months is maintained by the point that the name Chaitra is applied according to one practice to the solar Mīna, in which the lunar Chaitra begins, and according to another practice to the solar Mēsha, in which the lunar Chaitra ends. Like the lunar year, the lunar month begins for religious purposes with its first lunar day, and for civil purposes with its first civil day.

One mean lunar year of 12 lunations measures very nearly 354 days 8 hrs. 48 min. 34 sec.; and one Hindu solar year measures 365 days 6 hrs. 12 min. 30 sec. according to Āryabhata, or slightly more according to the other two authorities. (*See* CHRONOLOGY: *Hindu.*) (X.)

GREEK

(1) **General.**—The Greek calendar, even in its most developed forms, differed from all modern European systems in being soli-lunar; *i.e.*, in theory, every year began when the sun was in a certain position (solstice or equinox) and every month began with the new moon. But, as the solar year (solstice to solstice or equinox to equinox) is not even approximately divisible by the lunar month, the result was that some system of adjustment was necessary. This was found, at an uncertain but early date, in the *oktaeteris* or eight-year group. Eight solar years are 8 × 365·25 days, roughly, *i.e.*, 2,922 days. Eight lunar years, *i.e.*, eight groups of twelve lunar months each, are 8 × 12 × 29·50 days approximately, *i.e.*, 2,832 days. The difference, 90 days, is about three lunar months. Hence, by inserting, at different times within the *oktaeteris*, three extra months, approximate agreement with natural phenomena was obtained. But it was at best only approximate, for the above lengths of a solar year and a lunar month are not exact (*see* ASTRONOMY), and to bring the calendar into accuracy would have meant abandoning the principle of beginning each month at new moon; but this principle was sacred, and could not be abandoned, at least in theory. An important attempt at reform was made by the astronomer Meton of Athens. By his system, the years, commencing from the end of June, 432 B.C. of our reckoning, were grouped into "great years" of 19 each, with seven intercalary months. This gave, on an average, a month of 29 days, 12 hr., 45 min., 57 sec.,—less than 2 minutes too long. Callippus of Cyzicus later combined four Metonic cycles into one, and finally Hipparchus of Nicaea combined four Callippian periods into one cycle of 304 years, by which a very high degree of accuracy was obtainable. These theoretical constructions, however, affected the official years little, if at all, and intercalation went on in a very lax and unscientific fashion, resulting in civic calendars which were often some months out.

The month was not divided into weeks; the planetary week is astrological, connected with the dogma that every period of time, including the day, had a planet for its regent. It is not much older than the Christian era, and was never official in classical times (*see* F. H. Colson, *The Week*, 1926). There was, however, a division into thirds. The first ten days of the month were called *μὴν ἱστάμενος* or commencing month; the last third, *μὴν φθίνων*, or waning month; for the middle third, no regular term was in use. Days of a higher number than 20 were either called the first, second, etc., after the *eikades* (twenties), or numbered backwards; thus at Athens, *Βοηδρομιῶνος ἕκτη φθίνοντος* meant the sixth day, counting inclusively, from the *end* of the month Boedromion. The day was officially computed from sunset to sunset; practically it began at dawn.

Parallel with all this reckoning there ran the farmers' and sailors' calendars, based on observation of the heliacal rising and setting of the constellations (such-and-such work was to be done when the Pleiads rose, navigation was not safe after the setting of Arcturus, etc.), or on such phenomena as the appearance of various flowers, migratory birds, and the like. Many private persons had calendars (*parapegmata*), on which, by moving a peg from one hole to another, it was possible to see the relative positions of the civil and natural years.

(2) **Individual Calendars.**—That of Athens is the best known. It began, or was supposed to begin, at the summer solstice, or rather at the new moon next to that; hence about the end of June. The months were called *Hekatombaion, Metageitnion, Boedromion, Pyanopsion* (later *Pyanepsion*), *Maimakterion, Poseideon, Gamelion, Anthesterion, Elaphebolion, Mounichion, Thargelion,* and *Skirophorion.* When intercalation was necessary, the month *Poseideon* was repeated; the intercalary month was then called Second *Poseideon.* The first day of each month was called ἕνη καὶ νέα, *i.e.,* old and new; for as the month began officially at sunset, but most people reckoned the day from dawn (*see* above), the day of new moon fell between two months. Every month was either "full" (πλήρης), consisting of 30 days, or "hollow" (κοῖλος), with 29 days.

It is clear that the months are mostly named after gods (as *Poseideon,* cp. the Delian *Artemision,* the Delphic *Heraios,* and the Boeotian *Hermaios*) or after festivals (as *Anthesterion,* cf. *Pamboiotios* in Boeotia, *Karneios* in Laconia). This accords with the probable history of the calendar. It began, not as a scheme of continuous reckoning, but as a series of notable days or groups of days (ἑορταί, ἱερομηνίαι), corresponding in some cases at least to seasonal events, such as harvest. The days between these, unless they were days of new moon, or full moon, were not holy, and therefore not reckoned. The Boeotian year began with the winter solstice, the Laconian with the autumn equinox. In some of the later calendars, as those of Achaia and Phocis, the months were not named, but only numbered.

In Hellenistic times, more and more use was made of the official Egyptian year, which was in use under the Ptolemies. It consisted of 365 days, without intercalation, with the result that every four years it lost a day, and in 1,461 years it came right again. The months were called Thoth, Phaophi, Athyr, Choiak, Tybi, Mechir, Phamenoth, Pharmouthi, Pachon, Pauni, Epiphi and Mesori.

See A. Mommsen, *Das Kalenderwesen der Griechen* (1883); G. F. Unger in I. von Müller's *Handbuch* (1886); Schmidt and Ruhl, *Handbuch der Griech. Chronologie* (1888); and J. Gow in Whibley's *Companion to Greek Studies* (1916).

In 26 B.C., when Augustus reformed the Egyptian calendar to bring it into line with the Julian, Thoth 1 was equivalent to Aug. 29. This reformed Egyptian calendar had a long struggle to come into actual use, however. Also important for late times is the native Macedonian calendar, originally twelve lunar months called Dios, Apellaios, Audynaios, Peritios, Dystros, Xanthikos, Artemisios, Daisios, Panemos, Loïos, Gorpiaios, Hyerberetaios. About the beginning of our era this calendar, which was in common use in Asia Minor and Syria, was reformed on Julian lines.

BIBLIOGRAPHY.—(1) *Ancient.* Geminus of Rhodes, *Eisagoge*; Censorinus, *de die natali.* (2) *Modern.* L. Ideler, *Handbuch d. mathematischen u. technischen Chronologie* (Berlin, 1825) is still valuable. Good outline by G. F. Unger, *Zeitrechnung d. Griechen u. Römer,* in i. v. Muller's *Handbuch,* i., p. 711 ff. To his bibliography add: M. P. Nilsson, *Primitive Time-Reckoning* (Lund and Oxford, 1920); *Die Entstehung u. religiöse Bedeutung des gr. Kalendars,* in *Lunds Universitets Arsskrift,* N.F., Avd. 1, Bd. 14, Nr. 21 (Lund and Leipzig, 1918); J. K. Fotheringham in *Journ. Hell. Stud.,* xxxix. (1919), p. 164 foll.

ROMAN

The Roman Republican calendar was of the Greek type (*see* above), but rude and primitive, dating probably from the times of the Etruscan dynasty, but showing traces of a still earlier period. It consisted of twelve lunar months, *Martius, Aprilis, Maius, Iunius, Quintilis, Sextilis, September, October, November, December, Ianuarius, Februarius.* Of these, *Martius, Maius, Quintilis* and *October* had each 31 days, the rest 29, save *Februarius,* which had 28. The ancients attributed this to Numa, and a good tradition, unjustly suspected in ancient and modern times, declares that *Ianuarius* and *Februarius* were additions to an original year of 10 months. Such a year of course was discontinuous; between year and year there was a gap of some 60 days, a phenomenon quite well authenticated among savage and barbarous people. There was a dead season in winter; as this is better fitted to central European than to Italian climatic conditions, it seems likely that this very ancient calendar was brought by northern invaders. February was popularly thought to end, however, on the 23d, the *Terminalia,* and it was after this date that intercalation was made, which took place once or twice in four years. The *mensis intercalaris* or *Mercedonius* was followed by the remaining five days of February; the recently discovered *Fasti Antiates* (pre-Julian) show this system in use. In 153 B.C. Jan. 1 ousted Mar. 1 as the official New Year's day.

The working of the calendar was in the hands of the *pontifices,* who every month used to watch for the new moon, and, when it was seen, proclaimed from the Capitol the number of days, five or seven, to the Nones. Thus the first day of the month was called *kalendae,* or callings. Full moon was called the Ides (*idus*); this, in the four long months, was the 15th, in the others the thirteenth. The Nones (*nonae*), were the ninth day, by inclusive reckoning, before the Ides, *i.e.,* the 5th or 7th respectively. Other days were reckoned as so many before the Kalends, Ides, or Nones, e.g., *a*(*nte*) *d*(*iem*) *iii non*(*as*) *Quint*(*iles*), the 3rd day before the Nones of *Quintilis*=July 5. The 2nd, 6th (or 8th), and 14th (or 16th) were often called *postridie kalendas, nonas, idus., i.e.,* the day after the Kalends, etc. They were all, especially the day after the Kalends, unlucky (*dies postriduani*). The Ides were sacred to Jupiter; on the Kalends, sacrifice was offered to Juno and also to Janus; the Nones were sometimes a day of festival.

Eight-day Weeks.—Independent of the months were the eight-day "weeks" called *nundinae*; these had no individual names, were not closely connected with any religious practices of importance, and were simply the space from one market-day to another. They are marked on the surviving calendars with the letters A–H. The *dies Aegyptiaci* marked on some later calendars have no significance for Roman cult, but are astrological. Festivals were almost without exception on the odd-numbered days; if a festival lasted more than one day, there were breaks of one or three days in between, as *Lucaria, Quintilis* 19 and 21; *Carmentalia,* Jan. 11 and 15. Some months clearly arose out of seasons of ritual; thus *Martius* contains several important festivals connected with Mars, *Februarius* is the month of purifications (*februa*).

Owing to the clumsiness of the *pontifices,* and still more to political manoeuvres, by which intercalation was made or omitted recklessly to affect a magistrate's year of office, the calendar got into hopeless confusion by the end of the republic, and Julius Caesar undertook its reformation. In 46 B.C. he intercalated, and furthermore added 67 days between November and December, making a year of 445 days, and so bringing the civil abreast of the natural year. Then began the new, Julian calendar, which, with small modifications, lasted until the Gregorian reform. Its months were those still in use; intercalation was made, by repeating Feb. 23 (*a.d vi.kal.Mart.,* hence the name bissextile for a leap-year). The months *Quintilis* and *Sextilis* were renamed later, after *Iulius* and *Augustus* and, in spite of several strenuous efforts of the authorities, other attempts to give a month the name of an emperor were of no permanent effect.

Much of our information comes from inscriptions which set out the whole calendar, with a sign against each day indicating whether it is *F*(*as*), or available for legal business, *N*(*efas*), or not so available, *C*(*omitialis*), or available for a meeting of the Assembly, NP (*?nefas, feriae publicae*), or a feast-day, or *END* (*otercisus*), *i.e., nefas* morning and evening, *fas* in the middle. Certain other signs refer to special days, as *Q*(*uando*) *ST*(*ercus*) *D*(*elatum*) *F*(*as*) (June 15, cleansing of shrine of Vesta), *Q* (*uando*) *R* (*ex*) *C* (*omitiavit*) *F* (*as*), March 24.

The classical work is Mommsen, *Römische Chronologie*; to the literature given by Unger, add M. P. Nilsson, in *Strena Philologica Upsaliensis* (1922); H. J. Rose, *Primitive Culture in Italy* (1925).

(H. J. R.)

JEWISH

The Jewish Calendar in use to-day is both solar and lunar, the years being reckoned by the sun and the months by the moon. In order to adjust the two systems a month is intercalated in the 3rd, 6th, 8th, 11th, 14th, 17th, and 19th years of a 19-year cycle. For practical purposes, such as the beginning of Sabbath, the day begins at sunset but the calendar day of 24 hours, always begins at 6 p.m. The hour is divided into 1,080 parts (*Ḥalaqīm*) each part (*Ḥēlaq*) being equal to 3·3 sec. The *Ḥēlaq* is sometimes further divided into 76 *rega'īm.* A synodical month is the interval between two conjunctions (Conjunction = *Molad*) and amounts to 29 days 12 hours 44 min. $3\frac{1}{3}$ sec. The calendar month must, however, naturally contain an exact number of days, consequently the Hebrew month varies between 29 and 30 days, no month has either 28 or 31. The full (*Mālē*) month contains 30 and the defective (*Ḥāṣēr*) 29 days. The months *Nissan, Ṣivan, Ab, Tishri,* and *Shebaṭ* are always full; *Iyyār, Tammūz, Ellūl, Tebēth* and *Adar* are always defective, while *Marḥeshvān* and *Kiṣlev* may vary.

The number of days in a year naturally changes The total will be the days in month (29d. 12 h. 44 min. $3\frac{1}{3}$ sec.) multiplied by 12 in an ordinary year and by 13 in a leap year. But as either process would result in a fractional answer, the ordinary year has 353, 354 or 355 days and the leap year 383, 384 or 385. The New Year begins on *Tishri* 1, but it may be delayed by one or two days for various reasons. Thus, in order to prevent the Day of Atonement (*Tishri* 10) from falling on a Friday or Sunday, the New Year must avoid Sunday, Wednesday or Friday. Or again, if the conjunction of *Tishri* takes place after noon, so that the crescent would not be seen on that evening, the New Year is one, or sometimes two days later. Other causes may also produce delays (*deḥiyyōth*). A year in which *Marḥeshvan* and *Kiṣlev* are both full, is called complete (*Shelemāh*), and will contain 355 or 385 (if leap) days. In a normal (*Ke-Sidrāh*) year, in which the former month is defective and the latter full, the total of days will be 354 or 384, while in a defective (*Ḥaserāh*) year, when both months contain only 29 days each, the total of days will be 353 or 383. The character of a year (*qebīac*, lit. "fixing") is described by a group of three Hebrew consonants, the first and third giving the days and the week on which New Year and Passover fall respectively, while the middle consonant is the initial of "normal," "defective" or "complete." There can be only 14 types of *qebi 'oth*, seven in common and seven in leap years.

The mean beginning of the four seasons is called *Tequfāh* (lit orbit or course), spring beginning when the sun reaches the equinoctial point in *Nissan*, summer in *Tammūz*, autumn in *Tishri* and winter in *Ṭebeth*. The length of the seasons was variously fixed by different Rabbis. In the 3rd century A.D. Mar Samuel *Yarḥinai* (165–250, head of Academy of Nehardea) calculated the interval between *tequfōth* as 91 days, 7 hours, 30 min. It was observed that the first *tequfāh* always moves forward, year after year, by one day and six hours. The result is that after 28 years have elapsed the *Tequfāh* reverts to the same day and to the same time of day as at the beginning. This orbit is called the Great or Solar Cycle (*Mahzor Gadōl* or *Hammāh*). Samuel's length of the solar year ($365\frac{1}{4}$ days) was emended by R. Adda to 365 days, 5 hours, 55 min., $25\frac{25}{57}$ sec., a total approximating to the Ptolemaic year, but still too great by nearly seven minutes.

In addition to the solar cycle of 28 years, the Jewish Calendar employs, as mentioned above, a smaller or lunar cycle (*Maḥzōr qaṭān*) of 19 years in order to adjust the lunar months to the solar year by means of intercalations. The Feast of Passover, on 14 *Nissan* could not begin before the spring *Tequfāh* and therefore the intercalary month finally selected was Adar. A regular intercalation was not practised before the introduction of the continuous calendar and the adoption of the Metonic cycle. The *Maḥzōr qaṭan* is based on the equation $\frac{235}{19} = 12+7$, for 235 lunar months correspond to 19 solar years. In order, therefore, to keep 12 months in the year, seven intercalations are necessary: the periodicity of these additions has been given above. The era which is in use to-day is that of the Creation (*Anno Mundi, Li-yetzirāh, see* CHRONOLOGY).

The Jewish year 5689 A.M., 1928 in the Christian calendar, began on Sept. 15, 1928, and ended on Oct. 4, 1929. It was known as 689 according to the short system (*i.e.*, omitting the thousands); it was a leap year containing 13 months, 55 Sabbaths and 385 days. The *qebi'a* was *Zayin, Shin, hē*, which indicates that New Year fell on the 7th (*Zayin*) and Passover on the 5th (*hē*) day of the week and that *Marḥeshvan* and *Kiṣlev* each contained 30 days (complete, *shelemāh, shin*). 5689 was the 8th year of the 300th lunar cycle since the Creation and the 5th of the 204th of the solar cycle since the Creation.

Months and Important Days.—The following list enumerates the months and the chief days in each:

Tishri: 1 and 2, New Year; 3, Fast of Gedaliah (II Ki. xxv. 22–5; Zech. xiii. 19); 10, Day of Atonement; 15–21, Tabernacles; 22, Eighth day of Solemn Assembly; 23, Rejoicing of the Law.

Marḥeshvan: 22, 25 and 29, First Monday, Thursday and Second Monday, Fasts (in 1928).

Kiṣlev: 25, *Hanucah* (Feast of Dedication) begins.

Ṭēbēth 2, *Hanucah* ends; 10, Fast of *Ṭēbēth* (II Ki. xxv. 1: Zech. viii. 19).

Shebaṭ: 15, New Year of Trees.

Adar: 13, Fast of Esther; 14–15, Purim.

(*We-Adar;* Second Adar, intercalated month).

Nissan: 15–22, Passover.

Iyyar: 10, 13, 17, First Monday, Thursday and Second Monday, Fasts (in 1928).

Ṣivan: 6, 7, Pentecost

Tammūz 17, Fast (Zech. viii. 19).

Ab: 9, Fast (II Ki xxv 8, and Zech. viii. 19).

Ellūl.

Origin.—The Jewish Calendar is the result of long development; the present form is not of great antiquity. The ancient Hebrew names of the months disappeared in the Exile and were replaced by Babylonian names (given above); but even before the Exile the months were more commonly designated by numbers. The Bible records only four names, *Abib* (1st), *Ziv* (2), *Ethanim* (7), and *Bul* (8); and the Gezer calendar tablet, which belongs to the period of the Jewish monarchy, employs purely agricultural designations and avoids names. Until quite late times the influence of the crops on the fixation of the calendar was powerful. In Babylon the Jews adopted the Babylonian names, seven of which (*Nissan, Ṣivan, Tēbēth, Ellūl, Kiṣlev, Shebaṭ, Adar*) occur in Nehemiah and Esther, while six, *Tammūz, Ab, Ellūl, Tishri* and *Shebaṭ*) are mentioned in the Assouan Papyri (5th century B.C.). Though the habit of enumerating months continued, by the first century A.D. the complete 12 names are found in a list given in the Roll of Fasting (*Megillath Ta 'anith*).

The Mishnah already knows of casual intercalations and in Nedarim viii. 5, the second *Adar* is mentioned as the month to be added. The Jews did not, however, derive the cycle of 19 years from the Babylonians, who did not possess a system of intercalation. The dates in the Assouan Papyri, and Talmudic evidence, make it clear that Jewish intercalation was empirical and irregular. In the beginning of the 2nd century Aqiba reckoned three successive years as intercalary.

The calendar was originally fixed by observation, and ultimately by calculation. Up to the fall of the Temple (A.D. 70), witnesses who saw the new moon came forward and were strictly examined and if their evidence was accepted the month was fixed by the priests. Eventually the authority passed to the Sanhedrin and ultimately to the Patriarch. When necessary, a second *Adar* was inserted in order that the reaping of the corn should come at Passover. Gradually observation gave place to calculation. The right to determine the calendar was reserved to the Patriarchate; the Jews of Mesopotamia tried in vain to establish their own calendar but the prerogative of Palestine was zealously defended. So long as Palestine remained a religious centre, it was naturally to the homeland that the Diaspora looked for its calendar. Uniformity was essential, for if different parts had celebrated feasts on different days confusion would have ensued. It was not until the 4th century A.D. that Babylon fixed the Calendar.

The Book of Jubilees, written in the 2nd century B.C., contains a peculiar calendar, evidently based on a desire to reckon time in a distinctively Jewish way. Every event from the Creation to the beginning of the Exodus is dated in Jubilee periods of 49 years and in the heptads. The author uses a solar year of 364 days, or 52 weeks, divided into four quarters of 13 weeks. The calendar has been well described by Moore as a reaction against Hellenism. That it ever was used is more than doubtful.

The Qaraites (*q.v.*) opposed the Rabbanites on no point more vehemently than on the calendar; they regarded calculations as impious and useless and sought to reintroduce observation. In this matter they were victorious over the Great Rabbanite champion Ṣa‘adya (892–942), whose theory that calculation preceded observation they could easily disprove. By the end of the 15th century necessity forced the Qaraites to adopt calculation. Ṣa‘adya was more successful in his defence of the Jewish Exilarch against Ben Meir who, in 921, initiated a great controversy on the calendar. Ben Meir claimed to be a descendant of the Patriarchs, and hence asserted his right to fix the calendar. His main point was that New Year is not to be deferred unless the *Molad* takes place $\frac{642}{1,080}$ of an hour after midday.

The Talmud speaks of various New Year's days. It may be regarded as certain that in Palestine the New Year began in *Nissan* (*cf.* Exod. xii. 2) and in Babylonia in *Tishri.*

For roughly turning years *Anno Mundi* to *Anno Domini,* the number 240 should be added and the thousands neglected. Thus (5) 689 A.M. = (1) A.D. 929. Conversely, (1) 929 − 240 = (5) 689. Since the Jewish year begins about September, consequently between September and December 31st, a difference of one may have to be adjusted. For more exact work by far the best tables are those of Schramm (*Kalendariographische Tafeln*, Leipzig, 1908).

See the articles and bibliographies in the *Jewish Encyclopaedia* and in Hastings *Encycl. of Religion and Ethics.* For the Calendar in the Book of Jubilees *cf.* G. F Moore, *Judaism*, vol. i., pp. 193 *seq.* (1927).
(H. M. J. L.)

MAYA AND MEXICAN

MAYA CALENDAR

As this was the basis of the Mexican and allied calendars, it is here treated first. It appears at first sight very complex, but is fairly simple and is admirable from its symmetrical completeness.

Every Maya date is expressed by two numbers and two names, forming a group of four; *e.g.*, 4 Ahau 8 Cumhu, or 9 Imix 19 Zip This statement is similar to such a European date as Wed., Aug. 24, the 4 Ahau or 9 Imix being parallel to the Wednesday, as it gives the position in a gigantic week of 260 days, while the 8 Cumhu or 19 Zip is parallel to Aug. 24. But while in the European calendar Aug. 24 will fall on a Wednesday four times in 28 years and at unequal intervals therein, the Maya 4 Ahau or 9 Imix will not again occur on 8 Cumhu or 19 Zip until after the lapse of 52 years exactly. so there is no ambiguity. This period of 52 years is called the calendar round.

The Maya had a year of 365 days which was invariable, there being no leap year. This was divided into 18 months of 20 days each, together with five supplementary days at the end. The month names are, Pop, Uo, Zip, Zota, Tzec, Xul, Yaxkin, Mol, Chen, Yax, Zac, Ceh, Mac, Kankin, Muan, Pax, Kayab, Cumhu, together with the supplementary days, Uayeb. Within the month the days are numbered from 0 to 19 inclusive, instead of from 1 to 20, and similarly with Uayeb. Hence 8 Cumhu is what European usage would call the 9th of Cumhu. They also had a series of day names commencing with Imix as in the following table, the order of reading being down each column:

				Falls in month on the days			
Imix	Cimi	Chuen	Cib	4	9	14	19
Ik	Manik	Eb	Caban	5	10	15	0
Akbal	Lamat	Ben	Eznab	1	6	11	16
Kan	Muluc	Ix	Cauac	2	7	12	17
Chicchan	Oc	Men	Ahau	3	8	13	18

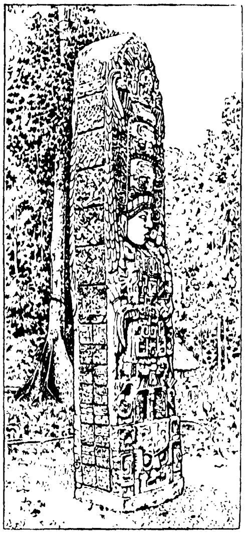
This series of day names, like the European week, ran on continuously through the months and years without any interruption. But as there were 20 days in the month it followed that if any day name, such as Akbal, fell on the day 1 in the first month of any year, it must fall on the day 1 of each month throughout that year, and also on 1 Uayeb. But the five days of Uayeb would use up five of the 20 names, so that in the next year the day 1 of each month would have the day name Lamat, in the year after it would have Ben, in the next year Eznab, and in the next year Akbal again, the day name returning to the same month-day every four years. Hence each day name [illegible] ly four possible month-days to fall on, as in above tal [illegible] Maya also had a series of 13 day numbers from 1 t [illegible] clusive. These also formed a continuous series like o [illegible] and ran on uninterruptedly throughout the years and [illegible] But each year contained 28 of these 13-day periods and [illegible] more, so that the year ended with the same day number with which it began, and therefore the next year began with the next day number. Hence each month-day would each year have a day number one larger than in the year before, until the 13 numbers were exhausted, and the same day number returned. Combining this with the five-day progression of the day names, it results that only after 52 years (4 times 13) will the same day number and day name fall upon the same day of the same month. Again, as 20 and 13 have no common measure it follows that a day name will only have the same day number once in 260 days. This 260-day period commencing with 1 Imix is called the *Tonalamatl,* which was the Aztec name for it. The Maya name is unknown. It was of great importance for ceremonial and magical purposes.

BY COURTESY OF DR. A. P. MAUDSLAY

STELA K. AT QUIRIGUA, GUATEMALA, OF THE "GREAT PERIOD" OF THE MAYA OLD EMPIRE. IT SHOWS DATE WITH "NORMAL" NUMERALS

The Calendar Considered Astronomically.—The Maya calendar forms a remarkably perfect instrument for reckoning time, as the various rules check each other like bookkeeping by double entry. This enables Americanists now to decipher partly obliterated inscriptions, and it directed the attention of the Maya to precision in time reckoning. Thereby they had the first requisite of science, namely accurate measurement, and their attainments in astronomy were surprising. The year of 365 days, being nearly six hours shorter than the true tropical year, caused 0 Pop gradually to fall earlier in the true year at the rate of nearly a day every four years, and after 1,508 years the Maya year and the true year would again coincide. There is some evidence that the Maya allowed for this error, not by intercalating a day, which would upset their whole elaborate system, but by calculating the error from time to time and altering the dates for their festivals or agricultural operations accordingly, but not disturbing the order of months and days in the calendar. Taking an imaginary example, let us assume that certain agricultural operations and the festivals connected with them were at one time performed in Yaxkin. Then after 80 years the shift of the calendar would make the same date in the true year fall 20 days later in the Maya year, namely in Mol. Apparently then they performed the work in Mol instead of Yaxkin, and got right with the seasons without disturbing the calendar.

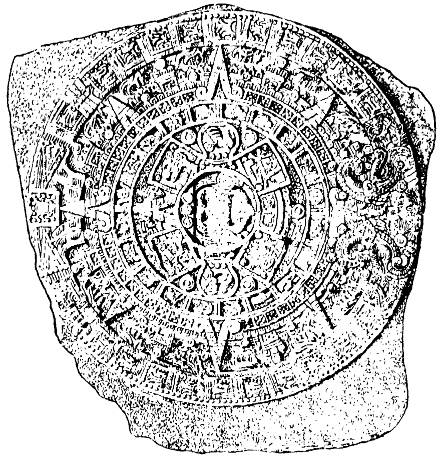
Probably the rising and setting of the sun over fixed landmarks was observed in order to correct the calendar, a method which would give the true length of the tropical year. In this connection the traditions of the Toltec and the Cakchiquel are instructive regarding the "sun" which their ancestors awaited, which was probably an observation of the sun by this method to correct the shifting calendar. The Cakchiquel annals mention the different places where each tribe saw its "sun," and as to one tribe it is said they had not finished drawing their lines when the sun appeared. It is also instructive to note that the Cakchiquel did not look for their "sun" until they arrived in or near the region where they were found at the Spanish conquest. It would seem then that having reached a new country they had to lay down lines of sight by which to observe sunrise or sunset, somewhat as the captain of a ship corrects his chronometer by observation of a known point of land.



STELA D. AT QUIRIGUA, GUATE-
THE MAYA OLD EMPIRE. IT BEARS DATE WITH FULL-FIGURE NUMERALS

The Dresden Codex shows that the Maya calculated the synodic period of Venus at 584 days, a good approximation, and divided this into four parts corresponding to the invisibility at inferior conjunction, visibility as morning star, invisibility at superior conjunction, and visibility as evening star. Dr. John E. Teeple makes it probable that they recognized the small error of this Venus table and applied a correction to it. The Dresden Codex also shows that they had made a close approximation to the true length of the lunar month. This lunar table was used for calculating eclipses. The synodic period of Mars was calculated and probably that of Jupiter; Saturn and Mercury are doubtful. Teeple shows that the supplementary series in the inscriptions contain a lunar count. A supplementary series only occurs in connection with an initial series (*see* Chronology), though not all initial series have them. They show the length of the lunar month, that is whether it is of 29 or 30 days, the number of days elapsed of the lunar month, and the number of the lunar month in a series of five or six lunar months. Attempts have been made to correlate this with the sets of five and six lunar months into which the Dresden Codex eclipse table is divided, but so far this has not worked out satisfactorily in all cases.

The New Empire Calendar.—The Maya who inhabited Yucatan at the coming of the Spaniards in the 16th century are spoken of as belonging to the new empire, as distinguished from those of the old empire, known only by their inscriptions in Guatemala and elsewhere and by the Dresden and two other hieroglyphic codices. The Books of Chilan Balam, written in Maya with Roman letters after the conquest, show the new empire method. The calendar was identical with that of the old empire except that the day names fell each one day earlier in the month. Thus Ahau fell on the month-day 2 instead of 3, etc. The reason for this is unknown. The new empire was much influenced by Nahua invaders from Mexico and this led to the use of the characteristic Nahua "Year-bearer," which is the day number and day name falling on 1 Pop and was used to name the year. Thus "the year-bearer was on 4 Kan" means that in that year 4 Kan fell upon 1 Pop. But the old calendar round method was still used, the year-bearer being sometimes given also. This is redundant since the year-bearer can be calculated from the calendar round date. But it had a practical use when the year-bearer alone was given, as it showed the year in which an event occurred without specifying the day. The old empire Maya seem, as far as our knowledge goes, to have had no way of doing this.



THE SO-CALLED CALENDAR-STONE OF MEXICO, AZTEC PERIOD IT SHOWS THE TWENTY DAY SIGNS IN INNER CIRCLE AND MAY RECORD CERTAIN IMPORTANT DATES IN MYTHOLOGICAL HISTORY

Quiché and Cakchiquel Calendar.—The Quiché and Cakchiquel of Guatemala had a similar system of day names and day numbers. The day names are: Imox, Igh, Akbal, Kat, Can, Camey, Quieh, Ganel, Toh, Tzii, Batz, Balam, Ah, Itz, Tziquin, Ahmak, Noh, Tihax, Caok, Hunahpu. Igh fell on the month-day 1, and so on. There were also 18 months of 20 days each and 5 supplementary days. The Cakchiquel names are: Tacaxepual, Nabey Tumuzuz, Rucab Tumuzuz, Zibix, Uchum, Nabey Mam, Rucab Mam, Likinka, Nabey Tok, Rucab Tok, Nabey Pach, Rucab Pach, Tziquin Kih, Cakan, Ibota, Katik, Itzcal Kih, Pariche and the supplementary days, Tzapi Kih. But the Cakchiquel only used the months for magical and ceremonial purposes, never for dating, neither did they use year-bearers. As they only cited the day number and day name in giving a date, *e.g.*, 10 Caok, and as such a date will recur every 260 days, their dates were fixed by giving also the position in their era, for which *see* Chronology.

MEXICAN CALENDAR

The Aztec system is the same as the Maya, but the names and glyphs are different. The day names are:—

				Falls in month on the days			
Cipactli	Miquiztli	Ozomatli	Cozcaquauhtli	4	9	14	19
Ehecatl	Mazatl	Mallinalli	Ollin	5	10	15	20
Calli	Tochtli	Acatl	Tecpatl	1	6	11	16
Cuetzpalin	Atl	Ocelotl	Quiauitl	2	7	12	17
Coatl	Itzcuintli	Quauhtli	Xochitl	3	8	13	18

The names of the months are: Atlcaualco, Tlacaxipeualiztli, Tozoztontli, Uei Tozoztli, Toxcatl, Etzalqualiztli, Tecuiluitontli, Uei Tecuiluitl, Tlaxochimaco, Xocouetzi, Ochpaniztli, Teotleco, Tepeiluitl, Quecholli, Panquetzaliztli, Atemoztli, Tititl, Izcalli and the supplementary days Nemontemi. The month-days seem to have been reckoned from 1 to 20. The monthly festivals regularly fell on the last month-day. In citing a date the practice was different from the Maya. The year-bearer was given and the day number and day name. Thus "year 3 Calli, day 1 Coatl." The month-day and the month were not given, and as there are 260 days in the Tonalamatl and 365 in the year, in certain cases a day name with its number may occur twice in the same year, thus causing an ambiguity. Often the year-bearer alone is given. When the Aztec had occasion to count a length of time they counted by years of 365 days, having none of the time periods of the Maya. The calendars of several other races of Mexico seem to have been similar with different names, but information is scanty regarding them. In all scientific knowledge the Aztec were much inferior to the Maya.

BIBLIOGRAPHY.—*See* CHRONOLOGY. (R. C. E. L.)

MUSLIM

The era of the Hejira, commonly called the Mohammedan era, is used principally in Turkey, Persia, Arabia, Egypt and some parts of India. The era is dated from the first day of the month preceding the flight of Mohammed from Mecca to Medina. This day was Thursday, July 16, in the year A.D. 622. Hejira years are purely lunar, always consisting of 12 lunar months, beginning with the approximate new moon. Having no intercalation to keep them to the same season in respect to the sun, these years retrogress through all the seasons every 32½ years.

The names of the months and the number of days in each are as follows:—

Muharram	30	Rajab	30
Saphar	29	Shaaban	29
Rabia 1	30	Ramadān	30
Rabia 2	29	Shawwāl	29
Jomada 1	30	Dulkaada	30
Jomada 2	29	Dulheggia	29

The last named month (Dulheggia) has, in intercalary years, 30 days. Ramadān, the ninth month, is observed throughout Islam as a fast month. (*See* CHRONOLOGY: *Muslim.*)

CALENDER. A machine consisting of two or more rollers or cylinders in close contact with each other, and often heated, through which are passed cotton, calico and other fabrics, for the purpose of having a finished smooth surface given to them; the process flattens the fibres, removes inequalities, and also gives a glaze to the surface. It is similarly employed in paper manufacture. The derivation is from the Fr. *calendre,* from the Med. Lat. *calendra,* a cylinder.

Calender is also the name (from the Arabic *galandar*) of an order of dervishes who separated from the Baktashite order in the 14th century; they were vowed to perpetual travelling. Other forms of the name by which they are known are Kalenderis, Kalenderites, and Qalandarites. (*See* DERVISH.)

CALENUS, QUINTUS FUFIUS, Roman general. As tribune of the people in 61 B.C., he helped to secure the acquittal of Clodius when charged with having profaned the mysteries of Bona Dea (Cicero, *Ad. Att.* i. 16). In 50 Calenus was praetor, and brought forward a law that the senators, knights, and *tribuni aerarii,* who composed the *iudices,* should vote separately, so that it might be known how they gave their votes (Dio Cassius xxxviii. 8). He fought in Gaul (51) and Spain (49) under Caesar; in 48, when fetching reinforcements for Caesar in Epirus, most of his ships were captured by Bibulus and he himself barely escaped. In 47 he became consul. After Caesar's death he joined Antony, whose legions he afterwards commanded in the north of Italy. He died in 41, while preparing to march against Octavian.

See Caesar, *B.G.* viii. 39; *B.C.* i. 87, iii. 20; Cic. *Philippic* viii. 4.

CALEPINO, AMBROGIO (1435–1511), Italian lexicographer, born at Bergamo on June 6, 1435, was descended of an old family of Calepio, whence he took his name. He became an Augustinian monk and compiled a polyglot dictionary, first printed at Reggio in 1502. This gigantic work was afterwards augmented by Passerat and others. The most complete edition (Basle, 1590) comprises 11 languages. The best edition is that published at Padua in seven languages in 1772. Calepino died blind in 1511.

CALES (mod. CALVI), an ancient city of Campania, belonging originally to the Aurunci, on the Via Latina, 8m. N.N.W. of Casilinum. It was taken by the Romans in 335 B.C., and was for a long time the centre of the Roman dominion in Campania. It was an important base in the war against Hannibal. The fertility of its territory and its manufacture of black glazed pottery (*see* Pagenstecher, *Calenische Reliefkeramik,* Berlin, 1909, and C. L. Woolley in *Journal of Roman Studies,* i. 199), which was even exported to Etruria, made it prosperous. In the 5th century A.D. it became an episcopal see, which (jointly with Teano since 1818) it still is, though it is now a mere village. The cathedral, of the 12th century, has a carved portal and three apses decorated with small arches and pilasters, and contains a fine pulpit and episcopal throne in marble mósaic. Near it are two grottos which have been used for Christian worship and contain frescoes of the 10th and 11th centuries. Inscriptions name six gates of the town, and the antiquarian remains are considerable, including parts of an amphitheatre and theatre, and of a supposed temple and other edifices.

CALEXICO, a city of Imperial county (Calif.), U.S.A., on the international border, opposite the Mexican city Mexicali; a port of entry, and the gateway to the Mexican Imperial valley. It is served by the Southern Pacific railway lines. The region produces cotton, fruit and livestock, and the city has large cotton gins. The population was 797 in 1910; 6,299 in 1930; 5,415 in 1940 by federal census. The city was incorporated in 1908.

CALF. (1) The young of the *Bovidae,* and particularly of the domestic cow, also of the elephant and of marine mammals, as the whale and seal. The word is applied to a small island close to a larger one, like a calf by its mother's side, as in "Calf of Man," and to a mass of ice detached from an iceberg. (2) The fleshy hinder part of the leg, between the knee and the ankle.

CALF, THE GOLDEN, an object of worship which appears in two (apparently) different connections in the Old Testament: (a) the molten image whose making by Aaron in the absence of Moses is described in Ex. xxxii.; (b) an idol set up by Jeroboam I. at Bethel and at Dan, on the secession of the northern tribes from the kingdom of the house of David.

The calf- (or rather, bull-) cult of northern Israel is condemned by Hosea, and was regarded as an act of apostasy by the compilers of the Books of Kings, probably under the influence of Deuteronomy. At the same time no objection seems to have been raised till the latter half of the 8th century.

Bull worship was common both in Egypt and Palestine, and it has been conjectured that the narrative in Ex. xxxii records an attempt to revive an older cult which the Israelites had known in Egypt. More probably, however, the narrative is a modified form of an ancient story told at Bethel, and possibly, also at Dan, to explain the cult—in other words the *hagios logos* of the shrine. If this be so, then the original probably made Moses himself, not Aaron, the originator of the cult, and explained that this was the divinely communicated form under which Yahweh wished to be worshipped. A later generation, convinced of the iniquity of any material representation of Yahweh, turned this into an act of apostasy and fathered it on Aaron, who elsewhere has hardly an independent character (*see* AARON). We may conjecture that the bull-cult itself was a native Canaanite form of Baal-religion, adopted by Israel with the change of the name of the deity revered.

See HEBREW RELIGION; W. R. Smith, *Prophets of Israel*, pp. 175 *seq.*; *Hastings' Dict. Bib.* i. 342; and T. H. Robinson on *The Golden Calf*, *Expositor*, 8th series, vol. xxiv. pp. 121 *seq.* (T. H. R.)

CALGARY, a city of the province of Alberta, Canada, at the junction of the Bow and Elbow rivers. Lat. 51° 4½' N.; Long. 114° 15' W. Pop. (1941) 88,904. It is a centre of the large wheat-growing and stock-raising region of north-western Canada, and a railway junction on the main line of the C.P.R. to the Pacific coast at Vancouver. The town is the seat of the Provincial Institute of Technology and Art and contains 10 public and 13 high schools. It contains repair shops, flour mills, and other industries; the electric power for lighting and manufacturing is developed on the Bow river, while natural gas is piped from the fields 45 mi. south, a good coal being also available from the mining districts of the Rocky mountains. Calgary was founded in 1883 and incorporated as a city in 1894. Branch lines connect it north with Edmonton, the capital of the province, and south with Lethbridge, while the main line, following the Bow river, enters the Rockies through the Kicking Horse pass, 40 mi. west. Calgary is on the Trans-Canada air route Lethbridge to Edmonton.

CALHOUN, JOHN CALDWELL (1782–1850), American statesman and parliamentarian, was born in Abbeville district, S.C., on March 18, 1782. He was of Scotch-Irish descent, his ancestors who came to America having settled originally in Pennsylvania during the first part of the 18th century and later gone southward across the mountains to the up-country of South Carolina. Calhoun's family were people of moderate means, owning but few Negro slaves, and more representative of the frontier farming class than of the established and wealthy slave-holding families of the southern coastal plain section. His father, Patrick Calhoun, was a man of some prominence in his community, representing it in the colonial assembly, and later in the State legislature. Calhoun's mother's name was Martha Caldwell.

As a small boy, Calhoun had little opportunity for education, but when he was 12 years of age he was sent to live for a year in the family of his brother-in-law, the Rev. Moses Waddell (1770–1840), a Presbyterian minister, who subsequently, from 1819 to 1829, was president of the University of Georgia. Later, under the direction of the Rev. Waddell, he prepared for college, entering the junior class at Yale in 1802. In 1804 he graduated from Yale with distinction, and commenced the study of law at a law school at Litchfield, Conn. Thereafter, he completed his law studies in a law office in Charleston, S.C., and in 1807 was admitted to the bar, and began practice in his native Abbeville district. Almost at once he entered politics. In 1808 and 1809 he was a member of the South Carolina legislature, and from 1811 to 1817 he served as a member of the House of Representatives of the national legislature.

In the year that Calhoun entered Congress, he was married to a wealthy cousin, Floride Bonneau Calhoun, whose family was identified with the Charleston aristocracy, and this, together with the acquisition of a plantation and Negroes, associated Calhoun's interests with those of the slave-holding and propertied classes of the South. However, when he ran for Congress in 1811, he advocated a warlike policy against Great Britain more as a representative of the frontier which was not concerned with British interference with shipping, but thought that her influence among the Indians was inimical to the western expansion of the United States. When Calhoun entered Congress, Henry Clay was then speaker of the House and one of the leaders of the group that was eager for war with England. Clay named Calhoun to a place on the important committee on foreign affairs. This committee, of which Calhoun soon became the dominating member, recommended the adoption of resolutions urging war with England. These resolutions were adopted by the House of Representatives, and it is estimated that no other two members of Congress were more influential in precipitating the War of 1812 than were Clay and Calhoun.

During the period of the embargo and during the War of 1812, manufacturing thrived in America, but with peace between the United States and Great Britain, and the termination of the Napoleonic régime on the continent of Europe, the American manufacturers began to feel the effects of European competition. In discussion of the tariff proposals that resulted, Calhoun, in 1816, delivered a speech in favour of protection. Ever after this speech was cited by his opponents in subsequent tariff controversies as evidence of his inconsistency as an opponent of protection. At this time Calhoun also advocated internal improvements and was an exponent of the "Nationalism" advocated by the younger men of the West who were intent upon building up that section of the country and developing its resources.

In 1817 Calhoun became secretary of war in Monroe's cabinet, the duties of which office he is credited with having performed with much ability. Following his service in Monroe's cabinet, he was, in 1824, elected vice president of the United States, and again re-elected in 1828. In 1832, in the course of the famous nullification controversy, he resigned from the office of vice president and was elected to the U.S. Senate, where he voiced the political philosophy of "States' rights" on behalf of the conservative slave-holding interests of the South, forming one of a remarkable company of legislators who comprised the Senate at that time. In 1844 Calhoun's name was considered for the presidency, but he declined to become a candidate, and in that year was appointed by President Tyler to the office of secretary of State, serving until March 1845. Upon his retirement as secretary of State he returned to the Senate, where he remained until he died in 1850.

His extraordinary faculties of mind were applied very arduously to the fundamental principles of the American governmental structure, and he is justly looked upon as one of the most astute of political thinkers among the public men of the United States. The significance of his career, aside from his endeavours for supremacy in the field of national politics at a time when affairs were in the hands of men of striking personalities and unusual capacities, lies in his advocacy of the doctrine of "States rights," as it related to the interests of the slave-owning aristocracy of the South and of the concomitant theory of nullification. It has been sometimes thought that Calhoun's political philosophy was developed as a result of his failure to attain a dominating position in the national Government and to achieve the presidency of the United States, to which it is said he aspired, and that he naturally turned his energies to strengthening those political entities, his own State, and his own section, in which he had come to occupy a place of supremacy. It is, however, more reasonable to explain his support of the theories to which he adhered upon the ground that they were the result of a class and economic consciousness of the group to which he belonged as an integral part and which as a leader he was called upon to defend in the realm of political thought. The South as a section was losing its place of dominance politically and economically, and, in addition, was on the defensive with respect to the morality of the institution of slavery. Calhoun's philosophy served to check the opposing forces with a threat and eventually, when put into practice by secession, precipitated civil war.

The immediate cause of the controversy leading to an advocacy of the States' rights or strict construction theories was the tariff. In 1824 there was a very large increase in protective duties. In 1828 a still higher tariff act, the so-called "tariff of abominations" was passed. The acts were disadvantageous to the agricultural South and of advantage to the North. The power of Congress to pass these discriminatory laws was questioned, and Calhoun, in an essay, "The South Carolina Exposition," took the position that the Federal Constitution was a compact between sovereign States by which each delegated to the central Government thereby set up certain limited powers. The acts of the U.S. Government must be within the sphere of power contemplated by the compact. Acts beyond the scope of the delegated power a State might in the exercise of its sovereignty nullify, or it might, within its rights, even withdraw altogether from the Union. This was not a new theory in American government, but Calhoun so clarified, expounded and amplified the "State's rights" philosophy that he became inseparably identified with it.

In 1832, Calhoun, who had up to that time been a regular Jeffersonian Democrat, broke with Jackson, who was head of the Party, and during the remainder of the Jackson régime, was a severe critic of Jacksonianism. He attacked the spoils system and opposed the removal of the Government deposits from the U.S. Bank. In 1831, in an "Address to the People of South Carolina," he elaborated his views as to the nature of the Union, and in 1832 addressed an essay letter to the governor of South Carolina, stating in final form his theory of the American governmental system. This last document resulted in the "nullification" by South Carolina of the Tariff acts of 1828 and 1832. There followed in 1833 the historic debate between Webster and Calhoun on the so-called "Force Bill," which had been introduced into the U.S. Senate to enlarge the jurisdiction of the Federal courts, and to give Jackson, as president, power to cope with the South Carolina situation. Webster maintained the doctrine of Federal supremacy as the expounder and interpreter of its own powers under the Constitution, while Calhoun argued the cause of State sovereignty. The opposing sides in this famous nullification controversy compromised. Congress reduced duties to an ultimate revenue basis, and South Carolina repealed the acts of nullification. Its consequence was, however, an acceptance by the South of Calhoun's doctrine as a protective political philosophy for slavery. To it and to Calhoun the slave-holding interests turned for a constitutional argument against any interference with the controverted institution. As the abolition movement developed and the question of the extension of slavery became a bitter one, it was Calhoun whose voice was heard in the Senate protesting on constitutional grounds against receiving abolition petitions, and it was under Calhoun's leadership that the forces opposing the Wilmot Proviso against the extension of slavery in the territory acquired from Mexico were marshalled and the Proviso defeated in the Senate. Calhoun took the extreme position that it was the duty of the U.S. Government under the Constitution to prevent any interference with slavery in the territories. In the course of the great debate on the admission of California into the Union as a free State, Calhoun died. In that controversy Webster made his famous "Seventh of March" speech, and Clay achieved his last great feat as peacemaker by the Compromise of 1850. Had Calhoun lived, the Compromise of 1850 might never have been made.

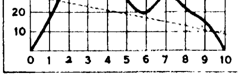
Calhoun was tall and slender, and in his later years emaciated. His features were angular and somewhat harsh, but he had a striking face and very fine eyes of a brilliant dark blue. To his slaves he was just and kind. He lived the modest unassuming life of a country planter when at home, and at Washington lived as unostentatiously as possible, consistent with his public duties and position. His character in other respects was of stainless integrity.

BIBLIOGRAPHY.—A collected edition of Calhoun's *Works* (1853–1855) has been edited by Richard K. Crailé. The most important speeches and papers are: *The South Carolina Exposition* (1828); *Speech on the Force Bill* (1833); *Reply to Webster* (1833); *Speech on the Reception of Abolitionist Petitions* (1836) and on the *Veto Power* (1842); a *Disquisition on Government*, and a *Discourse on the Constitution and Government of the United States* (1849–50)—the last two, written a short time before his death, defend with great ability the rights of a minority under a government such as that of the United States. *Calhoun's Correspondence*, edited by J. Franklin Jameson, has been published by the American Historical Association (see *Report* for 1899, vol. ii.). The biography of Calhoun by Dr. Hermann von Holst in the "American Statesmen Series" (1882) is a condensed study of the political questions of Calhoun's time. Wm. P. Trent, *Southern Statesmen of the Old Régime* (1897); G. M. Pinckney's *Life of John C. Calhoun* (1903) gives a sympathetic Southern view. Gaillard Hunt's *John C. Calhoun* (1908) is a valuable work; W. E. Dodd, *Statesmen of the Old South* (1911). (B. B. K.)

CALI, an inland town, capital of the department of Valle del Cauca, Colombia, South America, about 180 mi. S.W. of Bogotá and 50 mi. S.E. of the port of Buenaventura, on the Rio Cali, a small branch of the Cauca. The urban population was 88,366 in 1938. Cali stands 3,327 ft. above sea level on the western side of the Cauca valley, one of the most healthful regions of Colombia. The landlocked character of this region greatly restricts the city's trade and development; but it is considered the most important town in the department.

A railway from Buenaventura gives Cali and the valley behind it, with which it is connected by over 200 mi of river navigation, a good outlet on the Pacific coast.

CALIBRATION, a term primarily signifying the determination of the "calibre," or bore of a gun. The word *calibre* was introduced through the French from the Italian *calibro*, together with other terms of gunnery and warfare, about the 16th century. The origin of the Italian equivalent appears to be uncertain. It will readily be understood that the calibre of a gun requires accurate adjustment to the standard size, and, further, that the bore must be straight and of uniform diameter throughout. The term was subsequently applied to the accurate measurement and testing of the bore of any kind of tube, especially those of thermometers.



CALIBRATION CURVE

In modern scientific language, by a natural process of transition, the term "calibration" has come to denote the accurate comparison of any measuring instrument with a standard, and more particularly the determination of the errors of its scale. It is seldom possible in the process of manufacture to make an instrument so perfect that no error can be discovered by the most delicate tests, and it would rarely be worth while to attempt to do so even if it were possible. The cost of manufacture would in many cases be greatly increased without adding materially to the utility of the apparatus. The scientific method, in all cases which admit of the subsequent determination and correction of errors, is to economize time and labour in production by taking pains in the subsequent verification or calibration. This process of calibration is particularly important in laboratory research, where the observer has frequently to make his own apparatus, and cannot afford the time or outlay required to make special tools for fine work, but is already provided with apparatus and methods of accurate testing. For non-scientific purposes it is generally possible to construct instruments to measure with sufficient precision without further correction. The present article will therefore be restricted to the scientific use and application of methods of accurate testing.

General Methods and Principles.—The process of calibration of any measuring instrument is frequently divisible into two parts, which differ greatly in importance in different cases, and of which one or the other may often be omitted. (1) The determination of the value of the unit to which the measurements are referred by comparison with a standard unit of the same kind. This is often described as the *Standardization* of the instrument, or the determination of the *Reduction factor*. (2) The verification of the accuracy of the subdivision of the scale of the instrument. This may be termed calibration of the scale, and does not necessarily involve the comparison of the instrument with any independent standard, but merely the verification of the accuracy of the relative values of its indications. In many cases the process of calibration adopted consists in the comparison of the instrument to be tested with a standard over the whole range of its indications, the relative values of the subdivisions of the standard itself having been previously tested. In this case the distinction of two parts in the process is unnecessary, and the term calibration is for this reason frequently employed to include both. In some cases it is employed to denote the first part only, but for greater clearness and convenience of description we shall restrict the term as far as possible to the second meaning. The methods of standardization or calibration employed have much in common even in the cases that appear most diverse. They are all founded on the axiom that "things which are equal to the same thing are equal to one another." Whether it is a question of comparing a scale with a standard, or of testing the equality of two parts of the same scale, the process is essentially one of interchanging or substituting one for the other, the two things to be compared. In addition to the things to be tested there is usually required some form of balance, or comparator, or gauge, by which the equality may be tested. One of the simplest of such comparators is the instrument known as *calipers* (British spelling *callipers*), from the same root as calibre, which is in constant use in the workshop for testing equality of linear dimensions, or uniformity of diameter of tubes or rods. The more complicated forms of optical comparators or measuring machines with scales and screw adjustments are essentially similar in principle, being finely adjustable gauges to which the things to be compared can be successively fitted. A still simpler and more accurate comparison is that of volume or capacity, using a given mass of liquid as the gauge or test of equality, which is the basis of many of the most accurate and most important methods of calibration. The common balance for testing equality of mass or weight is so delicate and so easily tested that the process of calibration may frequently with advantage be reduced to a series of weighings, as for instance in the calibration of a burette or measure-glass by weighing the quantities of mercury, water or other liquid required to fill it to different marks. The balance may, however, be regarded more broadly as the type of a general method capable of the widest application in accurate testing. It is possible, for instance, to balance two electromotive forces or two electrical resistances against each other, or to measure the refractivity of a gas by balancing it against a column of air adjusted to produce the same retardation in a beam of light. These "equilibrium," or "null," or "balance" methods of comparison afford the most accurate measurements, and are generally selected if possible as the basis of any process of calibration. In spite of the great diversity in the nature of things to be compared, the fundamental principles of the methods employed are so essentially similar that it is possible, for instance, to describe the testing of a set of weights or the calibration of an electrical resistance-box, in almost the same terms, and to represent the calibration correction of a mercury thermometer or of an ammeter by precisely similar curves.

Method of Substitution.—In comparing two units of the same kind and of nearly equal magnitude, some variety of the general method of substitution is invariably adopted. The same method in a more elaborate form is employed in the calibration of a series of multiples or submultiples of any unit. The details of the method depend on the system of subdivision adopted, which is to some extent a matter of taste. The simplest method of subdivision is that on the binary scale, proceeding by multiples of 2. With a pair of submultiples of the smallest denomination and one of each of the rest, thus 1, 1, 2, 4, 8, 16, etc., each weight or multiple is equal to the sum of all the smaller weights, which may be substituted for it, and the small difference, if any, observed. If we call the weights A, B, C, etc., where each is approximately double the following weight, and if we write a for observed excess of A over the rest of the weights, b for that of B over $C+D+$ etc., and so on, the observations by the method of substitution give the series of equations,

$$A-\text{rest}=a,\ B-\text{rest}=b,\ C-\text{rest}=c,\ \text{etc.}\ \ldots \quad (1).$$

Subtracting the second from the first, the third from the second, and so on, we obtain at once the value of each weight in terms of the preceding, so that all may be expressed in terms of the largest, which is most conveniently taken as the standard

$$B=A/2+(b-a)/2,\ C=B/2+(c-b)/2,\ \text{etc.}\ \ldots \quad (2).$$

The advantages of this method of subdivision and comparison, in addition to its extreme simplicity, are (1) that there is only one possible combination to represent any given weight within the range of the series; (2) that the least possible number of weights is required to cover any given range; (3) that the smallest number of substitutions is required for the complete calibration. These advantages are important in cases where the accuracy of calibration is limited by the constancy of the conditions of observation, as in the case of an electrical resistance-box, but the reverse may be the case when it is a question of accuracy of estimation by an observer.

In the majority of cases the ease of numeration afforded by familiarity with the decimal system is the most important consideration. The most convenient arrangement on the decimal system for purposes of calibration is to have the units, tens, hundreds, etc., arranged in groups of four adjusted in the proportion of the numbers 1, 2, 3, 4. The relative values of the weights in each group of four can then be determined by substitution independently of the others, and the total of each group of four, making ten times the unit of the group, can be compared with the smallest weight in the group above. This gives a sufficient number of equations to determine the errors of all the weights by the method of substitution in a very simple manner. A number of other equations can be obtained by combining the different groups in other ways, and the whole system of equations may then be solved by the method of least squares; but the equations so obtained are not all of equal value, and it may be doubted whether any real advantage is gained in many cases by the multiplication of comparisons, since it is not possible in this manner to eliminate constant errors or personal equation, which are generally aggravated by prolonging the observations. A common arrangement of the weights in each group on the decimal system is 5, 2, 1, 1 or 5, 2, 2, 1. These do not admit of the independent calibration of each group by substitution. The arrangement 5, 2, 1, 1, 1 or 5, 2, 2, 1, 1, permits independent calibration, but involves a larger number of weights and observations than the 1, 2, 3, 4 grouping. The arrangement of ten equal weights in each group, which is adopted in "dial" resistance-boxes, and in some forms of chemical balances where the weights are mechanically applied by turning a handle, presents great advantages in point of quickness of manipulation and ease of numeration, but the complete calibration of such an arrangement is tedious, and in the case of a resistance-box it is difficult to make the necessary connections. In all cases where the same total can be made up in a variety of ways, it is necessary in accurate work to make sure that the same weights are always used for a given combination, or else to record the actual weights used on each occasion. In many investigations where time enters as one of the factors, this is a serious drawback, and it is better to avoid the more complicated arrangements. The accurate adjustment of a set of weights is so simple a matter that it is often possible to neglect the errors of a well-made set, and no calibration is of any value without the most scrupulous attention to details of manipulation, and particularly to the correction for the air displaced in comparing weights of different materials. Electrical resistances are much more difficult to adjust owing to the change of resistance with temperature, and the calibration of a resistance-box can seldom be neglected on account of the changes of resistance which are liable to occur after adjustment from imperfect annealing. It is also necessary to remember that the order of accuracy required, and the actual values of the smaller resistances, depend to some extent on the method of connection, and that the box must be calibrated with due regard to the conditions under which it is to be used. Otherwise the procedure is much the same as in the case of a box of weights.

Method of Equal Steps.—In calibrating a continuous scale divided into a number of divisions of equal length, such as a metre scale divided in millimetres, or a thermometer tube divided in degrees of temperature, or an electrical slide-wire, it is usual to proceed by a method of equal steps. The simplest method is that known as the method of Gay Lussac in the calibration of mercurial thermometers or tubes of small bore. It is essentially a method of substitution employing a column of mercury of constant volume as the gauge for comparing the capacities of different parts of the tube. A precisely similar method, employing a pair of microscopes at a fixed distance apart as a standard of length, is applicable to the calibration of a divided scale. The interval to be calibrated is divided into a whole number of equal steps or sections, the points of division at which the corrections are to be determined are called *points of calibration.*

Slide-wire.—The calibration of an electrical slide-wire into parts of equal resistance is precisely analogous to that of a capillary tube into parts of equal volume. The Carey Foster method, employing short steps of equal resistance, effected by transferring a suitable small resistance from one side of the slide-wire to the other, is exactly analogous to the Gay Lussac method, and suffers from the same defect of the accumulation of small errors unless steps of several different lengths are used. The calibration of a slide-wire, however, is much less troublesome than that of a thermometer tube for several reasons. It is easy to obtain a wire uniform to one part in 500 or even less, and the section is not liable to capricious variations. In all work of precision the slide-wire is supplemented by auxiliary resistances by which the scale may be indefinitely extended. In accurate electrical thermometry, for example, the slide-wire itself would correspond to only 1°, or less, of the whole scale, which is less than a single step in the calibration of a mercury thermometer, so that an accuracy of a thousandth of a degree can generally be obtained without any calibration of the slide-wire. In the rare cases in which it is necessary to employ a long slide-wire, such as the cylinder potentiometer of Latimer Clark, the calibration is best effected by comparison with a standard, such as a Thomson-Varley slide-box.

Graphic Representation of Results.—The results of a calibration are often best represented by means of a correction curve, such as that illustrated in the diagram (*see* p. 585) which is plotted to represent the corrections in Table I. The abscissa of such a curve is the reading of the instrument to be corrected. The ordinate is the correction to be added to the observed reading to reduce to a uniform scale. The corrections are plotted in the figure in terms of the whole section, taking the correction to be zero at the beginning and end. As a matter of fact the corrections at these points in terms of the fundamental interval were found to be −29 and −9 thousandths respectively. The correction curve is transformed to give corrections in terms of the fundamental interval by ruling a straight line joining the points +29 and +9 respectively, and reckoning the ordinates from this line instead of from the base-line. Or the curve may be replotted with the new ordinates thus obtained. In drawing the curve from the corrections obtained at the points of calibration, the exact form of the curve is to some extent a matter of taste, but the curve should generally be drawn as smoothly as possible on the assumption that the changes are gradual and continuous.

TABLE I. *Solution of Complete Calibration.*

Step No.	1	2	3	4	5	6	7	8	9	10
1	0	− 5	+11	+20	+34	+25	+ 7	+26	+23	+32
2	+ 5	0	+16	+23	+39	+29	+12	+31	+28	+37
3	−11	−16	0	+ 8	+24	+13	− 4	+15	+13	+22
4	−20	−23	− 8	0	+15	+ 5	−12	+ 7	+ 4	+13
5	−34	−39	−24	−15	− 0	− 9	−26	− 8	−10	− 2
6	−25	−29	−13	− 5	+ 9	0	−17	+ 2	− 1	+ 8
7	− 7	−12	+ 4	+12	+26	+17	0	+19	+16	+26
8	−26	−31	−15	− 7	+ 8	− 2	−19	0	− 3	+ 6
9	−23	−28	−13	− 4	+10	+ 1	−16	+ 3	0	+ 9
10	−32	−37	−22	−13	+ 2	− 8	−26	− 6	− 9	0
Error of step .	−17·3	−22·0	− 6·4	+ 1·9	+16·7	+ 7·1	−10·1	+ 8·9	+ 6·1	+15·1
Corrections . . .	+17·3	+39·3	+45·7	+43·8	+27·1	+20·0	+30·1	+21·2	+15·1	0

The ruling of the straight line across the curve to express the corrections in terms of the fundamental interval, corresponds to the first part of the process of calibration mentioned above under the term "Standardization." It effects the reduction of the readings to a common standard, and may be neglected if relative values only are required. A precisely analogous correction occurs in the case of electrical instruments. A potentiometer, for instance, if correctly graduated or calibrated in parts of equal resistance, will give correct relative values of any differences of potential within its range if connected to a constant cell to supply the steady current through the slide-wire. But to determine at any time the actual value of its readings in volts it is necessary to standardize it, or determine its scale-value or reduction-factor, by comparison with a standard cell.

A very neat use of the calibration curve has been made by Prof. W. A. Rogers in the automatic correction of screws of dividing machines or lathes. It is possible by the process of grinding, as applied by Rowland, to make a screw which is practically perfect in point of uniformity, but even in this case errors may be introduced by the method of mounting. In the production of divided scales, and more particularly in the case of optical gratings, it is most important that the errors should be as small as possible, and should be automatically corrected during the process of ruling. With this object a scale is ruled on the machine, and the errors of the uncorrected screw are determined by calibrating the scale. A metal template may then be cut out in the form of the calibration-correction curve on a suitable scale. A lever projecting from the nut which feeds the carriage or the slide-rest is made to follow the contour of the template, and to apply the appropriate correction at each point of the travel, by turning the nut through a small angle on the screw. A small periodic error of the screw, recurring regularly at each revolution, may be similarly corrected by means of a suitable cam or eccentric revolving with the screw and actuating the template. This error is important in optical gratings, but is difficult to determine and correct.

Calibration by Comparison with a Standard.—The commonest and most generally useful process of calibration is the direct comparison of the instrument with a standard over the whole range of its scale. It is necessary that the standard itself should have been already calibrated, or else that the law of its indications should be known. A continuous current ammeter, for instance, can be calibrated, so far as the relative values of its readings are concerned, by comparison with a tangent galvanometer, since it is known that the current in this instrument is proportional to the tangent of the angle of deflection. Similarly an alternating current ammeter can be calibrated by comparison with an electro-dynamometer, the reading of which varies as the square of the current. But in either case it is necessary, in order to obtain the readings in amperes, to standardize the instrument for some particular value of the current by comparison with a voltameter, or in some equivalent manner. Whenever possible, ammeters and voltmeters are calibrated by comparison of their readings with those of a potentiometer, the calibration of which can be reduced to the comparison and adjustment of resistances, which is the most accurate of electrical measurements. The commoner kinds of mercury thermometers are generally calibrated and graduated by comparison with a standard. In many cases this is the most convenient or even the only possible method. A mercury thermometer of limited scale reading between 250 and 400° C., with gas under high pressure to prevent the separation of the mercury column, cannot be calibrated on itself, or by comparison with a mercury standard possessing a fundamental interval, on account of difficulties of stem exposure and scale. The only practical method is to compare its readings every few degrees with those of a platinum thermometer under the conditions for which it is to be used. This method has the advantage of combining all the corrections for fundamental interval, etc., with the calibration correction in a single curve, except the correction for variation of zero which must be tested occasionally at some point of the scale. *See* also PHYSICAL UNITS. (For calibration of a mercury thermometer, *see* article THERMOMETRY.) (H. L. C.)

BIBLIOGRAPHY.—Guillaume, *Thermométrie de Précision* (1889) gives several examples of calibrations and references to several of the original memoirs; these are not restricted to calibrations of thermometers. A modern treatment of the calibration of the subintervals of line standards, with an annotated bibliography of 27 references, is given in *Calibration of a Divided Scale* by L. V. Judson, *Circular C 320* of the National Bureau of Standards, Washington, D.C. (1927). *Short Tests for Sets of Laboratory Weights* by A. T. Pienkowsky, *Scientific Paper S 527* of the National Bureau of Standards, 1926, describes methods for calibrating sets of weights and contains a bibliography. For other methods of calibration the publications of standardizing bureaus such as the International Bureau of Weights and Measures, Sevres, France, the National Bureau of Standards, Washington, D.C., and the National Physical Laboratory, Teddington, England, should be consulted. For details of the methods of calibration of electrical measuring devices discussed in the text see the following: Griffiths, *Phil. Trans.* A, 1893 (for dial resistance box); J. A. Harker and P. Chappuis, *Phil Trans.* A, 1900 (for platinum thermometry box); Callendar and Barnes, *Phil Trans.* A, 1901 (for Thomson-Varley Potentiometer and Binary Scale Box).

CALIBRE. The diameter of the bore of a gun, not counting the depth of the rifled grooves.

CALICO. A trade term to describe the simplest variety of plain cotton fabrics embodying what is variously known technically as the "plain," "calico" and "tabby" weave. This simple fabric structure is evolved by the most elementary plan of interweaving two distinct series of threads, constituting the warp and the weft series, respectively, and which cross each other at right angles. Each individual thread of these two series interweaves in an exactly corresponding manner; *i.e.*, with every thread in each series passing alternately under and over consecutive threads of the other series, uniformly, throughout the entire fabric. Hence, every thread in each series interweaves to the uttermost possible extent with every thread in the other series, and thereby produces a texture which is relatively firmer and stronger than that of any other elementary weave structure, for corresponding counts and quality of yarn, and ends and picks per inch in the fabric.

Calico fabrics comprise an infinite variety of different textures and qualities according to the different uses for which they are intended, ranging from the finest muslin and cambric textures to those of the coarser and stronger textures of cotton. In the cotton trade, however, the term "calico" applies more strictly to a true plain cloth in which the counts and quality both of the warp and weft, and also the number of ends and picks per inch correspond, approximately. Thus, a typical example of a fine texture is one containing 100 ends and picks per inch, of 40's counts of yarn both for warp and weft, though these data may be varied in either direction with considerable latitude, without departing from the true calico texture. When these items correspond, either exactly or approximately, the resultant texture, whether this is fine or coarse, will be produced with a general evenness of surface in consequence of the threads of both series each bending and yielding in the fabric in an exactly corresponding measure.

Tabby Weave.—Plain cloths, *i.e.*, woven fabrics embodying the simple calico or "tabby" weave, are probably produced in a greater variety of textures and from every kind of textile material, than those of any other fundamental weave in the entire range of fabric structure. Plain cloths produced from cotton yarn ranging from, say, about 10's to 100's counts both for warp and weft, and containing any number of threads ranging from, say, about 40 to 100 ends and picks per inch, would come under the designation of "calicoes"; whereas the finer textures of plain cotton fabrics would be described as "muslins" and "cambrics"; whilst the heavier textures of plain cotton fabrics would be given such descriptions as heavy "sheetings," "canvas," "duck," and many other varieties.

Calico fabrics are almost invariably woven in the "grey" state; *i.e.*, in the natural colour of the raw cotton staple. A considerable quantity of calico is used in the grey state for domestic purposes, as well as for many trade and other uses. It is also shipped in large quantities all over the world. A considerable amount of calico is also bleached, dyed, and printed, for every conceivable household use and articles of clothing. (*See* CRETONNE.)

Variations of Plain Calico.—Although the plain calico weave is the simplest possible fabric structure, yet it permits of several distinct modifications in the development of different textural effects without departing in the very least from the essential basis of that structure as defined in the first part of this article. Thus, instead of employing warp and weft of similar counts of yarn, and inserting a corresponding number of ends and picks per inch, as in a true calico fabric, warp and weft of widely different counts may be employed in order to produce ribs and cords either across, lengthwise, or in both directions of the fabric. The ribs or cords will lie in the direction of the coarser threads and will be more or less pronounced according to the disparity in the respective counts. For example, a warp-ribbed effect is produced across the fabric by employing a greater number of warp threads of finer counts of yarn, per inch, with a fewer number of picks of coarser counts of weft, as exemplified in "poplins" and similar textures. By adopting the reverse method, a weft-ribbed or corded effect is produced lengthwise of the fabric, by employing yarn of coarser counts for warp, and of finer counts for weft. The familiar example of "repp" fabric employed for upholstering railway carriages is virtually a plain texture evolved by employing yarn of both coarse and fine counts both in the warp and also in the weft series of threads, in order to develop a more pronounced ribbed effect, as well as a texture of greater strength and durability. (*See* also COTTON AND THE COTTON INDUSTRY; WEAVING.)

See H. Nisbet, *Grammar of Textile Design* (1927). (H. N.)

CALICO PRINTING. A means of producing decorative effects in the form of patterns or designs on cotton and other fabrics. The application of this art is not limited to the material generally known as calico, for almost all varieties of cotton fabric may be printed.

The effects produced are generally coloured, but many other substances besides colours are applied in printing, for example mordants to combine with colour principles in subsequent dyeing, "resists" to prevent dyeing, "discharges" to destroy the colour in certain places on already dyed fabric and substances capable of producing differences of texture and of lustre in the fabric.

The substance to be printed must either constitute or be made into a paste of such consistency that it will remain exactly where it is applied to the fabric and will not spread by capillary attraction beyond the limits of the design. With this object in view the substance is usually mixed with "thickening" which may be composed of such materials as starch, flour, British gum, gum tragacanth and less frequently albumen, casein or glue. Solutions used for the production of certain kinds of artificial silk may be already of such consistency that they can be applied directly for the purpose of producing a lustrous film. The mixture to be printed is prepared in the "colour" shop of the printworks and whether its essential constituent is or is not colour the paste produced is frequently known in the works as the "colour."

It is the essential substance printed or the manner in which this acts during or following printing which determines the "style" of printing. Only by ingenuity in the application of chemistry to "colour mixing," is it possible to satisfy the ever increasing demand for new and novel styles.

The local application of "colour" in the form of a pattern may also be carried out by the assistance of various instruments, but by far the most important is the *engraved cylinder* or *roller*. The first practically successful application of this form of printing machine was made in 1785 by Bell at the works of Livesey, Hargreaves and Co., near Preston. Roller printing is applicable to almost all types of ornament and fabric, it is capable of depositing from one to sixteen colours in a single printing operation and in one working day 18,000 yards of cloth can be printed in one colour and 8,000 to 9,000 yards in 12 colours. The pattern is engraved *intaglio* in fine lines or dots on a copper roller or in the case of a multicolour design as many rollers are engraved as the number of colours in the design demands and in the form taken by each colour which it is intended to print. This method of printing enables much detail in very fine designs to be clearly represented.

The *hand block* on which the pattern is cut in flat *relief* is unsurpassed for designs characterized by boldness and breadth of effect in rich transparent colours. By this method of printing which has been known from time immemorial such fabrics as cretonnes, table covers, curtains and chintz may be produced with fine effect. Although the method is necessarily slow it has never been superseded by any form of machine printing for certain classes of work.

In the best types of work whether produced by block or machine printing, it is not possible to observe any stiffness in the printed parts of the fabrics, for all starch or gum is removed. Moreover the results represent the combined efforts of artists, skilled craftsmen, chemists and engineers. (*See* TEXTILE PRINTING.)

(E. Hi.)

CALICUT, city, British India, headquarters of the Malabar district of Madras; on the coast, 6 mi. N. of Beypore. Pop. (1941) 126,352. The weaving of cotton, for which the place was at one time so famous that its name became identified with its *calico*, is no longer of any importance. About the 7th century Calicut grew largely through the immigration of the Moplahs, fanatical

Mohammedans from Arabia.

The Portuguese traveller, Pero de Covilham (*q.v.*) visited Calicut in 1487, and described its possibilities for European trade; and in 1498 Vasco da Gama, the first European navigator to reach India, arrived at Calicut, then a flourishing city. Da Gama tried to establish a factory, but he met with persistent hostility from the local chief (*zamorin*), and a similar attempt made by Cabral two years later ended in the destruction of the factory by the Moplahs In revenge the Portuguese bombarded the town; but no further attempt was made for some years to establish a trading settlement there. In 1509 the marshal Don Fernando Coutinho made an unsuccessful attack on the city. In the following year Albuquerque, with 3,000 troops, plundered the palace and burnt the town; but the Portuguese were finally repulsed, and fled to their ships after heavy loss. In the following year they concluded a peace with the zamorin and built a fortified factory, which was abandoned in 1525. In 1615 the town was visited by an English expedition; but it was not until 1664 that an English trading settlement was established by the East India Company. The French settlement, which still exists, was founded in 1698. The town was taken in 1765 by Hyder Ali, who expelled all the merchants, and destroyed the coconut trees, sandal-wood and pepper vines, that the country might not tempt Europeans. In 1782 Hyder's troops were driven from the town, but in 1788 it was destroyed by his son Tippoo, who, with great cruelty, carried off the inhabitants to Beypore. In 1790 the country was occupied by the British; and under the treaty concluded in 1792, whereby Tippoo was deprived of half his dominions, Calicut fell to the British. After this the inhabitants returned and rebuilt the town. Calicut is served by the Madras railway, and is the chief seaport on the Malabar coast, although steamers have to lie 3 mi. offshore, and the port is practically closed during the south-west monsoon from the end of May to mid-August. Beypore, where there are eight wharves, is included in the port. Two piers, about 1¾ mi. apart, have been built at Calicut. The principal exports are coconut products, coffee, tea, pepper, ginger, etc. There are factories for coffee cleaning, cotton-mills, saw-mills and tile, oil and soap works. A detachment of European troops is generally stationed there to overawe the fanatical Moplahs. There are two colleges, a hospital of the Basle mission, a fishery research station and a commercial school in the town.

CALIDARIUM, the hot room of the Roman baths (*see* BATHS).

CALIDIUS, MARCUS, Roman orator. His first speech of which we know was delivered in 64 B.C. against Gallius, who was defended by Cicero, for bribery. He was praetor in 57, and spoke in favour of Cicero's return and the restoration of his house. In the disturbances after Clodius' death he was a partisan of Milo. In the debate in the Senate in Jan. 49 he urged that Pompey should leave for his provinces to avoid war. On the outbreak of the Civil War he joined Caesar, who made him governor of *Gallia Togata*, where he remained till his death, at Placentia, in 48 B.C.

BIBLIOGRAPHY.—Cicero, *Brutus*, 79, 80, for a discussion of his style. Meyer, *Oratorum Romanorum Fragmenta*, 434; Westermann, *Gesch. der Rom. Beredtsamkeit*, 69, 6–11.

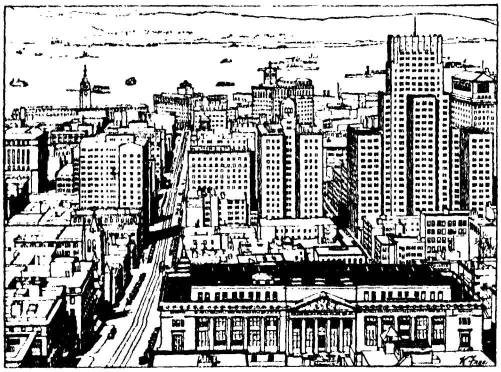
CALIFORNIA, popularly known as the "Golden State," is one of the Pacific coast group of the United States of America. Physically it is one of the most remarkable, economically one of the most independent, and in history and social life one of the most interesting of the Union. It is bounded on the north by Oregon, east by Nevada and Arizona, from which last it is separated by the Colorado river, and south by the Mexican territory of Lower California, and west by the Pacific ocean. The extreme limits of California extend from 114° to 124° 29′ W. and from 32° 30′ to 42° N. The length of its medial line north to south is about 780 mi., its breadth varies from 150 to 350 mi , and its total area is 158,693 sq.mi., of which 1,890 are water surface. The coast-line is more than 1,000 mi. long. In size California ranks second among the states of the union. California was given the name "Golden State" because of its early and continued production of enormous quantities of gold.

Physiography.—The physiography of the State is simple; its main features are few and bold; a mountain fringe along the ocean, another mountain system along the east border, between them—closed in at both ends by their junction—a splendid valley of imperial extent, and outside all this a great area of barren, arid lands, belonging partly to the great basin and partly to the open basin region. Along the Pacific, and some 20–40m. in width, runs the mass of the Coast range, made up of numerous indistinct chains—most of which have localized individual names —that are broken down into innumerable ridges and spurs, and small valleys drained by short streams of rapid fall. The range is cut by numerous fault lines, some of which betray evidence of recent activity; it is probable that movements along these faults cause the earthquake tremors to which the region is subject, all of which seem to be tectonic. The altitudes of the Coast range vary from about 2,000 to 8,000ft.; in the neighbourhood of San Francisco bay the culminating peaks are about 4,000ft. in height (Mt. Diablo, 3,856ft.; Mt. St. Helena, 4,343ft.), and to the north and south the elevation of the range increases. In the east part of the State is the magnificent Sierra Nevada, a great block of the earth's crust, faulted along its eastern side and tilted up so as to have a gentle back slope to the west and a steep fault escarpment facing east, the finest mountain system of the United States. The sierra proper, from Lassen peak to Tehachapi pass in Kern county, is about 430m. long (from Mt. Shasta in Siskiyou county to Mt. San Jacinto in Riverside county, more than 600 miles). Far higher and grander than the Coast range, the sierra is much less complicated, being indeed essentially one chain of great simplicity of structure. Precipitous gorges of canyons, often from 2,000 to 5,000ft. in depth, become a more and more marked feature of the range as one proceeds northward; over great portions of it they average not more than 20m. apart. The eastern slope is very steep, due to a great fault which threw the rocks of the great basin region abruptly downward several thousand feet Few passes cross the chain. Between 36° 20′ and 38° the lowest gap of any kind is above 9,000ft., and the average height of those actually used is probably not less than 11,000 feet. The Kearsarge, most used of all, is still higher. Some 40 peaks are catalogued between 5,000 and 8,000ft.. and there are 11 above 14,000. The highest portion of the system is between the parallels of 36° 30′ and 37° 30′; here the peaks range from 13,000ft. upward, Mt. Whitney, 14,495 ft., being the highest summit of the United States, excluding Alaska.

COLTON HALL, MONTEREY, CALIFORNIA, WHERE THE CONVENTION THAT FRAMED THE FIRST CONSTITUTION OF THE STATE MET IN 1849

Of the mountain scenery the granite pinnacles and domes of the highest sierra opposite Owens lake, where there is a drop eastward into the valley of about 10,000ft. in 10m.; the snowy volcanic cone of Mt. Shasta, rising 10,000ft. above the adjacent plains; and the lovely valleys of the Coast range, and the south fork of the Kings river—all these have their charms; but most beautiful of all is the unique scenery of the Yosemite (*q.v.*) valley. Much of the ruggedness and beauty of the mountains is due to the rosive action of many alpine glaciers that once existed on the higher summits, and which have left behind their evidences in leys and amphitheatres with towering walls, polished rock-expanses, glacial lakes and meadows, and tumbling waterfalls. Remnants of these glaciers are still to be seen—as notably on Mt. Shasta—though shrunk to small dimensions. The canyons are largely the work of rivers. The finest of the lakes is Tahoe, 6,225ft. above the sea, lying between the true sierras and the basin ranges, with peaks on several sides rising 4,000–5,000ft. above it. Clear lake, in the Coast range, is another beautiful sheet of water. Volcanic action has likewise left abundant traces, especially in the northern half of the range, whereas the evidences of glacial action are most perfect (though not most abundant) in the south. Lava covers most of the northern half of the range, and there are many craters and ash-cones, some recent and of perfect form. Of these the most remarkable is Mt. Shasta. In Owens valley is a fine group of extinct or dormant volcanoes.

Among the other indications of great geological disturbances on the Pacific coast may also be mentioned the earthquakes to which California like the rest of the coast is subject. They occur in all seasons, scores of tremors being recorded every year by the Weather Bureau; but they are of slight importance, and even of these the number affecting any particular locality is small. In 1812 great destruction was wrought by an earthquake that affected all the southern part of California; in 1868 the region about San Francisco was violently disturbed; in 1872 the whole sierra and the State of Nevada were shaken; in 1906 San Francisco (*q.v.*) was largely destroyed by a shock (and ensuing fire) that caused great damage elsewhere in the State; and in 1925 Santa Barbara was severely shaken. North of 40° N. lat. the Coast range and sierra system unite, forming an extremely rough country. The eastern half of this area is very dry and barren, lying between precipitous, although not very lofty, ranges; the western half is magnificently timbered, and toward the coast excessively wet. Between 35° and 36° N. lat. the sierra, at its southern end, turns westward towards the coast as the Tehachapi range. The valley is thus closed to the north and south, and is surrounded by a mountain wall, which is broken down in but a single place, the gap behind the Golden Gate at San Francisco. Through this passes the entire drainage of the interior. The length of the valley is about 450m., its breadth averages about 40m. if the lower foothills be included, so that the entire area is about 18,000 square miles. From the mouth of the Sacramento to Redding, at the northern head of the valley, the rise is 552ft. in 192m., and from the mouth of the San Joaquin southward to Kern lake it is 282ft. in 260 miles.



BY COURTESY OF THE SAN FRANCISCO CHAMBER OF COMMERCE

VIEW IN SAN FRANCISCO LOOKING EASTWARD TOWARD THE CITIES OF OAKLAND AND BERKELEY ACROSS THE BAY, HERE ABOUT 4 M. WIDE

Two river systems drain this central basin—the San Joaquin, whose valley comprises more than three-fifths of the entire basin, and the Sacramento, whose valley comprises the remainder. The eastward flanks of the Coast range are very scantily forested, and they furnish not a single stream permanent enough to reach either the Sacramento or San Joaquin throughout the dry season. On the eastern side of both rivers are various important tributaries, fed by the more abundant rains and melting snows of the western flank of the sierra. The Feather is the most important tributary emptying into the Sacramento river. A striking feature of the Sacramento system is that for 200m. N. of the Feather it does not receive a single tributary of any importance. Another peculiar and very general feature of the drainage system of the State is the presence of numerous so-called river "sinks," where the waters disappear, either directly by evaporation or (as in Death valley) after flowing for a time beneath the surface. These "sinks" are therefore not the true sinks of limestone regions. Some of the mountain lakes show by the terraces about them that the water stood during the glacial period much higher than it does now. Tulare lake, which has practically disappeared, was formerly a shallow body of water, some 25 miles broad, that received the drainage of the southern Sierra, a flow that is believed to have shrunk greatly since 1850. The drainage of Lassen, Siskiyou and Modoc counties has no outlet to the sea and is collected in a number of alkaline lakes.

Finally along the sea below Point Conception are fertile coastal plains of considerable extent, separated from the interior deserts by various mountain ranges from 5,000 to 7,000ft. high, and with peaks much higher (San Bernardino, 11,600; San Jacinto, 10,800; San Antonio, 10,140). Unlike the northern sierra, the ranges of southern California are broken down in a number of places. It is over these passes—Soledad, 2,822ft., Cajon, 2,631ft.; San Gorgonio, 2,560ft.—that the railways cross to the coast. That part of California which lies to the south and east of the Coast range and the sierra comprises an area of fully 50,000 sq.m. and belongs to the basin range region. For the most part it is excessively dry and barren. The Mohave desert—embracing parts of Kern, Los Angeles and San Bernardino, as also a large part of San Diego, Imperial and Riverside counties—belongs to the great basin, while a narrow strip along the Colorado river is in the open basin region. They have no drainage to the sea, save fitfully for slight areas through the Colorado river. In San Diego, Imperial and Riverside counties a number of creeks or so-called rivers, with beds that are normally dry, flow centrally towards the desert of Salton sink or sea; this is the lowest part of a large area that is depressed below level of the sea—at Salton 248·7ft. and 276ft. at the lowest point. In 1900 the Colorado river (*q.v.*) was tapped south of the Mexican boundary for water wherewith to irrigate land in the Imperial valley along the Southern Pacific railway, south of Salton sea. The river enlarged the canal, and finding a steeper gradient than that to its mouth, was diverted into the Colorado desert, flooding Salton sink, and when the break in this river was closed for the second time, in Feb. 1907, a lake more than 400 sq.m. in area was left. The region to the east of the sierra, between the crest of that range and the Nevada boundary, is very mountainous. Near Owens lake the scenery is extremely grand. The valley here is very narrow, and on either side the mountains rise from 7,000 to 10,000ft. above the lake and river. Still farther to the east some 40m. from the lake is Death valley—the name a reminder of the fate of a party of "forty-niners" who perished here, by thirst or by starvation and exposure. Death valley, some 50m. long and, on an average, 20–25m. broad from the crests of the enclosing mountain ranges (or 5–10m. at their base), constitutes an independent drainage basin. It is 276ft. below sea-level, and altogether is one of the most remarkable physical features of California. The mountains about it are high and bare and brilliant with varied colours. The Amargosa river, entering the valley from Nevada, disappears in the salty basin. Enormous quantities of borax, already exploited, and of nitrate of soda, are known to be present in the surrounding country, the borax an almost pure borate of lime in Tertiary lake sediments. California has the highest land and the lowest land of the United States, and the greatest variety of temperature and rainfall.

Climate.—The climate is very different from that of the Atlantic coast; and indeed very different from that of any part of the country save that bordering California. In the first place, the climate of the entire Pacific coast is milder and more uniform in temperature than that of the states in corresponding latitudes east of the mountains. A mean annual temperature as low as that of Halifax, Nova Scotia (in 44° 39′ N. lat.), is not found at any coastal point south of Sitka, Alaska (in 57° N. lat.), while the mean at San Diego is 6° to 7° less than that at Vicksburg, Miss., and Charleston, S.C., in roughly the same latitude. In the second place, the means of winter and summer are much nearer the mean of the year in California than in the east. This condition of things is not so marked as one goes inward from the coast; yet everywhere, save in the high mountains, the winters are comparatively mild. In the third place, the division of the year into two seasons—a wet one and a dry one—marks this portion of the Pacific coast in the most decided manner, being truly characteristic neither of Lower California nor of the greater part of Oregon, though more so of Nevada and Arizona. And finally, except on the coast (where temperatures rarely surpass 90° F.) the dryness of the air and the consequent rapidity of evaporation greatly lessen the disagreeableness of summer heat.

Along both the coast range and the sierra considerable rainfall is certain, although, owing to the slight snow accumulations of the former, its streams are decidedly variable. A heavy rain-belt, with a normal fall of more than 40 in., covers all the northern half of the sierra and the northwest counties; shading off from this is the region of 10–20 in. fall, which covers all the rest of the state except Inyo, Kern, San Bernardino, and Imperial counties, and the eastern portion of Riverside county; the precipitation of this belt is from 0 to 10 inches. In the mountains the precipitation increases with the altitude; above 6,000 or 7,000 ft. it is almost wholly in the form of snow; and this snow, melting in summer, is of immense importance to the state, supplying water at one time for placer-mining and later for irrigation. The northwest counties are extremely wet; many localities there have normal rainfalls of 60–70 in. and even higher annually. Along the entire Pacific coast, but particularly north of San Francisco, there is a night fog from May to September. Below San Francisco the precipitation decreases along the coast, until at San Diego it is only about 10 inches. The extreme heat of the southeast is tempered by the extremely low humidity characteristic of the great basin. Many places in northern, southern, central, mountain and southern coastal California normally have more than 200 clear days in a year; and many in the mountains and in the south, even on the coast, have more than 250.

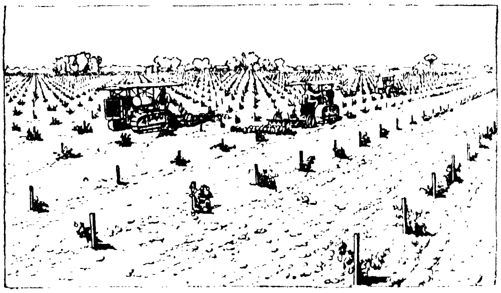
The Colorado desert (together with the lower Gila valley of Arizona) is the hottest part of the United States. Along the line of the Southern Pacific the yearly extreme is frequently from 124° to 129° F (*i.e.*, in the shade, which is almost, if not quite, the greatest heat ever actually recorded in any part of the world). At the other extreme, temperatures of −20° to −36° are recorded yearly near Lake Tahoe. The normal annual means of the coldest localities of the state are from 37° to 44° F; the monthly means from 20° to 65° F. The normal annual means on Indio, Mammoth Tanks, Salton, and Volcano Springs are from 73·9° to 78·4° F; the monthly means from 52·8° to 101·3° (frequently 95° to 98°). Another weather factor is the winds, which are extremely regular in their movements. There are brisk diurnal sea-breezes, and seasonal trades and counter-trades. Along the coast an on-shore breeze blows every summer day; in the evening it is replaced by a night fog, and the cooler air draws down the mountain sides in opposition to its movement during the day.

There is the widest and most startling variety of local climates. There are points in southern California where one may actually look from sea to desert and from snow to orange groves. Distance from the ocean, situation with reference to the mountain ranges, and altitude are all important determinants of these climatic differences; but of these the last seems to be most important. Death valley surpasses for combined heat and aridity any meteorological stations on earth where regular observations are taken, although for extremes of heat it is exceeded by places in the Colorado desert.

Soil.—Sand and loams in great variety, grading from mere sand to adobe, make up the soils of the state. The plains of the northeast counties are volcanic, and those of the southeast, sandy. It is impossible to say with accuracy what part of the state may properly be classed as tillable. Much land is too rough, too elevated or too arid ever to be made agriculturally available; but irrigation, and the work of the state and national agricultural bureau in introducing new plants and promoting scientific farming, have accomplished much that once seemed impossible. Irrigation was introduced in southern California before 1780, but its use was desultory and its spread slow till after 1850. There were 4,219,040 ac. irrigated in 1920 (a 181% increase since 1900), and 4,746,632 ac. in 1929, of which more than half was in San Joaquin valley. The state leads all others in area of irrigated land, and offers the most complete utilization of resources. In the south artesian wells, and in the great valley the rivers of the sierra slope, are the main sources of water-supply. On nearly all lands irrigated some crops will grow in ordinary seasons without irrigation, but it is this that makes possible selection of crops; practically indispensable for all field and orchard culture in the south, save for a few moist coastal areas, it everywhere increases the yield of all crops and is practised generally all over the state.

Government.—In the matter of constitutions California has been conservative, having had only two. The first was framed by a convention at Monterey in 1849, and ratified by the people and proclaimed by the U.S. military governor in the same year. The present constitution, framed by a convention in 1878–79, came into full effect in 1880, and was subsequently amended. It was the work of the Labour party, passed at a time of high discontent, and goes at great length into the details of government, as was demanded by the state of public opinion. The qualifications required for the suffrage are in no way different from those common throughout the union, except that by a constitutional amendment of 1894 it is necessary for a voter to be able to read the state constitution and write his name. As compared with the earlier constitution it showed many radical advances toward popular control, the power of the legislature being everywhere curtailed. Power was taken from the legislature by specific inhibition in 31 subjects previously within its power. "Lobbying" was made a felony; provisions were inserted to tax and control common carriers and great corporations, and to regulate telegraph, telephone, storage and wharfage charges. The constitution may be amended by a two-thirds vote of all the members elected to each house of the legislature, followed by ratification by a majority vote of the qualified electors voting on the proposition. Since 1911 amendments may be submitted directly to the people by means of the "initiative." A constitutional convention may be called if approved by a two-thirds vote of the entire membership of the legislature and by a majority vote at the next general election. The work of the convention itself must be submitted to the people for approval or rejection.

The executive officers of the state include the governor, lieutenant governor, controller, attorney-general and superintendent of public instruction. Each is elected by popular vote for a four-year term. In addition there are more than 50 administrative and other boards, commissions and officers appointed by the governor, in some cases subject to confirmation by the senate. The legislature consists of two houses—a senate of 40 members, not more than one to a county, and an assembly of 80 members, apportioned according to population, elected for four-year and two-year terms respectively. The legislature meets biennially, and



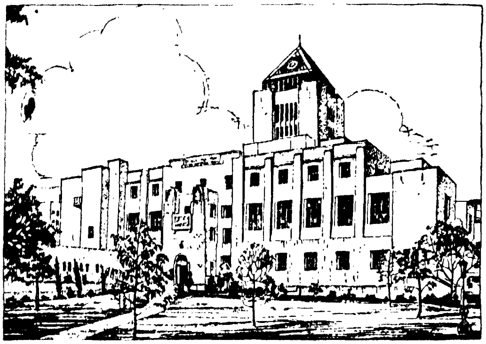
BY COURTESY OF U S BUREAU OF RECLAMATION

YOUNG GRAPE VINEYARD IN THE IMPERIAL VALLEY, CALIFORNIA

Modern cultivation using tractors in a district transformed by irrigation into a rich agricultural country producing a great variety of crops its sessions are divided into two parts, with a recess of at least 30 days intervening. In the latter part no new bills may be introduced without consent of three-fourths of the membership.

The state's judicial powers are vested in a supreme court, four district courts of appeal, superior courts, and justice of the peace and police courts.

The supreme court, consisting of a chief justice and six associate justices, holds regular sessions at Sacramento, San Francisco and Los Angeles. The district courts of appeal have six judges each for the first and second districts, and three each for the third and fourth; but in every case three judges constitute a separate court.



BY COURTESY OF THE LOS ANGELES CHAMBER OF COMMERCE

THE LOS ANGELES PUBLIC LIBRARY BUILDING

Supreme and district court judges serve 12-year terms. Under a constitutional amendment of 1934, they are appointed by the governor, with the approval of a special judicial council comprising the chief justice, the attorney-general, and the ranking appellate court justice. At the following general election, however, and again at the expiration of his term, the new appointee is subject to removal by a majority vote of the electorate. Any county so desiring may elect to adopt a similar system. Each county has a superior court, with one or more judges (50 in Los Angeles county), serving six-year terms.

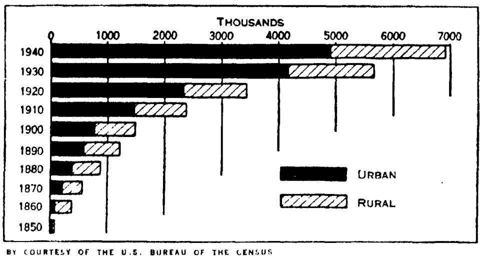
Justices of the peace (at least one for each township) are elected for four years.

The California constitution provides that agreement by three-fourths of a jury shall be sufficient in civil cases and that jury trial may be waived in minor criminal cases, the latter procedure based on experience under Mexican law.

The chief administrative functions of local government take place in the state's 58 counties. Municipalities are divided into six classes according to population. City government is diverse in type—the mayor-council, the commission and the city-manager systems are all in common usage. Notable among the measures granting a greater popular control of the government are the primary law of 1909 and the constitutional amendments of 1911 establishing the initiative and referendum, the recall (including the recall of judges), and the adoption of the short ballot.

Population.—The population of California in 1850 was 92,597; in 1880, 864,694; in 1910, 2,377,549; and in 1940, 6,907,387. This last figure represents an increase of 21·7% over the population in 1930.

The population per square mile was 44·1, as compared with 44·2 for the United States as a whole. Of the 1940 population, 4,902,265, or 71·0%, lived in urban places; that is, in cities and towns of 2,500 or more. The number of occupied dwelling units returned in the housing census of 1940 was 2,139,047, which is approximately the same as the number of families. The average population per family (occupied dwelling unit) declined from 3·5 in 1930 to 3·2 in 1940. The white population of California (including Mexicans) formed 95·5% of the total in 1940, as compared with 95·3% in 1930. The nonwhite population of California in 1930 was distributed as follows: Japanese, 36·2%; Chinese, 13·9%; Filipino, 11·3%; Negro, 30·1%; Indian, 7·1%; and miscellaneous races, 1·3%.



BY COURTESY OF THE U.S. BUREAU OF THE CENSUS

URBAN AND RURAL POPULATION OF CALIFORNIA 1850 TO 1940

California had 67·6% of all the Filipinos in the U.S. and 70·2% of the Japanese. The population of the state and of its principal cities is summarized for recent censuses in the following table:

Area	Population			Per cent of increase	
	1940	1930	1920	1930–40	1920–30
The State	6,907,387	5,677,251	3,426,861	21·7	65·7
Urban	4,902,265	4,160,596	2,331,729	17·8	78·8
Rural	2,005,122	1,516,655	1,095,132	32·2	37·9
Per cent urban	71·0	73·3	68·0	..	..
Principal cities:					
Los Angeles	1,504,277	1,238,048	576,673	21·5	114·7
San Francisco	634,536	634,394	506,676	..	25·2
Oakland	302,163	284,063	216,261	6·4	31·4
San Diego	203,341	147,995	74,361	37·4	99·0
Long Beach	164,271	142,032	55,593	15·7	155·5
Sacramento	105,958	93,750	65,908	13·0	42·2
Berkeley	85,547	82,109	56,036	4·2	46·5
Glendale	82,582	62,736	13,536	31·6	363·5
Pasadena	81,864	76,086	45,354	7·6	67·8
San Jose	68,457	57,651	39,642	18·7	45·4
Fresno	60,685	52,513	45,086	15·6	16·5
Stockton	54,714	47,963	40,296	14·1	19·0
Santa Monica	53,500	37,146	15,252	44·0	143·5

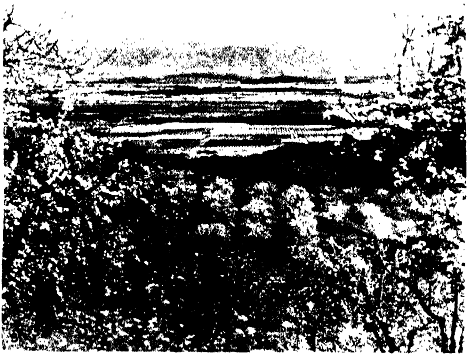
Finance.—The chief source of local revenue is the property tax. Until 1911 the state, too, drew most of its general revenue from levies on property, but since then no state levy has been made, although a 1933 constitutional amendment permits a property tax up to 25% of the amount of state appropriations.

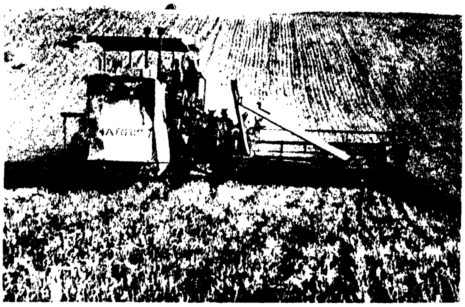
The chief sources of state revenue, with their approximate yields in 1940 were: retail sales tax (adopted in 1933), $102,000,000; unemployment insurance tax (adopted in 1935), $88,300,000; gasoline tax, $53,200,000; bank and corporation franchise tax, $23,500,000; personal income tax (adopted in 1935), $21,500,000. Proceeds of the gasoline tax and of motor vehicle licence fees may be used only for highway maintenance and motor vehicle regulation. In the fiscal year ending June 30, 1940 state revenues were $391,023,300, of which all but $15,334,515 came from taxes.

Expenditures of $223,076,171, almost ten times as much as in 1920, represented a per capita outlay of $32.29, as compared with $13.77 in 1930.

Of total disbursements, education took 32·06%, welfare 25·61%, and highways 20·78%. On Dec. 31, 1940 the net bonded debt was $164,377,304·11.

Education.—The educational system of California is one of the best in the country. It provides a complete system of free instruction from the kindergarten through the state university, and in the elementary and secondary schools even textbooks and supplies are furnished without cost to individual pupils. At the head of the public school system are the state superintendent of public instruction and the state board of education, a body consisting of seven members appointed by the governor. All schools are governed by a board of education. Outside the cities the school districts are governed by boards of trustees of three members, and, in the case of union districts, of five members. There was a compulsory attendance





BY COURTESY OF (2) THE CALIFORNIA PACKING CORPORATION, PHOTOGRAPHS, (1, 3) GABRIEL MOULIN, (4) EWING GALLOWAY

FRUIT-RAISING AND HARVESTING IN CALIFORNIA

1. View of cherry orchard in blossom in the Santa Clara valley, showing irrigation pipe outlets at the end of the rows. The water escapes through the vents in these pipes, each vent leading into a separate furrow
2. Peach-picking in the same orchard. As the buckets of peaches are transferred to the lug boxes, they are again inspected and any imperfect fruit not previously discarded by the pickers, is removed
3. View of Santa Clara valley, looking towards San Jose from the eastern side. The Santa Clara valley opens on San Francisco bay and extends in a southerly direction. It is bounded on the east by the Coast Range and on the west by the Santa Cruz mountains. Prunes as well as other fruits are raised in great quantities
4. A Harris Side Hill combined grain harvester at work in a field of grain near Stockton, California

PLATE II

CALIFORNIA

4

5

6

BY COURTESY OF (1, 2) THE SOUTHERN PACIFIC LINES, (3, 4) THE UNION PACIFIC SYSTEM, COPR. STEPHEN WILLARD, (5) THE CANADIAN PACIFIC RAILWAYS, (6) GABRIEL MOULIN

THE COAST AND INLAND COUNTRY OF CALIFORNIA

1. View of Emerald bay, a part of Lake Tahoe, the third largest fresh water lake in California. It is about 25 miles long. The water of the main lake is noted for its deep blue colour, while that of Emerald bay is crystal green

2. View of the rocky coast of Monterey, California, showing one of the residences which border the irregular shore

3. The sand dunes of Death valley, in Inyo county, California. This desert valley lies, at its lowest point, 276ft. below sea-level, and is one of the lowest land areas in the world. Borax deposits of immense extent are found in the valley

4. Part of Furnace Creek ranch, in southern California, showing the cultivation of the fan and feather palms. The tall fan palm grows wild in desert regions, but is cultivated widely in California

5. Yosemite falls, in the Yosemite national park. From a distance the falls give an impression of continuity, but the tremendous drop is in three stages; first, the Upper falls, then a series of cascades flowing south, and finally the Lower falls. The total height is 2,370 feet

6. A roadway in California lined with redwood trees. The redwood belt is situated chiefly in the Coast ranges of northern California. It consists of a series of groves extending from southern Oregon to Monterey

law passed in 1874 which has since been amended so as to require all children between the ages of eight and 16 to attend for the entire school year unless graduated from a four-year high school or exempted by the proper school authorities. Secondary schools are closely affiliated with, and inspected by, the state university. All schools are generously supported, salaries are usually good, and pension funds in all cities are authorized by state laws.

BY COURTESY OF THE NATIONAL PARK SERVICE

THE GENERAL SHERMAN TREE IN THE GIANT FOREST OF SEQUOIA NATIONAL PARK, SAID TO BE THE OLDEST LIVING THING IN THE WORLD. ITS AGE HAS BEEN ESTIMATED AT 3,500 YEARS

The school population (persons between the ages of five and seventeen years inclusive) was 1,194,400 in 1932. Public school enrolment for the same year was 1,123,550 or 94·1% of all persons who were of school age; and in addition to these, 65,830 were enrolled in private and parochial schools. In 1939 the enrolment in public schools was 1,765,998, of whom 68,077 were in kindergartens, 768,156 in the first eight grades, and 929,765 in high schools and junior colleges. The average number of days attended per pupil enrolled during the year 1936 was 156 as compared with 142 in 1910. Total expenditures for the year amounted to $152,856,000, or $134.04 for each person enrolled, placing California second only to New York, whose per capita expenditure was $141.43.

Of the state's higher educational institutions, the University of California (*q.v.*), with the two main parts at Berkeley and Los Angeles, is by far the most important. Its libraries at Berkeley alone contained more than 1,200,000 bound volumes in 1941.

The state also maintains seven four-year colleges, located at Chico, Arcata, Fresno, San Diego, San Francisco, San José and Santa Barbara, as well as a polytechnic school at San Luis Obispo. Among the endowed and denominational colleges, Stanford university, near Palo Alto, is the greatest, with a plant valued at above $15,971,000, productive funds of about $32,000,000, and a library of 740,000 volumes.

Another important university is the University of Southern California, at Los Angeles.

Agriculture.—The rapid development of irrigation and of intensive cultivation, and the increase of small farms during the last few decades have made California an agricultural region and a great fruit-producing area. Staple products have changed with increasing knowledge of climatic conditions, of life-zones and of the fitness of crops. Irrigation has shown that, given water, arid and barren plains—veritable deserts—may be made to bloom with an immense wealth of semitropical fruits. California leads all other states in acreage irrigated, with 4,746,630 ac. under irrigation in 1929, representing 16% of all farm land, and 56·6% of all land in crops. In 1940 there were 132,658 farms in the state (135,676 in 1930); of these 88,843 were operated by full owners, 13,991 by part owners, 25,399 by tenants, and 3,425 by managers. These farms aggregated 30,524,324 ac. of which 12,894,974 ac. were available for cultivation. The total value of all farm property was $2,166,452,648 in 1940, 36·6% less than the 1930 figure ($3,419,470,764). The value per acre increased from $47.16 in 1910 to $114 in 1925, but fell to $70.97 in 1940.

The average value per farm fell from $25,203 in 1930 to $16,331 in 1940 The average size of farms in 1850, when the large Mexican grants were practically the only farms, was 4,466 ac.; in 1910 it was 316·7 ac. and in 1935 only 202·4 ac., from which it rose to 230·1 in 1940.

In 1939 the estimated farm value of California crops was $383,000,000 ($542,000,000 in 1929), of which field crops and fruits and nuts each contributed approximately 39%.

The table below lists principal crops with their estimated values in 1939:

Product	*Farm value*
Oranges	$39,765,000
All forms of hay	38,310,000
Grapes	29,793,000
Lettuce	22,008,000
Cotton (lint)	20,475,000
Lemons	18,638,000
Beans	14,816,000
Sugar beets	13,403,000
Potatoes	13,134,000
Prunes	12,666,000
Barley	12,648,000
Peaches	11,648,000
Tomatoes	11,083,000
Apricots	10,133,000
Walnuts	9,160,000
Wheat	8,122,000
Cantaloupes	7,311,000
Asparagus	6,885,000
Peas	6,694,000
Carrots	6,143,000
Rice	6,120,000
Pears	6,114,000
Celery	5,781,000
Cotton-seed	5,480,000

An interesting recent development in California agriculture has been the increase of harvested flax area from seven acres in 1929 to 79,754 ac. in 1939, when the farm value of all flax was $2,765,000.

The livestock industry was introduced by the Franciscans and flourished throughout the Spanish and Mexican periods. In the development of California since 1848 the livestock industry has become subordinate but has not wholly lost its economic significance. In 1940 the state's cash farm income, from livestock and livestock products (chiefly milk, butter, cream and ice cream) was $215,943,000.

On Jan. 1, 1940, according to the California Crop Reporting service, there were in the state 2,161,000 head of cattle, valued at $97,071,000; 190,000 horses, valued at $17,283,000; 3,466,000 sheep and lambs of all ages, valued at $23,939,000; and 855,000 swine, valued at $7,219,000.

Horticultural products, as shown in the table, are the principal products of the soil. The modern orange industry practically began with the introduction into southern California in 1873 of two seedless orange trees from Brazil; from their stock have been developed, by budding, millions of trees bearing a seedless fruit which now holds high rank in the American market Shipments continue all the year round. Southern California by no means monopolizes the warm-zone fruits. Oranges, lemons and walnuts come chiefly from that section, but citrus fruits grow also in the sierra foothills of the great interior valley. Almonds and peaches, pears, plums, cherries and apricots, come mainly from the north. Over one-half of the prune crop comes from Santa Clara county, and the bulk of the raisin output from Fresno county Olives thrive as far north as the head of the great valley. Vines were first introduced by the Franciscans in 1771 from Spain, and until 1860 "Mission" grapes were practically the only stock in California. Afterwards many hundreds of European varieties were introduced with great success.

Fisheries.—Although in value fishing represents a bare 1% of the state's total production, the output is greater than that of any other state. In 1933 fish landings were 706,899,000 lb., valued at $7,094,300. In succeeding years the state's fisheries expanded phenomenally, and in 1937 the yield was 1,352,128,000 lb., valued at $18,944,000; the corresponding figures for Massachusetts, the second ranking state, were 531,110,000 lb., valued at $14,197,000.

The increase was due largely to expansion of the sardine fishery, one of the world's major fisheries and the largest in North America, with 891,431,000 lb. landed in 1937. In 1939 the total fish catch was 1,462,588,000 lb., of which sardines accounted for approximately 80%. Tuna (chiefly yellowfin and skipjack) and mackerel rank after sardines in importance. Other important fish are yellowtail, sole, cod and barracuda. The state is unrivalled in the canning of tuna and since 1926 has exceeded Maine in sardine packing.

Manufactures.—Previous to 1860 almost everything used in the state was imported from the east or from Europe. For many years manufacturing was handicapped by lack of coal, but opening of the petroleum fields and development of electric power obviated the difficulty. By 1919 manufacturing had replaced agriculture as the state's leading industry, increasing in importance thereafter until in 1939 it contributed approximately 48% of the total production value, as against 29% for agriculture. By 1937 California ranked seventh in value of manufactures. From 11,893 industrial establishments, with 289,550 workers, and an output worth $3,044,297,000 in 1929, industrial activity declined in 1933 to 8,429 establishments, 191,861 workers, and an output of $1,488,181,000, but by 1937 had risen to 10,861 establishments, 302,189 workers and an output of $2,899,865,426. Most important is petroleum refining, in which the state ranks second to Texas, with a 1937 production valued at $365,097,585 ($212,939,324 in 1933). Next is canning and preserving of fruits and vegetables, in which the state stands pre-eminent, with a 1937 production valued at $219,438,652. Other industries with products valued at above $60,000,000 in 1937 were: motor vehicles, $154,744,066; meat packing, $145,038,521; rolling mills, foundries and machine shops, $137,421,978; printing and publishing (newspaper and periodical), $115,979,259; textiles (chiefly clothing), $99,716,134; lumber and planing mill products, $91,252,321; baking, $89,389,654; liquors $65,968,256; rubber tires and inner tubes, $65,013,521. In the motion picture industry, centred at Hollywood (Los Angeles), the cost of production in 1937 was $171,943,000, nearly 88% of the U.S. total.

In lumber production the state ranked third in 1937, producing 1,776,000,000 board feet, exceeded only by Washington and Oregon. The chief varieties were redwood, yellow pine, fir, sugar pine, cedar and spruce. In 1938 the total forest land was 48,159,000 ac., of which 13,655,000 ac. were commercial forest area. There are 19 national forest reserves with an acreage of 25,042,762, four national parks, five national monuments, 70 state parks and historical monuments and several small state forest reserves.

Transcontinental Commerce.—The transportation facilities in California increased rapidly after the completion of the first continental line in 1869 by the connection of the Central Pacific and Union Pacific lines. The New Orleans line of the Southern Pacific was opened in Jan. 1883; the Atchison, Topeka and Santa Fe owns the lines built to San Diego in 1885, and to San Francisco bay in 1900. Other railways of importance are the San Pedro and Salt Lake (the Union Pacific) and the Western Pacific. The total steam railway mileage at the end of 1939 was 14,088. This was supplemented by 2,768 mi. of electric railways. After 1919 there was a rapid improvement in highways. The state highway system in 1936 had a total mileage of 13,582, of which 11,838 were surfaced. Total state highway and bridge disbursements in 1938 were $48,600,000, a figure surpassed only by Pennsylvania, New York and Illinois. An epochal event in the development of highway communication was the opening on Nov. 12, 1936 of the 8¼-mi. bridge from San Francisco across the bay to Oakland. This was followed on May 28, 1937 by the inauguration of the Golden Gate bridge, linking San Francisco with Marin county; the structure's 4,200-ft. suspension span was the largest in the world. The use of motor vehicles for passenger and freight transportation in California, as elsewhere, has increased rapidly in the last 25 years. Total motor vehicle registration in 1940 was 2,955,952 (as compared with 2,041,356 in 1930), a total exceeded only by New York state.

There is frequent freight and passenger service from San Francisco and the port of Los Angeles to Hawaii, Australia and eastern Asia, as well as to American ports, both Atlantic and Pacific. The outbreak of the European war in 1939 materially affected the volume of foreign trade through California ports. In 1940 water-borne exports aggregated $246,121,000 (11% less than in 1939) and imports $194,848,000 (a 51·2% gain). San Francisco exports were valued at $11,686,000 in 1940; those of Los Angeles, including most of the state's petroleum exportation, were $125,399,000. Imports were $93,908,000 for Los Angeles and $98,306,000 for San Francisco. One of the remarkable developments within recent years is the growing importance of the dredged harbour of San Pedro, the port for Los Angeles. San Diego has a very good harbour, but handles less tonnage than some of the secondary ports. The chief exports of California are petroleum, lumber, grains, fruit, vegetables and fish.

Mineral Products.—The existence of gold had long been suspected in California before 1848, and there had been desultory washings in parts where there was very little to reward prospectors. The first authenticated discovery was made near Los Angeles in 1842. The discovery of real historical importance was made on Jan. 24, 1848, at John A. Sutter's mill, on the south fork of the American river near Coloma, by a workman, James W. Marshall (1810–85). His monument marks the spot. At the time of their greatest productiveness, from 1850 to 1853, the highest yield of washings was probably not less than $65,000,000 a year. From the record of actual exports and a comparison of the most authoritative estimates of total production, it may be said that from 1848 to 1856 the yield was almost certainly not less than $450,000,000, and that about 1870 the $1,000,000,000 mark had been passed. Placer-mining was of chief importance in the early years, but after the richer deposits had been exploited the machine-worked quartz mines came into prominence. In 1933 more than half of the gold output was from such mines. Quartz veins are often as good at a depth of 3,000 ft. as at surface. A remarkable feature of mining since 1900 is gold "dredging." Thousands of acres of land have been thus recently treated.

In 1933 the stimulus of higher prices for the metal resulted in a marked expansion of gold mining in California. The number of placer mines rose from 828 in 1932 to 1,028 in 1939; the number of lode mines mounted from 718 to 797 in 1933, but had dropped to 749 in 1939. The total production of the state from all mines in 1932 was 569,166·99 fine ounces, valued at $11,765,726. By 1939 the total yield had risen to 1,435,264 fine ounces, worth $50,234,240. This was greater in quantity than for any year since 1862 and greater in value than for any year since 1856. In 1939 twenty-five mines produced 54% of the state's total gold output.

Petroleum and products associated with it have an annual value far in excess of the historically important gold. The production of crude petroleum grew rapidly after 1895, its output soaring from 4,325,000 barrels in 1900 to 262,876,000 barrels in 1923. This high figure sagged to 224,117,000 barrels in 1926 but more than recovered by 1929, when it stood at 292,534,000 barrels. The depression, however, inevitably drove it down once more so that in 1933 only 172,010,000 barrels were produced, with a value of about $115,246,700. There was a steady rise after 1933, however, until the total production reached 249,749,000 bbl. in 1938, with a value of $257,250,000. In 1939 there were 14,617 producing wells, with a total output of 224,354,000 bbl. (a 10% decrease from 1938), valued at $226,358,856 In volume, California's production slightly exceeded that of Russia, the world's second largest oil-producing country, but was slightly less than half that of Texas, to which the state ranked second in the United States. In 1939 California produced 17·7% of the national total, as compared with 22·2% in 1931. The largest production in 1940 came from the Los Angeles basin, where the wells of Wilmington, Long Beach, Santa Fe Springs and Huntington Beach were especially active; next in order, but declared to be of greatest future prospects, was the San Joaquin valley district, of which the most heavily producing wells were in the Midway-Sunset, Kettleman hills and Coalinga regions. In the coastal district the Ventura avenue area was the most important producer.

Natural gas was the state's third most valuable mineral product in 1939, with a value of $21,551,646. Fourth in rank was cement, the output of which in 1939 had a value of $15,616,219; and miscellaneous stone (crushed rock, sand, gravel, etc.), worth $10,316,787, was fifth. Other mineral products which had a value in excess of $1,000,000 were borates ($5,110,807), brick and tile ($3,063,660), soda ($2,055,608), silver ($1,764,264), salt ($1,174,386), tungsten ($1,153,735), and mercury ($1,102,563). Much of the world's mercury supply comes from a region about San Francisco bay, and practically the entire borax product of the United States comes from Death valley. The total mineral production of California in 1938, valued at $489,948,802, was exceeded by Texas only; it represented about 11% of the national total.

HISTORY

"Gold made California!" The most important feature of modern Californian history is the way in which the territory came to be a part of the United States, with gold as the underlying dramatic element. Fear lest England or Russia might obtain California, and thus threaten Mexico, caused Spain at length to occupy it. Otherwise, quite probably the land might have fallen to England. The Spanish occupation merely kept others out, thus in fact serving to the ultimate advantage of the American union, which would not have been strong enough to take over California much prior to the time when it actually did so. If the Spanish settlers had discovered California's gold, the destiny of the province would have been different from what it proved to be; in that event it might have become a Spanish-American republic, or England might have acquired it. The discovery of gold was postponed, however, until the Americans were already pouring into the province. Thereafter the rush of American settlers put the stamp of certainty on the connection with the United States.

Exploration and Early Settlement.—The name "California" was taken from Ordóñez de Montalvo's story, *Las Sergas de Esplandián* (Madrid, 1510), of black Amazons ruling an island of this name "at the right hand of the Indies . . . very close to that part of the Terrestrial Paradise." The name was given to the southern part of Lower California probably in 1533–34, but at any rate before 1542. By extension it was applied in the plural to the entire Pacific coast north from Cape San Lucas. Necessarily the name had for a long time no definite geographic meaning. The lower Colorado river was discovered in 1540, but the explorers did not penetrate California; in 1542–43 Juan Rodríguez Cabrillo and his successor, Bartolomé Ferrelo, explored probably the entire coast to a point just north of the present boundary; in 1579 Sir Francis Drake repaired his ships in Drake's bay, and named the land New Albion; Spanish galleons en route from the Philippines to Acapulco usually sighted the coast, and certainly did so in the voyages of 1584 and 1595; and in a famous voyage of 1602–03 Sebastián Vizcaíno carefully explored the coast, and discovered the Bay of Monterey. There was apparently no increase of knowledge thereafter for 150 years. Most of this time California was generally supposed to be an island or a group of islands. Jesuit missionaries entered Lower California as early as 1697, and maintained themselves there until expelled in 1768 by order of Charles III of Spain; but not until Russian explorations in Alaska from 1745–65 did the Spanish government take definite action to occupy Upper California. Because of the fear of foreign danger, and also the long-felt need of a refitting point on the California coast for the galleons from Manila, San Diego was occupied in 1769 and Monterey in 1770. San Francisco bay was discovered in 1769. Meanwhile the Jesuit property in the peninsula had been turned over to Franciscan monks, but in 1772 the Dominicans took over the missions, and the Franciscans not unwillingly withdrew to join their brethren who had gone with the expeditions of 1769 to Upper California. There they were to thrive remarkably for some 50 years. (*See* California, Lower.)

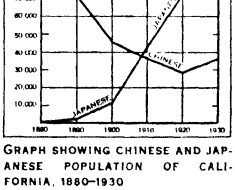
The Mission Period.—This is the so-called "mission period" or the pastoral period of California history. In all, 21 missions were established between 1769 and 1823. Economically the missions were the blood and life of the provinces. At them the neophytes worked up wool, tanned hides, prepared tallow, cultivated hemp and wheat, raised a few oranges, made soap, some iron and leather articles, mission furniture, and a very little wine and olive oil. The hides and tallow yielded by the great herds of cattle at the missions were the support of foreign trade, and did much toward paying the expenses of the government. As for the intellectual development of the neophytes the mission system accomplished nothing; save the care of their souls they received no instruction, they were virtually slaves, and were trained into a fatal dependence, so that once coercion was removed they relapsed at once into barbarism. The missions, however, were only one phase of Spanish institutions in California. The government of the province was in the hands of a military officer stationed at Monterey. There were also several other military establishments and civilian towns in the province, as well as a few private ranches. The political upheavals in Spain and Mexico following 1808 made little stir in this far-off province. When revolution broke out in Mexico (1811), California remained loyal to Spain. In 1820 the Spanish constitution was duly sworn to in California, and in 1822 allegiance was given to Mexico. Under the Mexican federal constitution of 1824 Upper California, first alone (it was made a distinct province in 1804) and then with Lower California, received representation in the Mexican congress.

Political Unrest.—The following years before American occupation may be divided into two periods. From about 1840 to 1848 foreign relations are the centre of interest. From 1824 to 1840 there is a complicated and not uninteresting movement of local politics and a preparation for the future—the missions fall, republicanism grows, the sentiment of local patriotism becomes a political force, there is a succession of sectional controversies and personal struggles among provincial chiefs, an increase of foreign commerce, of foreign immigration, and of foreign influence. The Franciscans were mostly Spaniards in blood and in sympathies. They viewed with displeasure and foreboding the fall of Iturbide's empire and the creation of the republic. After 1821 secularization of the missions was the burning question in California politics. Active and thorough secularization of the missions did not begin until 1834; by 1835 it was consummated at 16 missions out of 21, and by 1840 at all. In 1831 the mission question led to a rising against the reactionary clerical rule of Governor Manuel Victoria. He was driven out of the province. This was the first of the opéra bouffe wars. The causes underlying them were serious enough. In the first place, there was a growing dissatisfaction with Mexican rule, which accomplished nothing tangible for good in California, although its plans were as excellent as could be asked had there been peace and means to realize them. In the second place, there was growing jealousy between northern towns and southern towns, northern families and southern families. In 1831 Governor Victoria was deposed; in 1836 Governor Mariano Chico was frightened out of the province; in 1836 Governor Nicolás Gutiérrez and in 1844–45 Governor Manuel Micheltorena were driven out of office. The leading natives headed this last rising. There was talk of independence, but sectional and personal jealousies could not be overcome.

Foreign Influence.—By this time foreign influence was increasing. Foreign commerce, which was contrary to all Spanish laws, was active by the beginning of the 19th century. It was greatly stimulated during the Spanish-American revolutions for, as the Californian authorities practically ignored the law, smuggling was unnecessary. In the early '40s some three-fourths of the imports, even at Monterey itself, are said to have paid no duties, being landed by agreement with the officials. American trade was by far the most important. The trade supplied almost all the clothing, merchandise and manufactures used in the province; hides and furs were given in exchange. If foreign trade was not to be received, still less were foreign travellers, under the Spanish laws. However, the Russians came in 1805, and in 1812 founded on Bodega bay a post they held till 1841, whence they traded and hunted (even in San Francisco bay) for furs. In 1826 American hunters first crossed to the coast; in 1830 the Hudson's Bay Company began operations in northern California. The true overland immigration from the United States began only about 1840. As a class, foreigners were respected, and they were influential beyond proportion to their numbers. Many were naturalized, held generous grants of land, and had married into Californian families, not excluding the most select and influential. Most prominent of foreigners in the interior was John A Sutter (1803–80), who held a grant of 11 square leagues around the present site of Sacramento, whereon he built a fort. Though Sutter himself was Swiss, his establishment became a centre of American influence. His position as a Mexican official, and the location of his fortified post on the border, made him of great importance in the years preceding and immediately following American occupation. Americans were hospitably received and very well treated by the government and the people. There was, however, some jealousy of the ease with which they secured land grants, and an entirely just dislike of "bad" Americans. Many of the later comers wanted to make California a second Texas. As early as 1805 (at the time of James Monroe's negotiations for Florida), there are traces of Spain's fear of American ambitions, even in this far-away province. Spain's fears passed on to Mexico, the Russians being feared only less than Americans. An offer was made by President Jackson in 1835 to buy the northern part of California, including San Francisco bay, but was refused. From 1836 on, foreign interference was much talked about. Americans supposed that Great Britain wished to exchange Mexican bonds for California; France also was thought to be watching for an opening for gratifying supposed ambitions; and all parties saw that, even without overt act by the United States, the progress of American settlement seemed likely to gain the province.

In 1842 Commodore T. A. C. Jones (1789–1858) of the U.S. navy, believing that war had broken out between his country and Mexico, and that a British force was about to seize California, raised the American flag over Monterey (Oct 21), but finding that he had acted on misinformation, he lowered the flag next day with due ceremony and warm apology. In California this incident served to open up agreeable personal relations and social courtesies, but it did not tend to clarify the diplomatic atmosphere. By 1845 there was certainly an agreement in opinion among all American residents (then not 700 in number) as regards the future of the country. The American consul at Monterey, Thomas O. Larkin (1802–58), was instructed, in 1845, to work for the secession of California from Mexico, without overt aid from the United States, but with their good will and sympathy. He very soon gained from leading officers assurances of such a movement before 1848. At the same time American naval officers were instructed to occupy the ports in case of war with Mexico, but first and last to work for the good will of the natives.

In 1845 Captain J. C. Frémont (*q.v.*), while engaged in a government surveying expedition, aroused the apprehensions of the Californian authorities by suspicious and, very possibly, intentionally provocative movements, and there was a show of military force by both parties. In violation of international amities, and practically in disobedience of orders, he broke the peace, caused a band of Mexican cavalry mounts to be seized, and prompted some American settlers to occupy Sonoma (June 14, 1846). This episode is known as the "Bear Flag War," inasmuch as there was short-lived talk of making California an independent state, and a flag with a bear as an emblem flew for a few days at Sonoma. Fortunately for the dignity of history, and for Frémont, it was quickly merged in a larger question, when Commodore John Drake Sloat (1780–1867) on July 7 raised the flag of the United States over Monterey, proclaiming California a part of the United States. The opening hostilities of the Mexican War had occurred on the Rio Grande. The aftermath of Frémont's filibustering acts, followed as they were by wholly needless hostilities and by some injustice then and later in the attitude of Americans towards the natives, was a growing misunderstanding and estrangement, regrettable in Californian history.



GRAPH SHOWING CHINESE AND JAPANESE POPULATION OF CALIFORNIA, 1880–1930

A State of the Union.—By the treaty of Guadalupe Hidalgo, in 1848, Mexico ceded California to the United States. Gold was discovered, and the new territory took on great national importance. The discussion as to what should be done with it began in congress in 1846, immediately involving the question of slavery. A furious conflict developed, so that nothing was accomplished in two successive sessions; even at the end of a third, in March 1849, the only progress made toward creating a government for the territory was that the national revenue laws had been extended over it, and San Francisco had been made a port of entry. Meanwhile conditions grew intolerable for the inhabitants. Never was a population more in need of clear laws than the motley Californian people of 1848–49; yet they had none when, with peace, military rule and Mexican law technically ended. Early in 1849 temporary local governments were set up in various towns, and in September a convention framed a free state constitution and applied for admission to the union. On Sept. 9, 1850, a bill finally passed congress admitting California as a free state. This was one of the bargains in the "Compromise Measures of 1850."

Meanwhile the gold discoveries culminated and surpassed "three centuries of wild talk about gold in California." Settlements were completely deserted; homes, farms and stores abandoned. Ships deserted by their sailors crowded the bay at San Francisco—there were 500 of them in July 1850; soldiers deserted wholesale, churches were emptied, town councils ceased to sit, merchants, clerks, lawyers and judges and criminals, everybody in fact, flocked to the foothills. It is estimated that 80,000 men reached the coast in 1849, about one-half of them coming overland; three-fourths were Americans. Rapid settlement, excessive prices, reckless waste of money, and wild commercial ventures that glutted San Francisco with all objects usable and unusable, made the following years astounding from an economic point of view; but not less bizarre was the social development, nor less extraordinary the problems of state-building in a society "morally and socially tried as no other American community ever has been tried" (Royce). There was, of course, no home life in early California. In 1850 women numbered 8% of the population, but only 2% in the mining counties. Mining times in California brought out some of the most ignoble and some of the best traits of American character.

Through varied instruments—lynch law, popular courts, vigilance committees—order was, however, enforced as time went on, until stability was achieved.

The slavery question was not settled for California in 1850. Until the Civil War the division between the Whig and Democratic parties, whose organization in California preceded statehood, was essentially based on slavery. The followers of Senator Gwin hoped to divide California into two states and hand the southern over to slavery; on the eve of the Civil War they considered the scheme of a Pacific coast republic The state was thoroughly loyal when war came. The later '50s are characterized by H. H. Bancroft as a period of "moral, political and financial night." National politics were put first, to the complete ignoring of excessive taxation, financial extravagance, ignorant legislation, and corruption in California.

Land Grants.—One legacy that must be noted is that of disputed land grants. Under the Mexican régime such grants were generous and common, and the complicated formalities theoretically essential to their validity were very often, if not usually, only in part attended to. Instead of confirming all claims existing when the country passed to the United States, and so ensuring an immediate settlement of the matter, the U.S. government undertook through a land commission and courts to sift the valid from the fraudulent. Claims of enormous aggregate value were thus considered, and a large part of those dating from the last years of Mexican dominion, many probably antedated after the commission was at work, was finally rejected.

In state gubernatorial elections after the Civil War the Democrats won in 1867, 1875, 1882, 1886, 1894; the Republicans were successful in all the other contests. Features of political life and of legislation after 1876 were a strong labour agitation, the struggle for the exclusion of the Chinese, for the control of hydraulic-mining, irrigation, and the advancement by state aid of the fruit interests. Labour conditions were peculiar in the decade following 1870. Mining, war times, and the building of the Central Pacific had up to then inflated prices and prosperity. Then there came a slump; probably the truth was rather that money was becoming less unnaturally abundant than that there was any over supply of labour. The dismissal by the Central Pacific lines (principally in 1869–70) of some 15,000 Chinese, who flocked to San Francisco, augmented the discontent of incompetents, of disappointed late immigrants, and the reaction from flush times. Labour unions became strong and demonstrative. This is called the "sand-lots agitation" from the favourite meeting-place (in San Francisco) of the agitators. The outcome of these years was the constitution of 1879, and the exclusion of Chinese by national law. Congress re-enacted exclusion legislation in 1902. All authorities agree that the Chinese in early years were often abused in the mining country and their rights most unjustly neglected by the law and its officers. The exclusion had much to do with making the huge single crop ranches unprofitable and in leading to their replacement by small farms and varied crops.

One outcome of early mission history, the "Pious Fund of the Californias," claimed in 1902 the attention of the Hague Tribunal (*see* ARBITRATION, INTERNATIONAL: *Hague Cases and Commissions of Enquiry*). In 1906–07 there was throughout the state a remarkable anti-Japanese agitation, centring in San Francisco (*q.v.*) and affecting international relations and national politics. The Japanese question was brought to an acute situation in 1913 by the Webb Alien Land Law, which prevented Japanese from holding real estate. The question was then taken up diplomatically between the United States and Japan, and Japan agreed to the exclusion of further immigration of her citizens to the U.S.

The period 1910–25 was one of reform, designed largely to secure greater popular control of government. The state's subsequent history, up to 1941, broadly paralleled that of the nation at large.

The economic depression of the '30s, although generally less pronounced than in most other states, created great social unrest, which was accentuated by the influx of migrant labourers, chiefly from the dust-bowl area of the southwest. The result was the rise of various radical socio-economic nostrums (such as the EPIC scheme to "end poverty in California," and the Townsend and "$30 every Thursday" old-age pension plans) and the rapid growth of the Democratic party, long of minor importance in California.

In the 1932 presidential election the state rejected its native son, President Herbert Hoover, by a 3 to 2 vote in favour of the Democratic ticket headed by Franklin D. Roosevelt. In 1936 President Roosevelt received approximately 68% of the votes cast, and in 1940, despite the third-term issue, about 57%. Meanwhile the rising Democratic tide swept the Republicans from the governorship, which they had controlled since 1898. In 1934 Gov. Frank F. Merriam (who had succeeded James J. Kolph, Jr. upon the latter's death, June 2, 1934) won a close, bitterly fought campaign against Upton Sinclair, socialistic Democratic nominee, and leader of the EPIC movement; but in 1938 he was overwhelmingly defeated by Culbert L. Olson, a former EPIC but relatively moderate in his reform proposals, who became the state's first Democratic governor in 40 years.

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For physical features, minerals, flora, etc., *see* J. Muir, *Mountains of California* (1894); H. Gannet "Forests of the United States" in U.S. Geological Survey, *19th Annual Report*, pt. 5; U. S. Div. of Forestry, *Bull. No 28*, "Short Account of the Big Trees of California" (1900); *Ibid.*, No. 38, "The Redwood" (1 vol., 1903); W. L. Jepson, *The Trees of California* (1909, 1923); *Illus. Manual of the Flowering Plants of California* (1925).

(C. E. CH.; R. H. SH.)

CALIFORNIA, LOWER (Sp. *Baja California*), the peninsular part of California, formed by the Pacific ocean on the west and south and the Gulf of California on the east. It is part of Mexico and consists politically of two federal territories with the dividing line at the 28th parallel. On the north is the international boundary, separating Lower California from the state of California. The only land connection with the rest of Mexico is a narrow strip at the head of the Gulf of California, where Lower California and Sonora have a common boundary. The length of the peninsula is about 700 mi. and the width from 30 to 150 mi.; the area is 55,619 sq.mi. Its population (1940), 130,378.

Lower California consists of a chain of rugged, barren mountains, extending almost unbroken through the peninsula, with several disconnected smaller ranges, intersected by countless *arroyos* or dry river beds. The highest peak, known as La Providencia, is in the San Pedro Mártir range in the northern territory, and is 10,069 ft. above sea level. The other principal ranges are the Sierra Juárez, Sierra de la Giganta, Sierra de la Victoria and Sierra de la Laguna. There is an extinct volcano Las Tres Vírgenes, near the centre of the peninsula. The crest of the mountain chain is nearer the gulf than the ocean, and drops abruptly to the desert floor on the east, while trending gradually in a series of eroded valleys and plateaus to the west coast. There are several extensive plains, notably the Plain of Magdalena in the vicinity of Magdalena bay, the Vizcaino desert near the centre of the peninsula and the extension into Mexico of the Imperial valley, or, as it is known locally, the Valley of

Mexicali. Off both coasts of Lower California are a number of barren islands. The whole peninsula is excessively dry and arid, and covered with pronounced volcanic formations. The combination of favourable conditions has resulted in the most extensive and remarkable desert vegetation in the world, including vast forests of the giant cactus, or cardón (*Pachycereus*), the cirio (*Idria columnaris*), the weird-looking elephant wood (*Veatchia discolor*), and heavy growths of barrel cactus, various species of *Opuntia*, ocotillo, yucca and practically every known species of desert plant. The climate of the northern part of the peninsula is similar to that of the adjacent portions of upper California: the coastal regions are warm with deficient rainfall, somewhat offset by heavy dews and fog, the average annual rainfall at Ensenada being 9.91 in., and occurring mostly between December and March. Farther east, in the mountainous regions, temperate climatic conditions prevail, and there are extensive coniferous forests and well-watered mountain valleys. Finally, in the Mexicali valley and the delta region of the Colorado river, the climate is very hot and dry with occasional winter rains. Proceeding southward, the centre of the peninsula is the driest part of all, as neither the temperate rains from the north nor the tropical storms from the south reach this ill-favoured region (an observer at San Borja affirmed that no rain fell at that place during seven consecutive years). The southern tip of the peninsula, from La Paz to Cabo San Lucas, has tropical rains during the summer and fall months and two or three annual hurricanes, usually occurring in September. Both the central and southern parts of Lower California are extremely hot, particularly on the gulf coast, during the summer.

Because of rainfall deficiencies, the production of crops is confined to those areas where irrigation can be employed. This has been done successfully from the times of the missionaries in a few well-watered valleys which have the appearance of oases in the midst of the desert. When the Imperial valley was opened to agriculture by diverting water from the Colorado river, at the beginning of the 20th century, it became the most productive region in Lower California. The principal crop is cotton; alfalfa, wheat, barley, maize, grapes, melons, watermelons, lettuce, tomatoes and sugar cane are also produced in large quantities. The cape region, as the portion of the peninsula south of La Paz is called, is also an important agricultural district producing abundant crops of sugar cane and winter vegetables, particularly tomatoes, which are exported to the United States. There are a number of other agricultural colonies, notably Colonia Guadalupe, a Russian settlement north of Ensenada, and the new colony of the Sinarchists, Santo Domingo, founded in 1942 north of Magdalena bay, but for the most part farming is done on a subsistence scale because of the prohibitive expense of extensive irrigation projects. Mining and cattle raising, which formerly occupied first and second place in the industries, are now relegated to second and third place, respectively. The peninsula is rich in minerals, including gold, silver, copper, tungsten and manganese. Silver was the first mineral worked; for many years there was a refining plant at El Triunfo, but it is now abandoned. In 1872 gold was discovered near Real del Castillo and was worked for several years before the mines were abandoned. The only large mining enterprises in the peninsula are the great copper mines of the Boleo company, a French concern, at Santa Rosalía, and the Fenómeno tungsten mine, near Ensenada.

Lower California has inadequate communications. There has been scarcely any improvement in trans-peninsular travel since the construction of rocky trails by the missionaries; even today it sometimes requires two months for a letter to pass through the peninsula, whereas there was fairly reliable 15-day mail service 150 years ago. The only paved road is that connecting Tijuana and Ensenada, 68.5 mi. long. Beyond Ensenada a dirt road extends to the end of the peninsula; there are also dirt highways between Tijuana and Mexicali and between Mexicali and San Felipe, but all of these are impassable after a rain. There are three railroads, all near the border: the San Diego and Arizona Eastern (or Tijuana a Tecate), which connects Tijuana and Mexicali; the Inter-California, between Mexicali and Algodones; and the Inter-California del Sur (completed in 1940 as far as Punta Peñasco), which is intended to provide a direct land connection between Lower California and the rest of Mexico. There is regular air service from Mexicali, Santa Rosalía and La Paz to Mexico City. Both coasts of the peninsula contain several good harbours, and there is steamship communication between San Diego and La Paz and also across the Gulf of California, from Santa Rosalía to Guaymas and from La Paz to Topolobampo and Mazatlán.

The population of Lower California in 1940 was 130,378, as compared with 95,416 in 1930, 62,831 in 1921, 52,272 in 1910 and 47,624 in 1900. Of the 1940 population, 78,006 were in the Northern Territory and 51,199 in the Southern Territory, although previous to 1930 the southern half contained the larger proportion of inhabitants. Of the original Indian population (estimated at 25,000 in 1700) less than 400 remain. The percentage of illiteracy in 1930 was 21.3 in the north and 37.0 in the south. In 1936 there were 191 schools in the two territories, including a normal school for federal teachers at San Ignacio. The principal towns with their populations in 1940 are: Mexicali, an agricultural centre and capital of the Northern Territory since 1915, pop. 18,775; La Paz, capital of the Southern Territory, 10,401; Tijuana, 16,486; Santa Rosalía, 5,451; Ensenada, 4,616 and San José del Cabo, 2,553.

Since 1931 Lower California has been divided into two territories, each with a governor appointed by the president of Mexico and in other respects similar in political organization to a federal territory in the United States. The territories are further divided into *delegaciones*, three in the north and seven in the south.

The peninsular portion of California was the first to be discovered and settled by Spaniards, being sighted by one of Cortés' pilots in Dec. 1533. In 1535 Cortés himself tried to establish a settlement near what is now La Paz, but it was abandoned after less than a year. Francisco de Ulloa explored both coasts of Lower California in 1539–40, and in the latter year Melchor Díaz, on a land expedition, crossed the Colorado river into the peninsula and continued south a short distance before perishing on the desert. After the explorations of Cabrillo (1542–43) Lower California was neglected for more than 50 years. In 1597 a second attempt at settlement was made, also on the site of La Paz, but it was given up to the hostile Indians after two months. During the 17th century there were continued explorations, organized raiding of the Indian settlements to obtain pearls, and two more attempts to found a European colony, this time by Jesuit missionaries under the dauntless leadership of Juan María Salvatierra. The first, in 1683, was a failure, but in 1697 a second landing was made at Loreto which became the base of a mission system stretching both ways along the coast and eventually reaching into Upper California. The aborigines found in California by the Jesuits were extraordinarily primitive, living almost like animals, without agriculture, houses or clothing. In the 20 missions founded by the Jesuits before their expulsion in 1767, the Indians were collected into feudal establishments, made to construct the mission buildings and till the land and taught the rudiments of civilization by the *padres*. When the Jesuits were compelled to leave, their place was taken by Franciscans, who proceeded to construct a second chain of missions in Upper California. In 1772 the Franciscans evacuated the peninsula, leaving it to the Dominican missionaries, and Upper and Lower California were divided south of San Diego. A number of new missions were founded in the northern part of the peninsula by the Dominicans, but the Indian population began to be decimated by diseases introduced by the Spaniards, and the influence of the missions was further lessened after the Mexican revolution, culminating in their secularization in 1833. Previous to 1824, Upper and Lower California were administered as a single territory; in that year they were separated, although Lower California was attached as a military command to Upper California for five years. In 1829 the final separation was effected, and the capital of the peninsula was moved from Loreto, where it had been located since 1697, to La Paz. During the Mexican War, in 1847–48, Lower California was occupied by United

States troops, but it was returned to Mexico by the peace treaty. In 1853 the American filibuster William Walker landed at San José del Cabo with a small army and worked his way northward through the peninsula, proclaiming a "Republic of Lower California," but he was ejected early in the following year after a disastrous attempt to march overland to Sonora. On numerous occasions projects have been advanced for the occupation or purchase of Lower California by the United States. From 1866 to 1925 the American navy had a coaling station at Pichilingue bay, near La Paz, and from 1903 to 1910 Magdalena bay was used by the U.S. fleet for drills and target practice. In World War II Lower California constituted an important Mexican defense zone, with military headquarters at Ensenada and La Paz, and a base for the Mexican fleet in Magdalena bay.

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CALIFORNIA, UNIVERSITY OF, a state university, with seats at Berkeley, Los Angeles, San Francisco and elsewhere, founded in 1868. The centre of administration is at Berkeley.

In the '60s, upon suggestion from Governor Low, the trustees of the College of California, founded in 1855, offered the college to the state. The gift, grounds and buildings in Oakland, the library of 10,000 vols. and the property of 160 ac. were worth about $110,000. Accepting, the legislature appropriated $306,661.80 as a university fund and secured California's share of the federal land grant of 1862 in aid of education in agriculture and the mechanic arts. The university, chartered in 1868, opened its doors in 1869. In 1873 removal was made to its home on the slopes of the Berkeley hills, a site of great natural beauty, facing the Golden Gate. Here, 30 years later, the regents began to develop an enduring architectural plan based upon designs submitted by Emile Benard, of Paris, in a competition underwritten by Mrs. Phoebe Apperson Hearst (afterwards a regent) in 1896. The dominant style of the campus buildings is Italian Renaissance in white granite, and cement plaster on reinforced concrete.

Two notable outposts are the Scripps Institution of Oceanography, endowed by the Scripps family, on a 168 ac. site at La Jolla, near San Diego; and the Lick observatory, gift of James Lick in 1875, on a 3,000 ac. site on Mt. Hamilton, 90 mi. south of Berkeley.

The unparalleled scope and variety of California farming cause the college of agriculture to be the university's largest and most complex department. Its annual budget exceeds $2,500,000. Its functions centre at Berkeley; its principal rural seat is 75 mi. northeast at Davis. The college contains also the important citrus experiment station and graduate school of tropical agriculture at Riverside.

At Berkeley are the schools of architecture, education, jurisprudence, librarianship and (in part) of medicine, and the colleges of letters and science, commerce, chemistry, engineering and mining.

The University of California at Los Angeles comprises a college of letters and science, and of business administration, a branch of the college of agriculture, a teachers' college, and a division of graduate study offering the M.S., M.A. and Ph.D. degrees in certain departments.

Also in Los Angeles there is a medical department offering graduate instruction only.

The faculty in 1942–43 numbered 2,840. The libraries contained about 1,800,000 volumes, including the unique Bancroft collection of western Americana, at Berkeley, and the W. A. Clark library at Los Angeles. The university's endowment in 1942 was $28,096,046. Citizen residents of California are tuition-free at Berkeley, Los Angeles and Davis, but all students pay small sessional fees in support of infirmary and certain services. During the academic year 1942–43, there were 30,430 students enrolled, of whom 25,625 were full time. (R. G. S., X.)

CALIFORNIA LILAC (*Ceanothus thyrsiflorus*), a name given to a handsome North American tree of the buckthorn family (Rhamnaceae), called also blue blossom and blue myrtle. It grows on canyon sides from Monterey northward to Oregon and is especially abundant in the redwood belt. While usually a shrub, 3 ft. to 8 ft. high, it sometimes becomes a small tree 25 ft. in height with straight ascending branches. The small, smooth, oval or oblong leaves are green on both sides and shining above, with the edges minutely toothed. The showy blue or rarely white flowers are borne in dense clusters about 3 in. long. (*See* CEANOTHUS; NEW JERSEY TEA; OREGON TEA-TREE.)

CALIFORNIA POPPY (*Eschscholtzia californica*), a popular annual herb of the poppy family (Papaveraceae), abundant in the valleys and foothills of the Pacific coast. It has erect or diffusely spreading stems 1 ft. to 2 ft. high, finely dissected leaves and large pale yellow to deep golden-orange or red flowers, 4 in. or more across, the petals glowing with a brilliant sheen. It is one of the most handsome and best-known representatives of the California flora, is now widely cultivated as an ornamental and has become extensively naturalized in India and Australia. A red-flowered variety is known as Geisha.

CALIGULA (GAIUS CAESAR) (A.D. 12–41), Roman emperor 37–41, youngest son of Germanicus and Agrippina the elder, was born on Aug. 31, A.D. 12. He grew up in his father's camp among the soldiers, and was called Caligula from the *caligae*, or soldiers' boots which he used to wear. He accompanied his father to Syria and after his death returned to Rome. In 32 he was summoned by Tiberius to Capreae, and by skilful flattery managed to escape the fate of his relatives. After the death of Tiberius, mysterious no doubt, but by no means certainly a murder, Caligula succeeded to the exclusion of Tiberius Gemellus, son of Drusus. The traditional account shows him received with rejoicing, and for eight months delighting everybody by general concessions, and in particular by reversing Tiberius' policy. Then apparently he had a very severe illness, and for the rest of his life was the usual monster of cruelty and vice with whom we become so familiar in the history of the Roman emperors, with a few added extravagances, such as bestowing the consulship on his horse, that seem only explicable on the ground of madness. In the case of a good many emperors there is some material whereby we can discount some of the excesses of senatorial history; in Caligula's, very little. This much is clear, Caligula is the earliest of a tradition that eventually prevailed, the pioneer of the oriental type of monarchy. His upbringing tended that way; he was brought up by his grandmother Antonia, and Herod Agrippa was a frequent visitor. Hence his insistence on personal deification, the extravagant honours paid to the imperial family, the increasing importance of the women of the palace. But his anti-Roman tendencies, which made him, perhaps even more than his cruelties, an abomination to the senatorial class which furnished the histories of the time, produced effects favourable to the provinces. The strictness with which Augustus and Tiberius kept the citizenship closed was relaxed. We find provincial *equites* growing numerous, provincial senators even. He also reversed the policy of Tiberius towards Eastern religions, and rebuilt the temple of Isis that Tiberius had destroyed.

Caligula's reign was undisturbed externally; there is only the abortive expedition to the coast opposite Britain. He was murdered by Cassius Chaerea, a tribune in the guard, on Jan. 24, 41. That he was the savage tyrant that he appeared to senatorial Rome seems probable, in spite of attempts at rehabilitation. It is a pity, however, that there is not more to show whether he was not, in other directions, something more.

See Suetonius, *Caligula;* Tacitus, *Annals*, vi. 20 *sqq.;* Dio Cassius lix. *See* also S. Baring Gould, *The Tragedy of the Caesars* (3rd ed., 1892); J. B. Bury, *Students' Hist. of the Roman Empire* (1893). Mention may also be made of the pamphlet by L. Quidde, *Caligula, Eine Studie über römischen Cäsarenwahnsinn*, and an anonymous

supplement, *Ist Caligula mit unserer Zeit vergleichbar?* (both 1894); and a reply by G. Sommerfeldt, *Fin-de-Siècle-Geschichtsschreibung* (1895).

CALINGA, one of the nine kingdoms of southern India in ancient times. Its exact limits varied, but included the eastern Madras coast from Pulicat to Chicacole, running inland from the bay of Bengal to the Eastern Ghats. The name at one time had a wider and vaguer meaning, comprehending Orissa, and possibly extending to the Ganges valley. Rajahmundry, Coringa, Singapur, Calingapatam and Chicacole, have all been the chief cities of Calinga at different periods; but the capital of Calinga under the Ganga dynasty was probably at Mukhalingam in the Ganjam district.

CALIPASH and **CALIPEE,** the gelatinous substances in the upper and lower shells, respectively, of the turtle, the calipash being of a dull greenish and the calipee of a light yellow colour (possibly connected with *carapace*, the upper shell of a turtle). Both are highly esteemed by epicures.

CALIPH, a title of the head of the Muslim community, first applied to Abū Bakr, as successor of Muhammad (Arab, *khalīfah* lit. "successor," "viceregent"). For other meanings of the word, *see* T. W. Arnold, The Caliphate (1924), Appendix C. (*See* also ISLAMIC INSTITUTIONS.)

CALIPHATE. The history of the Muhammadan rulers in the East who bore the title of caliph (*q.v.*) falls naturally into three main divisions:—(*a*) The first four caliphs, the immediate successors of Muhammad; (*b*) The Umayyad caliphs; (*c*) The Abbasid caliphs. To these three groups the present article is confined; for the Western caliphs, *see* SPAIN: *History* (and minor articles such as ALMOHADES, ALMORAVIDES); for the Egyptian caliphs, *see* EGYPT: *History: Mohammedan Period* and FATIMITES. The history of Arabia proper will be found under ARABIA: *History*.

A.—THE FIRST FOUR CALIPHS

After the death of Muḥammad, homage was paid to Abū Bakr, as his successor.

1. **Reign of Abū Bakr.**—Abū Bakr's first task was the crushing of the revolt of the Bedouins who were compelled to submit. But the internal consolidation of Islam in Arabia was mainly brought about by its diffusion abroad. The holy war against the border countries which Muhammad had already inaugurated, was the best means for making the new religion popular among the Arabs, for opportunity was also afforded for gaining rich booty. After the subjugation of middle and north-eastern Arabia, Khālid b. al-Walīd proceeded by order of the caliph to the conquest of the districts on the lower Euphrates. Thence he was summoned to Syria, where hostilities had also broken out.

2. **Reign of 'Umar.**—Abū Bakr (d. Aug. 22, 634) was succeeded by 'Umar, to whose reign belong for the most part the great conquests. Damascus fell late in the summer of 635, and on Aug. 20, 636, was fought the great decisive battle on the Hieromax (Yarmūk), which caused the emperor Heraclius (*q.v.*) finally to abandon Syria. Left alone, the Christians henceforward defended themselves only in isolated cases in the fortified cities. Meanwhile the war was also carried on against the Persians in 'Iraq, unsuccessfully at first, until the tide turned at the battle of Qādisiyyah (end of 637). In consequence of the defeat which they here sustained, the Persians were forced to abandon the western portion of their empire and limit themselves to Iran proper. The Muslims made themselves masters of Ctesiphon (Madāin), the residence of the Sasanids on the Tigris, and conquered in the immediately following years the country of the two rivers. In 639 the armies of Syria and Iraq were face to face in Mesopotamia. In a short time they had taken from the Aryans all the principal old Semitic lands—Palestine, Syria, Mesopotamia, Assyria and Babylonia. To these was soon added Egypt, which was overrun with little difficulty by 'Amr ibn-al-'Āṣ in 640. (*See* EGYPT: *History: Mohammedan Period.*)

The lapse of the masses from Christianity to Islam, which took place during the first century after the conquest, is to be accounted for only by the fact that in reality they had no inward relation to the Gospel at all. They changed their creed merely to acquire the rights and privileges of Muslim citizens. In no case were they compelled to do so.

It would have been a great advantage for the solidity of the Arabian empire if it had confined itself within the limits of those old Semitic lands, with perhaps the addition of Egypt. But the Persians were not so ready as the Greeks to give up the contest; they did not rest until the Muslims had subjugated the whole of the Sasanid empire. The most important event in the protracted war which led to the conquest of Iran, was the battle of Nihāwand in 641; the most obstinate resistance was offered by Persis proper, and especially by the capital, Istakhr (Persepolis). In the end, all the numerous and partly autonomous provinces of the Sasanid empire fell, one after the other, into the hands of the Muslims, and the young king, Yazdegerd III. (*q.v.*), was compelled to retire to the farthest corner of his realm, where he came to a miserable end. But the subjection of the Persians was only external, nor did Islam ever succeed in assimilating them as the Syrian Christians were assimilated.

'Umar's military policy aimed at making the whole Arab nation an army of soldiers; his internal policy was directed chiefly towards financial questions—the incidence of taxation in the conquered territories, and the application of the vast resources which poured into the Treasury at Medina. In the mosque at Medina he was stabbed by a Kufan workman and died in Nov. 644.

3. **Reign of 'Uthmān.**—Under the weak 'Uthmān, who was elected to succeed 'Umar, the government of Islam fell entirely into the hands of the Meccan aristocracy. 'Uthmān did all in his power to press forward this development of affairs. He belonged to the foremost family of Mecca, the Umayyads, and that he should favour his relations and the Quraysh as a whole, in every possible way, seemed to him a matter of course. Every position of influence and emolument was assigned to them.

Against the rising tide of worldliness an opposition, however, now began to appear, led by what may be called the spiritual noblesse of Islam. Everywhere in the provinces there was agitation against the caliph and his governors, except in Syria, where 'Uthmān's cousin, Mu'āwiyah, carried on a wise and strong administration. The movement was most energetic in 'Irāq and in Egypt. Its ultimate aim was the deposition of 'Uthmān in favour of 'Alī, whose own services as well as his close relationship to the Prophet seemed to give him the best claim to the Caliphate.

The malcontents demanded the abdication of 'Uthmān, besieging him in his own house, where he was defended by a few faithful subjects. As he would not yield, they at last took the building by storm and put him to death, an old man of eighty.

4. **Reign of 'Alī.**—Controversy as to the inheritance at once arose among the leaders of the opposition. The mass of the mutineers summoned 'Alī to the Caliphate, and compelled even Ṭalḥa and Zubayr, disappointed candidates for the Caliphate, to do him homage. But soon these two, along with 'Ā'ishah, the mother of the faithful, who had an old grudge against 'Alī, succeeded in making their escape to 'Irāq, where at Baṣra they raised the standard of rebellion. The new caliph, however, found means of disposing of their opposition, and at the battle of the Camel, fought at Baṣra in Nov. 656 Ṭalḥa and Zubayr were slain, and 'Ā'ishah was taken prisoner.

But even so 'Alī had not secured peace. With the murder of 'Uthmān the dynastic principle gained the twofold advantage of a legitimate cry—that of vengeance for the blood of the grey-haired caliph—and a distinguished champion, the governor Mu'āwiyah, whose position in Syria was impregnable. He exhibited 'Uthmān's blood-stained garment in the mosque at Damascus, and incited his Syrians to vengeance.

'Alī's position in Kūfa was much less advantageous. The population of 'Irāq was already mixed up with Persian elements; it fluctuated greatly, and was largely composed of fresh immigrants. Islam had its headquarters here; Kūfa and Baṣra were the home of the pious and of the adventurer, the centres of religious and political movement. This movement it was that had raised 'Alī to the Caliphate, but yet it did not really take any personal interest in him. Religion proved for him a less trustworthy and more dangerous support than did the conservative and secular feeling of

Syria for the Umayyads. Mu'āwiyah could either act or refrain from acting as he chose, secure in either case of the obedience of his subjects. 'Alī, on the other hand, was unable to convert enthusiasm for the principle inscribed on his banner into enthusiasm for his person. It was necessary that he should accommodate himself to the wishes of his supporters, who compelled him suddenly to break off the battle of Siffīn, which he was apparently on the point of gaining over Mu'āwiyah because the Syrians fastened copies of the Qur'ān to their lances to denote that not the sword, but the word of God should decide the contest. But in yielding to the will of the majority he excited the displeasure of the minority, the genuine zealots; so when the negotiations failed and war was resumed, the Kharijites refused to follow 'Alī's army, and he had to turn his armies in the first instance against them. He defeated them at the battle of Nahrawān, but in his success he lost the soul of his following.

B.—THE UMAYYAD CALIPHS

1. **Reign of Mu'awiyah.**—Mu'āwiyah was a born ruler; Syria was the best administered province of the whole empire, and he was loved and honoured by the Syrians. On the murder of 'Alī in 661, his son Ḥasan was chosen caliph, but he recoiled before the prospect of a war with Mu'āwiyah, and resigning his position retired to Medina, where he died eight or nine years afterwards.

Mu'āwiyah now made his entry into Kūfa in the summer of 661 and received the oath of allegiance as Prince of the Believers. Just as soon as Mu'āwiyah had his hands free, he directed all his forces against the Greeks, and no year passed without a campaign. Twice he made a serious effort to conquer Constantinople, in 669 when he besieged it for three months, and in 674. In Africa also the extension of Muhammadan power was pursued energetically. In 670 took place the famous march of 'Uqbah b. Nāfi' and the foundation of Qayrawān, where the great mosque still bears his name.

The talented prefect of Kūfa, Mughīra broke down the resistance of Ziyād, who had been a faithful servant of 'Alī, and was said to be a bastard of Mu'āwiyah's father. Mu'āwiyah acknowledged him as the son of Abū Sufyān, and thus as his brother; in 664 this recognition was openly declared. In the next year Ziyād was appointed governor of Baṣra and the eastern provinces belonging to it. Mughīra died about 670, and the province of Kūfa also was entrusted to Ziyād. Kūfa and Baṣra were military colonies, and each tribe had its own quarter of the city. The policy of eastern expansion, which had been interrupted by the civil war, was resumed. The first army sent by Ziyād into Khurasan recaptured Merv, Herat and Balkh, conquered Tukhāristān and advanced as far as the Oxus. In 673 the son of Ziyād, crossed the river, occupied Bokhara, and returned laden with booty taken from the wandering Turkish tribes of Transoxiana. Other generals penetrated as far as the Indus and conquered Kabul, Sijistan, Makrān and Kandahar.

Ziyād governed 'Irāq with the greatest vigour, but as long as discontent did not issue in action, he let men alone. At his death (672–673), order was so generally restored that "nobody had any more to fear for life or estate, and even the unprotected woman was safe in her house without having her door bolted."

Mu'āwiyah was a typical Arab *sayyid* (gentleman). He governed, not by force, but by his superior intelligence, his self-control, his mildness and magnanimity. Mu'āwiyah was desirous of securing the Caliphate for his son Yazīd. The leadership with the Arabic tribes was, as a rule, hereditary, the son succeeding his father, but only if he were personally fit for the position, and were acknowledged as such by the principal men of the tribe. The hereditary principle had not been recognized by Islam in the cases of Abū Bakr, 'Umar and 'Uthmān, but had been adopted entirely for the election of Ḥasan. Mu'āwiyah succeeded in getting the succession of Yazīd generally acknowledged before his own death, except in Medina. He died in 680.

2. **Reign of Yazid.**—On the news of Yazīd's accession, the numerous partisans of the family of 'Alī in Kūfa sent addresses to Ḥusayn, inviting him to take refuge with them, and promising to have him proclaimed caliph in 'Irāq. Ḥusayn, having learned that the majority of the inhabitants were apparently ready to support him strenuously, prepared to take action. Meanwhile Yazīd, having been informed of the riotous behaviour of the Shī'ites in Kūfa, sent 'Ubaydallāh, son of the famous Ziyād and governor of Baṣra, to restore order. Using the same tactics as his father had used before, 'Ubaydallāh summoned the chiefs of the tribes and made them responsible for the conduct of their men. On the 8th of Dhu'l-Hijja Ḥusayn set out from Mecca with all his family, expecting to be received with enthusiasm by the citizens of Kūfa, but on his arrival at Karbala, west of the Euphrates, he was confronted by an army sent by 'Ubaydallāh under the command of 'Umar, son of the famous Sa'd b. Abī Waqqās, the founder of Kūfa. Ḥusayn gave battle, vainly relying on the promised aid from Kūfa, and fell, with almost all his followers, on Oct. 10, 680.

No other issue of this rash expedition could have been expected. But, as it involved the grandson of the Prophet, the son of 'Alī, and so many members of his family, Ḥusayn's devout partisans at Kūfa, who by their overtures had been the principal cause of the disaster, regarded it as a tragedy, and the facts gradually acquired a wholly romantic colouring. 'Umar b. Sa'd and his officers, 'Ubaydallāh and even Yazīd, came to be regarded as murderers, and their names have ever since been held accursed by all Shī'ites. They observe the 10th of Muharram, the day of 'Ashūra, as a day of public mourning. Among the Persians, stages are erected on that day in public places, and plays are acted, representing the misfortunes of the family of 'Alī. "Revenge for Ḥusayn" become the watchword of all Shī'ites, and the Mashhad Ḥusayn (Tomb of the martyr Ḥusayn) at Karbala is to them the holiest place in the world. 'Ubaydallāh sent the head of Ḥusayn to Damascus, together with the women and children. Yazīd was very sorry for the issue, and sent the prisoners under safe-conduct to Medina.

Ibn Zubayr profited greatly by the distress caused by Ḥusayn's death. He had himself secretly addressed as caliph, and many of the citizens of Medina acknowledged him as such. Yazīd, when informed of this, sent an army with orders first to exact submission from the Medinians, if necessary by force, and then to march against Ibn Zubayr. The Medinians fought valiantly, but could not hold out against the well-disciplined Syrians, and for three days the city was given up to plunder. But the city recovered very soon from the disaster, and remained the seat of holy tradition and jurisdiction, and of the Arabic aristocracy.

The army arrived before Mecca in Sept. 683 and found Ibn Zubayr ready to defend it. The siege had lasted 65—others say 40—days, when the news came of the death of Yazīd, which took place presumably on Nov. 12, 683; whereupon the army returned to Syria. Ibn Zubayr now openly assumed the title of caliph and invited men to take the oath of allegiance. He was soon acknowledged throughout Arabia, in Egypt and in 'Irāq.

3. **The Son of Yazīd.**—Mu'āwiyah II. had reigned a very short time when he fell sick and died. Marwān b. Ḥakam, of another branch of the Umayyads, who had been 'Uthmān's right-hand man, was proclaimed caliph and defeated the supporters of Ibn Zubayr in a battle (A.D. 684) which ensued at Marj Rāhiṭ, near Damascus.

4. **Reign of Marwān I.**—After the victory of Marj Rāhiṭ, Marwān conquered Egypt, and installed as governor his second son. An army sent to the rescue by Ibn Zubayr under the command of his brother Muṣ'ab was beaten in Palestine.

Meanwhile Mukhtār, a man of great talents and still greater ambition, after having supported Ibn Zubayr in the siege of Mecca, had gone to Kūfa, where he joined the Shī'ites, mostly Persians, and acquired great power. He claimed to be the vice-regent of 'Alī's son, Muḥammad ibn al-Hanafiyya, who after the death of Ḥusayn was recognized by the Shī'ites as their Mahdi. Ibn Zubayr's representative in Kūfa was compelled to flee, and all those who had participated in the battle of Karbala were put to death. Ibn Zubayr, determined to get rid at all costs of so dangerous an enemy, named his brother Muṣ'ab governor of Baṣra and ordered him to march against Kūfa. Mukhtār fell, and with him the ephemeral dominion of the Persian Shī'ites. This had been their first attempt to dispute the authority of their Arabian conquerors, but it was not to be the last.

5. **Reign of 'Abdalmalik.**—Marwān died on May 7, 685. The accession of his son, 'Abdalmalik, was attended with no difficulty, but the first years of his reign were occupied by troubles in northern Syria, and it was not until 689 that he made an expedition into 'Irāq to break Muṣ'ab, who in 691 was slain, sword in hand, by a Shi'ite of Kūfa.

This victory opened the gates of Kūfa to 'Abdalmalik, and all 'Irāq received him with acclamation. Thence, a few days later, he sent Ḥajjāj b. Yūsuf at the head of 2,000 Syrians against Ibn Zubayr in Mecca. In 692 Mecca was invested. The blockade lasted more than six months, during which the city was a prey to all the horrors of siege and famine, which at length triumphed over the last adherents of Ibn Zubayr; he resolved to die, and, when the Umayyad troops made their way into the city, attacked them furiously, notwithstanding his advanced age, and was slain. His head was cut off, and sent by Ḥajjāj to Damascus.

The caliph committed to Ḥajjāj the government of the Hijāz, and, later, made him governor of 'Irāq also with the most extensive powers. In Kūfa Ḥajjāj ordered that every man capable of bearing arms should immediately join Muhallab in Khūzistān (Susiana), and swore that all who should be found in the town after the third day should be beheaded. This threat had its effect, and Ḥajjāj proceeded to Baṣra, where his presence was followed by the same results. Muhallab, reinforced by the army of 'Irāq, at last succeeded, after a struggle of 18 months, in subjugating the Khārijites, and was able in 697 to return to Ḥajjāj at Baṣra. The latter loaded him with honours and made him governor of Khurasan, whence he directed several expeditions into Transoxiana. In the east the realm of Islam had been very much extended under the reign of Mu'āwiyah, when Ziyād was governor of 'Irāq and Khurasan. Balkh and Tokhāristān, Bokhara, Samarkand and Khwarizm (modern Khiva), even Kabul and Kandahar had been subdued; but in the time of the civil war a great deal had been lost again. Now at last the task of recovering the lost districts could be resumed. When, in 697, Ḥajjāj gave the government of Khurasan to Muhallab, he committed that of Sijistān (Seistan) to 'Ubaydallāh, a cousin of Ziyād. This prefect allowed himself to be enticed by Zanbil, prince of Zabulistan, to penetrate into the country far from his base, and narrowly escaped, not without severe losses. The command over Sijistān was now given to Ibn Ash'ath, who soon after his arrival in Sijistān, exasperated by the masterful tone of Ḥajjāj towards himself, decided to revolt. The soldiers of 'Irāq, who did not love the governor, and disliked the prospect of a long and difficult war far from home, eagerly accepted the proposition of returning to 'Irāq, and even proclaimed the dethronement of 'Abdalmalik, in favour of Ibn Ash'ath. When Ḥajjāj came up with him, Ibn Ash'ath drove him back to Baṣra, entered the city, and then turned his arms against Kūfa, of which he took possession with aid from within. In July 702, a decisive action took place at Dayr al-Jamājim. Ibn Ash'ath, defeated, fled to Baṣra; but having been again beaten in a furious battle that took place at Maskin near the Dujail, he sought an asylum with the king of Kabul, who betrayed him; so he killed himself. His head was sent to Ḥajjāj and then to Damascus. This happened in the year 703 or 704.

The struggle of Ibn Ash'ath was primarily a contest for hegemony between 'Irāq and Syria. The proud lords could not acquiesce in paying to a plebeian like Ḥajjāj, invested with absolute power by the caliph, the strict obedience he required. They considered it further as an injustice that the Syrian soldiers received higher pay than those of 'Irāq. Moreover, Ḥajjāj, in order to maintain the regular revenue from taxation, had been obliged to introduce stringent regulations, and had compelled a great many villagers who had migrated to the cities to return to their villages.

Immediately after the victories of Dayr al-Jamājim and Maskin, in 702, Ḥajjāj, built a new residence on the Tigris, between Baṣra and Kūfa, which he called Wāsiṭ ("Middle"). There his Syrian soldiers were not in contact with the turbulent citizens of the two capitals, and were at any moment ready to suppress any fresh outburst.

As soon as the expedition to 'Irāq against Muṣ'ab had terminated, the holy war against the Greeks was renewed. From this time forth the Muslims made yearly raids, the chief advantage of which was that they kept the Syrian and Mesopotamian Arabs in continual military exercise. In the year 696 'Abdalmalik sent into Africa a numerous army, which swept the coast as far as Carthage, expelling the Greek garrisons from all the fortified places; and then turned against the Berbers, who when they were ultimately subdued henceforward remained faithful to the Arabs.

In the meantime 'Abdalmalik reconstituted the administration of the empire on Arabic principles. Up to the year 693 the Muslims had no special coinage of their own, and chiefly used Byzantine and Persian money, either imported or struck by themselves. 'Abdalmalik instituted a purely Islamic coinage. A still greater innovation was that Arabic became the official language of the State. In the conquered countries till then, not only had the Greek and Persian administration been preserved, but Greek remained the official language in the western, Persian in the eastern provinces. All officials were now compelled to know Arabic and to conduct their administration in that language. Lastly, a regular post service was instituted from Damascus to the provincial capitals, especially destined for governmental dispatches. The postmasters were charged with the task of informing the caliph of all important news in their respective countries.

'Abdalmalik died on Oct. 9, 705, at the age of about sixty. His reign was one of the most stormy in the annals of Islam, but also one of the most glorious; he not only brought triumph to the cause of the Umayyads, but also extended and strengthened the Muslim power as a whole.

6. **Reign of Walīd I.**—This is the most glorious epoch in the history of Islam. In Asia Minor and Armenia, Walīd's generals obtained numerous successes against the Greeks, and in Armenia advanced even as far as the Caucasus. In Africa, Mūsā in a short time carried his conquests as far as Fez, Tangier and Ceuta, and one of his captains even made a descent on Sicily and plundered Syracuse. When he returned from the west to Kairawān, he made his client Ṭāriq governor of Tangier and of the whole western part of Africa. In the beginning of A.D. 711, Ṭāriq passed over into Spain with an army composed mainly of Berbers. The spot where he landed thence acquired the name of Jabal Ṭāriq, "Mountain of Ṭāriq," afterwards corrupted into Gibraltar. Having made himself master of Algeçiras and thereby secured his communication with Africa, Ṭāriq set out at once in the direction of Cordova, and after a brilliant campaign, in 712, proclaimed the caliph of Damascus as sole ruler of the whole peninsula.

In the East the Muslim armies gained the most astonishing successes. In the course of a few years Qutaybah b. Muslim conquered Paikand, Bokhara, Samarkand, Khwarizm (modern Khiva), Ferghana and Shāsh (Tashkent), and even Kashgar on the frontiers of China. Meanwhile Muḥammad b. Qāsim invaded Makran, took Daibal, passed the Indus, and marched, after having beaten the Indian king, Dahar, through Sind upon Multān, which he conquered and whence he carried off an immense booty.

Towards the end of this reign, died Ḥajjāj, the great viceroy of the Orient. He was a man of extraordinary ability, and accomplished the task committed to him with vigour and energy. To his unflagging constancy was due the suppression of the dangerous rebellion of Ibn Ash'ath. After the restoration of peace his capacity for organization was displayed in all directions. The draining and tilling of submerged or uncultivated land on a large scale, the promotion of agriculture in every way, in particular by the digging of channels, and the regulation of the system of taxation, were carried out on his initiative. He showed the utmost wisdom in the selection of his lieutenants. The fear of his name was so great that even in the desert there was security for life and property, and his brilliant military successes were unquestionably due in a great measure to the care which he bestowed on equipment and commissariat. The heavy expenses entailed thereby were largely met by the booty which he won.

7. **Reign of Sulaymān.**—Sulaymān succeeded on the death of his brother, Jumāda II. 96 (Feb. 715). Walīd had, in his last years made preparations against Constantinople. Sulaymān carried them on with energy, and as early as the autumn of A.D. 715 Maslama invaded Asia Minor at the head of a numerous army, whilst a well-equipped fleet sailed out to second him. The first year of the expedition was not unsuccessful. The siege of Amorium in Phrygia was broken up, but Pergamum and Sardis were taken. On Aug. 25, 716, the blockade of Constantinople began from the land side, and two weeks later from the sea side. The siege lasted about a year. The besieged were hard pressed, but the besiegers suffered by the severe winter, and were at last obliged to raise the siege. Maslama brought back the rest of his army in a pitiful state, while the fleet, on its return, was partly destroyed by a violent tempest. Maslama was still on his way back when Sulaymān died at Dābiq in northern Syria, which was the base of the expeditions into Asia Minor.

8. **Reign of 'Umar II.**—Sulaymān was succeeded by his devout cousin, 'Umar b. 'Abd al-'Azīz, who did his best to imitate his grandfather 'Umar in all things, and especially in maintaining the simple manner of life of the early Muslims. He was, however, born in the midst of wealth; thus frugality became asceticism, and in so far as he demanded the same rigour from his relatives, he grew unjust and caused uneasiness and discontent. In the matter of taxes, though actuated by the most noble designs, he did harm to the public revenues. The principle of Islam was, that no Muslim, whatever might be his nationality, should pay any tax other than the *zakāt* or poor-rate. (*See* ISLAMIC INSTITUTIONS) In practice, this privilege was confined to the Arabic Muslims. 'Umar wished to maintain the principle. The original inhabitants had been left on the conquered lands as agriculturists, on condition of paying a fixed sum yearly for each district. If one of these adopted Islam, 'Umar permitted him to leave his place, which had been strictly forbidden by Ḥajjāj in 'Irāq and the eastern provinces, because by it many hands were withdrawn from the tilling of the ground, and those who remained were unable to pay the allotted amount. 'Umar's system not only diminished the actual revenue, but largely increased in the cities the numbers of the *maula's* (clients), mainly Persians, who were weary of their dependency on their Arabic lords, and demanded equal rights for themselves. In north Africa particularly, and in Khurasan the effect of 'Umar's proclamation was that a great multitude embraced Islam. When it became necessary to impose a tribute upon the new converts, great discontent arose, which largely increased the number of those who followed the Shi'ite preachers of revolt. Conversion to Islam was promoted by the severe regulations which 'Umar introduced for the non-believers, such as Christians and Jews. It was he who issued those humiliating rescripts, which are commonly but unjustly attributed to 'Umar I. But he forbade extortion and suppressed more than one illegal impost. He followed the guidance of divines and devotees, in whose congenial company he delighted. It is, therefore, not to be wondered at that these men saw in 'Umar the ideal of a prince, and that in Muslim history he has acquired the reputation of a saint.

9. **Reign of Yazīd II.**—'Umar's reign was as short as that of his predecessor. He died on Feb. 9, 720. Yazīd II., son of 'Abdalmalik and, by his mother 'Ātika, grandson of Yazīd I., ascended the throne without opposition. He had at once, however, to put down a dangerous rebellion, which, commencing in Basra, spread to Ahwāz (Khūzistān), Fārs and Kirmān. As the rebellion threatened to spread far and wide, Yazīd II. was obliged to appeal to his brother, the celebrated Maslama, who with his Syrian troops completely defeated the rebels and ruthlessly hunted them to death.

Maslama was rewarded with the governorship of 'Irāq and Khurasan, but was soon replaced by Ibn Hubayra, who under 'Umar II. had been governor of Mesopotamia. He belonged to the tribe of Qays, and was very severe against the Azd and other Yemenite tribes, who had more or less favoured the rebellion. In these years the antagonism between Qays (Muḍar) and Yemenites became more and more acute, especially in Khurasan, where Ibn Hubayra caused large sums of money to be extorted from several of the most respectable Khurasanians. The discontent roused thereby became one of the principal causes of the fall of the Umayyads.

In Africa serious troubles arose from the same cause, when the governor issued orders that the villagers who, having adopted Islam, were freed from tribute according to the promise of 'Umar II., and had left their villages for the towns, should return to their domiciles and pay the same tribute as before their conversion. The Berbers rose in revolt, slaughtered the unfortunate governor, and put in his place the former governor. Yazīd II., died on Jan. 26, 724, according to the chroniclers, from grief for the loss of a favourite singing-girl. As his successor he had appointed in the first place his brother Hishām, and after him his own son Walīd.

10. **Reign of Hishām.**—Hishām was a wise and able prince and an enemy of luxury, not an idealist like 'Umar II., nor a worldling like Yazīd II., but more like his father 'Abdalmalik, devoting all his energy to the pacification of the interior, and to extending and consolidating the empire of Islam. But the discontent, which had been sown under his predecessors, had now developed to such an extent that he could not suppress it in detail.

In 'Irāq Zayd b. 'Alī, grandson of Ḥusayn b. 'Alī, who had come to Kūfa for a lawsuit, was persuaded by the chiefs of the Shi'a to organize a revolt in 740, but he was deserted by his troops and slain. His son Yaḥyā, still a youth, fled to Balkh in Khurasan, but was hunted down, till he fell, sword in hand, under Walīd II. Abū Muslim, the founder of the Abbasid dynasty, proclaimed himself his avenger, and on that occasion adopted the black garments, which remained the distinctive colour of the dynasty.

In Khurasan also there were very serious disturbances. The Sogdians implored the assistance of the Turks, who had long been contending earnestly against the Arabs for the dominion of Transoxiana. The Government troops suffered more than one defeat, but in 736 a brilliant victory over the Turks finally caused them to retreat. Hishām separated Khurasan from 'Irāq and chose as governor of the former Naṣr b. Sayyār, a valiant soldier who had grown grey in war. Naṣr instituted a system of taxation, which, if it had been introduced earlier, would perhaps have saved the Arabic domination. It was that which later on was generally adopted, viz., that all possessors of conquered lands (*i.e.*, nearly the whole empire except Arabia), whether Muslims or not, should pay a fixed tax, the latter in addition to pay a poll-tax, from which they were relieved on conversion to Islam. During the reign of Hishām, Naṣr made a successful expedition against the Turks. The propaganda of the Shi'a by the Abbasids was continued in these years with great zeal.

In India several provinces which had been converted to Islam under the Caliphate of 'Umar II declared themselves independent, because the promise of equal rights for all Muslims was not kept under the reign of his successors. This led to the evacuation of the eastern part of India (called Hind by the Arabs, Sind being the name of the western part), and to the founding of the strong cities of Maḥfūẓa and Manṣūra for the purpose of controlling the land.

In the north and north-west of the empire there were no internal disorders, but the Muslims had hard work to maintain themselves against the Alans and the Khazars. The war against the Byzantines was continued with energy during the whole of Hishām's reign.

In Africa the hand of government pressed heavily. The Berbers, though they had pledged themselves to Islam and had furnished the latest contingents for the Holy War, were treated as tributary serfs. The Kharijites, of whom a great many had emigrated to Africa, found them eager listeners, and a fierce insurrection broke out which was not easily suppressed.

Hishām died in Feb. 743, after a reign of 20 years. He had not been wanting in energy and ability, and kept the reins of the government in his own hands. His financial administration was sound and he guarded against any misuse of the revenues of the State. But he was not popular. Hishām tried to keep himself free from and above the rival parties, but his viceregents were inexorable. Notwithstanding his activity and his devotion to the management of affairs, the Muslim power declined rather than advanced, and signs of the decay of the Umayyad dynasty began to show themselves. The history of his four successors, Walīd II., Yazīd III., Ibrāhim and Marwān II., is but the history of the fall of the Umayyads.

11. **Reign of Walīd II.**—Walīd II. was a handsome man, possessed of extraordinary physical strength, and a distinguished poet. His first public action was to increase the pay of all soldiers by 10 dirhems, that of the Syrians by 20. The Umayyads who came to pay their respects to him received large donations.

But he made the mistake of designating his two sons as heirs to the Caliphate. These were still under age and were not the children of a free-born, noble mother. A conspiracy arose, headed by Yazid b Walīd I., and joined by the majority of the Marwanid princes and many Kalbites and other Yemenites. The conspirators met with slight opposition. Without difficulty, Yazīd made himself master of Damascus, and the caliph was murdered on April 17, 744.

12. **Reign of Yazīd III.**—Yazīd III., on his accession, made a fine speech, in which he promised to do all that could be expected from a good and wise ruler, even offering to make place immediately for the man whom his subjects should find better qualified for the Caliphate than himself. But the distant provinces, with the exception of Sind and Sijistan, renounced his authority. In Africa ‘Abdarrahman b. Ḥabīb was almost independent. In Spain every amir tried to free himself from a suzerainty which appeared to him only nominal. Naṣr b. Sayyār, the governor of Khurasan, had not yet decided whether he ought to take the oath of allegiance when Yazīd died, after a reign of only five months and a half in 744.

13. Yazīd III. left his brother **Ibrāhim** as his successor. He was acknowledged as caliph only in a part of Syria, and reigned no longer than two months, when he was obliged to abdicate and to submit to the authority of Marwān II.

14. **Marwan II.,** the son of Muḥammad b. Marwān and cousin of Maslama, was a man of energy, and might have revived the strength of the Umayyad dynasty, but for the general disorder which pervaded the whole empire. Marwān did all he could to pacify Syria, permitting the Arabs of the four provinces to choose their own prefects. He did not, however, wish to reside in Damascus, but transplanted the seat of government to his own town, Harran in Mesopotamia.

But the pacification was only on the surface. Many Umayyad princes considered Marwān as an upstart, his mother being a slave-girl; the Damascenes were angry because he had chosen Harran for his residence; the Kalbites felt themselves slighted, as the Qaisites predominated. Marwān, who wanted to march against ‘Irāq, was obliged to return to Syria, where he put an end to the troubles. Shortly afterwards Sulaymān b. Hishām persuaded the Syrians to proclaim him caliph. But Marwān utterly defeated him at Khosāf in the district of Kinnesrin, and then besieged his brother Sa‘īd in Homs. After the victory the walls were demolished, and likewise those of Baalbek, Damascus, Jerusalem and other towns. Syria was utterly crushed, and therewith the bulwark of the dynasty was destroyed. Not until 746 could Marwān resume his campaign against ‘Irāq. Here the Kharijites had set up a rival caliph and had captured (in Aug. 745) Hīra, the residence of the governor of the province.

Whilst Marwān besieged Homs, the Kharijite army, which now numbered 120,000 men, returned to Mesopotamia, took Mosul, and threatened Nisibis. Mesopotamia itself was in danger, when Marwān at last was able to march against the enemy. In a furious battle at Kafartūtha (Sept. A.D. 746) the Kharijites were defeated; and their rebellion was crushed during the campaign of the following year. Thus, at last, the western and south-eastern parts of the empire lay at the feet of Marwān. But in the north-east, in Khurasan, meanwhile a storm had arisen, against which his resources and his wisdom were alike of no avail.

When the news of the murder of Walīd II. reached Khurasan, Naṣr b. Sayyār did not at once acknowledge the Caliphate of Yazīd III., but induced the Arab chiefs to accept himself as amir of Khurasan, until a caliph should be universally acknowledged. But Naṣr had a personal enemy, the chief of the Azd (Yemenites), Kirmānī, a very ambitious man. A quarrel arose, and in a short time the Azd under Kirmānī, supported by the Rabī‘a, who always were ready to join the opposition, were in insurrection; Naṣr tried in vain to put it down by concessions, and finding that he could hold Merv no longer, retired to Nishapur.

Since the days of ‘Alī there had been two tendencies among the Shī‘ites. The moderate party distinguished itself from the other Muslims only by its doctrine that the *imamate* belonged legally to a man of the House of the Prophet. The other party, that of the ultra-Shī‘ites, named Hāshimīya after Abū Hāshim, the son of Muḥammad b. al-Ḥanafīya, preached the equality of all Muslims, Arabs or non-Arabs, and taught that the same divine spirit that had animated the Prophet incorporated itself again in his heirs. After the death of Ḥusayn, they chose for their Imām Muḥammad b. al-Ḥanafīya, and at his decease his son, Abū Hāshim, from whom Muḥammad b. ‘Alī, the grandson of ‘Abdallah b. ‘Abbās, who resided at Ḥomaima in the south-east of Syria, obtained the secrets of the party and took the lead. This Muḥammad, the father of the two first Abbasid caliphs, was a man of unusual ability and great ambition. He directed his energies primarily to Khurasan. The missionaries were charged with the task of undermining the authority of the Umayyads, by drawing attention to all the injustices that took place under their reign, and to all the luxury and wantonness of the court, as contrasted with the misery of many of their subjects. God would not suffer it any longer. As soon as the time was ripe He would send a saviour out of the House of the Prophet, the Mahdī, who would restore Islam to its original purity. The missionaries had great success, especially among the non-Arabic inhabitants of Khurasan and Transoxiana.

When Muḥammad b. ‘Alī died, his son Ibrāhīm, the Imām, took his place. Ibrāhīm had a confidant about whose antecedents one fact alone seems certain, that he was a *maula* (client) of Persian origin. This man, Abū Muslim by name, was a man of real ability and devoted to his master's cause. To him, in 745–746, the management of affairs in Khurasan was entrusted. At first the chiefs of the mission were by no means prepared to recognize Abū Muslim as the plenipotentiary of the heir of the Prophet. In the year 749 he judged that the time for open manifestation had arrived. His partisans were ordered to assemble from all sides on a fixed day at Sīqadanj in the province of Merv. Then, on June 15, 747, the first solemn meeting took place and the black flags were unfolded. By the end of the year Abū Muslim, whom the majority believed to belong himself to the family of the Prophet, was the acknowledged head of a strong army. Meantime, Naṣr had moved from Nishapur to Merv, and here the two Arabic armies confronted each other. Then, at last, the true significance of Abū Muslim's work was recognized. Naṣr warned the Arabs against their common enemy, "who preaches a religion that does not come from the Envoy of God, and whose chief aim is the extirpation of the Arabs." In vain he had entreated Marwān to send him troops before it should be too late. When at last it was possible to them to fulfil his wish, it was, in fact, too late. But Abū Muslim made himself master of Merv, in Dec. 747. Naṣr escaped only by a headlong flight to Nishapur. This was the end of the Arabic dominion in the East.

As soon as Abū Muslim had consolidated his authority, he sent his chief general, Qaḥṭaba, against Nishapur. Naṣr could not further resist. He reached Sāwā in the vicinity of Hamadan, where he died quite exhausted, at the age of 85 years. Rayy and Hamadan were taken without serious difficulty. In June 749 Nihāwand surrendered, and thereby the way to ‘Irāq lay open to Qaḥṭaba. Qaḥṭaba himself perished in the combat, but his son Ḥasan entered Kūfa without any resistance on Sept. 2, 749.

Marwān had at last discovered who was the real chief of the movement in Khurasan, and had seized upon Ibrāhīm the Imām and imprisoned him at Harran. There he died, probably from the plague, though Marwān was accused of having killed him.

The other Abbasids arrived at Kūfa in the latter half of Sept. 749, where in the meantime the head of the propaganda, Abū Salama, had previously undertaken the government. This Abū Salama seems to have had scruples against recognizing Abu'l-'Abbās as the successor of his brother Ibrāhīm, and to have expected that the Mahdī, whom he looked for from Medina, would not be slow in making his appearance, little thinking that an Abbasid would present himself as such. But Abū Jahm, on the instructions of Abū Muslim, declared to the chief officers of the Khurasanian army that the Mahdī was in their midst, and brought them to Abu'l-'Abbās, to whom they swore allegiance. Abū Salama also was constrained to take the oath. On Nov. 28, 749, Abu'l-'Abbās was solemnly proclaimed caliph in the principal mosque of Kūfa. The trick had been carried out admirably. On the point of gathering the ripe fruit, the Alids were suddenly pushed aside, and the fruit was snatched away by the Abbasids. The latter gained the throne and they took good care never to be deprived of it.

The advancing Abbasid army completely defeated Marwān near the Greater Zab, an affluent of the Tigris, in a battle which lasted 11 days. Marwān retreated to Harran, thence to Damascus, and finally to Egypt, where he fell in a last struggle (Aug. 750). His head was cut off and sent to Kūfa. In Syria, the Umayyads were persecuted with the utmost rigour. Even their graves were violated, and the bodies crucified and destroyed. Only a few Umayyads escaped the massacre. A grandson of Hishām, 'Abdarrahmān, reached Africa and founded in Spain the Umayyad dynasty of Cordova.

With the dynasty of the Umayyads the hegemony passes finally from Syria to 'Irāq. At the same time the supremacy of the Arabs came to an end. Thenceforth it is not the contingents of the Arabic tribes which compose the army, and on whom the Government depends; the new dynasty relies on a standing army, consisting for the greater part of non-Arabic soldiers. The barrier that separated the Arabs from the conquered nations begins to crumble away. Only the Arabic religion, the Arabic language, and the Arabic civilization maintain themselves, and spread more and more over the whole empire.

C.—THE ABBASID CALIPHS

We now enter upon the history of the new dynasty, under which the power of Islam reached its highest point.

1. **Abu'l-'Abbās** inaugurated his Caliphate by a harangue to the people of Kūfa, in which he announced the era of concord and happiness which was to begin now that the House of the Prophet had been restored to its right. He asserted that the Abbasids were the real heirs of the Prophet, as the descendants of his oldest uncle 'Abbās. He did not, however, trust the Kufians. He resided outside the town with the Khurasanian troops, and with them went first to Hīra, then to Hāshimīya, which he caused to be built in the neighbourhood of Anbar.

The ruin of the Umayyad empire and the rise of the new dynasty did not take place without mighty convulsions. In Bathanīya and the Ḥaurān, in the north of Syria, in Mesopotamia and 'Irāq Khurasan insurrections had to be put down with fire and sword. The new caliph then distributed the provinces among the principal members of his family and his generals. Africa and Spain are omitted from this catalogue, because the Abbasids never gained any real footing in Spain, while Africa remained, at least in the first years, in only nominal subjection to the new dynasty. In 754 Abū Muslim came to 'Irāq to visit Abu'l-'Abbās and was received with great honour.

Abu'l-'Abbās died on June 5, 754. He seems to have been a man of limited capacity, and had very little share in the achievements accomplished in his name. In the few cases where he had to decide, he acted under the influence of his brother Abū Ja'far.

2. **Reign of Mansur.**—Abu'l-'Abbās had designated as his successors first Abū Ja'far, surnamed al-Manṣūr (the victorious), and after him his cousin 'Īsā b. Mūsā.

The first care of Manṣūr was now to get rid of the powerful Abū Muslim. On pretence of conferring with him on important business of state, Manṣūr induced him to come to Madāin (Ctesiphon), and in the most perfidious manner caused him to be murdered by his guards.

About the same time Africa and Spain escaped from the dominion of the eastern Caliphate; the former for a season, the latter permanently. But in the year 761 Muḥammad b. Ash'ath, the Abbasid general, entered Kairawan and regained possession of Africa in the name of the eastern caliph. From the year 800, it must be added, Africa only nominally belonged to the Abbasids; for, under the reign of Hārūn al-Rashīd, Ibrāhīm b. al-Aghlab, who was invested with the government of Africa, founded in that province a distinct dynasty, that of the Aghlabites.

At the same time as the revolt in Africa, the independent Caliphate of the western Umayyads was founded in Spain by one of the last survivors of the Umayyads, 'Abdarrahmān b. Mu'āwiyah, grandson of the caliph Hishām. (*See* SPAIN: *History*.)

While Manṣūr was thus losing Africa and Spain, he was trying to redeem the losses which the Byzantines had inflicted on the empire on the northern frontier. But from 758 till 763 Manṣūr was so occupied with his own affairs that he could not think of further raids.

In 758 (others say in 753 or 754) a body of 600 sectaries, called the Rāwandīs, went to Hāshimiya, the residence of the caliph, and began to pay him divine honours. These fanatics, having later risen in revolt, were hunted down and massacred to the last man, and thereby the ties that bound the Abbasids to the ultra-Shi'ites were severed. From that time forward the Abbasid caliphs became the maintainers of orthodox Islam, just as the Umayyads had been.

A much greater danger now threatened Manṣūr. In the last days of the Umayyads, the Shi'ites had chosen as caliph, Muḥammad b. 'Abdallāh b. Ḥasan, whom they called the Mahdī, and Manṣūr had been among those who pledged themselves to him by oath. Not unnaturally, the Alids in Medina were indignant at being supplanted by the Abbasids, and Manṣūr's chief concern was to get Muḥammad into his power. In 758 Manṣūr, informed that a revolt was in preparation, came himself to Medina and ordered 'Abdallāh to tell him where his sons were. As he could not or would not tell, he together with all his brothers and some other relatives were seized and transported to 'Irāq where 'Abdallāh and his brother 'Alī were beheaded and the others imprisoned. Notwithstanding all these precautions, a vast conspiracy was formed. In 762 Muḥammad took Medina and had himself proclaimed caliph, but was defeated and slain. In the meanwhile Ibrāhīm had not only gained possession of Basra, Ahwāz and Fārs, but had even occupied Wāsit. The empire of the Abbasids was in great jeopardy. Had Ibrāhīm marched at once against Kūfa he might have crushed Manṣūr, but he let slip the opportunity. A terrible conflict took place at Bā-Khamra, 48m. from Kūfa, and Ibrāhīm was finally defeated. His head was cut off and brought to Manṣūr.

Manṣūr could now give his mind to the founding of the new capital. He made choice of the admirable site of the old market-town of Baghdad on the western bank of the Tigris. Strictly it was a huge citadel, in the centre of which was the palace of the caliph and the great mosque. But around this nucleus there soon grew up the great metropolis which was to be the centre of the civilized world as long as the Caliphate lasted. The building lasted three years and was completed in the year 766.

'Īsā b. Mūsā had been designated, as we have seen, by Abu'l-'Abbās as successor to Manṣūr. The latter having vainly tried to compel 'Īsā to renounce his right of succession, in favour of Manṣūr's son, Muḥammad al-Mahdī, produced false witnesses who swore that he had done so. However unwillingly, 'Īsā was obliged at last to yield. One of the false witnesses was, it is asserted, Khālid b. Barmak, the head of that celebrated family, the Barmecides (*q.v.*), who played so important a part in the reign of Hārūn al-Rashīd. This Khālid, who was descended from an old sacerdotal family in Balkh, and had been one of the trusty supporters of Abū Muslim, Manṣūr appointed as minister of finance.

In 775 Manṣūr died after having reigned for 22 years. He was a man of rare energy and strength of mind. His ambition was boundless and no means, however perfidious, was despised by him. But he was a great statesman and knew how to choose able officers for all places.

3. **Reign of Mahdī.**—As soon as Manṣūr was dead, Rabī', his client and chamberlain, induced all the princes and generals who accompanied the caliph, to take the oath of allegiance to his son Muḥammad al-Mahdī, who was then at Baghdad. In 161, Mahdī was menaced by a dangerous revolt, led by a sectary, known generally as Muqanna' or "the veiled one," because he always appeared in public wearing a mask. He took up his abode in the Transoxianian province of Kish and Nakhshab, where he gathered around him a great number of adherents. After some successes, the pretender was ultimately cornered at the castle of Sanām near Kish, and took poison together with all the members of his family. His head was cut off and sent to Mahdī.

During the reign of Manṣūr the annual raids against the Byzantines had taken place almost without intermission, but the only feat of importance had been the conquest of Laodicea, called "the burnt" (ἡ κατακεκαυμένη) by Ma'yūf b. Yaḥyā in the year 770. At first the armies of Mahdī were not successful. The Greeks even conquered Marash (Germanicia) and annihilated the Muslim army sent from Dābiq. In 778, however, Ḥasan b. Qaḥṭaba made a victorious raid as far as Adhrūliya (Dorylaeum); it was on his proposition that Mahdī resolved on building the frontier town called Ḥadath (Adata), which became an outpost. In 779 the caliph decided on leading his army in person. Traversing Mesopotamia and Syria, he entered Cilicia, and established himself on the banks of the Jihan (Pyramus). Thence he despatched an expeditionary force, nominally under the command of Hārūn, but in reality under that of his tutor, the Barmecide Yaḥyā b. Khālid. Hārun captured the fortress Samalu after a siege of 38 days. In consequence of this feat, Mahdī made Hārūn governor of the whole western part of the empire, including Azerbaijan and Armenia. Two years later war broke out afresh between the Muslims and the Greeks. The Muslims invaded Cilicia under the orders of 'Abdalkabīr who, being afraid of encountering the enemy, retired with his troops. Irritated by this failure, the caliph in 781 sent Hārūn, accompanied by his chamberlain Rabī', with an army of nearly 100,000 men, with orders to carry the war to the very gates of Constantinople. Hārūn marched against Nicomedia, where he vanquished the domesticus, the chief commander of the Greek forces, and pitched his camp on the shores of the Bosporus. The regent, Irene, sued for peace, and obtained a truce for three years, but only on the humiliating terms of paying an annual tribute of 90,000 denarii, and supplying the Muslims with guides and markets on their way home. This brilliant success so increased Mahdī's affection for Hārūn that he appointed him successor-designate after Mūsā and named him *al-Rashīd* ("the follower of the right cause"). Three years later, he died suddenly, at the age of only 43.

The reign of Mahdī was a time of great prosperity. Much was done for the organization of the huge empire; agriculture and commerce flourished; the revenues were increasing, whilst the people fared well. The power of the State was acknowledged even in the Far East: the emperor of China, the king of Tibet, and many Indian princes concluded treaties with the caliph. He was an ardent champion of the orthodox faith, and persecuted mercilessly the Manichaeans and all kinds of freethinkers.

4. **Reign of Hadī.**—On the death of Mahdī, Hārūn, following the advice of Yaḥyā b. Khālid, sent the insignia of the Caliphate, with letters of condolence and congratulation, to Mūsā and brought the army which had accompanied Mahdī peacefully back from Media to Baghdad. Mūsā returned in all haste to the capital, and assumed the title of *al-Hādī* ("he who directs").

Hādī, who had never been able to forget that he had narrowly escaped being supplanted by his brother, formed a plan for excluding him from the Caliphate and transmitting the succession to his own son Ja'far. To this he obtained the assent of his ministers and the principal chiefs of his army, with the exception of Yaḥyā b. Khālid, Hārūn's former tutor, who showed such firmness and boldness that Hādī cast him into prison and resolved on his death. Some historians say that he had already given orders for his execution, when he himself was killed (Sept. 14, 786) by his mother Khaizurān, who had systematically and successfully intrigued against him with the object of gaining the real power for herself.

5. **Reign of Hārūn al-Rashīd.**—Hārūn ascended the throne without opposition. His first act was to choose as prime minister his former tutor, the faithful Yaḥyā b. Khālid, and to confide important posts to the two sons of Yaḥyā, Faḍl and Ja'far, of whom the former was his own foster-brother, the latter his intimate friend. Loaded with all the burdens of government, Yaḥyā brought the most distinguished abilities to the exercise of his office. He put the frontiers in a good state of defence; he filled the public Treasury, and carried the splendour of the throne to the highest point. His sons, especially Faḍl, were worthy of their father.

Although the administration of Hārūn's States was committed to skilful hands, yet the first years of his long reign were not free from troubles. Towards the year 793 a man of the house of 'Alī, named Yaḥyā b. 'Abdallāh, another brother of Muḥammad and Ibrāhīm, publicly claimed the Caliphate, but he was induced to submit by a promise of safety and a brilliant position at the court of Baghdad. At the end of some months, however, he was calumniously accused of conspiracy, and the caliph, seizing the opportunity of ridding himself of a possible rival, threw him into prison, where he died, according to the majority of the historians, of starvation. Others say that Ja'far b. Yaḥyā b. Khālid, to whose care he had been entrusted, suffered him to escape, and that this was the real cause of Hārūn's anger against the Barmecides (*q.v.*). Dreading fresh insurrections of the Alids, Hārūn secured the person of another descendant of 'Alī, Mūsā b. Ja'far, surnamed al-Kāẓim, who enjoyed great consideration at Medina, and had already been arrested and released again by Mahdī. The unfortunate man was brought by the caliph himself to Baghdad and there died, apparently by poison.

Meanwhile Hārūn did not forget the hereditary enemy of Islam. Almost every year successful raids were made into Asia Minor, in the year 797 under the command of the caliph himself, so that Irene was compelled to sue for peace. Even in the midst of the cares of war, Hārūn was assiduous in his religious duties, and few years passed without his making the pilgrimage.

It was in the beginning of the following year, at the very moment when the Barmecides thought their position most secure, that Hārūn brought sudden ruin upon them. The causes of their disgrace have been differently stated by the annalists. (*See* BARMECIDES.) The principal cause appears to have been that they abused the sovereign power which they exercised. Not a few were jealous of their greatness and sought for opportunities of instilling distrust against them into the mind of Hārūn, and of making him feel that he was caliph only in name. The secret dissatisfaction thus aroused was increased, according to some apparently well-informed authorities, by the releasing of the Alid Yaḥyā b. 'Abdallāh, already mentioned. Finally Hārūn resolved on their destruction, and Ja'far b. Yaḥyā was arrested and beheaded. The following day, his father Yaḥyā, his brother Faḍl, and all the other Barmecides were arrested and imprisoned; all their property was confiscated. The only Barmecide who remained unmolested with his family was Muḥammad the brother of Yaḥyā, who had been the chamberlain of the caliph till 795, when Faḍl b. Rabī' got his place. This latter had henceforward the greatest influence at court.

In the same year hostilities broke out again with the Greeks, and the new emperor, Nicephorus, was so completely beaten that he was compelled to submit to very harsh conditions.

The disturbances in Khurasan were caused by the malversations of the governor of that province, 'Alī b. 'Īsa b. Māhān. The caliph went in person to Merv, in order to judge of the reality of the complaints which had reached him, but confirmed 'Alī in his post, and, after having received the chiefs of Tabaristān who came to tender their submission, returned through Baghdad to Rakka on the Euphrates, which city was his habitual residence. In the following year Rāfi' b. Layth, a grandson of Naṣr b. Sayyār, raised the standard of revolt in Samarkand. The caliph's hope that Rāfi' would submit on condition of receiving a free pardon was not fulfilled, and he resolved to set out himself to Khurasan, taking with him his second son Ma'mūn. On the journey he was attacked by an internal malady, from which he died, ten months after his departure from Baghdad in March 809, just on his arrival at the city of Tūs. Hārūn was only 45 years of age. As long as the Barmecides were in office, he acted only on their direction. After their disgrace he was led into many impolitic actions by his violent and often cruel propensities. But the empire was, especially in the earlier part of his reign, in a very prosperous state, and was respected widely by foreign Powers. Embassies passed between Charlemagne and Hārūn in the years 797 and 801, by which the former obtained facilities for the pilgrims to the Holy Land, the latter probably concessions for the trade on the Mediterranean ports.

Under the reign of Hārūn, Ibrāhīm b. al-Aghlab, the governor of Africa, succeeded in making himself independent of the Central Government, on condition of paying a fixed annual tribute to his suzerain the caliph. This was, if we do not take Spain into account, the first instance of dismemberment, later to be followed by many others.

6. **Reign of Amin.**—On the death of Hārūn his minister, Fadl b. Rabī‘, with the view of gaining the new caliph's confidence, hastened to call together all the troops of the late caliph and to lead them back to Baghdad, in order to place them in the hands of the new sovereign, Amīn. War soon broke out between the two brothers, and their respective armies met under the walls of Rayy (May 811), where Ma’mun's general Ṭāhir gained a brilliant victory. Ma’mūn now no longer hesitated to take the title of caliph.

Tāhir continued his victorious march and one after the other the provinces fell away from Amīn, and he soon found himself in possession of Baghdad alone. The city, though blockaded on every side, made a desperate defence for nearly two years. Ultimately the eastern part of the city fell into the hands of Tāhir, and Amīn, deserted by his followers, was compelled to surrender and was put to death. His head was sent to Ma’mūn (Sept. 813). Amīn was only 28 years old. As a ruler he was wholly incompetent, and the five years of his reign were disastrous to the empire, and in particular to Baghdad, which never entirely recovered its old splendour.

7. **Reign of Ma’mun.**—On the day following the death of Amīn, Ṭāhir caused Ma’mūn to be proclaimed at Baghdad, and promised in his name a general amnesty. The accession of this prince appeared likely to restore to the empire the order necessary for its prosperity. It was not so, however. The reign of Ma’mūn had a very stormy beginning; he was in no haste to remove to Baghdad, but continued to reside at Merv. The Alids seized on his elevation as a pretext for fresh revolts, and Mecca, Medina and Yemen fell into their hands, and several cities of ‘Irāq were occupied by rebels, but at last the tide of disaster was checked. The troops of the Alids were everywhere driven back, and the whole of ‘Irāq fell again into the hands of the Abbasids, and peace seemed within reach. This, however, was by no means the case. The disorder of civil war had caused a multitude of robbers and vagabonds to emerge from the purlieus of Baghdad. These ruffians proceeded to treat the capital as a conquered city, and it became necessary for all good citizens to organize themselves into a regular militia.

Meanwhile, at Merv, Ma’mūn was adopting a decision which fell like a thunderbolt on the Abbasids. In 817 under pretence of putting an end to the continual revolts of the partisans of ‘Alī, he publicly designated as his successor in the Caliphate ‘Alī ar-Riḍā, a son of that Mūsā al-Kāzim who perished in the prison of Mahdī. The people of Baghdad refused to take the oath to ‘Alī b. Mūsā, declared Ma’mūn deposed, and elected his uncle, Ibrāhīm, son of Mahdī, to the Caliphate. Ma’mūn was much incensed and wrote that he was coming to Baghdad in a short time. From that moment the pseudo-caliph Ibrāhīm found himself deserted, and was obliged to seek safety in concealment. His precarious reign had, however, lasted nearly two years. Having taken all precautions, Ma’mūn now made his solemn entry into Baghdad in Aug. 819.

When welcoming Ṭāhir, Ma’mūn bade him ask for any reward he might desire. Ṭāhir, fearing lest the caliph, not being able to endure the sight of the murderer of his brother, should change his mind towards him, contrived to get himself appointed governor of Khurasan. Like most of the great Muslim generals, Ṭāhir, it is said, had conceived the project of creating an independent kingdom for himself. His death (A.D. 822), prevented its realization; but as his descendants succeeded him one after the other in the post of governor, he may be said in reality to have founded a dynasty in Khurasan.

The pseudo-caliph, Ibrāhīm was eventually arrested, but Ma’mūn generously pardoned him.

Tranquillity being now everywhere re-established, Ma’mūn gave himself up to science and literature. He caused works on mathematics, astronomy, medicine and philosophy to be translated from the Greek, and founded in Baghdad a kind of academy, called the "House of Science," with a library and an observatory. Ma’mūn interested himself, too, in questions of religious dogma. He had embraced the Mu‘tazilite doctrine about free will and predestination, and in 827 he published an edict by which the Mu‘tazilite doctrine was declared to be the religion of the State, the orthodox faith condemned as heretical. At the same time he ordered all his subjects to honour ‘Alī as the best creature of God after the Prophet, and forbade the praise of Mu‘āwiyah. In 833 a new edict appeared by which all judges and doctors were summoned to renounce the error of the uncreated word of God. In the reign of Mutawakkil the orthodox faith was restored, never to be assailed again.

In spite of these manifold activities Ma’mūn did not forget the hereditary enemy of Islam. In the years 830, 831 and 832 he made expeditions into Asia Minor with such success that Theophilus, the Greek emperor, sued for peace, which Ma’mūn haughtily refused to grant. Accordingly, he decided on marching in the following year against Amorium, and thence to Constantinople itself. He set out for Asia Minor to put himself at the head of the army, but died of a fever brought on by bathing in the chill river, Pedendon, 40m. from Tarsus, in Aug. 833, at the age of forty-eight.

Ma’mūn was a man of rare qualities, and one of the best rulers of the whole dynasty after Mansūr. By him the ascendancy of the Persian element over the Arabian was completed. Moreover, he began to attract young Turkish noblemen to his court, an example which was followed on a much larger scale by his successor and led to the supremacy of the Turks at a later period

8. **Reign of Mu‘tasim.**—Abū Isḥāq al-Mu‘taṣim had for a long time been preparing himself for the succession. Every year he had bought Turkish slaves, and had with him in the last expedition of Ma’mūn a bodyguard of 3,000. Backed by this force he seems to have persuaded the ailing caliph to designate him as his successor. He made his public entry into Baghdad on Sept. 20, 833.

Mu‘taṣim wanted officers for his bodyguard. Immediately after his coming to Baghdad, he bought all the Turkish slaves living there who had distinguished themselves. But the excesses of his Turkish soldiery so stirred up the anger of the inhabitants of Baghdad, that he resolved to move the capital, and having bought in 834 territories at Sāmarrā, a small place situated a few leagues above Baghdad, he established himself there in 836. This resolution of Mu‘taṣim was destined to prove fatal to his dynasty; for it placed the caliphs at the mercy of their praetorians In fact, from the time of his son, Wāthiq, the Caliphate became the plaything of the Turkish guard, and its decline was continuous

Mu‘taṣim was faced with the difficult task of suppressing the revolt of Bābak al-Khurramī in Azarbaijan. The Khurrami were not really Muslims, but Persian Mazdaqites, or communists Their object was to abolish Islam and to restore "the white religion." During the civil war their power was steadily increasing, and spread not only over Azarbaijan, but also over Media (Jabal) and Khurasan. The numerous efforts of Ma’mun to put them down had been all in vain, and they were now in alliance with the Byzantine emperor. Therefore, in the year 835, Mu‘taṣim made Afshin, a Turkish prince, governor of Media, with orders to take the lead of the war against Bābak. After three years' fighting, Bābak was taken prisoner, carried to Sāmarrā, and put to death.

In the hope of creating a diversion in Bābak's favour, Theophilus in 837 fell upon and laid waste the frontier town of Zibatra. There and in several other places he took a great number of prisoners, whom he mutilated. The news arrived just after that of the capture of Bābak, and Mu‘taṣim swore to take exemplary vengeance. He assembled a formidable army, penetrated into Asia Minor, and took the city of Amorium, where he gained rich plunder.

Mu‘taṣim had just returned to Sāmarrā when a serious revolt broke out in Ṭabaristān, which was suppressed with great difficulty. Mu‘taṣim died a year later, in Jan. 842.

9. **Reign of Wâthiq.**—His son Wāthiq, who succeeded, though not in the least to be compared with Ma’mūn, had yet in common with him a thirst for knowledge and an intolerant adherence to the doctrine of the created Qur’ān. He carried his zeal to such a point that, on the occasion of an exchange of Greek against Muslim prisoners in 845, he refused to receive those Muslim captives who would not declare their belief that the Qur’ān was created. The only other event of importance in the reign of Wāthiq was a rising of the Arabian tribes in the environs of Medina, which the Turkish general, Boghā, with difficulty repressed. When he reached Sāmarrā with his prisoners, Wāthiq had just died (Aug. 846). That the predominance of the praetorians was already established is clear from the fact that Wāthiq gave to two Turkish generals, Ashnās and Itākh respectively, the titular but lucrative supreme government of all the western and all the eastern provinces. In his days the soldiery at Sāmarrā was increased by a large division of Africans (Maghribīs).

10. **Reign of Mutawakkil.**—Wāthiq was succeeded by his brother Ja‘far, who at his installation adopted the name of *al-Mutawakkil ‘ala’llah* ("he who trusts in God").

One of the first acts of Mutawakkil was the release of all those who had been imprisoned for refusing to admit the dogma of the created Qur’ān, which was declared heresy; therewith began a persecution of all the adherents of that doctrine and other Mu‘tazilite tenets. Orthodoxy triumphed, never again to lose its place as the State religion. Hand in hand with these reactionary measures came two others, one against Jews and Christians, one against the Shi‘ites. Mutawakkil, in 850, formulated an edict by which these sectaries were compelled to wear a distinctive dress and to distinguish their houses by a figure of the devil nailed to the door, excluding them at the same time from all public employments, and forbidding them to send their children to Muslim schools. He showed his hatred for the Shi‘ites by causing the mausoleum erected over the tomb of Ḥusayn at Karbala, together with all the buildings surrounding it, to be levelled to the ground and the site to be ploughed up, and by forbidding anyone to visit the spot.

In the year 848–849 a revolt broke out in Azerbaijan and another, in 851–852, in Armenia. The annual raids of Muslims and Greeks in the border districts of Asia Minor were attended with alternate successes, though on the whole the Greeks had the upper hand. In 856 they penetrated as far as Amid (Diyārbakr), and returned with 10,000 prisoners. But in the year 859 the Greeks suffered a heavy defeat with losses of men and cattle, the emperor, Michael, himself was in danger, whilst the fleet of the Muslims captured and sacked Antalia. This was followed by a truce and an exchange of prisoners in the following year.

In 855 a revolt broke out in Homs (Emesa), where the harsh conditions imposed by the caliph on the Christians and Jews had caused great discontent. It was repressed after a vigorous resistance. A great many leading men were flogged to death, all churches and synagogues were destroyed and all the Christians banished.

About this time Sijistan liberated itself from the supremacy of the Tāhirids. Ya‘qūb b. Layth al-Ṣaffār proclaimed himself amīr of that province in the year 860, and was soon after confirmed in this dignity by the caliph.

In 858 Mutawakkil, hoping to escape from the arrogant patronage of the Turkish guard, contrived to enrol in his service nearly 12,000 men, for the greater part Arabs, in order to crush the Turks. The day had been fixed on which Muntaṣir, Waṣīf and several other Turkish generals were to be assassinated. But Waṣīf and Muntaṣir had been informed, and resolved to anticipate him. In the night before Dec. 10, 861, Mutawakkil was murdered.

11. **Reign of Muntasir.**—On the very night of his father's assassination Muntaṣir had himself proclaimed caliph. He was a man of very feeble character, and a mere puppet in the hands of his vizier and the Turkish generals. He died six months after, by poison, it is said.

12. **Reign of Musta‘în.**—The Turkish soldiery, now the chief power in the State, chose in succession to Muntaṣir, his cousin, Aḥmad, who took the title of *al-Musta‘īn billāh* ("he who looks for help to God"). In the reign of this feeble prince the Greeks inflicted serious losses on the Muslims in Asia Minor. In 865 the caliph's brother, Mu‘tazz, was proclaimed caliph at Sāmarrā. A terrible war ensued; Musta‘īn was obliged to abdicate, and was killed in the following year.

In 864 a descendant of ‘Alī, named Ḥasan b. Zayd, gained possession of Tabaristān and occupied the great city of Rayy near Teheran. A year later the province was reconquered by the Ṭāhirid governor of Khurasan, so that Ḥasan was obliged to retreat for refuge to the land of the Dailam. But he returned soon, and after many reverses ruled over Tabaristān and Jurjān for many years.

13. **Reign of Mu‘tazz.**—Mu‘tazz, proclaimed caliph at Baghdad in Jan. 866, devoted himself to the object of freeing himself from the omnipotent Turkish generals, especially Waṣīf and Boghā, who had opposed his election. But such a task demanded an ability and energy which he did not possess. He was obliged to grant them amnesty and to recall them to Sāmarrā. But a more difficult problem was the payment of the Turkish, Persian and African guards, which was said to have amounted in A.H. 252 to 200,000,000 dirhems (about £6,500,000), or apparently twice the revenue derived from the land-tax. As the provincial revenues annually decreased, it became impossible to pay this sum. Upon a further demand, Mu‘tazz, having failed to procure the money, was seized upon and tortured, and died of starvation in prison (July 868).

The dismemberment of the empire continued fast in these years, and the caliph was compelled to recognize the virtual independence of the governors Ya‘qūb the Saffārid (*see* SAFFĀRIDS and PERSIA, HISTORY, § B) in Sīstān, and Aḥmad b. Ṭūlūn in Egypt.

14. **Reign of Muhtadî.**—Immediately after the seizure of Mu‘tazz, the Turks proclaimed as caliph one of the sons of Wāthiq with the title of *al-Muhtadī billāh* ("the guided by God"), who, however, refused to occupy the throne until his predecessor had solemnly abdicated. Muhtadī, who was a man of noble and generous spirit and had no lack of energy, began by applying the precarious measure of power which was left him to the reform of the court. He devoted himself to the administration of justice, and gave public audiences to the people for the redress of their grievances, and endeavoured to break the supremacy of the Turks and other mercenaries. But Muhtadī came too late, and the Turks did not leave him time to finish his work. The soldiery he had gained over for himself were not strong enough. Muhtadī was overwhelmed and killed by the Turks (June 870).

15. **Reign of Mu‘tamid.**—A son of Mutawakkil was brought out of prison to succeed his cousin, and reigned for 23 years under the name of *al-Mu‘tamid-‘ala’llāh* ("he whose support is God"). During his reign the Ṭāhirids were crushed in 873 by Ya‘qūb the Saffārid, whose short-lived empire in 900 passed into the hands of the Sāmānids, who had been governors of Transoxiana from the time of Ma’mūn, and after the fall of the Ṭāhirids, had been confirmed in this office by the caliph. After 900 they were independent princes, and under their dominion these districts attained to high prosperity.

Mu‘tamid had also to deal with a rising of the negro slaves in the province of Baṣra; it lasted from 869 to 883, and tasked the Government to its utmost. He died in Oct. 892. The seat of the Caliphate had already been restored to Baghdad.

16. **Reign of Mu‘taḍid.**—Mu‘taḍid may be called, after Manṣur, the most able and energetic of all the Abbasid rulers. He took good care of the finances, reformed the administration,

was an excellent commander in war, and maintained order as far as possible.

Almost simultaneously with the rising of the Negro slaves in Baṣra there arose in the province of Kūfa the celebrated sect of the Carmathians (*q.v.*), Fātimites or Ismā‘ilites. The founder of a Carmathian state in Bahrein, the north-eastern province of Arabia (actually called Lahsā) in the year 900 routed an army sent against him by Mu‘taḍid.

Mu‘taḍid died in March 902 leaving the Caliphate to his son.

17. **Reign of Muqtafī.**—Muqtafī inherited his father's intrepidity, and seems to have had high personal qualities, but his reign of six years was a constant struggle against the Carmathians. But, to avenge their defeat, they lay in wait for the great pilgrim caravan on its return from Mecca in 906 and massacred 20,000 pilgrims, making an immense booty. This horrible crime raised the whole Muslim world against them.

The war with the Byzantines was conducted with great energy during the reign of Muqtafī, and the dominion of the Tūlūnids in Egypt was overthrown.

18. **Reign of Muqtadir.**—The sudden death of Muqtafī in Aug. 908 was a fatal blow to the prestige of the Caliphate, for the new caliph, his brother, *al-Muqtadir billāh* ("the powerful through God") was only 13 years of age when he ascended the throne, and allowed himself to be governed by his mother and her ladies and eunuchs. The 24 years of Muqtadir's reign are a period of rapid decay. The most important event in the reign was the foundation of the Fātimite dynasty, which reigned first in the Maghrib and then in Egypt for nearly three centuries. (*See* FATIMITES and EGYPT: *History: Mohammedan Period.*)

Far more dangerous, however, for the Caliphate of Baghdad at the time were the Carmathians of Bahrein. In 923 they took and ransacked Baṣra; in the first month of the following year the great pilgrim caravan on its return from Mecca was overpowered; 2,500 men perished, while an even larger number were made prisoners and brought to Lahsā, the residence of the Carmathian princes, together with an immense booty. Then Kūfa underwent the fate that had befallen Baṣra.

In 926 the caravan was allowed to pass on payment of a large sum of money. The Government of Baghdad resolved to crush the Carmathians, but a large army was utterly defeated in 927 and Baghdad was seriously threatened. Next year Mecca was taken and plundered; even the sacred Black Stone was transported to Lahsā, where it remained till 950, when by the express order of the Imām, the Fātimite caliph, it was restored to the Ka‘bah. Muqtadir fell in battle against a rebel commander in Oct. 932 at the age of 38 years. His reign, which lasted almost 25 years, was in all respects injurious to the empire.

19. **Reign of Qāhir.**—A brother of Muqtadir, named Qāhir, succeeded him; he was a drunkard, and derived the money for his excesses from promiscuous confiscation. In April 934 he was dethroned and blinded, and died in poverty seven years later.

During the last years of Muqtadir and the reign of Qāhir a new dynasty rose in the north of Persia, the Būyids. (*See* PERSIA: *History.*)

20. **Reign of Rāḍī.**—Muqtadir's son, who was then proclaimed caliph under the name of *ar-Rāḍī billāh* ("the content through God"), was pious and well-meaning, but inherited only the shadow of power. He created the office of Amīr al-Umarā, which nearly corresponds to that of Mayor of the Palace among the Franks. The empire was by this time practically reduced to the province of Baghdad; Khurasan and Transoxiana were in the hands of the Sāmānids, Fārs in those of the Būyids; Kirman and Media were under independent sovereigns; the Hāmdānids possessed Mesopotamia; the Sājids Armenia and Azerbaijan; the Ikshīdites Egypt; as we have seen, the Fātimites Africa, the Carmathians Arabia.

21. **Reign of Muttaqī.**—Rāḍī died in Dec. 940. Another son of Muqtadir was then proclaimed caliph under the name of *al-Muttaqī billāh* ("he who guards himself by God"). At the time of his accession the Amīr al-Umarā was the Turkish general, Bajkam. Unfortunately Bajkam died soon after, and his death was followed by general anarchy. A certain Barīdī, who had carved out for himself a principality in the province of Baṣra, laid siege to Baghdad, and Muttaqī fled to the Hāmdānid, prince of Mosul, who then marched against Baghdad, and succeeded in repelling Barīdī. In return he obtained the office of Amīr al-Umarā. But the Dailamite and Turkish soldiery did not suffer him to keep this office longer than several months. Tūzūn, a former captain of Bajkam, compelled him to return to Mosul and took his place. Muttaqī fled again to Mosul and thence to Rakka. Tūzūn found means to entice him to his tent, and had his eyes put out (Oct. 944).

22. **Reign of Mustakfī.**—As successor Tūzūn chose *al-Mustakfī billāh* ("he who finds full sufficiency with God"), a son of Muktafi. This prince, still more than his predecessors, was a mere puppet. One of the Būyid princes marched about this time against Baghdad, which he entered in Dec. 945 and was acknowledged by the caliph as legal sovereign, under the title of sultan He assumed at this time the name of Mu‘izz addaula. Mustakfī was soon weary of this new master, and plotted against him. At least Mu‘izz addaula suspected him and deprived him of his eyesight (Jan. 946). There were thus in Baghdad three caliphs who had been dethroned as well as blinded, namely, Qāhir, Muttaqī and Mustakfī.

23. **Reign of Muṭī‘.**—Mu‘izz addaula's choice fell on a son of Muqtadir, who took the title of *al-Muṭī‘ billāh* ("he who obeys God"). The sultan, reserving to himself all the powers and revenues of the Caliphate, allowed the caliph merely a secretary and a pension of 5,000 dirhems a day. Muṭī‘ was compelled to abdicate in Aug. 974.

24. **Reign of Ṭa'i‘.**—Muṭī‘ left the empty title of caliph to his son *al-Ṭā' i‘ li-amri'llāh* ("the obedient to the command of God"). Under ‘Aḍud addaula the power of the Būyids reached its zenith. His empire stretched from the Caspian to the Persian sea, and in the west to the eastern frontier of Syria. But after his death in the year 983 his sons fought one against the other. In 990 the youngest of them, Bahā addaula, had the upper hand, and wishing to deprive the caliph Ṭā'i‘ of his possessions, compelled him to abdicate (A.D. 991).

25. **Reign of Qādir.**—A grandson of Muqtadir was then made caliph under the name of *al-Qādir billah* ("the powerful through God"). During this Caliphate the Būyid princes were in continual war with one another. Meanwhile events were preparing the fall of their dynasty. In 961 a Turkish general of the Sāmānids had founded for himself a principality in Ghazni, and one of his successors, Maḥmūd, conquered the whole of Khurasan and Sijistān, with a great part of India. He then attacked the Būyids, and would have destroyed their dynasty but for his death in the year 1030. Qādir died in Nov. 1031.

26. **Reign of Qa'im.**—He was succeeded by his son, who at his accession took the title of *al-Qā'im bi-amri' llah* ("he who maintains the cause of God"). During the first half of his long reign took place the development of the power of the Seljuk Turks. In 1038 Tughril Beg, their chief, beat the army of the Ghaznavids and made his entry into Nishapur. Thenceforth his progress was rapid. (*See* SELJUKS.) The situation in Baghdad had become so desperate that the caliph called Tughril to his aid This prince entered Baghdad in Dec. 1055, and overthrew finally the dynasty of the Būyids. In 1058 he received from the caliph the title of "King of the East and West"; he was succeeded by his nephew, Alp Arslan, who died in 1072. Qā'im died two years later, April 1075.

27. **Reign of Muqtadī.**—In the first year of the Caliphate of *al-Muqtadī bi-amri' llāh* ("he who follows the orders of God"), a grandson of Qā'im, the power of the Seljuk empire reached its zenith. All the eastern provinces, a great part of Asia Minor Syria with the exception of a few towns on the shore, the main part of West Africa acknowledged the caliph of Baghdad as the Imām. Yemen had been subjected, and at Mecca and Medina his name was substituted in the public prayers for that of the Fātimite caliph. But after the death of Malik Shah a contest for the sultanate took place; the day after his son, Barkiyāroq entered Baghdad in triumph (Feb. 1094) the caliph died suddenly, apparently by poison.

28. **Reign of Mustaẓhir.**—*Al-Mustaẓhir billāh* ("he who seeks to triumph through God"), son of Muqtadī, was only 16 years old when he was proclaimed caliph. His reign is memorable chiefly for the growing power of the Assassins (*q.v.*) and for the first crusade. (*See* Crusades.) After the death of Barkiyāroq in Nov. 1104, his brother, Muḥammad, reigned till April 1118. His death was followed about four months later by that of Mustaẓhir.

29. **Reign of Mustarshid.**—*Al-Mustarshid billāh* ("he who asks guidance from God"), who succeeded his father in Aug. 1118, distinguished himself by a vain attempt to re-establish the power of the caliph. In 1135 he was assassinated.

30. **Reign of Rāshid.**—*Al-Rāshid billāh* ("the just through God") tried to follow the steps of his father. But the Seljuk sultan, Mas'ūd took Baghdad and had Rāshid deposed (Aug. 1136). Rāshid escaped, but was murdered two years later.

31. **Reign of Muqtafī.**—His successor *Al-Muqtafī li-amri'llāh* ("he who follows the orders of God"), son of Mustaẓhir, had better success. He was real ruler not only of the district of Baghdad, but also of the rest of 'Irāq, which he subdued by force. He died in March 1160. Under his reign the central power of the Seljuks was rapidly sinking. In the west, Zengī, the prince of Mosul, had extended his dominion over Mesopotamia and the north of Syria, where he had been the greatest defender of Islam against the Franks. At his death in 1146, his noble son, Nūraddīn, continued his father's glorious career.

32. **Reign of Mustanjid.**—*Al-Mustanjid billāh* ("he who invokes help from God"), the son of Muqtafī, enlarged the dominion of the Caliphate by making an end to the State of the Mazyadites in Hillah. The greatest event towards the end of his Caliphate was the conquest of Egypt by the army of Nūraddīn, the overthrow of the Fātimite dynasty, and the rise of Saladin. He was killed by his major-domo in Dec. 1170.

33. **Reign of Mustaḍī.**—His son and successor *al-Mustaḍī bi-amri'llāh* ("he who seeks enlightenment by the orders of God"), though in Egypt his name was now substituted in public prayers for that of the Fātimite caliph, was unable to obtain any real authority. By the death of Nūraddīn in 1174 Saladin's power became firmly rooted. Mustaḍī died in the month of March 1180.

34. **Reign of Nāṣir.**—Quite a different man from his father was his successor *al-Nāṣir li-dīni'llāh* ("he who helps the religion of God"). During his reign Jerusalem was reconquered by Saladin on Oct. 2, 1187. Nāṣir was very ambitious; he had added Khūzistān to his dominions, and desired to become also master of Media. Here, however, he came into conflict with the then mighty prince of Khwārizm (Khīva), and invoked the help of the Mongols against him. When Nāṣir died (Oct. 1225), the eastern provinces of the empire had been trampled down by the Mongol hordes under Jenghiz Khān, the towns burned, and the inhabitants killed without mercy.

35. **Reign of Ẓāhir.**—*Al-Ẓāhir bi-amri'llāh* ("the victorious through the orders of God") died within a year after his father's death, in July 1226.

36. **Reign of Mustanṣir.**—*Al-Mustanṣir billāh* ("he who asks help from God") was caliph till his death in Dec. 1242. In 1227 Jenghiz Khān died, but the Mongol invasion continued to advance with immense strides.

37. **Reign of Musta'ṣim.**—*Al-Musta'ṣim billāh* ("he who clings to God for protection"), the last caliph of Baghdad, was a narrow-minded, irresolute man, guided, moreover, by bad counsellors. In Jan. 1256 Hūlāgū, the brother of the great khān of the Mongols, crossed the Oxus, and began by destroying all the strongholds of the Ismā'īlīs. In Jan. 1258 Hūlāgu arrived under the walls of Baghdad. Musta'ṣim was obliged to surrender and came with his retinue into the Mongol camp. The city was then given up to plunder and slaughter; the caliph, after having been compelled to bring forth all the hidden treasures of the family, was killed with two of his sons and many relations. With him expired the eastern Caliphate of the Abbasids, which had lasted 524 years, from the entry of Abu'l-'Abbās into Kūfa.

In vain, three years later, did Abu'l-Qāsim Aḥmad, a scion of the race of the Abbasids, who had taken refuge in Egypt with Baybars the Mameluke sultan, and who had been proclaimed caliph under the title *al-Mustanṣir billāh* ("he who seeks help from God"), make an effort to restore a dynasty which was now for ever extinct. At the head of an army he marched against Baghdad, but was defeated and killed before he reached that city. Then another descendant of the Abbasids, who also had found an asylum in Egypt, was proclaimed caliph at Cairo under the name of *al-Ḥākim bi-amri'llāh* ("he who decides according to the orders of God"). His sons inherited his title, but, like their father, remained in Egypt without power or influence. (*See* Egypt: *History: Mohammedan Period.*) This shadow of sovereignty continued to exist till the conquest of Egypt by the Turkish sultan, Selim I., who deposed the last of them, Mutawakkil. (*See* Turkey: *History.*) He died at Cairo, a pensionary of the Ottoman Government, in 1538.

There has been much diversity of opinion in the Muslim world on the subject of the Caliphate since the 1st century of the Muhammadan era, but only one theory—that of Sunni orthodoxy—has obtained more than temporary or local realization. (*See* Islamic Institutions.) This theory of the Sunni Caliphate grew out of the actual political facts connected with the establishment of the vast Arab empire stretching from the shores of the Atlantic to Transoxiana; it assumed that all believers would always live under one Muslim ruler, who would be of the tribe of Quraysh (to which the Prophet himself had belonged), and for nearly nine centuries the caliph was actually a Qurayshite. But the empire remained undivided for little more than a century, and broke up into a number of independent states; so that by the 10th century the authority of the caliph in Baghdad hardly extended beyond the walls of that city, and he himself was a puppet in the hands of his Turkish mercenaries. The theory, however, survived its failure to realize itself and even independent monarchs recognized the caliph as the source of all authority, and would apply to him for a diploma of investiture or a title of honour, in order that their position might be legitimatized and the tender consciences of their subjects satisfied. After the last Abbasid caliph in Baghdad was put to death by the Mongols in 1258, a shadowy continuation of the dynasty was set up in Cairo under the protection of the Mameluke sultans and, though the caliph was now powerless to exercise any influence on political affairs, he was still regarded in popular sentiment as the only legitimate source of authority, and requests still came for titles and diplomas from independent princes. On the other hand, particularly after the Mongol conquests, a new theory of sovereignty was devised by the Muslim legists, who began to represent the authority of the ruler as derived directly from God Himself, "Who giveth the kingdom to whomsoever He wills, and raiseth whomsoever He wills to honour." No authorization, therefore, from the caliph was any longer held to be necessary, and the legists impressed the duty of obedience to any ruler who had established his position by force of arms.

Development from 13th Century.—Accordingly from the latter part of the 13th century onwards, independent sultans—Maghrebins, Indians, Seljuks and even Turkomans and Shaybanids— began to assume to themselves the title of caliph in addition to other high-sounding titles, and this title, which in earlier ages had been considered to be the exclusive prerogative of one supreme sovereign, now came to be applied to any number of princes, some of whom were persons of quite insignificant status. The rising power of the Ottoman sultans naturally fell in with prevailing fashion, and we accordingly find that the title Khalīfah was applied as early as 1362 to Murād I., and afterwards to each one of his descendants on the Ottoman throne. There is, therefore, no justification for the legend that the first of the Ottoman sultans to assume this title was Selim I., and still less historical evidence is there for the story that after his occupation of Cairo in 1517 the dignity of the caliph was transferred to him by the last of the Abbasid caliphs, Mutawakkil. This legend was first put forward in 1787 by D'Ohsson and passed unchallenged from one European history to another, and was adopted by Turkish writers also, and in modern times it became a commonplace in the propagandist literature of the Muhammadan world in support of the Ottoman claim to the

Caliphate. As the Ottoman conquests extended the boundaries of their enormous empire, it became clear that the Turkish sultan was the only Muhammadan monarch possessing territories, power and wealth commensurate with the dignity of so exalted a title, and the same halo of glory gathered round Constantinople as in former centuries had been associated with the cities of Damascus and Baghdad.

The Ottoman Diplomacy.—The Ottoman sultans do not appear to have attached much importance to the title of Khalifah until in the 18th and 19th centuries Turkish diplomatists found it convenient in their relations with Christian Powers to make use of the false analogy current in Europe between the caliph and the pope, and to claim for the sultan spiritual authority over Muslims who were not actually his subjects. Abdul Hamīd II. (1876–1908) especially emphasized this claim, and from the outset of his reign endeavoured to obtain recognition of himself as caliph by sending emissaries to Egypt, Tunis, India, Afghanistan, Java and China. His deposition in 1908 did not entail the abandonment of this policy, and in the treaties made between the new constitutional Government in Turkey and the States which between 1908 and 1913 annexed territories formerly provinces of the Turkish empire, *e.g.*, Bosnia, Hercegovina, Libya, Bulgaria and Macedonia, it was stipulated (in regard to the first three) that the name of the sultan should continue to be mentioned in the public prayers as caliph, and that in all of them the appointment of Muslim ecclesiastics should be authorized by the Shaykh al Islam in Constantinople.

When Turkey entered into the World War in 1914 a further attempt was made to make political use of the Turkish claim to the Caliphate by the proclamation of a Jihād in which all Muslims were called upon to fight in defence of the Khalīfah and were threatened with the punishment of hell if they supported his enemies. The lack of response to this appeal revealed the unreality of this assumption of authority, but many Muslims, especially in India, were undoubtedly distressed at the fact of hostilities between Turkey and the Governments under which they themselves lived, and after the Armistice in 1918 much sympathy was aroused for the Caliphate, and fears were expressed lest the terms of peace should cripple the power of Turkey.

Abolition of Sultanate and Caliphate.—In Nov. 1922 the National Assembly declared a republic and abolished the Sultanate; Muhammad VI. was deposed and his cousin, Abdul Mejid, elected Khalīfah of all the Muslims, but the exact nature of his functions had not been clearly defined before he was sent into exile in March 1924 and the Ottoman Caliphate abolished altogether. A few days later King Husayn of the Hijaz was proclaimed caliph in Mecca and Transjordan, and received some recognition also in Palestine and Syria; but in the following October he abdicated, just before the victorious Wahhabis entered Mecca. All three of these claimants have since died, and the recognition paid to any holders of this title is merely local, *e.g.*, the sherif of Morocco is regarded as caliph by his own subjects. and four petty chiefs in the Malay archipelago enjoy the title.

Future of the Caliphate.—Meanwhile the problem that faces the Muslim world is being much discussed. The orthodox Sunni legists maintain that the Muslim world must always have a Khalīfah as head of the community, and those in sympathy with this view held an international Caliphate Congress in Cairo in May 1926; but no practical conclusion was arrived at. The number of those Muslim theologians who brave orthodox opinion by declaring that there is no longer any need for such an institution, is small; but, outside theological circles, there is a growing readiness to accept the altered circumstances of the case.

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CALIVER, a firearm used in the 16th century. The word is an English corruption of "calibre," and arises from the "arquebus of calibre," that is, of standard bore, which replaced the older arquebus. "Caliver," therefore, is practically synonymous with "arquebus." The heavier musket, fired from a rest, replaced the caliver or arquebus towards the close of the century.

CALIXTUS or CALLISTUS, the name of three popes.

CALIXTUS I., pope from 217 to 222, was little known before the discovery of the book of the *Philosophumena*. From this work which is in part a pamphlet directed against him, we learn that Calixtus was originally a slave and engaged in banking. Falling on evil times, he was brought into collision with the Jews, who denounced him as a Christian and procured his exile to Sardinia. On his return from exile he was pensioned by Pope Victor, and, later, was associated with Pope Zephyrinus in the government of the Roman Church. On the death of Zephyrinus (217) he was elected in his place and occupied the papal chair for five years. His theological adversary Hippolytus, the author of the *Philosophumena*, accused him of having favoured the modalist or Patripassian doctrines and of certain relaxations of discipline. Calixtus died in 222. In the time of Constantine the Roman Church reckoned him officially among the martyr popes. (L. D.)

CALIXTUS II. (d. 1124), pope from 1119 to 1124, was Guido, a member of a noble Burgundian family, who became archbishop of Vienne about 1088, and belonged to the party which favoured reform in the Church. In Feb. 1119 he was chosen pope at Cluny, succeeding Gelasius II., and in opposition to the anti-pope Gregory VIII., who was in Rome. Soon after his consecration he opened negotiations with the emperor Henry V., to dispose of the dispute over investiture. Terms of peace were arranged, but at the last moment difficulties arose and the treaty was abandoned; and in Oct. 1119 both emperor and anti-pope were excommunicated at a synod held at Reims. The journey of Calixtus to Rome early in 1120 was a triumphal march. He was received with great enthusiasm in the city, while Gregory having fled to Sutri, was delivered into his hands and treated with great ignominy. Through the efforts of some German princes negotiations between pope and emperor were renewed, and the important Concordat of Worms made in Sept. 1122 was the result. He died in Rome on Dec. 13 or 14, 1124.

See M. Maurer, *Pabst Calixt II.* (Munich, 1889); U. Robert, *Histoire du pape Calixte II.* (Paris, 1891); and A. Hauck's *Realencyklopädie*, Band iii. (Leipzig, 1897).

CALIXTUS III. (*c.* 1378–1458), pope from 1455 to 1458, was a Spaniard named Alphonso de Borgia, or Borja. A native of Xativa, he gained a great reputation as a jurist, becoming professor at Lerida; in 1429 he was made bishop of Valencia, and in 1444 a cardinal, owing his promotion mainly to his close friendship with Alphonso V., king of Aragon and Sicily. Chosen pope in April 1455, he endeavoured fruitlessly to organize a crusade Calixtus became involved in a quarrel with his former friend, Alphonso of Aragon, now also king of Naples, and after the king's death in June 1458 he refused to recognize his illegitimate son, Ferdinand, as king of Naples, asserting that this kingdom was a fief of the Holy See. Notorious for nepotism, he was responsible for introducing his nephew, Rodrigo Borgia, afterwards Pope Alexander VI., to Rome He died on Aug 6, 1458.

See A. Hauck's *Realencyklopädie*, Band iii. (Leipzig, 1897).

CALIXTUS, GEORG (1586–1656), Lutheran divine, was born at Medelbye, Schleswig, on Dec. 14, 1586. After studying philology, philosophy and theology at Helmstedt, Jena Giessen, Tübingen and Heidelberg, he travelled through Holland, France and England, where he became acquainted with the leading reformers. On his return in 1614 he was appointed professor of theology at Helmstedt by the duke of Brunswick, who had admired the ability he displayed when a young man in a dispute with the Jesuit Augustine Turrianus. Calixtus held this post for 40 years, and made Helmstedt a centre of reasonableness in an age of bitter theological controversy. He constantly pressed for a milder treatment of confessional differences, and thought that a basis for the reunion of all the churches could be found in the study of the Christian fathers. His ideas were those later advocated (also fruitlessly) by Leibnitz. In 1613 he published a book, *Disputationes de praecipuis religionis christianae capitibus*, which provoked the hostile criticism of orthodox scholars; in 1619 he published his *Epitome theologiae*, and some years later his *Theologia Moralis* (1634) and *De Arte Nova Nihusii*. Statius Buscher charged the author with a secret leaning to Romanism. Calixtus refuted the accusation of Buscher, but after the conference of Thorn (1645), a new charge was preferred against him, principally at the instance of Abraham Calovius (1612–1686), of a secret attachment to Calvinism. The disputes on the possibilities of the reconciliation desired by Calixtus known in the Church as the Syncretistic controversy, lasted during the whole lifetime of Calixtus, and distracted the Lutheran Church, till a new controversy arose with P. J. Spener and the Pietists of Halle. Calixtus died on March 16, 1656.

See E. L. T. Henke, *Georg Calixtus und seine Zeit* (1853–60); also Isaak Dorner, *Gesch. d. protest. Theol.* pp. 606–624; and especially Herzog Hauck, *Realencyklopädie*.

CALL. A term used on the English and American stock exchanges for a contract by which, in consideration of a certain sum, an "option" is given by the person making or signing the agreement to another named therein or his order or to bearer, to "call" for a specified amount of stock at a certain day for a certain price. A "put," which is the reverse of a "call," is the option of selling (putting) stock at a certain day for a certain price. A combined option of either calling or putting is termed a "straddle," and sometimes on the American stock exchange a "spread-eagle."

The word is also used in connection with joint-stock companies, to signify a demand for instalments due on shares, when the capital of the company has not been demanded or "called" up at once. (*See* OPTIONS.)

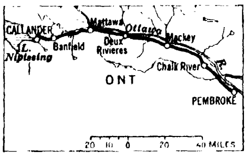
CALLA, a genus of the arum family (Araceae), comprising only one species (*C. palustris*), known as arum lily, water arum or wild calla, found widely in wet places in cool north temperate and subarctic regions. It is a handsome plant, with heart-shaped leaves, showy white flowering spathes and a fruit cluster of brilliant red berries. The well-known calla or calla lily of the gardeners is a species of *Zantedeschia*.

CALLABLE, a term relating to securities, meaning that the issuer retains the right to call in, repay, or redeem them under specified conditions. Callable or redeemable stock is that upon which the issuing company has retained the option, under the conditions and upon the terms specified in its certificate of incorporation, of redeeming it or buying it back from the stockholders. Callable or redeemable bonds are those which by the terms of their issue may be called for redemption by the issuing company before the date of their maturity.

CALLAGHAN, SIR GEORGE ASTLEY (1852–1920). British admiral, was born in London on Dec. 21, 1852, the son of an army captain, and entered the navy in 1866. He was promoted captain while on service on the China station in 1894, and was then (1894–97) naval adviser to the inspector of fortifications at the War Office. He was in command of the "Endymion" on the China station at the time of the Boxer rising in 1900, and commanded the naval brigade which entered Peking. He held various other important commands in the years 1900–14 and for the three years immediately before the World War was commander-in-chief of the home fleets, which he brought to a high state of efficiency and readiness. Callaghan was commander-in-chief at the Nore (Jan. 1915–March 1918), and was promoted admiral of the fleet in 1917. He died in London on Nov. 23, 1920.

CALLANDER, a small burgh, Perthshire, Scotland, 16 mi. N.W. of Stirling by the L.M.S.R. Pop. (1938), 1,484. Situated on the north bank of the Teith, here crossed by a three-arched bridge, and sheltered by a ridge of wooded hills, it is in repute as a health resort, and there is a large hydro on the south side of the river. A mile and a half northeast are the Falls of Bracklinn (Gael. "white-foaming pool"), while 2 mi. N.W. is the Pass of Leny. Callander owes much of its prosperity to the fact that it is the centre from which the Trossachs is usually visited, the route being that described in Scott's *Lady of the Lake*. The ascent of Ben Ledi is commonly made from the town. Loch Katrine, about 9 mi. distant, is the source of Glasgow's water supply.

CALLANDER-PEMBROKE ROAD, a highway beginning at Pembroke on the Ottawa river and ending at Lake Nipissing in the province of Ontario, Canada. It forms part of the Trans-Canada highway and is about 140 mi. in length, improved throughout. It passes through Algonquin Provincial park, which is notable as a hunting and fishing region, while Chalk River, Mackey and Mattawa also lie in its path.



CALLANDER-PEMBROKE ROAD

CALLAO, a city, chief port and constitutional province of Peru. Pop. (1940) 84,438, 71,-217 of whom were in the city. The province (area 14½ sq.mi.), a low peninsula south of the Rimac river, includes the city and its suburbs, Bellavista to the east, with a large Anglo-American colony, La Punta, at the western extremity of the peninsula, a bathing resort with casino, pier, hotels, private houses and naval academy, and Chucuito, between La Punta and Callao; also the islands of San Lorenzo, Frontón, Los Palominos and other islets. San Lorenzo (1 by 4½ mi. in extent, 1,050 ft. high) has an arsenal and submarine base, Los Palominos, a revolving light with a visibility of 18 miles. Though politically and administratively a province, Callao has the standing of a department. The climate is temperate and equable, although the sky is overcast for half the year. Agricultural products include sugar, maize, fruits and vegetables for local markets. The city (12° 4′ S., 77° 13′ W.) is the port of Lima, 8½ mi. distant, with which it is connected by train, electric tramway and automobile. This section of the Central railway was opened in 1851, the first in South America. The Avenida del Progreso, built in 1924, is a modern, reinforced concrete highway.

The harbour of Callao, a bay sheltered by a tongue of land on the south (La Punta) and by San Lorenzo, is one of the best anchorages on the Pacific coast of South America. The city is south of the bay, 8 ft. above sea-level. The houses are mostly adobe, of poor design, the streets narrow and ill-paved. Recent public improvements, however—widening and paving the streets, beautifying the plazas, restoring the castle of Real Felipe (1770–75), building reservoirs to double the water-supply and new systems of sewage disposal, as well as many imposing new edifices—are fast changing the appearance of Callao. A slaughter-house and refrigerating plant, the first of its kind in Peru, was finished in 1927. It supplies meat to Lima and vicinity and handles dairy products and fruit for the local trade. Among the principal buildings are the customs-house, prefecture, post-office, court-house, barracks, churches, hospitals, markets, clubs and large commercial houses. There are five plazas with statues of national heroes. Business activities are largely connected with shipping and forwarding merchandise. As Callao handles most of the imports of the country, there are many wholesale firms, banks, steamship offices and consulates. Manufactories include flour-mills, breweries and bottling works, foundries, machine-shops.

Prior to 1928 the port of Callao was poorly equipped to handle the traffic which normally passed through it. Improvements and modernization, involving the building of breakwaters, piers, warehouses, a new customshouse and the dredging of the channel and harbour, were contracted for by a North American corporation in 1928. In 1943, two granite breakwaters, with an entrance 450 ft. wide, enclosed the inner harbour, which was dredged from the entrance to the new port works to a depth of 37 ft. Facilities for dockage consist of three separate units: the new port works, the Muelle de Darsena (old French port works), and the Dry Dock and Naval arsenal. These units form the *Terminal Maritimo*, a division of the Peruvian Ministry of Finance, but the operation of them will remain under the administration of the contracting corporation until payments have been completed. The completion in 1938 of a bulkhead (1,532 ft. long), connecting the new port works with the Muelle de Darsena, makes it possible to accommodate 11 large vessels at one time in the port. Four reinforced concrete warehouses at the new port works offer a combined covered storage space of 190,000 sq.ft., in addition to which there are more than 500,000 cu.ft. of refrigerated storage space. Dry dock facilities (1938) can accommodate vessels of 10,000 displacement tons. In 1940, 2,023 vessels with a tonnage of 2,258,000, entered the port. Chief exports are copper, cotton, ores and minerals, cottonseed cake and wool; chief imports, wheat, lumber, machinery, coal, paper, hardware, textiles and foodstuffs.

Callao has had an eventful history. Founded in 1537, two years after Lima, it was repeatedly sacked by Drake (1578) and other buccaneers. The centre of trade with Spain, it had become the richest port on the Pacific when it was destroyed by a tidal wave and earthquake in 1746 in which 6,000 persons perished. It was rebuilt and strongly fortified. Several times besieged by Spanish fleets, it was finally abandoned by Spain in 1826. A Spanish squadron which attacked it on May 2, 1866, was defeated, and Spanish claims in Peru came to an end.

CALLCOTT, SIR AUGUSTUS WALL (1779–1844), English landscape painter, was born at Kensington in 1779 and died there in 1844. His first study was music; but by the age of 20 he had determined to give up music, and had exhibited his first painting at the Royal Academy. He became R.A. in 1810, was knighted in 1827, and in 1834 was appointed surveyor of the royal pictures.

His wife, Maria, Lady Callcott (1785–1842), whom he married in 1827, was a daughter of Admiral Dundas and widow of Captain Thomas Graham, R.N. (d. 1822). She published accounts of her visits to India (1812) and to the environs of Rome (1820); *Memoirs of Poussin* (1820); a *History of France;* a *History of Spain* (1828); *Essays toward a History of Painting* (1836); *Little Arthur's History of England* (1836); and the *Scripture Herbal* (1842); etc.

CALLCOTT, JOHN WALL (1766–1821), English musician, brother of Sir Augustus Callcott, R.A., was born in Kensington Nov. 20, 1766, his father having been a bricklayer and builder. His reputation as a composer rests chiefly upon his concerted vocal works, such as the catch "O beauteous fair," the canon "Blessed is he" and the glee "Dull repining sons of care."

Callcott's son, William Hutchins Callcott (1807–1882), inherited to a large extent the musical gifts of his father. His song, "The last man," and his anthem, "Give peace in our time, O Lord," were his best-known compositions.

CALLENDAR, HUGH LONGBOURNE (1863–1930), British physicist, was born at Hatherop in Gloucestershire. He was educated at Marlborough and at Cambridge; he held the post of professor of physics at McGill college, Montreal (1893–98); at University college, London (1898–1902) and at the Imperial College of Science.

His work in physics is mainly on heat and thermodynamics; he has been successful in devising and carrying out accurate methods of measurement and in designing new apparatus. The electrical resistance thermometer, with the Callendar-Griffiths bridge and various recording devices used with it, was the subject of papers published in 1886–87. This was followed by his work on the electrical continuous flow calorimeter, giving a new method of measuring specific heats of liquids, which eliminates the water equivalent of the apparatus and simplifies the radiation correction; the full description was given in 1902. In addition, Callendar is responsible for a compensated air thermometer (1891) and a radio-balance (1910).

His researches on steam led to the formulation of the Callendar steam equation and the publication of *Callendar Steam Tables* (1915); *Properties of Steam and Thermodynamic Theory* (1921); *Abridged Callendar Steam Tables C. and F. Units* (1922 and 1927), and *Callendar Steam Diagram C. and F. Units* (1922). The work on steam at high pressures and temperatures is still carried forward at the direct request of steam turbine manufacturers and the Electrical Research Association. In 1925 he presented a report to the latter association on the continuous flow method of measuring the total heat of steam at high pressures. Callendar is the author of a number of papers on various subjects such as internal combustion engines, thermometric scales, radiation, vapour pressure, osmotic pressure of solutions, absolute expansion of mercury and the boiling point of sulphur. He is also responsible for Air Ministry reports and memoranda on work carried out by himself and colleagues on *Dopes and Detonation* (1926) and on the effect of anti-knock compounds on engine-knock (1927). He died in London on Jan. 21, 1930.

Callendar was a member and officer of many learned societies; he was awarded the Rumford Medal of the Royal Society in 1906 and the first Duddell Memorial Medal of the Physical Society in 1924; he received the C.B.E. in 1920.

CALLES, PLUTARCO ELÍAS (1877–1945), Mexican statesman and military leader, president of Mexico in 1924–28, born at Guaymas, Sonora, Sept. 25, 1877. Little is known of his early life, however, it is certain that almost to manhood he lived the life of the poorer class. He attended the school of his native town, where at the age of 17 years he became a teacher in the primary school. Later he became superintendent of schools in Hermosillo, and it was there that he began to show the qualities which made him an outstanding figure in Mexico. His interest in social and economic reforms caused him to join the revolutionary movement which overthrew Porfirio Díaz. In 1913 he joined the forces of Gen. Carranza in the struggle against the Huerta administration, attaining the rank of general. In the border wars of 1915 he served with Gen. Obregón in the campaigns against Villa, and in 1917 became governor of Sonora. He was minister of commerce, labour and industry under Carranza, secretary of war under the provisional government of Adolfo de la Huerta and secretary of the interior under President Obregón. In 1924, as the candidate of the Labour party, he was elected president for the four-year term ending Dec. 1, 1928. President Calles came into power pledged to continue the work begun under President Obregón: land for the peasants, work for the workers, education for the masses and legitimate profits for decent capital and honest business. The chief international problems of the administration grew out of the alien land and petroleum laws passed by the Mexican congress, at the president's request, in Dec. 1925 (*see* Mexico: *History*). Early in Jan. 1926, just as a spirited diplomatic controversy with the United States concerning these laws reached an apparent crisis, the Mexican Roman Catholic episcopate took a positive stand against the religious and educational provisions of the Constitution and thus precipitated a conflict between church and state.

Calles was succeeded in 1928 by Emilio Portes Gil, but he continued to wield powerful influence in the National Revolutionary party. It was his political support that led to the election of Gen. Lázaro Cárdenas as president in 1934. But Cárdenas entered into a violent political quarrel with Calles and exiled him in April, 1936.

Calles set up residence in San Diego, California, but returned to Mexico in May 1941 and later resumed his post in the army. He died in Mexico City on Oct. 19, 1945.

CALLIAS, tyrant of Chalcis in Euboea, wished, with the assistance of Philip of Macedon, to subdue the whole island. But, finding Philip unwilling to help him, he applied to the Athenians, though he had previously fought against them. They were persuaded by Demosthenes to make an alliance with Callias, with whose help they drove out the pro-Macedonian tyrants from Eretria and Oreus, and at Demosthenes' suggestion handed over the tribute formerly paid by the Euboic cities to Athens to a Euboic synod sitting at Chalcis (Demosthenes, *De Pace*, 58; *Ep. Philippi,* 59; Diod. Sic. XVI. 74). At the end of his life he seems to have lived at Athens, and Demosthenes proposed to grant him the citizenship (Aeschines, *Contra Ctesiph.*, 85, 87).

CALLIAS and **HIPPONICUS,** two names borne alternately by the heads of a wealthy Athenian family. During the 5th and 4th centuries B.C. the office of *daduchus* or torch-bearer at the Eleusinian mysteries was the hereditary privilege of the family. The following members deserve mention.

1. Callias, the second of the name, fought at the battle of Marathon (490). After the accession of Artaxerxes he was sent on an embassy to the Persian court (Herod vii. 151). This

visit has been connected with the Peace referred to by the orators and Diodorus as the "Peace of Callias," but the contradictory nature of their statements about its date and terms, and the silence of Thucydides, make it doubtful whether any formal peace was concluded. (*See* CIMON.) At all events Callias's mission does not seem to have been successful; he was indicted for high treason on his return and sentenced to a fine of fifty talents.

See Grote, who refers to the ancient authorities, and accepts the treaty as a historical fact, *History of Greece*, ch. xlv., Curtius, bk. iii. ch. ii., denies the conclusion of any formal treaty; *see* also Ed. Meyer, *Forschungen*, ii.; J. B. Bury in *Hermathena*, xxiv. (1898); E. M. Walker, note 3, "The Peace of Callias," in *Camb. Anc. Hist.* vol. v.

2. HIPPONICUS, son of the above. Together with Eurymedon he commanded the Athenian forces in the incursion into Boeotian territory (426 B.C.) and was slain at the battle of Delium (424).

See Thucydides iii. 91; Diod. Sic. xii. 65; Andocides, *Contra Alcibiadem*, 13.

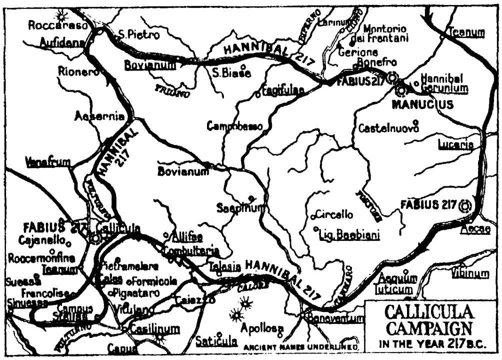
3. CALLIAS, son of the above, was notorious for his profligacy and extravagance, and was ridiculed by the comic poets (Aristophanes, *Frogs*, 420, *Birds*, 283, and schol. Andocides, *De Mysteriis*, 110–131). His house is the scene of Xenophon's *Symposium* and Plato's *Protagoras* (*Var. Hist.* iv. 23). In 392 he was in command of the Athenian hoplites at Corinth, when the Spartans were defeated by Iphicrates. In 371 he was at the head of the embassy which made the "Peace of Callias."

See Xenophon, *Hellenica*, iv. 5, vi. 3; and DELIAN LEAGUE.

CALLICRATIDAS, Spartan admiral, succeeded Lysander as admiral of the Lacedaemonian fleet in 406 B.C. He found at once that his predecessor had made his position as difficult as possible, by setting his subordinates against him and returning to Cyrus all the supplies that he held. He won over the captains by calling them together, explaining that he had been appointed their commander, and asking "Now shall I stay, or go back and report that you do not wish me to command?", but he found the necessity of coming to Cyrus for money irksome, and declared that when he got home he would do his best to reconcile Sparta with Athens. He eventually got some money from Miletus, and fitted out a new fleet of 140 sail. He captured Methymna in spite of Conon's attempt to save it, and refused to sell into slavery the prisoners he took. He then chased Conon to Mitylene, and after a successful engagement in the harbour blockaded him there. Athens sent out a fleet of 150 sail to relieve Conon, and Callicratidas left 50 ships to hold Mitylene and took 120 to meet the new fleet. In the battle of Arginusae that followed, we find a complete reversal of the old tactics, the Spartan fleet sailing one deep and aiming at the *diekplous*, while the Athenians massed their weight in the wings to defeat it. But all order was soon lost, and an individual struggle followed, in which the Spartans were defeated and Callicratidas was killed. In his honesty and straightforwardness Callicratidas was a Spartan of the old type, but with advanced Pan-Hellenic sympathies.

See Xen. *Hell.* I., vi. 1–33. Plut. *Lysander* 5–7.

CALLICULA, a historic mountain of Campania, Italy, some 4m. N.E. of Teanum (mod. Teano) (*q.v.*). After the victory of Trasimenus (*q.v.*) and the Roman failure to block Hannibal's (*q.v.*) march into Picenum at the pass of Plestia, the Carthaginian army remained at rest in Picenum for some time, and then marched along the Adriatic coast into northern Apulia, encamping first near Luceria and then near Vibinum (Bovino). The dictator, Q. Fabius Maximus, encamped near Aecae (Troia), about 6 miles away from him, and when Hannibal offered battle, wisely refused it. Hannibal, therefore, who had no supply or recruiting base, and was living from hand to mouth, crossed the Apennines for the third time in the same year (217) and marched into Campania plundering the territory of Beneventum and taking the town of Telesia on his way down the valley of the Calor (mod. Calore) and up that of the Volturnus (mod. Volturno). Leaving the latter valley near Allifae he entered Campania by the defile below the ridge of Callicula, to the north-east of the modern village of Pietravairano, and plundered the Falernian territory. Unable to bring Fabius to battle, he planned to return to Apulia with the booty he had collected by the way by which he had come, but found it blocked by Fabius. Hannibal, however, collected 2,000 of the strongest oxen among those he had captured, and after nightfall sent them off by a higher pass, crossing the ridge of Callicula in a westerly direction, with lighted torches tied to their horns, with a detachment of light troops, who had orders to make as much noise as possible. The Roman force which held the defile was completely deceived, left its position to pursue them, while Hannibal with the main body marched through the defile unhindered back to the valley of the Volturnus, and sent a detachment of light troops which successfully disengaged the light troops and the oxen.



PLAN OF CALLICULA CAMPAIGNS 217 B.C.

Hence he marched through Samnium and into the country of the Paeligni, as though he were moving towards Rome, making Fabius keep between him and the city; and then he suddenly turned back and marched eastwards to Gerunium, Apulia, which is to be placed at Colle d'Armi, on the right bank of the Fortore some 20m. E.N.E. of Luceria and the same E.S.E. of Larinum—which he captured and used as a supply base, encamping outside the town and pillaging the countryside. The Romans eventually heard where he was, came up with him and established a camp on the left bank of the river, near Calene in the territory of Larinum. Both sides then advanced their camps closer to the river, so that each lay on a hill above it, but on opposite sides. Minucius, the master of the horse, who was in command in Fabius's absence, took advantage of the fact that the greater part of the Carthaginians were on a foraging expedition to attack their camp, and very nearly took it, so that Hannibal thought it more prudent to withdraw to his old camp near Gerunium itself, while Minucius occupied the abandoned camp on the right bank. Fabius now returned from Rome, and divided the army with him, each taking two legions; the camps were 1½m. apart and that of Fabius appears to have been on the left bank of the river. Between that of Minucius and that of Hannibal there was a hill and a deep ravine, in which the latter concealed 5,000 light troops and some cavalry; he then occupied the hill at dawn with a small force, and when Minucius attacked, as he expected, he sent continual reinforcements, and when the Romans were sufficiently engaged, threw in his reserves from both wings and the rear. A catastrophe was only avoided by the intervention of Fabius with his two fresh legions, and the Carthaginians sounded the retreat, Hannibal declaring that he had beaten Minucius, but that Fabius had beaten him. He had, indeed, succeeded in living on the country, so that in the next summer he was able to win the victory of Cannae; and he had sufficient self-restraint and self-confidence to be ready to wait for a decisive battle until the circumstances were favourable to his tactics of surrounding the enemy.

See Kromayer, *Antike Schlachtfelder*, iii. 1 (Berlin, 1912) for a full description of these operations in which it is once more clear that Polybius' authority is to be preferred to that of Livy. (T. A.)

CALLIGRAPHY is the art of fine writing. Writing is a means of communication by agreed signs; if these signs or symbols are painted or engraved on wood or stone we have that extension and application of writing known as *lettering, i.e.,* a large script generally formed with mechanical aids such as the rule, compass and square. But it is the essence of handwriting that it be free from such, though not from all, government; and of beautiful handwriting that it possess style. When the agreed forms, passing through a mind sensitive to symmetry, are expressed upon vellum, paper or other suitable material by an instructed hand with an appropriate tool, the result may be a handwriting possessing style. Calligraphy may be defined as freehand in which the freedom is so nicely reconciled with order that the understanding eye is pleased to contemplate it. Hence we immediately recognize the beauty resulting from right proportion of the components to the whole of a letter, and between the parts to the whole of a word. Many scripts of the remote or recent past, such as the Rustic Capitals, Uncial, Half-Uncial, Quarter-Uncial, the Caroline Minuscule and the later Gothics, demonstrate that handwriting, though an elementary craft, is capable of infinite variations. Changes of fashion so affect the form, the cutting of the tool and the manner of holding it, that a collection of the hands employed in pre-Renaissance Europe exhibits a series of almost bewildering variations. The necessity for speed is the first great cause of variation; a second equally potent occasion lay in the use of special hands for certain purposes. In the mediaeval period, outside the monastic scriptoria where the most formal upright and deliberate text hands were written, there were several recognized classes occupied with writing such as clerks, public scriveners, public notaries and in addition certain others who were ancestors of the later professional writing-masters. Finally, there were writers of the special hands used in documents issued from the papal and other chanceries. Most of these classes, in the hope of preventing forgery, wrote hands of deliberate complexity.

The Renaissance, by its reaction from the complicated late Gothic and reversion to the simpler Caroline hands, indeed changed the writing tradition of all Europe, but not all the cisalpine countries adopted the new hands simultaneously—the tenacity, in fact, of Gothic is only in our own day being broken in its chief stronghold, Germany. Though the humanists deliberately reverted to the Caroline hand, theirs was not a barren facsimile of the 9th century letter for, since they laboured for a return to classical traditions, many scribes broke completely with the Caroline exemplars in the matter of majuscules, so that adaptations of the old Roman geometrically formed inscription letters appear upon the vellum pages of humanistic codices equally with majuscules based upon the fine Tours forms.

The Renaissance did more than merely revert to the art styles of antiquity. In its early phase it was a movement in which a limitless curiosity of the mind—the mark of the true humanist—predominated and had not yet aroused the jealousy of the church. Indeed in the early 15th century, ecclesiastics vied with secular scholars in the task of renewing art and science. To record our least legacy of that age, we make acknowledgement to the secular humanistic scribes for the fine round book letter which is the foundation of our "roman" printing; to the scriveners of the papal chancery for our running hand. In an age in which science, religion and art were the chief, and commerce a subordinate interest, these novel scripts were introduced and propagated by artists and ecclesiastics, while merchants, bankers and lawyers kept accounts and indited conveyances in a tortuous Gothic. The development of handwriting owes nothing to commerce until the next century, and then everything.

In mediaeval society it depended upon the officials of Church and State. Hands were invented and books written in accordance with liturgical, administrative and judicial requirements. Like other courts, the Roman *Curia* maintained (and maintains) a group of canon lawyers and scriveners known as the Apostolic Chancery from which were issued papal bulls, and later a more modest class of document. A small easily formed hand was[1] reserved by order of Pope Eugenius IV. (1431–47) for the engrossing of these minor documents written fast (*brevi manu*) and known as "briefs." The script itself became famous as "*cancellerresca corsiva*," chancery cursive, and in the next century printed and engraved models of it abounded.

The first works on letter formation deal with capital letters and were compiled by enthusiastic admirers of the old Latin inscriptions, like Ciriaco of Ancona, who transcribed, collated and copied all the memorials, gravestones and tablets they could discover. Andrea Mantegna introduced into his famous frescoes at the Eremitani in Padua careful renderings of certain inscriptions (since destroyed). Feliciano of Verona compiled a collection of inscriptions and dedicated it to Mantegna; and from the same scholar's hand we have (Cod. Vaticanus 538) a codex which represents the earliest extant treatise on the shapes of inscription letters. The ms. is dated 1463 and is the first to give diagrams and instructions for the geometrical formation of Roman capitals.

The earliest printed work of the kind is a modest anonymous work with an undated colophon: "*impressum Parme per Damianum Moyllum, Parmensem.*" As there are extant several mss. signed by Damiano Moille we may guess that he had a share in the authorship as well as in the printing of the alphabet. There is bibliographical evidence for concluding the date of publication to lie between 1480–83.

At about the same time the friar and mathematician Pacioli, notable as a friend of Leonardo, was busy on his *De Divina Proportione*, a treatise which included an appendix on the geometry of letter-making. The Padre's book was not printed until 1509, but existed in a finely illuminated manuscript copy much earlier, having been presented to Ludovico Sfroza (*Il Moro*) of Milan.

Fanti of Ferrara brought out in 1514 the first extension of the geometrical method to the rounded Gothic letter then greatly used for large choir-books: *Theorica et practica Perspicassimi Sigromundi de Fantis . . . De Modo Scribendi Fabricandique omnes Litterarum species* (Venice, Rubeus, 1514). The title is fuller than the contents, for Fanti gives no more than the Roman capitals in the method of Feliciano, Moille and Pacioli, plus a set of round semi-Gothic letters similarly made, which designs were roughly cut on wood by da Carpi. Whereas the models of capitals already published had been useful to architects and antiquarians and a few scribes, Fanti's small Gothic letters (lower case) of the kind then known as "modern letter" (*lettera moderna*) were serviceable to the numerous clerks in monasteries and elsewhere. Arrighi, a calligrapher from Vicenza and subsequently an assistant in the Apostolic Chancery, published in 1522 a book of models of a current correspondence hand based upon the *lettere de brevi*. This, the first of all copybooks, was entitled *Il Modo et Regola da Imparare di scriuere littera corsiua ouer cancellerescha nouamente composto per Ludovico Vicentino*. The script in this first publication of Arrighi, *scrittore de breui apostolici in Roma*, as he styles himself, is a singularly effective and beautiful combination of the neo-Caroline minuscule, slightly inclined by speed, with perpendicular majuscules reminiscent of the inscriptions, whose austerity is relieved with additional characters of a decorative form, B C D E P R N. There are also to be found flourishes, ligatures, initial and terminal letters of grace and freedom. Arrighi's fine professional hand is ornamental in comparison with the somewhat angular and pinched version of the same hand as it was officially used 50 years before. The popularity gained by the chancery script during the half-century 1470–1520 exposed it to great risks. Writers of diplomatic documents practised it with a discretion foreign to the temper of Mantegna, Cellini, da Vinci and scores of other artists, nobles and scholars who adopted it. The habit of writing "private" letters with a view to their being handed about as specimens of true Latinity developed interest in calligraphy, and with this powerful support the new cursive rapidly became the favourite correspondence script of the fashionable classes, absorbing a multitude of mannerisms which corrupted it until its original simplicity was scarcely recognizable. While in Vicentino's specimens flourished forms were offered as an occasional pleasant alternative to the rigid capital and both were modestly proportioned to the height of the ascending letters *d*, *h* and *l*, later models exhibit an irritating superfluity of display. The burin of the copper engraver produced an excessively brilliant line which tempted pupils to employ a correspondingly fine pen, so that

[1] Mas Latrie (*Trésor de Chronologie*).

the later writing of the century was dominated rather by the technique of the engraver's burin than that of the scribe's pen The first book in copper-plate is the handsome and ornate though practical, *Libro* of Hercolani, a notary of Bologna (1571).

His book is valuable as a good specimen of the late chancery hand distinguished by its decorative treatment of the ascending and descending letters. In the pure Vatican style these forms terminated in an angular serif, which existed side by side with a variety which terminated in a short blunt curve from right to left. The angular serif went out of use before 1520 and thereafter no models of the chancery hand for secular or official Vatican use recommend it.

Gradually, by means of a fine pen and a supple wrist, the originally unassuming serif was turned into the most conspicuous feature in the word—and in the page—so that a late Italian 16th century letter is almost a network of deliberately formed blots. This development may be conveniently watched in the books of Palatino, a first-rate scribe who gained great renown in Spain where he was copied by Ycia. Pens then became finer and enabled Periccioli (Siena 1610) not only to execute very delicate calligraphical *entrelac* borders but exceedingly subtle script which gained a seductive sparkle when reproduced from intaglio plates. All the Italian scripts found their way abroad; the fine early hands and their bulbous successors may be met in various parts of Europe. The Italian artists transplanted to Fontainebleau by Francis I. included a humbler rank of decorators, craftsmen and calligraphers. These found Gothic, formal and cursive, generally practised. Tory wrote an Italian hand and his *Champfleury* a plea for beautiful lettering and an elaboration of the geometrical method of making Roman capitals he had learned from Pacioli and Dürer. Gothic book hands are also given, but we have to wait a generation for a French pattern book of correspondence hands. In the books of Hamon and de la Rue we find good chancery models and a number of *Lettres de Fantaisie* (alphabets of wavy, crooked, club-footed and other similarly treated latins). *Cursive françoyse*, as current Gothic was called, always appears in the early French books. This was the letter from which the *Civilité* type was made, and which in the next generation was to be amalgamated with the Italian hand producing the elegant compromise known as "Ronde." It has a vigorous character and may rank as the French national hand, still employed to-day, but with its Gothicisms heavily diluted. Early fine Rondes are to be found in the book of Louis Barbedor (1628).

In the middle of the 17th century, Colbert, when Louis XIV.'s financial secretary, took in hand the revision of French official scripts and, in consequence, the clerks in the offices of State were instructed to abandon the old Gothic cursives and to confine themselves to the upright Ronde known as *financière,* inclined *bâtarde,* and a running form known as *coulée*.

Such changes gained effect gradually: generations of masters recommended almost non-Gothic as the "Italian hand," so great was the prestige of that name. The rise of the fine French school of portrait engraving influenced the use of Roman scripts and the opposition of Colbert left Gothic scarcely a vestigial existence by the end of the century.

To Colbert, the eminent master Senault dedicated his fine book—*Livre d'ecriture representant la beauté de tous les caractères financiers maitenant à la mode* (1660). Other French models of calligraphy circulated also in England and in Holland; French influence in England being more direct than the Italian, though there were such Italians as Petruccio Ubaldini who taught calligraphy to the English Court (*c.* 1580). Jean de Beauchesne and John Baildon's *A Booke containing divers sortes of hands,* also a "*True and just proportiõ of the capitall Romae*" (London, Thomas Vautrouillier, 1571) is the first English manual of calligraphy. Beauchesne is the same who had brought out *Le Thresor d'Escripture* in Paris (1550). Both contained admirable models; the English book having handsome forms of current Gothic and secretary hands as well as fine italics.

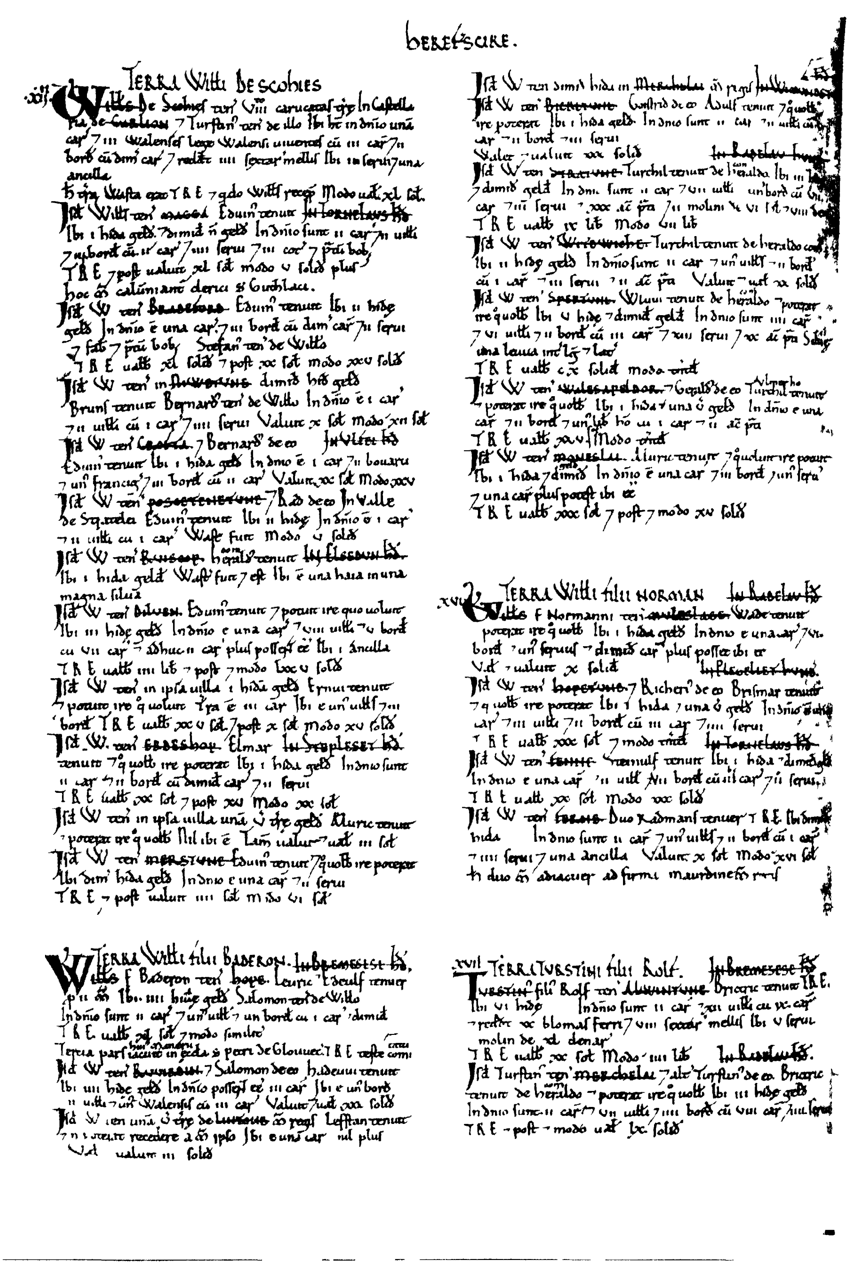
Billingsley's *The Pens Excellencie* (London) still has many more secretary, court and other Gothic hands than Roman. Billingsley's is one of the few English books independent of the designs of Barbedor and Materot which powerfully affected London masters of the 17th century. But though England learned much from France, specimens of the work of Van de Velde, Boissens, Perlingh and other conspicuous Dutch exponents of the art were highly esteemed when the London writing-masters found their services demanded by youths training for clerkships in the growing English commercial houses. The Dutch possessed at that time most of the carrying trade and were for that reason directly imitated in England. The Dutch naturally copied the Frenchmen since French literature was not only read but, owing to the repressive legislation against Paris printers, also printed in the Low Countries.

The difference between the late Italian 16th, early French and Dutch 17th century hands was not considerable—mainly a matter of width of letter. The Italians had a habit of angularizing the letter, the Dutch of widening and giving it greater inclination. What French, Dutch and English writers commonly called the "Italian" hand is a free, flowing and obviously inclined hand in which the ascenders are looped and the majuscules entirely cursive—wholly different from the Chancery of Vicentino. This was the result of the demand for speed, itself the concomitant of commercial development.

English writing gained in currency as commerce expanded. When in 1658, Oliver Cromwell broke the Dutch commercial power and, by his Mercantile Act, secured that every cargo shipped to England was carried in English bottoms, there resulted a vast increase in the nation's shipping. Commercial clerkships became desirable positions, bringing a fine opportunity for such professors as Snell (1693), Seddon (1695) and others who all learned from the Dutch masters, but whose hands drew away from their models and finally expressed those characteristics which came in another generation to be regarded by the rest of the world, if not by Englishmen, as thoroughly English and admirable for the purposes of salesmanship. Thus the commercial success of England drew hearty foreign respect for the script in which English Bills of Lading and Notes of Exchange were made out; named *Anglaise* in France, *letra Inglesa* in Spain, it dominated in Italy itself at the end of the 19th century as "*Lettere Inglese.*" Gothic now persists only with the greatest difficulty—where once it had been used for the text of deeds it fights for existence as a script for titles, and to-day **Whereas** and **This Indenture** witnesseth its sole traces.

In contemporary France the *ronde* is being hard pressed by *anglaise*. The *Cours d'Inscription Calligraphique*, published by École des Travaux Publics has a very extensive circulation, and though treating of *bâtarde* and *ronde* gives primary place to *anglaise*.

The situation is not very different in present-day Spain. The magnificent 16th century specimens of Iciar (1550) and Brun (1583) were adaptations of the hand of Palatino and Vicentino, but these writers succeeded neither in acclimatizing these nor inventing any new, living, national hands. This was achieved by Lucas, who created a characteristic Spanish upright round-hand and companion inclined *bâtarde* which with astonishingly trifling variations remained in possession for two centuries, giving way only before *anglaise*. The hands of many English writing-masters were familiar to the leading Spanish calligraphers of the 18th century. It would be an exaggeration to claim that the script, which we are accustomed to term "copper-plate," possesses an attractive personality It is colourless, thoroughly unromantic and dull. These, however, were precisely the qualities which commended it to those who wrote out invoices. Above all it was expeditious, and the writing-masters of London knew better than to teach them to tricking out of ascenders with solid blacks or capitals with meandering loops which a generation of earlier masters thought would endear their own calligraphy to present and future. The simple and practical nature of English business hand did not exactly serve the material interests of the English writing-master. Plain round-hand is not so difficult to acquire as to need either perpetual practice at home or continual resort to a master. The early American colonists followed the calli-



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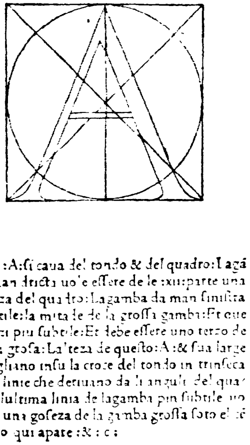
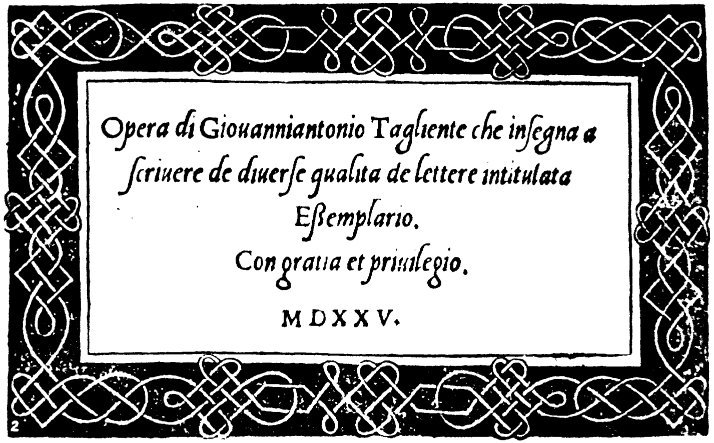
THE HANDWRITING OF THE DOMESDAY BOOK

Excerpts from the Domesday Book a census of lands in England prepared by command of William the Conqueror in the 11th century xiv Itemisation of the lands of Wm de Scohies in Carlion Castle and Tornelaus hundred xv Itemisation of the land held by Wm Son of Baderon in Bremesese hundred xvi Itemisation of the land held by Wm Son of Norman in Radelau hundred xvii Itemisation of the land held by Thurstin Son of Rolf in Bremesese hundred

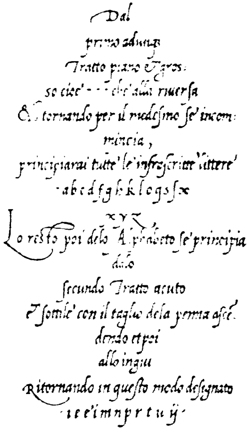


Queſto :A:ſi caua del tondo & del quadro:Lagāba da man dricta uole eſſere de le :xii:parte una de lalteza del quadro:La gamba da man ſiniſtra piu ſubtile:la mita de de la groſſa gamba:Et que la dimezi piu ſubtile:Et debe eſſere uno terzo de la gamba groſa:La lteza de queſto:A :& ſua largeza ſi pigliano inſu la croce del tondo in trinſecato da le linie che deriuano da li anguli del quadro :Et lultima linia de lagamba piu ſubtile uole eſſere una goſeza de la gamba groſſa ſoto el cetro como qui apare :& : c :



Opera di Giouanniantonio Tagliente che inſegna a
ſcriuere de diuerſe qualita de lettere intitulata
Eſsemplario.
Con gratia et priuilegio.
MDXXV.

2



Dal
primo adunque
Tratto piano & gros:
so cioe' ... che' alla riuerſa
& tornando per il medeſimo ſe' incom:
mincia,
principiarai tutte' le infraſcritte littere'
·a b c d f g h k l o g s ſ x
x y z,
Lo reſto poi delo Alphabetto ſe' principia
dalo
ſecundo Tratto acuto
& ſottile' con il taglio dela penna aſce:
dendo et poi
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Ritornando in queſto modo deſignato
·i e e' i m n p r t u y·

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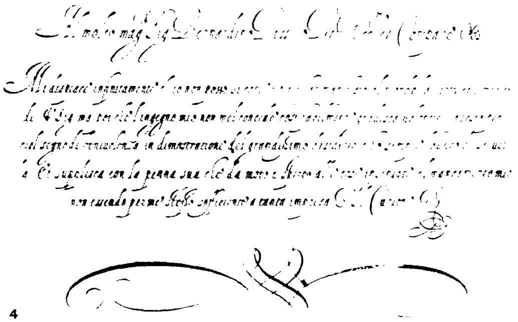

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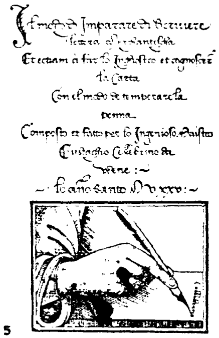

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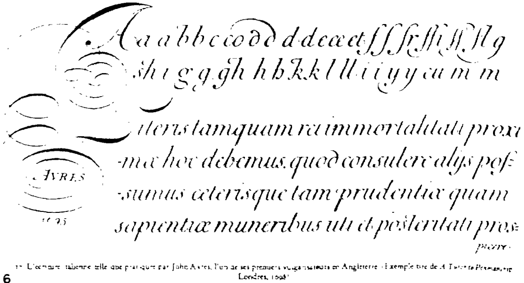


Literis tamquam rei immortalitati proxi
-mæ hoc debemus, quod consulere alijs poſ:
-sumus cæterisque tam prudentiæ quam
sapientiæ muneribus uti et posteritati pro:
picere·

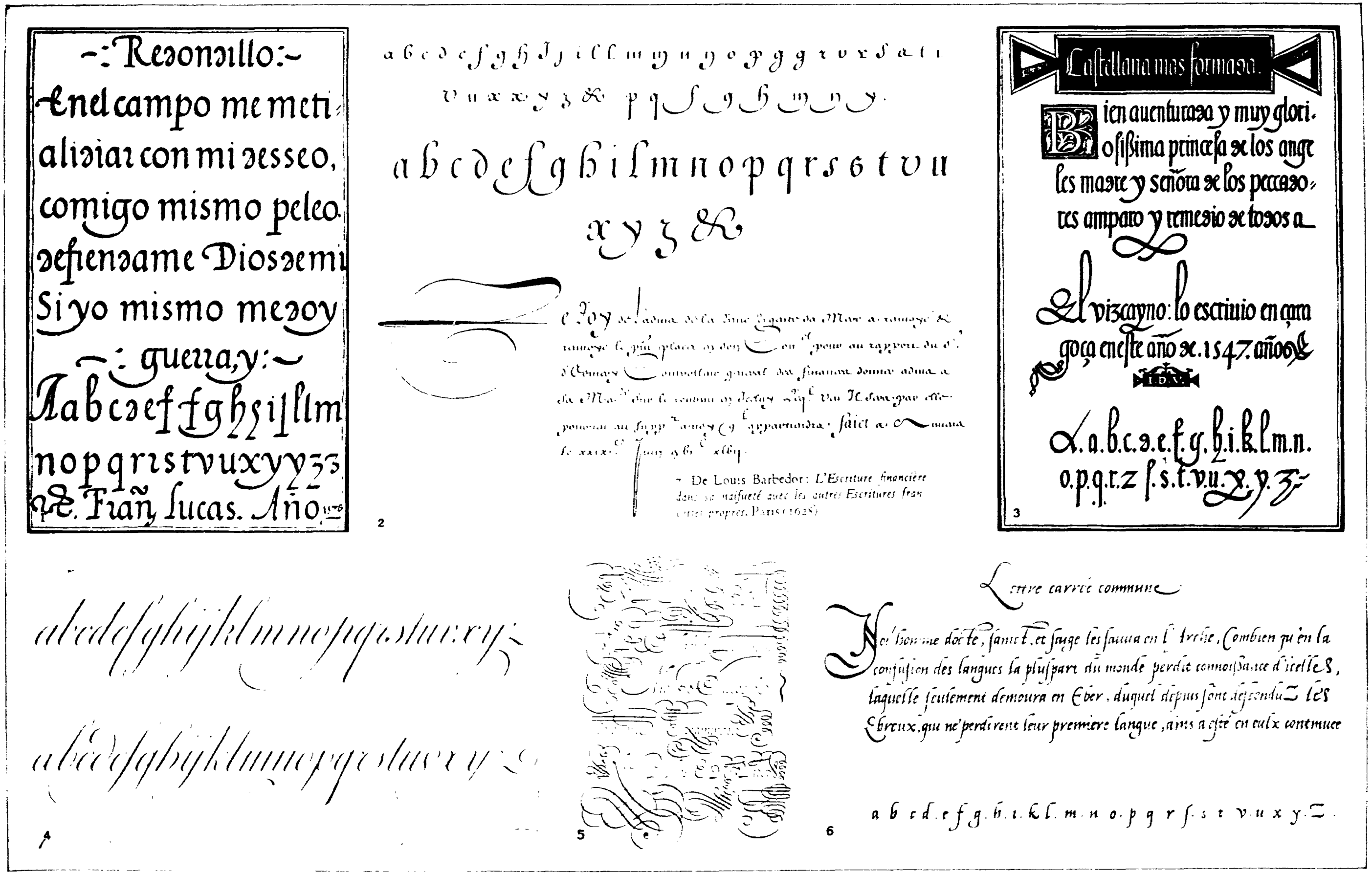
AYRES

6

BY COURTESY OF (1, 6) THE PEGASUS PRESS "A NEWLY DISCOVERED TREATISE ON CLASSICAL LETTER DESIGN" (FACSIMILE BY STANLEY MORISON

CALLIGRAPHY FROM THE 15TH TO THE 17TH CENTURY

1. Excerpt from "Damianus Moyllus, Alphabetum," the first known printed work on letter-formation, Parma, 1480. Facsimile by Stanley Morison from "A Newly Discovered Treatise on Classical Letter Design"
2. From a writing-book by Giovanniantonio Tagliente, Italian, 1525
3. Specimen from the first copybook of script, written by Ludovico degli Arreghi, surnamed Vicentino, and published 1522. Facsimile by Stanley Morison
4. Excerpt from Lodovico Curione, "Il teatro delle cancellaresche corsine." Rome, 1594
5. Eustachio Cellebrino; specimen of Italian semi-gothic hand used by legal and commercial classes. Very rare. One copy in a private library in New York and one in Berlin
6. Excerpt from John Ayres, "Tutor to Penmanship." London, 1698. Facsimile by Stanley Morison, from "Caracteres de l'Ecriture dans la Typographie"



-:Redondillo:-
En el campo me meti:
a lidiar con mi desseo,
comigo mismo peleo
defiendame Dios de mi
Si yo mismo me doy
-: guerra, y:-
Aabcdeffghhijllm
nopqrstvuxyyzz
Fr. Fran. Lucas. Año 1576

a b c d e f g h i l m n o p q r s 6 t v u
x y z &

— De Louis Barbedor: *L'Escriture financière dans sa naifueté avec les autres Escritures fran çoises propres.* Paris (1628)

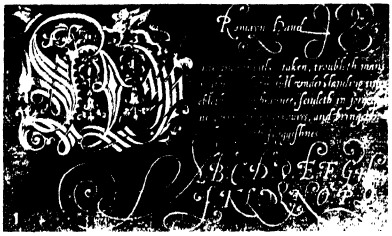
Caſtellana mas formada.
Bien auenturada y muy glori-
oſiſsima princeſa de los ange-
les madre y señora de los peccado-
res amparo y remedio de todos a.
El vizcayno: lo escriuio en çara
goça en eſte año de. 1547. años
I.D.V.
A.a.b.c.d.e.f.g.h.i.k.l.m.n.
o.p.q.r.z ſ.s.t.v.u.x.y.z.

Lettre carrée commune
Noé homme docte, ſanct, et ſage les ſauua en l'Arche, Combien qu'en la
confuſion des langues la pluſpart du monde perdit connoiſſance d'icelles,
laquelle ſeulement demoura en Eber, duquel depuis ſont deſcendus les
Ebreux, qui ne perdirent leur premiere langue, ains a eſté en eulx continuée
a b c d e f g h i k l m n o p q r ſ s t v u x y z

BY COURTESY OF (1, 3, 4, 5) PETER JESSEN, FROM "MEISTER DER SCHREIBKUNST AUS DREI JAHRHUNDERTEN" (JULIUS HOFFMANN), (2) THE PEGASUS PRESS FROM "CARACTÈRES DE L'ÉCRITURE DANS LA TYPOGRAPHIE" FACSIMILE BY STANLEY MORISON, (6) THE TRUSTEES OF THE BRITISH MUSEUM

EXAMPLES OF EUROPEAN CALLIGRAPHY DURING THE 16TH AND 17TH CENTURIES

1. **Excerpt** from "Arte de Escrivir" by Lucas (Madrid 1608)
2. **Excerpt** from "L'Ecriture Nationale Française se développant de la Civilité à l'Ecriture Financière"
3. Page from "Recopilación Subtilíssima," by Yciar (Saragossa, 1548)
4. Excerpt from "Expédiée Bâtarde, Anglaise coulée," by Bourgoin (Paris, about 1810)
5. Page from "Arte de Escrivir" by Casanova (Madrid, 1650)
6. Page from Pierre Hamon's, "Alphabet de l'invention des Lettres en diverses ecritures" (1651)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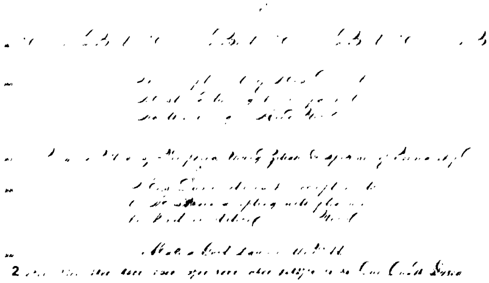
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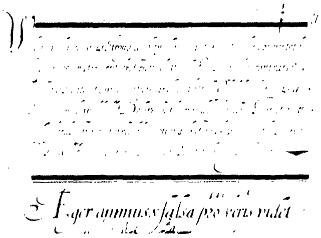
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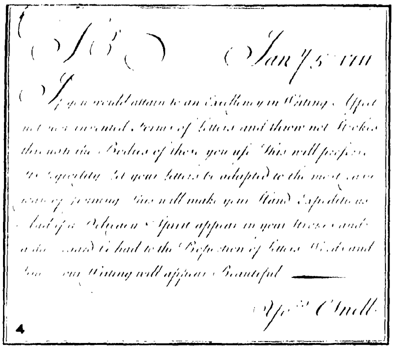
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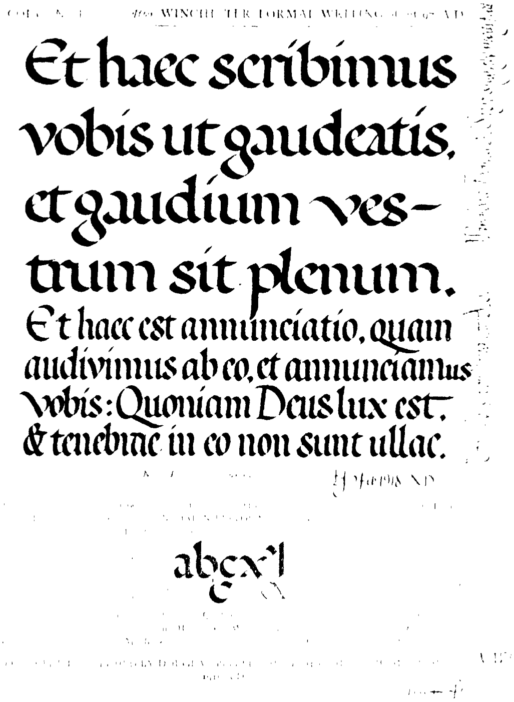
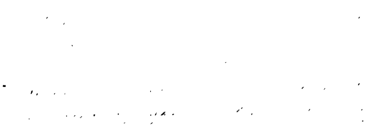

Et haec scribimus vobis ut gaudeatis, et gaudium vestrum sit plenum. Et haec est annunciatio, quam audivimus ab eo, et annunciamus vobis: Quoniam Deus lux est: & tenebrae in eo non sunt ullae.

abcx'l

5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BY COURTESY OF (1, 3, 4) THE TRUSTEES OF THE BRITISH MUSEUM, (5) DOUGLAS PEPLER

EXAMPLES OF CALLIGRAPHY FROM THE 16TH TO 20TH CENTURY

1. Excerpt from *A Booke containing divers sortes of hands*, the first English manual of calligraphy, written in 1571 by John Baildon and Jean de Beauchesne, showing the influence of early French script
2. Spencerian or semi-angular penmanship engraved about 1857 by Gerlack, and published by Plunney and Company, Buffalo, N. Y.
3. Specimen of penmanship from Martin Billingsley's *The Pens Excellencie or the Secretaries Delight*, 1618, showing Gothic influence
4. A copy of an engraving by Charles Snell in *The art of writing in its Theory and Practice*, published in London in 1712
5. Copy sheet from Edward Johnston's manuscript illustrating his particularly handsome type of calligraphy, a blend of roman and italic hands introduced at the beginning of the twentieth century
6. Illustration from *The Fashionable Penman*, showing the method of handwriting advocated by Joseph Carstairs. According to this system, the forearm, not the fingers, controlled the script

graphical styles of the home country and Benjamin Franklin practised a fine *anglaise* from which a printing type was subsequently engraved. The first American copybook (Jenkins, 1791) continued the mid-18th century English script. In 1809 Joseph Carstairs of London championed a theory of handwriting in which the forearm and not the fingers controlled the script. His book was translated into French and Spanish and was introduced into the United States by Foster in 1830. It was employed overseas with such success that it even became known as the American System. The American hand,[1] however, did in fact develop from a continuation of this movement of the forearm and a condensation of the running hand exemplified in Jenkins. Dayton copyrighted in 1855 the first specimen of what developed into a style which now may fairly claim to rank as the national American hand. It is a style which requires a very fine pen as the down strokes taper from top to bottom. There is a slightly increased slope, a tendency to flourished terminations and a noticeable degree of condensation. It had little success at first and it is possible that it would have made no progress but for the plagiarization by the very active "Professor" Spencer, who, in spite of the protests of Dayton, claimed the design as his own and taught it throughout a chain of business colleges established in 44 cities by the time of his death in 1861. The style which is known to this day as the Spencerian system is by no means without its exponents. It is not a particularly unpleasant letter except when written carelessly.

Nineteenth-century England learned to write from the copybooks of Vere Foster, whose lithographed models expressed edifying admonitions in a flawless current hand of the plainest style. The "Civil Service" hand also, an upright version of the same design, was and is commonly practised. Both scripts are declining, for one thing because when written with great speed they become illegible. The pressure of life to-day tells heavily against decent handwriting. Writing too much and therefore too quickly we corrupt the shape and become accustomed to low standards. We may find a way out by practising two hands, a rough scribble and a ceremonial script. Twentieth-century mechanics ensure a future for correspondence calligraphy if the desk equipment of every schoolboy and girl could include a typewriter.

To inculcate a good modern current hand Mr. Hewitt's *Oxford Copy Books* are to be recommended.

So much for the epistolary department of post-Renaissance calligraphy (the early fine formal book hands may be studied in the article on PALAEOGRAPHY: *Latin*). Calligraphical book hands settled the forms of the earliest printing types, but were themselves affected when the type forms acquired a momentum of their own. It is not true that typography killed calligraphy outright—some of the finest calligraphy in the history of book production was executed within the memory of the generation which witnessed the invention of printing, as may be seen from the work of Antonio Sinibaldi of Florence and Mennius of Naples, to name only two famous scribes of the Italian school. The anonymous calligrapher whose splendid "Chantilly" *Caesar* is fit to rank with the finest of mediaeval manuscripts, heads a not less brilliant French school. The art died for lack of patrons, not for lack of calligraphers. These eked out a penurious existence as rubricators attached to printing houses, or as engrossers of choir-books which required larger characters than type founders were willing to cast.

The age of Louis XIV. witnessed an abortive revival of calligraphy to which the manuscripts by Jarry, Gilbert, Damoiselet and Rousselot remain a pathetic testimony. This school so formalized their book hands and cursives as to deceive the eye into thinking that they were types. Scribes like Eclabart were in fact able to write whole books in a letter indistinguishable from printing type.

Gothic remained here and there in occasional use and, even in our own day, it not infrequently garnishes a presentation address. Col. Lindbergh's reception by the City of New York in 1927 was signalized by the presentation of a gorgeous address of welcome in which the regard of the American nation was tendered in a text comprising four or five cacophonous Gothics, semi-Gothics and Romans. If in any English address the calligraphy has been handsome and noble or even sober and dignified, it will have been due entirely to the teaching and practice of Mr. Edward Johnston whose *Writing and Illuminating and Lettering* (London, 1906) created a new interest in calligraphy among wealthy amateurs and collectors and a new school of excellent scribes. To Mr. Johnston's teaching therefore we owe that revival of fine calligraphy in which England may well take great pride. Mr. Johnston did what the renaissance had done before him: he went back to the Caroline Minuscule and though he learned, and learned well, from certain fine English mediaeval hands his own beautiful book-hand is individual and underived. As the Exhibition of the Society of Scribes and Illuminators (London) proves, he has created a body of skilful English calligraphers, whose fine scripts give us no excuse for using the debased Gothics and pinchbeck Romans laboriously confected by the hack employees of the west-end heraldic-artist, the court stationer and the Fifth-Avenue bookseller.

Johnston's influence has not been merely national; it has perhaps been greatest in Germany. The works of Neff, Dürer and of Baurenfeind were succeeded by an indifferent posterity and until our own generation Germany used a mean informal Gothic for commemorative and other purposes where a ceremonial writing was required. In 1910 Mr. Edward Johnston's pupil Fräulein Simons introduced his teaching into Germany with great success and the printing revival due to William Morris which had already made rapid progress rallied to its support. In 1928 Germany has a school of calligraphers second to none in inventiveness and skill. The Gothic letter does not lack champions: the Austrian Professor Larisch and Herr Otto Hupp, two of the generation who were writing before Mr. Johnston's movement assumed its present importance, both practised Gothic. Prof. Koch of Offenbach is a representative of the present lively generation and for a variety of national and other reasons prefers to work in Gothic, though he learned from Johnston the handsome Roman and italic hands. F. H. Ehmcke, though skilled in Gothic, specializes in Roman. There are not wanting certain influences in Germany which while seeking inspiration from the new movement would be happier if the old Gothic hands could be revived. Thus the *Bund für Deutsche Schrift* exists to encourage the Gothic hands. It remains to be seen whether this reaction will be successful.

There is perhaps a tendency on the part of the Johnstonian school to narrow its interest and practice to formal book-hands and to ignore the need for a simple, easy, running cursive. The layman fears that if he writes with a modicum of care his script will be confounded with his office boy's, and it is even claimed that "character" in handwriting is more important than legibility. This is a *reductio ad absurdum* and it may be replied that a self-respecting person employing the inevitable and natural movement of his pen to make modest capitals and a lower-case script in which the angles shall be regular, the characters symmetrically rounded, the descenders and ascenders proportionate to their bodies will there and then have the elements of legibility, style and character.

See also PALAEOGRAPHY; PRINTING TYPE; TYPOGRAPHY; WRITING.

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CALLIMACHUS, an Athenian sculptor of the second half of the 5th century B.C. Ancient critics associate him with Calamis. He is given credit for two inventions, the Corinthian column and the running borer for drilling marble. He made a golden lamp for the Erechtheum (Paus. I. xxvi., 2). His "dancing Laconian maidens" was a work "of flawless precision," but spoilt, like his other sculptures, by over-elaboration of detail. (Pliny, *Nat. His.*, xxxiv. 92.)

See A. Furtwängler (trans. E. Sellars), *Masterpieces of Ancient Sculpture,* p. 437 ff. (1895).

CALLIMACHUS, Greek poet and grammarian, a native of Cyrene, flourished about 250 B.C. He opened a school in the suburbs of Alexandria, and some of the most distinguished grammarians and poets were his pupils. He was subsequently appointed by Ptolemy Philadelphus chief librarian of the Alexandrian library, which office he held till his death (about 240). His *Pinakes* (tablets), in 120 books, a critical and chronologically arranged catalogue of the library, laid the foundation of a history of Greek literature. Of his 800 works, only six hymns, 64 epigrams and some fragments are extant; a considerable fragment of the *Hekale,* an idyllic epic, has also been discovered in the Rainer papyri (*see* Kenyon in *Classical Review,* Nov. 1893). His *Kome Berenikes* is known from the imitation of Catullus and partly in Greek from papyrus fragments (cf. *Classical* Philology for 1929). His *Aitia* (causes) was a collection of elegiac poems According to Quintilian (*Instit.* X. i. 58) he was the chief of the elegiac poets, and imitated by Ovid, Catullus and especially Propertius. The extant hymns are extremely learned, and written in a laboured style, unrelieved by poetic genius. The epigrams are in the Greek anthology.

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CALLINUS of Ephesus, the oldest of the Greek elegiac poets and the creator of the political and warlike elegy. He is supposed to have flourished between the invasion of Asia Minor by the Cimmerii and their expulsion by Alyattes (630–560 B.C.). During his lifetime his own countrymen were also engaged in a life-and-death struggle with the Magnesians. These two events give the key to his poetry in which he tries to rouse the Ionians to patriotism. Only scanty fragments of his poems remain; the longest of these (preserved in Stobaeus, *Florilegium,* li. 19) has even been ascribed to Tyrtaeus.

See edition of the fragments by N. Bach (1831), and in Bergk, *Poetae Lyrici Graeci* (1882). On the date of Callinus, *see* the histories of Greek literature by Mure and Mueller; G. H. Bode, *Geschichte der hellenischen Dichtkunst,* ii. pt. i. (1838); and G. Geiger, *De Callini Aetate* (1877), who places him earlier, about 642.

CALLIOPE, the chief of the Muses (*q.v.*), occasionally in late authors the Muse of epic poetry (Gr., "beautiful voice"). *See* Hesiod, *Theog.,* 79; *Anth. Pal.* ix. 504, 1.

CALLIRRHOE, in Greek legend, second daughter of the river-god Achelous and wife of Alcmaeon (*q.v.*). On his death, she prayed that her two young sons might grow to manhood at once and avenge their father. This prayer was granted; and her sons, Amphoterus and Acarnan, slew Phegeus, the murderer of Alcmaeon, and returning with the necklace and robe (*peplos*) of Harmonia (*q.v.; see* also ALCMAEON), dedicated them at Delphi (Ovid, *Metam.* ix. 413).

CALLISTHENES (*c.* 360–328 B.C.), of Olynthus, Greek historian, a relative and pupil of Aristotle, through whose recommendation he was appointed to attend Alexander the Great in his Asiatic expedition. He censured Alexander's adoption of oriental customs; this offended the king, and he was accused of being privy to a conspiracy and thrown into prison, where he died. His death was commemorated in a treatise (Καλλισθένης ἢ περὶ πένθους) by his friend Theophrastus. Callisthenes wrote an account of Alexander's expedition, a history of Greece from the peace of Antalcidas (387) to the Phocian War (357), a history of the Phocian War and other works, all of which have perished. The romantic life of Alexander, the basis of all the Alexander legends of the middle ages, originated during the time of the Ptolemies, but in its present form belongs to the 3rd century A.D. Its author is usually known as pseudo-Callisthenes, although in the Latin translation by Julius Valerius Alexander Polemius (beginning of the 4th century) it is ascribed to Aesopus; Aristotle, Antisthenes, Onesicritus and Arrian have also been credited with the authorship. There are also Syrian, Armenian and Slavonic versions, in addition to four Greek versions (two in prose and two in verse) in the middle ages (*see* Krumbacher, *Geschichte der byzantinischen Litteratur,* 1897, p. 849). Valerius's translation was completely superseded by that of Leo, arch-priest of Naples in the 10th century, the so-called *Historia de Preliis.*

See *Scriptores rerum Alexandri Magni* (by C. W. Müller, in the Didot edition of Arrian, 1846), containing the genuine fragments and the text of the pseudo-Callisthenes, with notes and introduction; A. Westermann, *De Callisthene Olynthio et Pseudo-Callisthene Commentatio* (1838–42); J. Zacher, *Pseudo-Callisthenes* (1867); W. Christ, *Geschichte der griechischen Litteratur* (1898), pp. 363, 819; article by Edward Meyer in Ersch and Gruber's *Allgemeine Encyklopädie;* A. Ausfeld, *Zur Kritik des griechischen Alexanderromans* (Bruchsal, 1894); Plutarch, Alexander, 52–55; Arrian, *Anab.* iv. 10–14; Diog. Laërtius v. 1; Quintus Curtius viii. 5–8; Suidas *s.v.* *See* also ALEXANDER III, THE GREAT (*ad fin.*). For the Latin translations see Teuffel-Schwabe, *Hist. of Roman Literature* (Eng. trans.) § 399; and M. Schanz, *Geschichte der römischen Litteratur,* iv. 1, p. 43.

CALLISTHENICS: *see* GYMNASTICS; PHYSICAL CULTURE.

CALLISTO, in Greek mythology, an Arcadian nymph, daughter of Lycaon and companion of Artemis; probably a local form of Artemis *Kalliste* (fairest). She bore Zeus a son, Arcas, the ancestor of the Arcadians, and was transformed into a bear by Hera, Zeus, or Artemis. Arcas, when hunting, encountered the bear Callisto, and would have shot her, had not Zeus carried up both to the skies, where he placed them as constellations.

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CALLISTRATUS, an Athenian poet, only known as the uthor of a hymn in honour of Harmodius (*q.v.*) and Aristogeiton. This ode, which is to be found in Athenaeus (p. 695), has been beautifully translated by Thomas Moore.

CALLISTRATUS of Aphidnae, Athenian orator and general n the 4th century B.C. For many years, as *prostates,* he supported Spartan interests at Athens. On account of the refusal of the

Thebans to surrender Oropus, which on his advice they had been allowed to occupy temporarily, Callistratus, despite his magnificent defence (which so impressed Demosthenes that he resolved to study oratory), was condemned to death, 361 B.C. He fled to Methone in Macedonia, and on his return to Athens in 355 he was executed.

See Xenophon, *Hellenica*, iii. 3, vi. 2; Lycurgus, *In Leocr.* 93; and P. Cloché, *La Politique de l'Athénien Callistratos*, in *Revue des Études Anciennes*, vol. xxv. (Bordeaux, 1923), where references are given to other modern works.

CALLISTRATUS, Alexandrian grammarian, flourished at the beginning of the 2nd century B.C. He was one of the pupils of Aristophanes of Byzantium. Callistratus wrote commentaries on Greek poets, a few fragments of which have been preserved in the scholia and in Athenaeus. He was also the author of a miscellaneous work called Συμμικτά, used by the later lexicographers, and of a treatise on courtesans (Athenaeus iii. 125 B, xiii. 591 D). He is not to be confused with Callistratus, the pupil and successor of Isocrates and author of a history of Heraclea in Pontus.

See R. Schmidt, *De Callistrato Aristophaneo*, appended to A. Nauck's *Aristophanis Byzantii Fragmenta* (1848); also C. W. Müller, *Fragmenta Historicorum Graecorum*, iv. p. 353 note.

CALLISTRATUS, Greek sophist and rhetorician, probably flourished in the 3rd century. He wrote *Ekphraseis*, descriptions of 14 works of art in stone or brass by distinguished artists. This little work is usually edited with the *Eikones* of Philostratus.

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CALL MONEY. A London money-market term used to describe short-term loans advanced to bill-brokers by banks on security. Another name for such advances is "day-to-day money," or even "over-night money." Such advances are essential to the bill-broker, who requires prompt loans to deal with bills offering. Call money is advanced on the security of bills of exchange or of bearer securities, and the name expresses the fact that, lent for a very short period, the bank making the advance has the money for practical purposes at call. (*See* MONEY MARKET.)

Call Loan.—According to the custom in use by the New York Stock Exchange, a lender wishing repayment of a call loan must notify the borrower by 12.30 P.M. in order to receive payment on that day, and a borrower wishing to terminate a call loan must notify the lender before 1 P.M., or else he can be charged another day's interest. It is possible to stipulate a rate of interest on a call loan but this practice is quite unusual. Interest is commonly paid at the "call loan rate," which may vary from day to day. The lender notifies the borrower of any rise or fall in the interest rate, which is known as "marking up rates" or "marking down rates."

CALLOT, JACQUES (1592–1635), French engraver, was born at Nancy in Lorraine, where his father, Jean Callot, was a herald-at-arms. When only 14 years old, he was allowed to accompany the duke of Lorraine's envoy to the papal court in order to study art in Rome. His first care was to study the art of design, of which in a short time he became a perfect master. Philip Thomasin instructed him in the use of the graver, which, however, he ultimately abandoned, substituting the point as better adapted for his purposes. From Rome he went to Florence, where he remained till the death of Cosimo II., the Maecenas of those times. On returning to his native country he was warmly received by the then duke of Lorraine, who admired and encouraged him. As his fame was now spread abroad in various countries of Europe, many distinguished persons gave him commissions to execute. By the Infanta Isabella, sovereign of the low countries, he was commissioned to engrave a design of the siege of Breda; and for Louis XIII. he executed a design of the siege of Rochelle and the attack on the Isle of Ré. He engraved in all about 1,600 pieces, the best of which are those executed in aqua fortis. No one ever possessed in a higher degree the talent for grouping a large number of figures in a small space, and of representing with two or three bold strokes the expression, action and peculiar features of each individual. Freedom, variety and *naïveté* characterize all his pieces. His Fairs, his Miseries of War, his Sieges, his Temptation of St. Anthony and his Conversion of St. Paul are the best-known of his plates.

See also Edouard Méaume, *Recherches sur la vie de Jacques Callot* (1860).

CALLWELL, CHARLES EDWARD (1859–1928), only son of Henry Callwell, of Lismoyne, Antrim, was born in London on April 2, 1859, and educated at Haileybury. He entered the Royal Military Academy in 1876. He saw active service in India, in the Transvaal 1881, and in the South African War. He had resigned from the intelligence department of the war office, where he was D.A.Q.N.G. in that branch, in 1909, but returned to the service in 1914, held the post of Director of Military Operations at the War Office during the Great War and was largely responsible for the plans of the Dardanelles campaign, although opposed to it in principle. From 1915 onwards he was employed first in Russia and then on munitions work, and in 1917 was promoted major-general and created K.C.B. He was an acknowledged authority on small overseas campaigns, and his chief contribution to literature is his *Small Wars* (1897), which has remained a standard work. His other works include: *Tactics of To-day* (1897), *Military Operations and Maritime Preponderance* (1897), *The Tactics of Home Defence* (1897) and *The Dardanelles* (1920).

CALMET, ANTOINE AUGUSTIN (1672–1757), French Benedictine, was born at Mesnil-la-Horgne, on Feb. 26, 1672. He joined the Benedictines in 1688, and in 1698 was appointed to teach theology and philosophy at the abbey of Moyen-Moutier. He was successively prior at Lay, abbot at Nancy and of Sénones in Lorraine. He died in Paris on Oct. 25, 1757. The erudition of Calmet's exegetical writings won him a universal reputation but they have failed to stand the test of modern scholarship. The most noteworthy are:—*Commentaire de la Bible* (1707–16), and *Dictionnaire historique, géographique, critique, chronologique et littéral de la Bible* (1720). His numerous other works and editions of the Bible are known only to students, but as a pioneer in exegesis, Calmet is noteworthy. As a historical writer he is best known by his *Histoire ecclésiastique et civile de la Lorraine* (Nancy, 1728), founded on original research, and by various useful works on Lorraine, of which a full list is given in Vigouroux's *Dictionnaire de la Bible*.

See A. Digot, *Notice biographique et littéraire sur Dom Augustin Calmet* (Nancy, 1860).

CALMETTE, GASTON (1858–1914), French journalist and writer, was born at Montpellier on July 30, 1858. In 1884 he joined the staff of *Le Figaro*, and in 1894 became editor. He attracted much notice in 1913 and 1914 as the originator of the bitter attacks on the policy of M. Caillaux; especially with regard to M. Caillaux's attitude in the Rochette case of 1911, in which it was alleged by *Le Figaro* that the director of public prosecutions had been influenced by the Ministry to delay the course of justice. As a result of these newspaper attacks Mme. Caillaux called at the office of *Le Figaro* on March 16, 1914 and shot M. Calmette dead. (*See* CAILLAUX, JOSEPH MARIE AUGUSTE.)

CALNE (Kawn), a market town and municipal borough in the Chippenham parliamentary division of Wiltshire, England, 90 mi. W. of London by the G.W.R. Pop. (1938) 4,824. Area, 1.9 sq.mi. It lies in the valley of the Calne, and is surrounded by the high tableland of Salisbury plain and the Marlborough downs. In the 10th century Calne (*Canna, Kalne*) was the site of a palace of the West-Saxon kings. Here a synod met in 978 and a witenagemot was summoned in 997. In the Domesday survey Calne was a royal borough with 47 burgesses. In 1565 it possessed a gild merchant. Calne claimed to have received a charter from Stephen and a confirmation from Henry III; the charter issued by James II in 1687 apparently never came into force. The borough returned two members to parliament somewhat irregularly from 1295 until 1832, then one member until 1885. Noteworthy buildings, besides the church of St. Mark, are a grammar school, founded by John Bentley in 1660, and the town hall. Bacon-curing is the staple industry. The area of the borough was more than tripled by the 1934 extension.

CALOMEL occurs in nature as the mineral horn-quicksilver, found as translucent tetragonal crystals with an adamantine lustre and whitish grey or brownish colour; it is mercurous chloride (mercury subchloride), Hg_2Cl_2. The chief localities are Idria, Obermoschel, Horowitz in Bavaria and Almaden in Spain. It was used in medicine as early as the 16th century under the names *Draco mitigatus, Manna metallorum, Aquila alba, Mercurius dulcis;* later it became known as calomel, a name probably derived from the Greek *καλός*, beautiful, and *μέλας*, black, in allusion to its blackening by ammonia, or from *καλός* and *μέλι*, honey, from its sweet taste. It may be obtained by heating mercury in chlorine, or by reducing mercuric chloride (corrosive sublimate) with mercury or sulphurous acid. It is manufactured by heating a mixture of mercurous sulphate and common salt in iron retorts, and condensing the sublimed calomel in brick chambers. In the wet way it is obtained by precipitating a mercurous salt with hydrochloric acid. Calomel is a white powder which sublimes at a low red heat; it is insoluble in water, alcohol and ether. Long continued boiling or prolonged digestion with water, dilute hydrochloric acid or solutions of alkaline chlorides convert it into mercuric chloride with deposition of mercury.

The molecular weight of mercurous chloride has given occasion for much discussion. E. Mitscherlich determined the vapour density to be 8·3 (air = 1), corresponding to HgCl. The supporters of the formula Hg_2Cl_2 pointed out that dissociation into mercury and mercuric chloride would give this value, since mercury is a monatomic element. A. Werner determined the molecular weight of mercurous chloride in pyridine solution, and obtained results pointing to the formula HgCl. However, the double formula, Hg_2Cl_2, has been completely established by H. B. Baker, 1900, by vapour density determinations of the absolutely dry substance.

Calomel possesses certain special properties and uses in the pharmacology and therapeutics of mercury (*q.v.*). The specific value of mercurous chloride is that it exerts the valuable properties of mercuric chloride in the safest and least irritant manner, as the active salt is continuously and freshly generated in small quantities. Its pharmacopeial preparations are the "Black wash," in which calomel and lime react to form mercurous oxide, a pill still known as "Plummer's pill," and an ointment. Externally the salt has not any particular advantage over other mercurial compounds, despite the existence of the officinal ointment. Internally the salt is given in doses—for an adult of from one-half to five grains. It is an admirable aperient, acting especially on the upper part of the intestinal canal (duodenum and jejunum). It is well to follow a dose of calomel with a saline purgative a few hours afterwards. The special value of the drug as an aperient depends on its antiseptic power and its stimulation of the liver. The salt is often used in the treatment of syphilis, but is probably less useful than certain other mercurial compounds. Calomel or alternatively mercuro-salicyl arsenate is the active constituent of an ointment (unguentum prophylaxis) employed as a prophylactic measure against syphilis.

CALONNE, CHARLES ALEXANDRE DE (1734–1802), French statesman, was born at Douai on Jan. 20, 1734. He became in succession advocate to the general council of Artois, *procureur* to the parlement of Douai, master of requests, then intendant of Metz (1768) and of Lille (1774). Calonne assumed office as controller-general of finance on Nov. 3, 1783. He found "300 millions to pay and neither money nor credit." He attempted to carry on the government by means of loans and thus made a position which was already serious practically hopeless. The parlement protested against registering the edicts for raising the loans, but in vain. In October 1785 he recoined the gold coinage, and he developed the *caisse d'escompte*. When it became impossible to raise any more loans Calonne proposed to the king the suppression of internal customs, duties, and the taxation of the property of nobles and clergy. Turgot and Necker had attempted these reforms, and Calonne attributed their failure to the malevolent criticism of the parlements. An assembly of "Notables" was called together in January 1787. Before it he exposed the deficit in the treasury, and proposed the establishment of a *subvention territoriale,* which should be levied on all property without distinction. This suppression of privileges was badly received by the privileged notables. Calonne, angered, printed his reports and so alienated the court. Louis XVI. dismissed him on April 8, 1787, and exiled him to Lorraine; from there he went to England. In 1789, when the states-general were about to assemble, he crossed over to Flanders in the hope of being allowed to offer himself for election, but he was sternly forbidden to enter France. He then joined the *émigré* party at Coblenz. His *Etat de la France à present et à venir,* a violent criticism of the financial measures of Necker, was published in London in 1700. He was allowed to return to France in 1802, and died in Paris on Oct. 30 of that year.

See Ch. Gomel, *Les Causes financières de la Révolution* (1893); R. Stourm, *Les Finances de l'ancien régime et de la Révolution* (1885); Susane, *La Tactique financière de Colonne,* with bibliography (1902).

CALOOCAN, a municipality (with administrative centre and 21 *barrios* or districts) of the province of Rizal, Luzon, Philippine Islands, not far from Manila. Pop. (1939) 38,820 (a gain of 4,734 since 1918), of whom 19,524 were males, and 119 were whites. It was the rendezvous of plotters against the Spaniards and one of the starting points of the insurrection. The region produces palay (rice), sugar and coconuts. Of those inhabitants aged 6 to 19, inclusive, 42·9% attended schools, and of those 10 years old and over 69·8% were literates. The vernacular is Tagalog.

CALORESCENCE. When radiant energy is absorbed by a substance (*i.e.*, when the sum of the reflected and transmitted energies is not equal to the incident energy) the absorbed energy is usually transformed into radiant energy of a different wavelength or refrangibility, or into energy of another form. The conversion of the rays belonging to the dark (infra-red) portion of the spectrum into the shorter, more refrangible waves of visible light was demonstrated by John Tyndall and the term *calorescence* (from the Lat. *calor,* heat) was invented by him to describe this phenomenon.

Tyndall sifted out the long, dark, infra-red waves from the shorter, visible waves associated with them in the light from the sun or electric arc, and concentrated them to a focus. A piece of charcoal or blackened platinum placed at this focus was raised to incandescence. The emission of light (visible rays) by the charcoal or platinum is purely a temperature effect, therefore calorescence is not to be regarded as the strict converse of the phenomenon shown by Sir G. G. Stokes to occur in fluorescent bodies (*see* Fluorescence and Phosphorescence).

See also John Tyndall, *Heat as a Mode of Motion.*

CALORIC, a hypothetical imponderable fluid to whose action the early scientists ascribed the manifestations of heat (*q.v.*).

CALORIE (also spelt Calory). A unit of heat defined as the quantity of heat required to raise a unit mass of water one degree in temperature on the Centigrade scale, in which the freezing point of water is taken as 0°C. and the boiling point as 100°C. The magnitude of the unit is proportional to the unit of mass selected, so that it is also necessary to specify the unit of mass in defining the quantity of heat measured. The following units of this type are in general use for various purposes.

The *gramme-calorie* (or *small calorie*) defined as the quantity of heat required to raise the temperature of 1 gramme of water by 1°C., is the unit of heat most commonly employed for scientific purposes for which the gramme is taken as unit of mass. The *kilogramme-calorie* (*kilocalorie* or *large calorie*) is equal to 1,000 gramme-calories, and is commonly employed by engineers in countries where the metric system is adopted. The *pound-calorie* is similarly employed in connection with the British system of weights, and is equal to 453·6 gramme-calories, if 1 lb. is taken as 453·6 gm.

The term calorie is also employed in stating the total heat or total energy of a substance, such as water, or steam, when measured per unit mass on the Centigrade scale. It is unnecessary in this case to specify the unit of mass because the total heat measured in pound-calories per pound is obviously the same for any given substance and range of temperature as that measured in gramme-calories per gramme, provided that the same unit of mass is employed in either case in measuring the substance and in defining the heat unit. In this connection the *mean calorie* is most commonly employed, defined as one hundredth part of the increase of total heat of water per unit mass between 0° and 100°C. under atmospheric pressure.

Similar units of heat may be defined in terms of the Fahrenheit and Réaumur scales of temperature, but are rarely, if ever, called by the name calorie, or employed for purely scientific purposes. By far the most important of these is the *British Thermal Unit* (B.Th.U.), defined as the quantity of heat required to raise one pound of water one degree on the Fahrenheit scale. One B.Th.U. is equal to 453·6/1·8 or 252 gramme-calories precisely.

The absolute values of all the above units of heat depend on the properties of water in a manner which is explained in the article CALORIMETRY. Their relations to other units are further illustrated in the article HEAT.

CALORIFIC VALUE, the number of heat units obtained by the complete combustion (*q.v.*) of unit mass of a fuel (*see* FUEL).

CALORIMETRY, is the scientific term for the measurement of quantities of heat and must be carefully distinguished from thermometry, which signifies the measurement of temperature or degree of hotness. Quantities of heat may be measured in various ways by observing the effects they produce. The most important of these effects for the present purpose are (*a*) rise of temperature, (*b*) a change of state, (*c*) transformation of electrical or mechanical energy into heat, or vice versa. The object of the present article is to illustrate the various methods of measurement by reference to historical experiments, to discuss the assumptions made and the experimental difficulties involved in their application, and to compare the results with special reference to the mechanical equivalent of heat, and to the order of accuracy attainable.

The fundamental assumption made in measuring quantities of heat by any method is that the quantity of heat contained in any body in a given state at a definite temperature and pressure must always be the same under the same conditions at any time, no matter what changes the body may have undergone in the interval, provided that it has been restored to its original state. This was assumed by all observers from the earliest times, but was first put in categorical form by Carnot (*see* HEAT) as the basis of his argument on the motive power of heat by the method of the cycle. It was also assumed as self-evident that the total heat per unit mass of any substance, such as water, in a homogeneous state, must be the same for different portions of the substance when thoroughly mixed to a uniform temperature and pressure. In other words that the heat-content of any body of uniform composition must be simply proportional to its mass, other things being equal. Since it was manifestly impossible to deprive any body completely of heat, the absolute value of the total heat contents could not be measured in any case; but it sufficed for practical purposes to be able to measure the change of total heat between any limits, from which the total heat of any substance per unit mass, reckoned from a convenient zero such as 0°C., could be inferred for any temperature. But with the rough apparatus employed by the early experimentalists, it appeared that the increase of total heat was so nearly proportional to the rise of temperature within the limits of error of their measurements that it sufficed to tabulate for each substance a single specific constant S, called the "specific heat," representing the rate of increase of the total heat with temperature. Taking water as the standard substance of specific heat unity, the unit of heat on this system is the quantity required to raise unit mass of water 1° in temperature. In terms of this unit the specific heat s of any other substance may be defined as the quantity required to raise unit mass of the substance 1° in temperature. It follows that a body of mass m, composed of a substance of specific heat s, will require per degree rise of temperature a quantity of heat represented by the product ms, which is called the "thermal capacity" of the body considered. These approximate definitions, tacitly assuming the constancy of the specific heat, will suffice for the immediate purpose as a basis of discussion of experimental methods of measurement in illustration of the various points in which further precision of statement or manipulation is required in accurate calorimetry.

Method of Mixtures.—The method originally employed in nearly all cases was the familiar method of mixtures as described in textbooks. The apparatus in its simplest form consists of an open vessel, of known thermal capacity, containing a known mass of water at atmospheric temperature t_0, and provided with a thermometer and a stirrer. A known mass m of the substance to be tested is heated to a suitable temperature t_1 in a separate heater, and is then quickly immersed in the calorimeter. The water is well stirred, and its final temperature t_2 is noted as soon as equilibrium has been reached. The loss of heat of the hot substance in cooling from its initial temperature t_1 to the final temperature t_2 is represented by the product of its thermal capacity ms by the drop of temperature (t_1-t_2). This is equated to the gain of heat by the calorimeter and the contained water due to the rise of temperature (t_2-t_0), which is represented by the product $M(t_2-t_0)$, where M includes, in addition to the actual mass of the water, a small correction, called the "water-equivalent," representing a mass of water equivalent in thermal capacity to the calorimeter, thermometer and stirrer. The value of s is thus obtained in the form, $s = M(t_2-t_0)/(t_1-t_2)m$, and represents the *mean* specific heat of the substance tested over the range t_1 to t_2 expressed in terms of that of water over the range t_0 to t_2. If specific heats were all constant, as originally assumed, the mean specific heat over any range would be the same as the actual specific heat at any point. But since we know that the specific heat of any substance may often vary considerably with temperature, it is usually necessary to specify the range of temperature over which the measurement is made. Further, since the scales of different thermometers differ quite appreciably, it is desirable in accurate work to reduce the results to the absolute scale of temperature for the sake of uniformity. It will easily be seen that, unless the specific heat is nearly constant, the familiar method of expression in terms of specific heat becomes rather complicated and difficult to apply. Thus in dealing with cases in which the specific heat is variable, it is usually preferable to express the observations of *mean* specific heats over large ranges directly in terms of the total heat h, which greatly simplifies the necessary reduction and tabulation of the results. The total heat per unit mass at any temperature is a definite physical property of the substance, and is that most often required in practical calculations. The quantity actually measured in an experiment like the above is the drop of total heat, h_1-h_2, which is equal to $s(t_1-t_2)$, where s is the mean specific heat over the same range of temperature. Further examples of this method of expression are given in the later sections of this article.

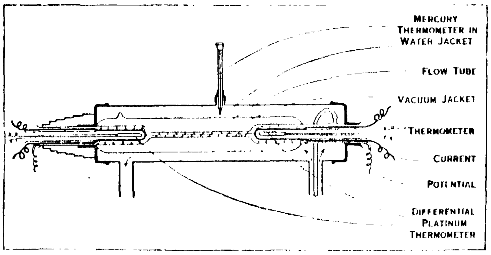

MERCURY THERMOMETER IN WATER JACKET
FLOW TUBE
VACUUM JACKET
THERMOMETER
CURRENT
POTENTIAL
DIFFERENTIAL PLATINUM THERMOMETER

FIG. 1.—CONTINUOUS ELECTRIC CALORIMETER FOR OBSERVING THE VARIATION OF THE SPECIFIC HEAT OF WATER

One of the chief sources of uncertainty in all calorimetric experiments is that heat cannot be perfectly insulated or prevented from escaping. Thus in the simple experiment above described, some heat is lost while the heated body is being transferred to the calorimeter, some heat is lost from the calorimeter as soon as its temperature is raised above that of its surroundings, and some is usually lost by evaporation from the exposed surface of the water. The degree of accuracy attainable in the measurements depends to a great extent on the possibility of preventing all such losses as are avoidable, and of estimating those which can not be eliminated. Various methods of effecting this desirabl result are described and compared with special reference to th problem of determining the variation of the specific heat o water, which is one of the most fundamental questions in calorim etry, and affords many good illustrations of the difficulties t be encountered in accurate work.

Variation of the Specific Heat of Water.—It would appear at first sight to be a simple matter to test the constancy of the specific heat of water by mixing equal weights of water at different temperatures and observing whether the final temperature o the mixture was the mean of the two initial temperatures. I reality the result of any such experiment would depend quite a much on the scale of the thermometers employed, and on uncertainties of heat-loss, as on the actual variation of the specific heat H. V. Regnault, who made so many advances in calorimetry an thermometry, appears to have come to the conclusion by makin some tests of this nature that the variation of the specific heat at temperatures such as are used in calorimetry, was too small t be detected with certainty. He also made some very elaborat measurements on a large scale with water from a boiler unde steam-pressure, over the range from 110° to 190°C., which showe that the total heat h of water increased somewhat more rapidly at higher temperatures and pressures in a manner which could be represented within the limits of error of his experiments by the simple formula,

$$h = t + 0{\cdot}2(t/100)^2 + 0{\cdot}3(t/100)^3 \qquad (1$$

The corresponding value of the specific heat s at any temperature t was deduced by differentiation, thus,

$$s = dh/dt = 1 + 0{\cdot}004(t/100) + 0{\cdot}009(t/100)^2 \qquad (2)$$

These formulae were accepted for more than 50 years as the basis of calculation in steam-engine practice, for which they afforded ample accuracy. They implied a gradual increase of specific heat, starting from the value 1 at 0°C. and reaching 1·00116 at 20°, 1·00425 at 50°C., and 1·0130 at 100°C., thus confirming the conclusion that the variation of the specific heat at ordinary atmospheric temperatures was too small to be worth taking into account in calorimetric experiments, the accuracy of which under the best conditions rarely exceeded 2 or 3 parts in 1,000.

Many able experimentalists who succeeded Regnault found much larger rates of increase of the specific heat at ordinary temperatures. Many of their methods were highly ingenious, but their results were so discordant as to leave little doubt that the remarkable discrepancies between different observers were due mainly to lack of appreciation of the difficulty of the problem The first reliable indication of the true mode of variation between 0° and 40°C. was that obtained by H. A. Rowland (*see* below) in his experiments on the mechanical equivalent of heat. His observations led to the totally unexpected result that the specific heat of water, instead of increasing steadily with rise of temperature from the freezing point, showed at first a fall of more than 1%, reaching a minimum at 30°, after which a slight increase was indicated But owing to the rapid increase of the heat-loss at higher temperatures the observations were not continued beyond 35°C. Rowland himself was doubtful on this account about the exact position of the minimum, and considered that the specific heat might go on decreasing as far as 40°. The fact of the diminution of the specific heat in this region was soon verified by many independent observers, though they differed somewhat in the rate of diminution and in the position of the minimum. But they differed so widely at higher temperatures that they did not throw any light on the relation between the thermal unit at 20°C., as employed in the method of mixtures, and the mean thermal unit from 0° to 100°C., as commonly adopted by engineers and used in ice-calorimetry.

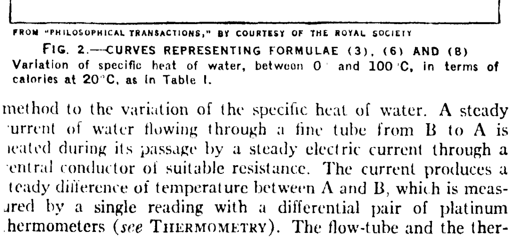
The first investigation covering the whole range 0° to 100°, in which due attention was paid to the thermometric difficulties, was that made by Lüdin (Zürich, 1895) under the direction of Prof. Pernet, employing the method of mixtures with mercury thermometers of the Paris type. The results were probably as good as could be obtained by the method employed, which is not very suitable for the purpose, since the highest observation with the hot water at 97° does not give the ***actual*** specific heat at 97°, but only the ***mean*** specific heat from 97° to 18°, the final temperature of the calorimeter. The quantities of hot water added were adjusted to give nearly the same rise of temperature, 11° to 18°, in the calorimeter in each case, so that the mean specific heat of the hot water over each range could be compared with the same standard. The observations of the mean specific heat, six of which were taken for each of ten ranges, seldom differed by more than 2 or 3 parts in 1,000 from the mean at each point, but may have been liable to systematic errors due to evaporation or similar causes. The deduction of the formula for the actual specific heat from the observed values of the mean specific heat over different ranges is a somewhat indirect process which greatly increases the uncertainty of the values of the actual specific heat in the region near 100°C. Lüdin's formula for the actual specific heat s at any temperature t between 0° and 100°C. is often quoted, and is as follows:—

$$s = 1 - 0{\cdot}07668(t/100) + 0{\cdot}196(t/100)^2 - 0{\cdot}116(t/100)^3 \qquad (3)$$
$$\pm 0{\cdot}00025 \qquad \pm 0{\cdot}040 \qquad \pm 0{\cdot}030$$

The probable errors of the coefficients, as calculated by Lüdin, are given in the line below the formula itself. The curve represented by this formula is shown by the line marked "Lüdin's formula" in fig. 2. It shows a minimum at 25°C. followed by a rapid rise to a maximum at 87°, and falls rapidly beyond 100° instead of rising continuously like Regnault's curve given by formula (2). But a formula of this type, in which the coefficients are large and of opposite signs, cannot be trusted for extrapolation.

Method of Electric Heating.—The method of electric heating, which is now commonly applied for measuring specific heats at high or low temperatures, offers special advantages for the variation of the specific heat. After the substance to be tested has been heated or cooled to any desired temperature in a suitable thermostat, a measured quantity of heat is imparted to it by an electric heating coil, sufficient to produce a small rise of temperature, which is carefully measured. The actual specific heat is thus obtained over a small range at the desired point, in place of the mean specific heat over a large range of temperature. The method has the additional advantage that the heat-loss in transference, which is such an uncertain element in the method of mixtures, may be entirely avoided, since the substance is heated after being placed in position in the calorimeter.

The arrangement shown in fig. 1 was employed by H. L. Callendar and H. T. Barnes (*Phil. Trans.* 1902) in applying the electric method to the variation of the specific heat of water. A steady urrent of water flowing through a fine tube from B to A is ieated during its passage by a steady electric current through a entral conductor of suitable resistance. The current produces a teady difference of temperature between A and B, which is measured by a single reading with a differential pair of platinum hermometers (*see* THERMOMETRY). The flow-tube and the therneter pockets at either end are protected from heat-loss y enclosure in a silvered vacuum jacket, which is surrounded by n external water jacket maintained at the desired temperature



FROM "PHILOSOPHICAL TRANSACTIONS," BY COURTESY OF THE ROYAL SOCIETY

FIG. 2.—CURVES REPRESENTING FORMULAE (3), (6) AND (8)
Variation of specific heat of water, between 0° and 100°C, in terms of calories at 20°C, as in Table I.

by a vigorous circulation of water from a delicate thermostat. The adoption of a steady-flow method eliminates all the discontinuities of operation which are so troublesome in the method of mixtures. After turning on the electric current and allowing sufficient time for the temperature to become perfectly constant in the outflow pocket A, the water current through AB is switched over into a weighing flask (not shown in the figure) without altering any of the conditions, and is collected for a suitable interval of time, recorded on an electric chronograph, in order to deduce the flow m in gm. per second. Meanwhile one observer records the difference of temperature dt between A and B, which remains practically constant, while another records the difference of potential E between the ends of the central heater and the current C passing through it by means of a potentiometer. The water-equivalent of the calorimeter, consisting mainly of the outflow pocket A, is very small, and is not required at all in the calculation if the temperature is constant. Sufficient stirring is effected by causing the water to circulate spirally round the bulbs of the thermometers and round the central heater in the flow tube AB. The heat generated by the stirring can be measured by observing the difference of pressure between A and B, but never exceeds 1 in 10,000 of the heat supplied electrically. The temperature of the external water jacket, which is always nearly the same as that of the inflow pocket B and of the thermostat, is not required with great accuracy, and is read by the mercury thermometer shown in the figure. The use of a differential pair of platinum thermometers for measuring the rise of temperature dt of the water in passing through the fine flow tube (which is required with the greatest accuracy) ensures that the observation shall be simultaneous for both thermometers, and avoids the uncertain corrections for change of zero and for stem-exposure to which even the best mercury thermometers are liable.

The steady-flow method possesses the advantage that the external loss of heat is greatly reduced and is rendered more regular, so that it becomes easier to measure with certainty. There is no free surface of water to permit loss by evaporation as in an open calorimeter. The vacuum jacket eliminates the possibility of loss by convection or by deposition and evaporation of dew, which are common sources of trouble in calorimetric experiments by other methods, but it cannot entirely eliminate losses by conduction or radiation. The direct determination of these residual losses, by experiment at each observation, is readily effected by the following method.

The rate of heat supply by the electric current in watts is given by the product EC, and is equal to the rate at which heat is being carried off by the water together with the rate of heat loss by conduction and radiation; these may be expressed in watts and represented by the products $Jsmdt$ and $h\,dt$, respectively, since both are proportional to the rise of temperature dt. We thus obtain the general equation of the method,

$$EC=Jsmdt+h\,dt \qquad (4)$$

in which Js is the variable specific heat to be determined in joules or watt-seconds per gram per degree rise of temperature, m is the flow of water in grams per second, and h is the rate of heat-loss in watts per degree rise. A second observation is then taken at the same temperature with a different value of the water flow m, and the current C is adjusted to give the *same* rise of temperature. We thus obtain a second equation in which the term $h\,dt$ is the same as in (4) and can be eliminated by subtraction. The required value of Js is thus obtained in the form,

$$Js=(E'C'-E''C'')/(m'-m'')\,dt, \qquad (5)$$

where the quantities observed in the two separate flows are distinguished by dashes. In practice it is seldom possible to get the rise of temperature precisely the same in both observations, and the other theoretical conditions cannot be satisfied exactly, but it is easy to allow for any small deviations of this kind by making slight modifications in the calculation.

The results obtained by this method over the whole range 0° to 100°C. can be represented satisfactorily by the following formula:—

$$s=0{\cdot}98536+0{\cdot}504/(t+20)+0{\cdot}0084\,(t/100)+0{\cdot}009(t/100)^2 \qquad (6)$$

in which the value of the constant 0·98536 is adjusted to make $s=1$ when $t=20°$, or the specific heat is expressed in terms of a unit at 20° C. The other terms are small and positive, and can be calculated with ample accuracy for all possible purposes by means of a 10in. slide rule. The corresponding curve is shown by the line marked "Callendar's formula" in fig. 2. Some of the separate observations, taken with six different calorimeters, are plotted in the figure in order to indicate the order of agreement obtained. Lüdin's observations could not be plotted in the same way, since they did not represent the actual specific heat at any point but only the mean specific heat over considerable ranges. Formula (6) shows a minimum at 37·5°C., and differs from Lüdin's by about 1% between 70° and 90°C., but shows no sign of a maximum, and continues to rise at a rate very similar to Regnault's formula (2), with which it agrees closely at 200° C. It is not intended for extrapolation above 100°C. as it represents the specific heat at a constant pressure of 1 atmosphere, which cannot be directly measured at temperatures above the boiling-point.

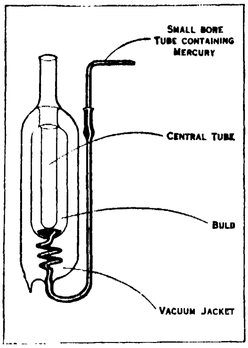


FIG. 3.—BUNSEN ICE CALORIMETER. ENCLOSED IN VACUUM JACKET TO PREVENT CREEP OF ZERO

TABLE I.

Specific heat s, and total heat h of water at atmospheric pressure in terms of a thermal unit at 20°C. for the range 0° to 100°C.

Temperature centigrade	Specific heat Callendar (6)	Total heat h, reckoned from 0° C.		
		Callendar	Rowland	Lüdin
0° . .	1·01056	0·00	. .	0·00
5° .	1·00596	5·040	5·041	5·033
10° .	1·00310	10·062	10·062	10·052
15° .	1·00122	15·072	15·072	15·060
20° . .	1·00000	20·075	20·075	20·061
25° . .	0·99922	25·073	25·071	25·061
30° .	0·99877	30·068	30·071	30·050
35° .	0·99856	35·062	35·058	35·060
40° .	0·99856	40·054	. .	40·065
45° .	0·99871	45·047	.	45·077
50° .	0·99901	50·042	.	50·095
60° .	0·99994	60·036	.	60·156
70° . .	1·00125	70·042		70·251
80° .	1·00288	80·062	.	80·372
90° .	1·00470	90·100	. .	90·505
100° . .	1·00696	100·150	. .	100·814

The figures in the column headed "Specific Heat" show the variation given by formula (6). It will be seen that the specific heat at 15° exceeds that at 20° by little more than 1 in 1,000, which is beyond the limits of error of ordinary calorimetric experiments. The figures in the next column give the corresponding values of the total heat h obtained by integrating the same formula for the specific heat. The mean thermal unit over the range 0° to 100° is obtained by dividing the value of h at 100° by 100, and is seen to be 1·0016 times the specific heat at 20°. The mean specific heat over any range is most easily obtained from this column by dividing the drop of total heat by the corresponding drop of temperature. But for most experiments in which large ranges of temperature are used in the calorimeter the converse process is required, namely, to deduce the drop of total heat $h'-h''$ from the observed drop of temperature $t'-t''$. This is most easily done by adding the small difference $h'-t'$, and subtracting $h''-t''$, which may be obtained from the table by inspection.

In comparing results obtained by different methods it is always desirable to go back to the quantities actually measured, whenever possible. Rowland in his experiments observed the increase of total heat from 5° to 35° in mechanical units, which are reduced to thermal units in the column headed "Rowland" by dividing by his value of the mechanical equivalent at 20°. His results thus reduced are seen to agree very closely with those found by the electric method over the same range, although the values of the specific heat for successive intervals of 5° (which are generally taken as the basis of comparison) are somewhat irregular owing to the increasing uncertainty of the heat-loss towards the latter part of the range. Similarly in Lüdin's experiments, the quantity measured was not the specific heat at *t*, but the drop of total heat of the hot water (or the gain of total heat of the cold water) introduced into the calorimeter. His values of the total heat agree as closely as could be expected with the continuous electric method from 0° to 40°. Beyond 40° they show an increasing divergence, which amounts, however, to only 0·2% at 70°, where his curve of specific heat shows a discrepancy of nearly 1%.

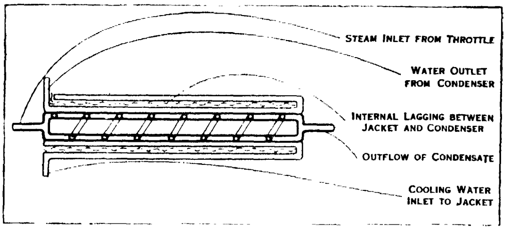
Lüdin's curve of specific heat was reproduced with remarkable fidelity by W. R. and W. E. Bousfield (*Phil. Trans.* 1911), who employed a most ingenious method of electric heating in a Dewar-flask calorimeter. They measured the rise of temperature with mercury thermometers, and were unable to extend the observations beyond 80° on account of evaporation from the surface of the water. When expressed in terms of total heat, the discrepancies of their results from formula (6) are somewhat smaller than those of Lüdin's formula, and may probably be attributed to uncertainties of heat-loss by evaporation, etc., at the upper limit of their range, or to errors due to stem-exposure and variations of zero such as are inevitable with mercury thermometers, or possibly to the difficulty of determining the water-equivalent of the calorimeter and heater satisfactorily. In any case the type of variation shown by Lüdin's curve for the specific heat, with a maximum below 100° followed by a rapid fall at higher temperatures, is quite inadmissible on theoretical grounds, besides being in contradiction with the results of experiments at higher temperatures, all of which appear to require a continuous increase of the specific heat with rise of temperature.

Theoretical Explanation of the Variation.—Rowland suggested that the increase of the specific heat of water on approaching the freezing-point should be due to an increasing proportion of molecules of ice in the liquid. Assuming that each ice molecule in melting absorbs a quantity of heat equivalent to its latent heat of fusion, the proportion of ice molecules in water at the freezing-point would be something in the order of 1% of the mass. Nearly all of these would be melted by the time the water reached a temperature of 40°, where the specific heat has already begun to increase again. H. T. Barnes has succeeded in measuring the specific heat of supercooled water below the freezing point, and finds that it continues to increase as the temperature falls, following a prolongation of the same curve as that found above the freezing point. The high specific heat of water has often been attributed to the complexity of the water molecule, which has been the subject of much speculation; but it is futile to speculate until something definite is known of the nature of the polymers present and the laws of equilibrium between them. There is no doubt that the formation and dissociation of complex molecules must profoundly affect the specific heat.

In the case of the vapour, on the other hand, there is little doubt that the great majority of the molecules of steam are single molecules of the type H_2O. (*See* VAPORIZATION.) It appears highly probable that a certain proportion of steam molecules must also exist in solution in the *liquid* when in equilibrium with the vapour in the state of saturation, and that these molecules are chiefly responsible for the increase of specific heat of the liquid. According to the vapour-pressure theory of osmotic pressure (*see* THERMODYNAMICS) the surface of any liquid acts as a semi-permeable membrane, which allows free passage to the vapour-molecules. This implies that the density of the vapour molecules in the liquid should be the same as that of the vapour with which it is in equilibrium, or that water at any temperature should contain its own volume v per unit mass of saturated steam at the same temperature. Since a volume v of steam already exists in the water in the state of vapour, the vaporization of unit mass of water with increase of volume from v to V (the corresponding volume of steam) involves the vaporization of a volume V-v of steam. Thus the whole latent heat L of vaporization per unit mass corresponds with the generation of a volume V-v of steam, and the latent heat of the volume v already contained in the water should add the fraction $v/(V\text{-}v)$ of L to the total heat h of the water. According to this view, the effect of the steam molecules on the variation of the total heat h of the liquid, reckoned from 0°C., may be represented by the simple formula:

$$h = s_0 t + vL/(V - v) \qquad (7)$$

A formula of this type, though without any theoretical interpretation, was first proposed by Paul de St. Robert (Turin, 1857), as representing Regnault's results between 100° and 200°C. just as well as formula (1). It was also pointed out by J. MacFarlane Gray (*Proc. Inst. C.E.* 1902) that, by superposing on formula (7) the effect of the ice molecules near the freezing point, a curve very similar to that found by the continuous electric method for the variation of the specific heat between 0° and 100°C. would be obtained. Since the effect of the ice molecules becomes evanescent above 40°C., the simple formula (7) was adopted as the basis of Callender's steam tables, though formula (6), including the effect of the ice molecules, is still required for calorimetric experiments between 0° and 40°


STEAM INLET FROM THROTTLE
WATER OUTLET FROM CONDENSER
INTERNAL LAGGING BETWEEN JACKET AND CONDENSER
OUTFLOW OF CONDENSATE
COOLING WATER INLET TO JACKET

FROM "WORLD POWER"

FIG. 4.—SECTIONAL DIAGRAM OF JACKETED CONDENSER, FOR MEASURING TOTAL HEAT OF STEAM AT HIGH PRESSURE

TABLE II.

Total heat h of water under saturation pressure. In terms of mean thermal unit 0° to 100°C.

Temperature C.	Regnault (1)	Dieterici (8)	(8) +*apv*	Formula (7)
150° . .	150·7	150·02	151·16	150·01
200° . .	202·2	203·11	203·54	203·55
250° . .	254·7	257·16	258·36	259·78
300° . .	308·3	313·46	316·41	322·86
350° . .	363·6	374·98	382·03	401·12
374° . .	390·5	401·91	418·01	481·25

The first column gives the temperature. The column headed Regnault (1) gives values of h by formula (1) reduced in the proportion 100/100·5, since the value of h at 100°C. is 100 in terms of the mean thermal unit, whereas Regnault's formula (1) gives $h = 100{\cdot}5$ at 100°C. in terms of a unit at 0°C. In the case of Dieterici's formula (8) (*see* below) the values are already expressed in terms of the mean thermal unit. His formula for h is very similar to Regnault's but with different coefficients. Both are liable to the objection that they do not make the total heat increase sufficiently fast to satisfy the theoretical conditions at the critical point, 374°C. The values of the thermodynamic formula (7) are expressed in terms of the mean thermal unit by choosing the value of the constant s_0 to be 0·99666, which is very nearly the same as the minimum value of the specific heat 0·99697 given by formula (6) in terms of the mean thermal unit.

Method of Fusion.—The measurement of quantities of heat in terms of change of state, *e.g.*, fusion of ice or condensation of steam at constant temperature, is theoretically the most perfect in that no question of the thermometric scale is directly involved. The practical difficulties encountered by Black and other observers (*see* HEAT) in applying the method of fusion lay in the measurement of the quantity of ice melted. These troubles were first successfully overcome by R. Bunsen (*Phil. Mag.* 1871), who constructed an apparatus in which the diminution of volume due to the melting of the ice could be observed. The construction of a modern calorimeter of this type is illustrated in fig. 3. The central tube A serving for the reception of the heated body is surrounded by a bulb B filled with air-free water, which communicates at its lower end with a tube C of small bore containing mercury, by which any changes of volume of the water in freezing or melting can be observed with considerable accuracy. The vacuum jacket J surrounding the bulb B was not included in Bunsen's original design but is a later addition intended to eliminate creep of zero, as explained below. In using the instrument, the first operation is to freeze some of the water in B by circulating a freezing liquid, such as alcohol or ether at a low temperature, through the inner tube A, which thus becomes coated with a sheath of ice. The whole apparatus is then immersed in a bath of melting ice, leaving only the upper end of A and the tube C exposed. If a hot body is now dropped into the tube A, the quantity of heat which it gives up in cooling to 0°C. will melt a corresponding amount of the ice sheath. The quantity of ice melted is shown by the retreat of the mercury along the tube C, or preferably by observing the weight of mercury sucked into the tube as in using a weight thermometer. Since the weight thus observed is directly proportional to the quantity of heat added, and is independent of the dimensions of the calorimeter, the constant factor for reducing weight of mercury drawn in to gram-calories of heat added is the same for all ice-calorimeters of this type. The constant is usually determined by adding known quantities of heat in the form of water at its boiling-point. Dieterici (*Ann. Phys.* 1905) used the method for observing the variation of the mean specific heat of water at temperatures up to 300°C., by sealing known weights of water in quartz-glass bulbs which were heated to various temperatures and dropped into an ice-calorimeter. By using thin bulbs heated to 100°C. he was thus able to determine the constant of the ice-calorimeter in terms of the mean thermal unit with an accuracy not previously achieved. The value found was 15·492 mg. of mercury per mean gram-calorie centigrade, in place of the value 15·44 previously employed as the mean of the results of other workers. Dieterici's value of this important constant has since been confirmed by E. Griffiths (*Proc. Phys. Soc.* 1913), who found 15·491 mg. of mercury as the equivalent of the mean gm. calorie of 4·185 joules, as given by the electric method shown in fig. 1.

The chief advantage of the ice calorimeter is that it is very perfectly protected against external loss of heat provided that the internal ice sheath is sufficiently continuous to prevent any heat escaping directly from the heated body to the external ice bath, and that the temperature of the ice bath is precisely the same as that of the ice sheath inside the calorimeter. Sometimes there may be a slight difference in quality of the ice, causing a gradual creep of zero when the calorimeter is directly immersed in the ice bath. This creep of zero, which is often troublesome in delicate experiments, may be completely eliminated, as has been explained by H. L. Callendar (*Ency. Brit.* 1902), by enclosing the bulb of the calorimeter in a vacuum jacket, as indicated in fig. 3, which reduces any possible interchange of heat about 1,000 times as compared with direct immersion of the calorimeter in the ice bath. The method is then very convenient for measuring small quantities of heat, such as those due to the Peltier effect (*see* also ELECTRICITY), especially when the heat is generated inside the calorimeter. The risk of heat-loss in transference cannot be avoided, any more than in the method of mixtures, if the heated body has to be dropped into the calorimeter, though the uncertainty may be reduced by skilful manipulation.

The most important correction in Dieterici's experiments on water was that for the thermal capacity of the quartz bulbs, which amounted to about a quarter of that of the contained water in the experiments at 100° to 130°C., and was calculated from a formula for the specific heat of quartz-glass. He estimated the order of accuracy of the experiments at 100°C. as 1 in 1,000 on the mean specific heat, but stated that the precision attainable diminished at lower temperatures as the quantity of heat to be measured was reduced. For this reason the method was not suited for giving accurate results for the variation of the specific heat near the freezing point. The correction for the water equivalent of the quartz bulbs became more important at higher temperatures, where it was necessary to use much thicker bulbs in order to withstand the steam pressure. From 150° to 220°, bulbs having a thermal capacity about equal to the contained water were employed. Above this point up to 300°, the limit of the experiments, the bulbs had a capacity nearly 4 times that of the water, which would greatly increase the uncertainty of the results. Another small correction was applied for the internal latent heat of the steam generated in the space left vacant above the water level, since the bulbs could not be completely filled without risk of bursting under the enormous pressures which might be generated by the expansion of the water. When these corrections are applied the quantity measured, as Dieterici points out, is the drop of internal energy of the water in cooling to 0°C. from its initial temperature, since the water is enclosed in a practically non-expansive envelope, and no external work is done either in heating or cooling. Thus the formula given by Dieterici for the mean specific heat $s_{0,\,t}$ from 0° to t, namely

$$s_{0,\,t}=0\cdot99827-0\cdot005184(t/100)+0\cdot006912(t/100)^2 \qquad (8)$$

when multiplied by t, represents the internal energy of water at t under saturation pressure, reckoned from 0°C. and expressed in terms of the mean thermal unit, giving $s_{0,\,t}=1$ when $t=100$. This formula gives slightly higher values for the internal energy than Regnault's formula (1) for h, as shown in Table II., and has commonly been adopted for the total heat of water by Continental and American writers on the subject. But in order to deduce the total heat h from the internal energy, the quantity apv should be added, representing the thermal equivalent of the work required to pump a volume v into a boiler against the steam-pressure p. This correction is indicated in the next column of Table II. and gives higher values than (8), agreeing very well with the thermodynamic formula (7) up to 200°C., but still falling short of the rapid increase shown by (7) near the critical point. The corresponding formula for the specific heat s at t, as obtained from (8) by differentiation, and expressed in terms of a unit at 20°C., is represented by the curve marked "Dieterici" in fig. 2. As Dieterici remarks, the formula for s has an inferior degree of accuracy to that representing the mean specific heat, $s_{0,\,t}$ since it does not so directly represent the results of observation. Some additional uncertainty in the reduction arises from the value of the unit at 20°, which Dieterici gives as 0·9974 in terms of the mean unit, in place of the value 0·9984 given by the continuous electric method. The agreement of these two values to 1 in 1,000 coincides with Dieterici's estimate of the limit of accuracy of the ice calorimeter.

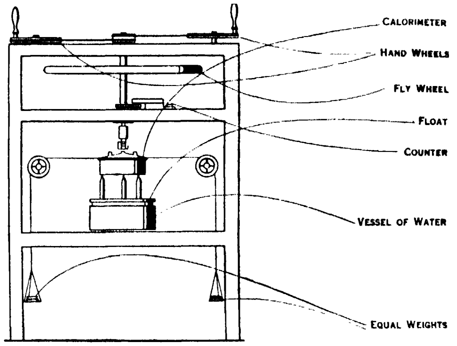


FIG. 5.— JOULE'S APPARATUS FOR THE DETERMINATION OF THE MECHANICAL EQUIVALENT OF HEAT, 1878. JOULE'S ORIGINAL APPARATUS OF

Method of Condensation.—The Steam Calorimeter, in which quantities of heat are measured in terms of the latent heat of condensation of steam, has been applied with success by J. Joly (*Proc. R.S.* 1889) to the difficult problem of measuring the specific heats of gases at constant volume, and is undoubtedly capable of giving very accurate results under suitable conditions. But its use for accurate work is practically restricted to the range from atmospheric temperature to 100°C., and it is of less general applicability than the ice calorimeter The method also requires very delicate weighing of the quantity of steam condensed, as 1gm. calorie corresponds to the condensation of less than 2mg. of steam. Assuming Regnault's value 536·68 for the latent heat of steam at 100° C., Joly found, by weighing the steam condensed in heating a known mass of water from 12° to 100°C., that the mean specific heat of water between these limits was only 0·9952, whereas the value given by Regnault's formula was 1·0053, and that given by Lüdin's formula 1·0086, exceeding the value found by Joly by more than 1%. Joly's observation was of special interest at the time (1895) as the first suggestion that the accepted values of the total heat of water at 100° and the latent heat of steam were discordant by an amount which could hardly be neglected in the case of such important constants. Joly's observation was probably very accurate but gave only the ratio of the two, and not the actual value of either. The truth probably lay between the two extremes, as was subsequently found to be the case. Thus if we take the values of the total heat of water at 12° and 100°, as deduced from formula (6) and given in Table I., we find the mean specific heat 1·00104 in terms of a unit at 20°C. and deduce for the latent heat from Joly's observation the value 540·0 in place of Regnault's 536·7. The higher value, 540 in terms of a unit at 20°C., has since been confirmed by other observers, though it may still be a little too low on account of the difficulty of eliminating the last traces of moisture in saturated steam or any other vapour. For this reason it is usually preferable, in finding the total heat, or the latent heat, of a saturated vapour, to observe the total heat at the required temperature *t*, but at pressures slightly below that of saturation to make sure that the vapour is dry. Values for the dry saturated vapour may then be deduced by extrapolating the isothermal curves thus obtained on the *PT* diagram to the saturation pressure.

Steady Flow Methods.—In place of measuring the rise of temperature in a fixed mass of water, as in the method of mixtures, it is often preferable, in cases where the heat to be measured can be supplied at a steady rate, to keep the temperature in every part of the apparatus constant by removing the heat as fast as it is generated by means of a steady flow of cooling water. When the conditions have become stationary the rate of heat supply can be measured by observing the rate of flow and the rise of temperature of the cooling water. The method is especially suitable for measurements of the total heat of liquids or vapours, and of the calorific values of gaseous and liquid fuels, which include many of the most important cases in practice. It has the advantage that the water equivalent of the apparatus is not required, which greatly facilitates work at higher temperatures and pressures, where the thermal capacity of the apparatus is often large and its accurate determination would be a matter of considerable difficulty. A steady flow method combined with electric heating has already been illustrated in fig. 1. The object in that case was to determine the variation of the specific heat of the steady current of water. The total heat of other fluids in steady flow may then be measured by using a steady flow of water to carry off the heat. In this case there are two flows to be measured, but the complication of electric heating is no longer required. As a good illustration of the way in which difficulties of measurement may be circumvented by the employment of a steady flow method, we may take the measurement of the total heat of steam at high temperatures and pressures, which is a problem of some practical interest and importance, but has hitherto resisted solution by any of the older methods.

The heart of the apparatus, in which the steam is condensed and its drop of total heat measured, is called a jacketed condenser and is shown in section in the annexed fig. 4, omitting such details of construction as are not essential to the principle of the method. The auxiliary apparatus required for generating a steady flow of steam consists of a feed-pump, designed to work up to a pressure of 4,000 lb. per sq. in., delivering water at the desired pressure to an electric boiler and superheater capable of generating steam and heating it up to the desired temperature. The steam then passes through a thermometer pocket in which its initial temperature and pressure are accurately observed, defining the state in which its total heat H_1 is to be measured. Immediately on leaving this high-pressure pocket, the steam is passed through a throttle tube (which reduces the pressure to atmospheric without altering its total heat) before entering the condenser through the inlet marked A on the left of the figure. The condenser proper consists of the annular space between the two inner tubes, in which the steam is caused to circulate spirally, as indicated in the figure, in order to increase the efficiency of condensation. After being condensed to water at atmospheric pressure the steam leaves the condenser at B and passes through a thermometer pocket, not shown in the figure, in which its final temperature as condensate is observed. Its total heat H_2 in this state is known from the table already given. Finally the condensate is cooled to atmospheric temperature before being collected in the tanks, which are weighed at suitable intervals in order to determine the flow of steam *M* in lb./min or gm./sec. or other convenient units.

The steady flow of cooling water by which the steam is condensed is supplied from a large tank in which the level is maintained constant. After passing through a thermometer pocket at C, where its temperature is observed, the cooling water circulates round the jacket shown in the figure, which is separated from the condenser proper by the layer of lagging. It then circulates round the condenser tube, abstracting heat from the steam and rising in temperature, and leaves the apparatus through a thermometer pocket attached to the outlet at D. It is cooled again to atmospheric temperature on its way to the weighing tank, in which the flow *m* of cooling water is measured for the same intervals as hat of the condensate *M* by switching over the flows simultaneously into their respective tanks. The function of the jacket, through which the cooling water enters the apparatus, is to catch any heat which might otherwise escape from the hot water surrounding the condenser. In addition to this, the whole apparatus is enclosed in an external jacket, not shown in the figure, supplied with circulating water from the same tank as the cooling water. This external jacket is protected by lagging and, being always at the same temperature as the internal jacket surrounding the con-

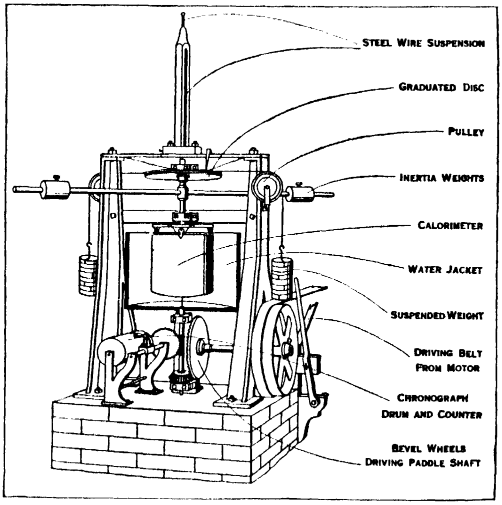


FIG. 6.—ROWLAND'S APPARATUS FOR THE DETERMINATION OF THE MECHANICAL EQUIVALENT OF HEAT, 1879

denser, serves to prevent any heat reaching the cooling water from outside, after its inflow temperature has been measured at C. With these precautions, the external loss of heat from the condenser is almost incredibly small, rarely exceeding a fifth of 1%, even with a rise of temperature of 80°C. in the cooling water.

The theory of the method is extremely simple and has the advantage of giving the result directly in terms of total heat, without any ambiguity with regard to the quantity measured. The kinetic energy of flow through the pockets being negligible, when everything is steady, the rate at which heat is being carried in by the steam, namely MH_1, must be equal to the rate at which heat is being carried off by the condensate and the cooling water, namely $MH_2+m(h_2-h_1)$, together with the rate of heat-loss X from the high-pressure pocket, and x from the condenser. Dividing each of these quantities by M, so as to obtain the total heat H_1, of the high-pressure steam per unit mass, we find the equation,

$$H_1=H_2+(h_2-h_1)m/M+(X+x)/M \tag{9}$$

It should be observed that H_2 and $X+x$ are small compared with H_1, and that the term requiring the greatest accuracy of measurement is h_2-h_1, the gain of total heat of the cooling water. This is always very nearly equal to the corresponding rise of temperature, as directly measured with a differential pair of platinum thermometers, from which the gain of total heat is easily deduced by adding and subtracting the small differences shown in Table I. between h and t, as previously explained. The rates of heat-loss, X and x, can be found, as in the continuous electric method, by varying the flows M and m independently in suitable ratios. This is more troublesome than in the electric method, but need not be repeated at every observation if the same apparatus is employed for a considerable period.

It might be thought that it would be necessary to condense the steam under its original pressure in order to measure the total heat. This was the case according to the old definition of the total heat by Regnault, who actually measured the total heat of steam in this way up to 12 atmospheres. Owing to the high pressure, he met with many difficulties from leakage and measured the total heat of water in a different way, which led to awkward discrepancies in the theory. With the new definition of total heat, first proposed by Callendar in a previous edition (*Ency. Brit.* 1902), and now generally accepted, all these difficulties and discrepancies disappear, and the steam may be condensed at any convenient pressure without affecting the results for the total heat. The advantage of condensing always at atmospheric pressure is that only one design of condenser is required. Moreover the best security against any possibility of leakage between the steam and the cooling water is obtained, since the perfect absence of leakage may be tested at any time by employing much higher pressures. Nevertheless it is essential, in order to secure permanent immunity from leakage, to design the condenser in such a way that every tube is perfectly free to expand. Otherwise it would rack itself to pieces in time by differences of expansion between the hot and cold tubes. In practice both the inside and the outside of the annular space are utilized for condensing the steam, by making the cooling water circulate through the whole length of both. But these details of construction could not be shown in the diagram without obscuring the main principle.

It is a great advantage of the method that the same apparatus, without any modification, can be applied for measuring the total heat of water by simply pumping hot water through it. In point of fact it was first designed with the object of verifying the thermodynamic formula (7) for the variation of the total heat of water at high pressures near saturation; but owing to the difficulty of procuring the expensive apparatus required for high pressures it was first applied (*Phil. Trans.* 1912) to the verification of Table I. for the total heat between 0° and 100°C. as deduced from the observation of the specific heat by the continuous electric method. Since the World War, with the assistance of the British Electrical Research Association, who provided the necessary funds, it has been possible to extend the measurements for both steam and water to pressures in some cases exceeding 3,500 lb. There was no difficulty in measuring the total heat h of water at high pressure provided that the temperature was 2° or 3° below that of saturation; but, at or near the saturation point, any trace of air in the water caused profuse generation of steam in the air bubbles and tended to give results appreciably higher than equation (7). This difficulty was surmounted by supplying the pump with distilled water from a special apparatus, by which it was freed from air immediately before passing into the pump. This led to so great an improvement that there seems to be little doubt that equation (7) holds up to the critical temperature where the volume of water becomes indeterminate. The actual value of h at the critical point, as given in Table II., remained uncertain, so long as the corresponding value of the volume v rested on theoretical assumptions, such as those of van der Waals, which were very doubtful, if not entirely erroneous. But both h and v have now been determined by direct experiment at this point, and are found to satisfy formula (7).

Mechanical Equivalent of Heat.—The history of the establishment of the mechanical theory of heat is reviewed in the article HEAT, in which a general account is given of the early experiments by Joule and others demonstrating the transformation of other kinds of energy into heat. The phrase "mechanical equivalent" was originally employed to denote the number of gravitational units of mechanical work, such as foot-pounds or kilogram-metres, required to produce one unit of heat when completely converted into heat by friction or otherwise. By a natural process of transition the same phrase is now commonly used for the numerical ratio of equivalence between units of energy in any form and the various units of heat. Since most forms of energy are measured directly or indirectly in terms of mechanical work done against gravity, it is merely a question of conversion of units, when one value of the mechanical equivalent of a particular thermal unit has been found by experiment, to deduce the corresponding result for any other thermal unit in terms of any other unit of energy. Owing to the multiplicity of units both of energy and heat, there are many different values for the mechanical equivalent on this basis; but for scientific purposes it is usual to reduce experimental results to absolute units on the C.G.S. system, taking the joule or watt-second as the absolute unit of energy and the gram-calorie centigrade at 20°C. on the scale of the hydrogen thermometer as the unit of heat. This has the advantage of excluding the effect of local variations of gravity and fits conveniently with the electrical system of units. Engineers, on the other hand, still prefer the gravitational system as fitting better with the practical measurement of pressure in terms of weight per unit area, since the variations of gravity are relatively small and can be taken into account if necessary in special cases.

The experimental measurement of the mechanical equivalent of heat requires the accurate determination of the quantity of heat generated by the expenditure of a known amount of mechanical work, and is mainly a question of calorimetry. The simplest method to use in the laboratory is the electric method, since the measurement of electric energy requires no moving parts in the apparatus, and is very accurate if the absolute values of the electric standards employed are known. Accordingly as soon as the absolute value of the ohm had been determined by the committee of the British Association, the electric method of calorimetry was applied to the verification of Joule's determination of the mechanical equivalent of heat. The result gave a value more than 1% lower than the mechanical method employed by Joule in 1850. As these early experiments had been carried out on a small scale with a very laborious method of measuring the work and applying corrections for heat-loss, Joule consented to repeat them on a much larger scale with a greatly improved method, as shown in fig. 5. The calorimeter h containing about 12 lb. of water, was supported on a float w in a vessel of water v, so as to be in neutral equilibrium, but was kept at rest by a pair of fine strings passing round a horizontal wheel of radius r on the circumference of the calorimeter, and supporting equal weights kk by means of frictionless pulleys. During an experiment the paddles inside the calorimeter were rotated by means of the hand-wheels at the top of the apparatus at such a speed as to keep the weights floating steadily, balancing the turning moment due to the friction of the paddles churning the water. If the sum of the weights is equal to W' the work done against friction in n revolutions as shown by the counter will be $2\pi rnW'$ in mechanical units. The corresponding value of the heat generated is calculated in the usual way from the product of the thermal capacity M of the calorimeter and its contents, by the observed rise of temperature $(t'-t'')$ corrected for heat-loss. The ratio $J = 2\pi rnW'/M\ (t'-t'')$ gives the required value of the mechanical equivalent in terms of the units employed in the measurement.

As the result of this series of experiments Joule found that 772·55ft. lb. of work in the latitude of Greenwich were required to raise the temperature of 1 lb. of water 1° at 60° on the scale of his mercury thermometers. This agreed very closely with the value 772 under similar conditions obtained in his earlier experiments in 1850, but disagreed with the value obtained by the electric method on the assumption that the B.A. unit of resistance correctly represented the absolute value of the ohm. The discrepancy was subsequently explained by the discovery that the absolute value of the B.A. unit of resistance was about 1·3% too small as compared with the true ohm.

About the same time H A. Rowland (*Proc. Amer. Acad.* xv. p.75, 1880) repeated the measurement of the mechanical equivalent, employing the same method as Joule in 1878, but with many improvements in detail, as illustrated in fig. 6. His calorimeter was suspended by a steel wire, the torsion of which made the equilibrium stable, and was slightly larger and more compact than Joule's. To reduce the relative importance of the heat-loss, he found it necessary to secure a greater rate of heat-supply, about 17 times that employed by Joule. The paddles were mounted on a vertical spindle F, passing through a gland in the bottom of the calorimeter, and were driven through bevel gearing *g* by a belt from a petroleum motor running at a nearly constant speed. The greater part of the torque due to the friction of the paddles inside the calorimeter was balanced by the floating weights O and P, suspended by silk ribbons passing over pulleys and round the wheel *kl*. The small variations of torque with speed were balanced by the twist of the steel wire suspension, and were observed by a scale on the circumference of the wheel *kl*. The number of revolutions of the paddles was recorded automatically on a chronograph drum driven by a worm gear from the spindle *f*. The rise of temperature was recorded on the same sheet by an observer watching the thermometer and pressing a key at the moment when the mercury passed each division of the scale. The paddles were made very light and rigid, in order to reduce their water-equivalent, and were arranged to give the greatest possible uniformity of torque and efficiency of stirring. The lower part of the calorimeter was surrounded by a water jacket at a definite temperature in order to protect it from draughts and to make the heat-loss consistent. The heat-loss at any temperature was estimated by observing the rate of rise of temperature in subsidiary experiments when the paddles were driven at a much slower rate than in the main series of observations. It was found possible to obtain reliable observations in this way over a range from 5° to 35°C. about 14 times greater than in Joule's experiments, owing to the greater rate of work supply. But some of the observations were vitiated by deposition of dew on the calorimeter at the lower limit, and the heat-loss at the upper limit was rendered somewhat uncertain by upward convection currents from the heated calorimeter, which could not be completely enclosed. That Rowland's calorimetric observations were more accurate than those of any previous observer was clearly indicated by the fact that they conclusively demonstrated the diminution of the specific heat of water with rise of temperature from 5° to 30°C., which had never been suspected, and has since been confirmed with remarkable precision.

Rowland was the first to appreciate the importance of reducing results for the mechanical equivalent to the absolute scale of temperature in place of the arbitrary scale given by a particular mercury thermometer. He considered that the comparison of his mercury thermometers with the air thermometer was the most difficult part of the investigation, and estimated the limit of accuracy at only 1 in 500 on this account; especially as the thermometers could not be compared under the actual conditions of the experiments, with the temperature rising at the rate of nearly 1°C. per minute, owing to the excessive lag of the air thermometer and the time required for taking readings. Nevertheless, the probable accuracy of his result, namely, 4·179 joules per gm.cal. at 20°C., the middle point of his range, may be taken as at least 1 in 2,000, since it was only raised to 4·181 by an elaborate comparison of his thermometers with Paris standards by Day, and with the platinum thermometer by Griffiths. Some 20 years later his result at 20°C. was further confirmed by the continuous electric method already described, in terms of the standard ohm and the Clark standard cell. By that time the absolute value of the ohm was known to at least 1 in 5,000, but that of the Clark cell was more doubtful, and was accordingly determined by R. O. King (*Phil. Trans.* 1902) using a special form of electrodynamometer which he set up for the purpose. The accuracy of this instrument has since been confirmed by Norman Shaw (*Phil. Trans.* 1915), who employed it without any alteration for a similar determination of the absolute value of the Weston standard cell. Including all known corrections for the values of the electric units since ascertained, the electric method gives 4·178 joules, agreeing closely with Rowland's uncorrected result for the absolute value of the gm.cal. C. at 20°C. The corresponding value for the mean gm.cal. 0° to 100°C. would be 4·185 joules according to Table I. This also agrees very closely with the value 4·184 joules for the mean calorie as directly obtained by Reynolds and Moorby (*Phil. Trans.* 1897) with a 100h.p. steam engine, using a Froude-Reynolds brake, in which the water was heated from near 0°C. to 100°C. This agreement may be regarded as confirming the variation of the specific heat of water as given by equation (6). It is usual, however, to take the round number 4·180 joules as the equivalent to the gm. calorie at 20°C., giving greater weight to Rowland's corrected result. A very accurate determination of the gm. calorie in joules has recently been made by Laby and Hercus (*Phil. Trans.* A. 1927) between 15° and 20° by a steady flow method, in which the work was directly measured in mechanical units. They give the value 4·1809 joules for the gm. calorie at 20°C., but it is uncertain how far the last figure may be regarded as significant.

For special methods commonly employed in the determination of the heats of combustion and calorific values of fuels, *see* article THERMOCHEMISTRY. For specific heats of gases and vapours, *see* articles HEAT, THERMODYNAMICS and VAPORIZATION. (H. L. C.)

CALOVIUS (1612–1686) (the latinized name of Abraham Calau), German Lutheran divine, was born at Mohrungen, East Prussia, on April 16, 1612. After studying at Königsberg, in 1650 he was appointed professor of theology at Wittenberg, where he afterwards became general superintendent and primarius. He died there on Feb. 25, 1686. Calovius was the powerful champion of Lutheran orthodoxy in the 17th century. He opposed Catholics, Calvinists, and Socinians, attacked in particular the reconciliation policy or "syncretism" of Georg Calixtus. His chief dogmatic work, *Systema locorum theologicorum* (1655–77), represents the climax of Lutheran scholasticism. His *Biblia Illustrata* was written to refute the statements made by Hugo Grotius in his Commentaries. His *Historia Syncretistica* (1682) was suppressed.

CALPRENÈDE, G. DE C. DE LA: *see* LA CALPRENÈDE, G. DE C. DE.

CALPURNIA, wife of Julius Caesar, was the daughter of L. Calpurnius Piso, consul in 58 B.C. She married Caesar in 59. Alarmed by the rumours of conspiracy current before Caesar's murder, she did her best to dissuade him from going to the Senate-House on the 15th of March 44. After the murder, she secretly moved his money and private papers to Anthony's house.

See Appian, *B.C.* II, 14, 115, 125; Plutarch, *Caesar;* Suetonius, *Caesar,* 27; *C.I.L.* VI., 14211.

CALPURNIUS, TITUS, Roman bucolic poet, surnamed SICULUS, probably flourished during the reign of Nero. Eleven eclogues have reached us under his name, of which the last four, from metrical considerations and express ms. testimony, are now generally attributed to Nemesianus (*q.v.*) who lived in the time of the emperor Carus and his sons (latter half of the 3rd century

A.D.). We gather from the poems (in which he is obviously represented by "Corydon") that Calpurnius was in poor circumstances and was on the point of emigrating to Spain, when "Meliboeus" came to his aid and helped him to a post at Rome. The time at which Calpurnius lived has been much discussed, but the references to the emperor seem to point to the time of Nero. Meliboeus has been variously identified, but what is known of Calpurnius Piso fits in with what is said of Meliboeus by the poet. His claim is further supported by the poem *De Laude Pisonis* (ed. C. F. Weber, 1859), which there is considerable reason for attributing to Calpurnius.[1] Further, the similarity between the two names can hardly be accidental; it is suggested that the poet may have been adopted by the courtier, or that he was the son of a freedman of Piso. The attitude of the author of the *Laus* towards the subject of the panegyric seems to show less intimacy than the relations between Corydon and Meliboeus in the eclogues, and there is internal evidence that the *Laus* was written during the reign of Claudius (Teuffel-Schwabe, *Hist of Rom. Lit.* § 306,6).

The two short hexameter poems in an Einsiedeln ms., obviously belonging to the time of Nero, if not written by Calpurnius, were imitated from him.

Although there is nothing original in Calpurnius, he is "a skilful literary craftsman." Of his models the chief is Virgil, of whom (under the name of Tityrus) he speaks with great enthusiasm; he is also indebted to Ovid and Theocritus. Calpurnius is "a fair scholar, and an apt courtier, and not devoid of real poetical feeling. The bastard style of pastoral cultivated by him, in which the description of nature is made the writer's pretext, while ingenious flattery is his real purpose, nevertheless excludes genuine pleasure, and consequently genuine poetical achievement. He may be fairly compared to the minor poets of the reign of Anne" (Garnett).

Calpurnius was first printed in 1471, together with Silius Italicus and has been frequently republished, generally with Gratius Faliscus and Nemesianus. The separate authorship of the eclogues of Calpurnius and Nemesianus was established by M. Haupt's *De Carminibus bucolicis Calpurnii et Nemesiani* (1854). Editions by H. Schenkl (1885), with full introduction and *index verborum*, and by C. H. Keene (1887), with introduction, commentary and appendix and by Giannatano (Naples, 1910), and by H. Schenkl in Postgate's *Corpus* (1920); English verse translation by E. J. L. Scott (1891); *see* H. E. Butler, *Post-Augustan Poetry* (Oxford, 1909), pp. 150 foll; F. Skutsch in Pauly-Wissowa's *Realencyklopädie*, iii. I. (1897); C. Chiavoli, *Della vita e dell' Opere di T. Calpurnio Siculo* (Ragusa, 1921).

CALTAGIRONE, a city and episcopal see of the province of Catania, Sicily, situated 1,999ft. above sea-level, 36m. S.W. of Catania direct (55m. by rail). Pop. (1936), town 31,028; commune 39,349. Extensive Sicel cemeteries have been explored to the north of the town, and a Greek necropolis of the 6th and 5th centuries B.C. has been found to the south-east. Remains of buildings of Roman date have also been discovered; but the name of the ancient city is unknown. The present name is a corruption of the Saracen *Kalat-al-Girche* (the castle of Girche, the chieftain who fortified it). Majolica is made here, and the town is prosperous.

CALTANISSETTA, a town and episcopal see of Sicily, the capital of a province of the same name, 60 m. S.E. of Palermo direct and 83 m. by rail, situated 1,930 ft. above sea-level. Pop. (1936 census) 37,403 (town); 50,467 (commune). The town is of Saracenic origin, and some ruins of the old castle (called *Pietrarossa*) still exist. The cathedral and the church of the former Jesuit college are interesting baroque buildings. There is a famous procession on Holy Thursday. It is the centre of the Sicilian sulphur industry and the seat of a royal school of mines. It is connected by a short branch with the main line from Palermo to Catania; and a railway to Caltagirone and Syracuse is in construction. Two miles east is the Norman abbey of S. Spirito.

CALTROP (from the Mid. Eng. *calketrappe*, probably derived from the Lat. *calx*, a heel, and *trappa*, late Lat. for a snare), an iron ball, used as an obstacle against cavalry, with four spikes so arranged that, however placed in or on the ground, one spike always points upwards. It is also the botanical name for several species of thistles.

CALUIRE-ET-CUIRE, a town of eastern France, in the department of Rhône, 2½ mi. N.E. of Lyons. Pop. (1936), 15,677. It makes chemical products, velvet, combs and pins and has copper and bronze foundries and nursery-gardens.

CALUMET, the name given by the French in Canada to the "peace-pipe" of the American Indians (Norm. Fr. *chalumet*, Lat. *calamus*, a reed). This pipe occupied among the tribes a position of peculiar symbolic significance, and was the object of profound veneration. It was smoked on all ceremonial occasions, even on declarations of war, but its special use was at the making of treaties of peace. It was usually about 2½ ft. long, and in the west the bowl was made of red pipestone (catlinite). The pipe stem was of reed decorated with eagles' quills or women's hair. Native tobacco mixed with willow-bark or sumac leaves was smoked. The pipe was offered as a supreme proof of hospitality to distinguished strangers, and its refusal was regarded as a grievous affront. In the east and south-east the bowl was of white stone, sometimes pierced with several stem holes so that many persons might smoke at once.

See Joseph D. Macguire, "Pipes and Smoking Customs of the American Aborigines" in *Smithsonian Report* (American Bureau of Ethnology) for 1897, vol. i.; and authorities quoted in *Handbook of American Indians* (Washington, 1907).

CALUMPIT, a municipality (with administrative centre and 24 *barrios* or districts) of the province of Bulacan, Luzon, Philippine Islands, at the junction of the Quiñgua and Pampanga rivers, about 25 mi. N.W. of Manila. Pop. (1939) 17,047 (a gain of 2,203 since 1918), of whom 8,320 were males, and one was white. It is on the Manila and Dagupan railway. During the insurrection the municipality suffered great losses. Palay (rice), maize (corn), sugar and tropical fruits are produced in the surrounding country and offered in the market, which is quite extensive. Of those inhabitants aged 6 to 19, inclusive, 53·5% attended school, and of those 10 years old and over 74·4% were reported as literate The vernacular is Tagalog. The number of parcels of land taxed in 1938 was 3,706, and the number of owners, 2,466.

CALVADOS, a department of northwestern France, formed in 1790 out of Bessin, Cinglais, Hiémois, Bocage, the Campagne de Caen, Auge and the western part of Lieuvin. Pop. (1936) 404,901. Area, 2,198 sq.mi. It received its name from a ledge of rocks (named after a Spanish vessel in 1588) along the coast for about 15 mi. between the rivers Orne and Vire. It is bounded north by the English channel, east by the department of Eure, south by that of Orne, west by that of Manche. In the south-west are the hills of Normandy (maximum height 1,197 ft.) which run in a northwesterly direction and cross a portion of the *Bocage*—a region of Devonian, Silurian and Cambrian rocks related structurally to the Armorican massif. The remainder of the department is low-lying and is drained by numerous streams. The deep valleys of the lower courses of the Orne and the Touques suggest that the slope was once greater than it is at present and a recent subsidence as elsewhere in the English channel has led to the formation of estuaries. The *Campagne de Caen* is a region of Jurassic rocks noted for its horse-breeding. In the north-west and east are Cretaceous rocks. Here is good pasture land and butter, eggs and cheese (Camembert, Livarot, Pont l'Évêque) are exported. The chief crops are wheat, oats, barley, colza and potatoes. The orchards of Auge and Bessin produce good cider and cider brandy (known as "Calvados") is distilled. The spinning and weaving of wool and cotton are the chief industries. There are also iron-mines, paper-mills, oil-mills, tanneries, saw-mills, ship-building yards, rope-works, dye-works, distilleries and bleach-fields, scattered throughout the department, and building stone, slate and lime are plentiful. There are many fishing villages, lobster, oyster, herring and mackerel fisheries being important. Deauville and Trouville are the chief of the numerous coast resorts. Caen and Honfleur are the most important commercial ports. There is a canal 9 mi. in length from Caen to Ouistreham on the coast.

The department is served by the Ouest-État railway. It is divided into the four arrondissements (38 cantons, 763 communes) of Caen, Bayeux, Lisieux and Vire. Caen, the capital, is the seat of a court of appeal and the centre of an *académie* (educational division). The department forms the diocese of Bayeux, in the ecclesiastical province of Rouen, and belongs to the region of the III. Army Corps. The other principal towns are Falaise, Lisieux Conde-sur-Noireau, Vire, Honfleur and Trouville (*q.v.*).

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[1] It has been variously ascribed to Virgil, Ovid, Lucan, Statius, and Saleius Bassus.

Caen has fine Romanesque and Gothic churches, St. Étienne La Trinité, St. Pierre; and fine Gothic churches occur elsewhere, particularly at St. Pierre-sur-Dives, Lisieux, Bayeux, Norrey, a good example of the Norman-Gothic style, and Tour-en-Bessin in which Romanesque and Gothic architecture are mingled. Fontaine-Henri has a château of the 15th and 16th centuries. The castle at Falaise is an important historic monument.

CALVART, DENIS (1540–1619), Flemish painter, was born at Antwerp. After studying landscape-painting in his native city he went to Bologna, where he perfected himself in the anatomy of the human form under Prospero Fontana, and so completely lost the mannerism of Flemish art that his paintings appear to be the work of an Italian. From Bologna he went to Rome, where he assisted Lorenzo Sabbatini (1533–1577) in his works for the papal palace, and devoted much of his time to copying and studying the works of Raphael. He ultimately returned to Bologna and founded a school, of which the greatest ornaments are Guido and Domenichino.

CALVARY, the scene of Christ's crucifixion; the word is the English form of the Vulgate, *Calvaria*, Greek *κράνιον*, "skull," Hebrew, Golgotha. The name is applied to a sculptured representation of the Crucifixion, either inside a church or in the open air. Important examples of the latter are the Sacro Monte (1486) at Varallo in Piedmont, and those at Guimiliau (1581), Plougastel (1602), St. Thegonnec (1610) and Pleyben, near Quimper (1670), in Brittany, all in good preservation.

CALVÉ, EMMA (1858?–1942), operatic singer, was born at Decazeville, Aveyron, and was trained in Paris, making her first important appearance in opera at Brussels in 1882. She sang mainly in Paris for some years, but in 1892 she went to London and achieved immediate fame and popularity at Covent Garden, more especially by her wonderful Carmen (in Bizet's opera), a part with which her name will always be associated. She also sang at the Metropolitan and Manhattan opera houses in New York city. Her death was announced at Vichy Jan. 6, 1942.

CALVERLEY, CHARLES STUART (1831–1884), English poet and wit, and the literary father of what may be called the university school of humour, was born at Martley in Worcestershire on Dec. 22, 1831, and died on Feb. 17, 1884. His father, the Rev. Henry Blayds, resumed in 1852 the old family name of Calverley which his grandfather had exchanged for Blayds in 1807. Charles Blayds went up to Balliol from Harrow in 1850. At Oxford he was a universal favourite, a delightful companion, a brilliant scholar and the playful enemy of all "dons." In 1851 he won the Chancellor's prize for Latin verse but a year later he took his name off the books, to avoid the consequences of a college escapade, and migrated to Christ's college, Cambridge. There he was again successful in Latin verse. In 1856 he took second place in the first class in the Classical Tripos He was elected fellow of Christ's (1858), published *Verses and Translations* in 1862, and was called to the bar in 1865. Owing to an accident while skating, he was prevented from following up a professional career, and during the last years of his life he was an invalid. His *Translations into English and Latin* appeared in 1866; his *Theocritus translated into English Verse* in 1869; *Fly Leaves* in 1872; and *Literary Remains* in 1885. His sparkling, dancing verses had many imitators.

His *Complete Works*, with a biographical notice by Sir W. J. Sendall, appeared in 1901.

CALVERT, the name of three English artists: CHARLES (1785–1852), a well-known landscape painter; EDWARD (1803–1883), an important wood-engraver and follower of Blake; and FREDERICK, an excellent topographical draughtsman, whose work in water-colour is represented at the Victoria and Albert Museum, London, and who published a volume of *Picturesque Views in Staffordshire and Shropshire* (1830).

CALVERT, FREDERICK CRACE (1819–1873), English chemist was born in London on Nov. 14, 1819. From about 1836 till 1846 he lived in France. On his return to England he settled in Manchester as a consulting chemist, and was appointed professor of chemistry at the Royal Institution in that city. He gave much attention to the manufacture of coal-tar products, and particularly carbolic acid, for the production of which he established large works at Manchester in 1865. He died in Manchester on Oct. 24, 1873.

CALVERT, SIR HARRY, BART. (1763–1826), British general, was born in 1763 at Hampton, near London. He was educated at Harrow, and in 1778 entered the army. In the following year he served with his regiment in America, being present at the siege of Charleston, and from 1781 to 1783 was a prisoner of war. He next saw active service in 1793–94 in the Low Countries, where he was aide-de-camp to the duke of York. In 1799, he was made adjutant-general, holding the post till 1818, and did much to improve the administration of the army medical and hospital department; he introduced regimental schools, developed the two existing military colleges and helped to found the duke of York's school, Chelsea. He was made a G.C.B. (1815), and, on retiring from office, received a baronetcy (1818). In 1820 he was made governor of Chelsea hospital. He died on Sept. 3, 1826, at Middle Claydon, Buckinghamshire.

The Journals and correspondence of General Sir Harry Calvert . . . comprising the Campaigns in Flanders in 1793–94 were edited by his son, Sir Harry Verney (1853).

CALVES' HEAD CLUB, a club established shortly after the death of Charles I, in derision of his memory. Its chief meeting was held each Jan. 30, the anniversary of the king's execution, when the dishes served were a cod's head to represent the individual, Charles Stuart; a pike representing tyranny; a boar's head representing the king preying on his subjects; and calves' heads representing Charles as king and his adherents. After the Restoration the club met secretly. It survived till 1734, when the diners were mobbed, and the riot which ensued put a stop to the meetings.

CALVI, a seaport of northwest Corsica, having railway connections with Île Rousse eastwards along the coast. Pop. (1936) 2,824. Situated on the Bay of Calvi, it is the nearest Corsican port to France, being 109 mi. from Antibes; the harbour, however, is exposed to the east and north-east winds.

Calvi was founded in 1268, and in 1278 passed into the hands of the Genoese. In recognition of its repulsion of the united attacks of the French and the Turks in 1553, the Genoese senate caused the words *Civitas Calvi semper fidelis* to be carved on the chief gate of the city, which still preserves the inscription. In 1794 Calvi was captured by the British, but it was re-taken by the Corsicans in the following year. The old palace of the Genoese governor is used as barracks. The modern town lies at the foot of a rock, on which stands the old town with its steep rock-paved streets and fortified walls, commanded by the Fort Muzello. Fishing is carried on, and some timber, oil, wine and lemons are exported. Calvi claims to be the birthplace of Columbus (1451).

CALVIN, JOHN (1509–1564), Swiss divine and reformer, was born at Noyon, in Picardy, on July 10, 1509, and was the second son of Gérard Cauvin or Calvin, a notary-apostolic and procurator-fiscal for the lordship of Noyon, and of Jeanne le Franc, daughter of an innkeeper at Cambrai. (The family name of Calvin seems to have been written indifferently Cauvin, Chauve, Chauvin, Calvus, Calvinus. In the contemporary notices of Gérard and his family, in the capitular registers of the cathedral at Noyon, the name is always spelt Cauuin. The anagram of Calvin is Alcuin, and this, in its Latinized form Alcuinus, appears in two editions of his *Institutio* as that of the author [Audin, *Vie de Calvin*, i. 520]. The syndics of Geneva address him in a letter written in 1540, and still preserved, as "Docteur Caulvin." In his letters written in French he usually signs himself "Jean Calvin." He affected the title of "Maître," for what reason is not known.)

Of Calvin's early years little is known. Destined for an ecclesiastical career, he was educated in the household of the noble family of Hangest de Montmor. In May 1521 he was appointed to a chaplaincy in the cathedral of Noyon, and received the tonsure. Calvin accompanied the Hangests to Paris in Aug. 1523, being enabled to do so by the income received from his benefice. He attended as an out-student the Collège de la Marche, at that time under the regency of Mathurin Cordier, who in later days taught at Neuchâtel, and died in Geneva in 1564. Calvin dedicated to him his *Commentary on the First Epistle to the Thessalonians.* From the Collège de la Marche he removed to the Collège de Montaigu, where the atmosphere was more ecclesiastical. (Pierre de Montaigu refounded this institution in 1388. Erasmus and Ignatius Loyola also studied here.) In the college disputations he gave fruitful promise of that consummate excellence as a reasoner in the department of speculative truth which he afterwards displayed. Among his friends were the Hangests (especially Claude), Nicolas and Michel Cop, sons of the king's Swiss physician, and his own kinsman Pierre Robert, better known as Olivétan. Such friendships contradict the legend that he was an unsociable misanthrope. The canons at Noyon gave him in Sept. 1527 the curacy of St. Martin de Marteville, which he exchanged in July 1529 for the cure of Pont l'Évêque. But Calvin was not destined to become a priest. Gérard Cauvin began to suspect that the law offered to a youth of his talents and industry a more promising sphere. He was also now out of favour with the cathedral chapter at Noyon. It is said that John himself, on the advice of Olivétan, the first translator of the Bible into French, had begun to study the Scriptures and to dissent from the Roman worship. He readily complied with his father's suggestion, and removed from Paris to Orleans (March 1528) in order to study law under Pierre Taisan de l'Étoile, the most distinguished jurisconsult of his day. Other studies, however, besides those of law occupied him, and moved by the humanistic spirit of the age, he eagerly developed his classical knowledge. His friends here were Melchior Wolmar, François Daniel, François de Connam and Nicolas Duchemin; to these his earliest letters were written. From Orleans Calvin went to Bourges in the autumn of 1529 to continue his studies under the brilliant Italian, Andrea Alciati (1492–1550). His friend Daniel went with him, and Wolmar followed a year later. By Wolmar Calvin was taught Greek, and introduced to the study of the New Testament in the original.

Twelve years had elapsed since Luther had published his theses against indulgences. In France there had not been as yet any overt revolt against the Church of Rome, but multitudes were in sympathy with the reformers' ideals. Calvin's own record of his "conversion" is so scanty that it is extremely difficult to trace his religious development with any certainty. But it seems probable that at least up to 1532 he was far more concerned about classical scholarship than about religion.

His residence at Bourges was cut short by the death of his father in May 1531. He went to Paris, where the "new learning" was now at length ousting the mediaeval scholasticism from the university. He lodged in the Collège Fortet, reading Greek with Pierre Danès and beginning Hebrew with François Vatable. In April 1532 Calvin published his commentary in Latin on Seneca's tract *De Clementia.*

Soon afterwards Calvin returned to Orleans. He visited Noyon in Aug. 1533, and by October of the same year was settled again in Paris. Here and now his destiny became certain. The conservative theology was becoming discredited, and humanists like Jacques Lefèvre of Étaples (Faber Stapulensis) and Gérard Roussel were favoured by the court under the influence of Margaret of Angoulême, queen of Navarre and sister of Francis I. Calvin's old friend, Nicolas Cop, had just been elected rector of the university and had to deliver an oration according to custom in the church of the Mathurins, on the feast of All Saints. The oration (certainly influenced but hardly composed by Calvin) was in effect a defence of the reformed opinions, especially of the doctrine of justification by faith alone. To the period between April 1532 and November 1533, and in particular to the time of his second sojourn at Orleans, we may assign the great change in Calvin which he describes (*Praef. ad Psalmos;* opera xxxi. 21–24) as his "sudden conversion" and attributes to direct divine agency. But Cop's address was followed by a summons to the orator to appear before the parlement of Paris, and as he failed to secure the support either of the king, or of the university, he fled to Basle. An attempt was made at the same time to seize Calvin who, being forewarned of the design, also made his escape. He went to Noyon, but, proceedings against him being dropped, soon returned to Paris. He left the city again about New Year of 1534 and became the guest of Louis du Tillet, a canon of the cathedral, at Angoulême. Here, in du Tillet's splendid library, he began the studies which resulted in his great work, the *Institutes,* and paid a visit to Nérac, where the venerable Lefèvre, whose revised translation of the Bible into French was published about this time, was spending his last years under the kindly care of Margaret of Navarre.

Up to this time Calvin's work for the evangelical cause was not so much that of the public preacher or reformer as that of the retiring but influential scholar and adviser. Now, however, he had to decide whether, like Roussel and other of his friends, he should strive to combine the new doctrines with a position in the old church, or whether he should definitely break away from Rome. His mind was made up, and on May 4 he resigned his chaplaincy at Noyon and his rectorship at Pont l'Évêque. Towards the end of the same month he was arrested and suffered two short terms of imprisonment, the charges against him being not strong enough to be pressed. His movements now become difficult to trace, but he visited Paris, Orleans and Poitiers.

The Anabaptists of Germany had spread into France, and among other notions which they had spread abroad was that of a sleep of the soul after death. To Calvin this notion appeared so pernicious that he composed a treatise of refutation of it, under the title of *Psychopannychia.* The preface to this treatise is dated Orleans 1534, but it was not printed till 1542. At Poitiers, in a grotto near the town, he for the first time celebrated the communion in the Evangelical Church of France, using a piece of rock as a table.

The year 1534 was thus decisive for Calvin. From this time forward his influence became supreme, and all who had accepted the reformed doctrines in France turned to him for counsel and instruction. Renan, no prejudiced judge, pronounces him "the most Christian man of his time," and attributes to this his success as a reformer. But his life was in danger, and, in company with his friend Louis du Tillet, whom he had again gone to Angoulême to visit, he set out for Basle. Here Calvin was welcomed by the band of scholars and theologians who made that city the Athens of Switzerland, and especially by Oswald Myconius, the chief pastor, Pierre Viret and Heinrich Bullinger. Under the guidance of Sebastian Münster, Calvin now gave himself to the study of Hebrew.

Francis I., desirous to continue the suppression of the Protestants, but anxious, because of his strife with Charles V., not to break with the Protestant princes of Germany, instructed his ambassador to assure these princes that it was only against Anabaptists, and other parties who called in question all civil magistracy, that his severities were exercised. Calvin, indignant at the calumny which was thus cast upon the reformed party in France, hastily prepared for the press his *Institutes of the Christian Religion.* The work was dedicated to the king, and Calvin says he wrote it in Latin that it might find access to the learned in all lands. Soon after it appeared he set about translating it into French, as he himself attests in a letter dated October 1536. This sets at rest a question at one time much agitated, whether the book appeared first in French or in Latin. The earliest French edition known is that of 1540, and this was after the work had been much enlarged, and several Latin editions had appeared. In its first form the work consisted of only six chapters, and was intended merely as a brief manual of Christian doctrine. The chapters follow a traditional scheme of religious teaching. (1) The Law (as in the Ten Words), (2) Faith (as in the Apostles' Creed), (3) Prayer, (4) the Sacraments; to these were added (5) False Sacraments, (6) Christian liberty, ecclesiastical power and civil administration. The closing chapters of the work are more polemical than the earlier ones. His indebtedness to Luther is of course great, but his spiritual kinship with Martin Bucer of Strasbourg is even more marked. The book appeared anonymously, the author having, as he himself says, nothing in view beyond furnishing a statement of the faith of the persecuted Protestants. In this work, written at the age of 26, we find a complete outline of the Calvinist theological system. Nor is there any reason to believe that he ever changed his views on any essential point from what they were at the period of its first publication. It exercised a prodigious influence upon the opinions and practices both of contemporaries and of posterity.

After a short visit (April 1536) to the court of Renée, duchess of Ferrara (cousin to Margaret of Navarre), Calvin returned through Basle to France to arrange his affairs before finally taking farewell of his native country. His intention was to settle at Strasbourg or Basle, and to devote himself to study. Unable, in consequence of the war between Francis I. and Charles V., to reach Strasbourg by the ordinary route, he journeyed to Lyons and so to Geneva, making for Basle. In Geneva his progress was arrested by the "formidable obtestation" of Guillaume Farel (*Praef. ad Psalmos*) who had succeeded in planting the evangelical standard at Geneva. Anxious to secure the aid of such a man as Calvin, he entreated him on his arrival to devote himself to the work in that city. Calvin, after some hesitation, consented, hurried to Basle, transacted some business, and returned to Geneva in Aug. 1536. He at once began to expound the epistles of St. Paul in the church of St. Pierre, and after about a year was also elected preacher by the magistrates with the consent of the people. His services were at first rendered gratuitously.

Calvin was in his 28th year when he settled at Geneva; and in this city the rest of his life, with the exception of a brief interval, was spent. The post to which he was thus called was not an easy one. Though the people of Geneva had cast off the obedience of Rome, it was largely a political revolt against the duke of Savoy, and they were still (says Beza) "but very imperfectly enlightened in divine knowledge." This laid them open to the incursions of those fanatical teachers, whom the excitement attendant upon the Reformation had called forth, and who hung mischievously upon the rear of the reforming body. To obviate the evils thence resulting, Calvin, in union with Farel, drew up a condensed statement of Christian doctrine consisting of 21 articles. This the citizens were summoned, in parties of ten each, to profess and swear to as the confession of their faith. As the people took this oath in the capacity of *citizens*, we may see here the basis laid for that theocratic system which subsequently became peculiarly characteristic of the Genevan polity. Calvin and his coadjutors were solicitous to establish schools throughout the city, and to enforce attendance; and as he had no faith in education apart from religious training, he drew up a catechism of Christian doctrine which was an obligatory part of the curriculum. Of the troubles which arose from fanatical teachers, the chief proceeded from the efforts of the Anabaptists; a public disputation was held on March 16–17, 1537, and so excited the populace that the Council of Two Hundred stopped it, declared the Anabaptists vanquished and drove them from the city. About the same time the peace of Calvin and his friends was much disturbed and their work interrupted by Pierre Caroli, chief pastor at Lausanne. Calvin brought Caroli before the commissioners of Berne on a charge of advocating prayers for the dead as a means of their earlier resurrection. Caroli brought a counter-charge against the Geneva divines of Sabellianism and Arianism. In a synod held at Berne the matter was fully discussed, a verdict was given in favour of the Geneva divines, and Caroli deposed from his office and banished. Two brief anti-Romanist tracts, one entitled *De fugiendis impiorum sacris*, the other *De sacerdotio papali abjiciendo*, were also published by Calvin early in this year.

But the austerity, both of ritual and living, enjoined by Calvin and his endeavour to effect the complete freedom of the Church from State control, was deeply resented. He and his colleagues refused to administer the sacrament in the Bernese form, *i.e.*, with unleavened bread, and on Easter Sunday, 1538, declined to do so at all because of the popular tumult. For this they were banished from the city. They went at first to Berne, and soon after to Zürich, where they pleaded their cause before a synod of Swiss pastors, and declared that they would yield in the matter of ceremonies so far as to employ unleavened bread in the eucharist, to use fonts in baptism and to allow festival days, provided the people might pursue their ordinary avocations after public service. These Calvin regarded as matters of indifference, provided the magistrates did not make them of importance, by seeking to enforce them; and he was the more willing to concede them, because he hoped thereby to meet the wishes of the Bernese brethren whose ritual was less simple than that established by Farel at Geneva. But he and his colleagues insisted, on the other hand, that for the proper maintenance of discipline, there should be a division of parishes—that excommunications should be permitted, and should be under the power of elders chosen by the council, in conjunction with the clergy—that order should be observed in the admission of preachers—and that only the clergy should officiate in ordination by the laying on of hands. It was proposed that the sacrament of the Holy Communion should be administered more frequently, at least once every month, and that congregational singing of psalms should be practised in the churches. On these terms the synod interceded with the Genevese to restore their pastors; but through the opposition of some of the Bernese (especially Peter Kuntz, the pastor of that city) this was frustrated, and a second edict of banishment was the only response.

Calvin and Farel betook themselves to Basle, where they soon after separated, Farel to go to Neuchâtel and Calvin to Strasbourg, where he remained until the autumn of 1541. These years were not the least valuable in his experience. In 1539 he attended Charles V.'s conference on Christian reunion at Frankfurt as the companion of Bucer, and in the following year he represented the city of Strasbourg at Hagenau and Worms. He was present also at the diet at Regensburg, where he formed with Melanchthon a lifelong friendship. He also did something to relieve the persecuted Protestants of France. To this period we owe a revised and enlarged form of his *Institutes*, his *Commentary on the Epistle to the Romans*, and his *Tract on the Lord's Supper*. During his residence at Strasbourg he married, in Aug. 1540, Idelette de Bure, the widow of one Jean Stordeur of Liége, whom he had converted from Anabaptism. In her Calvin found, to use his own words, "the excellent companion of his life," a "precious help" to him amid his manifold labours and frequent infirmities. She died in 1549. Their only child, Jacques, born on July 28, 1542, lived only a few days.

During Calvin's absence disorder and irreligion had prevailed in Geneva. An attempt made by Cardinal Jacopo Sadoleto (1477–1547), bishop of Carpentras, to restore Roman Catholicism was frustrated by a letter written by Calvin at the desire of the Bernese authorities. The letter was a popular yet thoroughgoing defence of the whole Protestant position, perhaps the best apologia for the Reformation that was ever written. While he was still at Strasbourg there appeared at Geneva a translation of the Bible into French, bearing Calvin's name, but in reality only revised and corrected by him from the version of Olivétan. Meanwhile his enemies in Geneva gradually lost power and office. Farel worked unceasingly for his recall. He returned to Geneva, where he was received with the utmost enthusiasm, on Sept. 13, 1541. He now determined to carry out his whole original scheme of reform, and to set up in all its integrity that form of church polity which he had carefully matured during his residence at Strasbourg. He now became the sole directive spirit in the Church at Geneva. Farel was retained by the Neuchâtelois, and Viret, soon after Calvin's return, removed to Lausanne.

He recodified the Genevan laws and constitution, and was the leading spirit in the negotiations with Berne that issued in the treaty of Feb. 1544. He spent much time in controversy, notably over the doctrine of predestination and election. His three chief opponents were Albert Pighius, who subsequently embraced his views, Jerome Bolsec, Sébastien Castellio and, greatest of all, Michael Servetus (*q.v.*). At Calvin's instance Servetus was arraigned for blasphemy, condemned, and burnt to death. Even though the opprobrium of this procedure must be shared by the Genevan fathers, the Swiss authorities, and some of the more famous reformers like Melanchthon, who approved it, Calvin cannot be held guiltless of perpetrating a martyrdom that did much to sully the cause he had so greatly at heart.

Calvin was also involved in a protracted and somewhat vexing dispute with the Lutherans respecting the Holy Communion, which ended in the separation of the evangelical party into the two great sections of Lutherans and Reformed—the former holding that in the eucharist the body and blood of Christ are objectively and consubstantially present, and so are actually partaken of by the communicants, and the latter that there is only a virtual presence of the body and blood of Christ, and consequently only a spiritual participation thereof through faith. In addition to these controversies on points of faith, he was for many years greatly disquieted by opposition in Geneva to the ecclesiastical discipline which he had established there. His system of church polity was essentially theocratic; it assumed that every member of the State was also under the discipline of the Church; and he asserted that the right of exercising this discipline was vested exclusively in the consistory or body of preachers and elders. Calvin's views on Church discipline naturally brought him into conflict with the civil authority and with the people. But his courage, his perseverance and his earnestness at length prevailed and, before he died, his system of church polity was firmly established, not only at Geneva, but in other parts of Switzerland, and was adopted substantially by the Reformers in France and Scotland. The men whom he trained at Geneva carried his principles into almost every country in Europe. Nor was it only in religious matters that Calvin busied himself; he was consulted on every affair, great and small, that came before the council—on questions of law, police, economy, trade and manufactures, no less than on questions of doctrine and Church polity. To him the city owed her trade in cloths and velvets, from which so much wealth accrued to her citizens; sanitary regulations were introduced by him which made Geneva the admiration of all visitors; and in him she reverences the founder of her university. This institution was in a sense Calvin's crowning work. It added religious education to the evangelical preaching and the thorough discipline already established, and so completed the reformer's ideal of a Christian commonwealth.

Amidst these multitudinous cares and occupations, Calvin wrote many controversial and many exegetical works. We have from him expository comments or homilies on nearly all the books of Scripture, written partly in Latin and partly in French. Though naturally knowing nothing of the modern idea of a progressive revelation, his judiciousness, penetration and tact in eliciting his author's meaning, his precision, condensation and concinnity as an expositor, the accuracy of his learning, the closeness of his reasoning and the elegance of his style, all unite to confer a high value on his exegetical works. The series began with *Romans* in 1540 and ended with *Joshua* in 1564. In 1558–59 also, though in very ill health, he finally perfected the *Institutes*.

The incessant and exhausting labours to which Calvin gave himself could not but tell on his fragile constitution. On Feb. 16, 1564, he preached his last sermon, having with great difficulty found breath enough to carry him through it. On April 20 he made his will, on the 27th he received the Little Council, and on the 28th the Genevan ministers, in his sick-room; on May 2 he wrote his last letter—to his old comrade Farel, who hastened from Neuchâtel to see him once again. He spent much time in prayer and died quietly, in the arms of his faithful friend Theodore Beza, on the evening of May 27. The next day he was buried without pomp "in the common cemetery called Plain-palais," in a spot not now to be identified.

Calvin was of middle stature; his complexion was somewhat pallid and dark; his eyes, to the latest clear and lustrous, bespoke the acumen of his genius. He was sparing in his food and simple in his dress; he took but little sleep, and was capable of extraordinary efforts of intellectual toil. He had a most retentive memory and a very keen power of observation. He spoke without rhetoric, simply, directly, but with great weight. He had many acquaintances, but few close friends. If somewhat severe and irritable, he was at the same time scrupulously just, truthful and steadfast; he never deserted a friend or took an unfair advantage of an antagonist; and on befitting occasions he could be cheerful and even facetious among his intimates.

Though Calvin built his theology on the foundations laid by earlier reformers, and especially by Luther and Bucer, his peculiar gifts of learning, of logic and of style made him pre-eminently the theologian of the new religion

Calvin's dominant thought is the infinite and transcendent sovereignty of God, to know whom is man's supreme end. God is known to man especially by the Scriptures, whose writers were "sure and authentic amanuenses of the Holy Spirit." While God is the source of all good, man is guilty and corrupt. The first man was made in the image of God, which not only implies man's superiority to other creatures, but indicates his original purity, integrity and sanctity. Through Adam's fall, depravity and corruption attach to all men. On account of such corruption all are deservedly condemned before God, by whom nothing is accepted save righteousness, innocence and purity. When it is said that we through Adam's sin have become obnoxious to the divine judgment, it is not to be taken as if we being ourselves innocent and blameless, bear the fault of his offence, but that, we having been brought under a curse through his transgression, he is said to have bound us. From him, however, not only has punishment overtaken us, but a pestilence instilled from him resides in us, to which punishment is justly due. Thus even infants, whilst they bring their own condemnation with them from their mothers' wombs, are bound not by another's but by their own fault. For though they have not yet brought forth the fruits of their iniquity, they have its seed; nay, their whole nature is a sort of seed of sin, therefore it cannot but be hateful to God (*Instit.* bk. ii. ch. i. sec. 8).

To redeem man from this state of corruption, the Son of God became incarnate. He took on Him the offices of prophet, priest and king, and by His humiliation, obedience and suffering unto death, followed by His resurrection and ascension to heaven, He has perfected His work and fulfilled all that was required in a redeemer of men, so that it is truly affirmed that He has merited for man the grace of salvation (bk. ii. ch. 13–17). But until a man is united to Christ, the benefits of Christ's work cannot be attained by him. This union is achieved through the special operation of the Holy Spirit in the faithful, who thus become partakers of His death and resurrection, so that the old man is crucified with Him and they are raised to a life of righteousness and holiness. Thus joined to Christ, the believer has life in Him and knows that he is saved, having the witness of the Spirit that he is a child of God, and having the promises, the certitude of which the Spirit had before impressed on the mind, sealed by the same Spirit on the heart (bk. iii. ch. 33–36). From faith springs repentance, proceeding from a sincere fear of God, and consisting in the mortification of the flesh and the old man within us and a vivification of the Spirit. Through faith also the believer receives justification, his sins are forgiven, he is accepted of God, and is held by Him as righteous, the righteousness of Christ being imputed to him. This imputed righteousness, however, is not disjoined from real personal righteousness, for regeneration and sanctification come to the believer from Christ no less than justification; the two blessings are not to be confounded, but neither are they to be disjoined The assurance which the believer has of salvation he receives from the operation of the Holy Spirit; but this again rests on the divine choice of the man to salvation; and this falls back on God's eternal sovereign purpose, whereby He has predestined some to eternal life and some to eternal death. The former he effectually calls to salvation, and they are kept by Him in progressive faith and holiness unto the end (bk iii. *passim*). The external means by which God unites men into the fellowship of Christ, and advances those who believe, are the Church and its ordinances, especially the sacraments. The Church universal is the multitude gathered from diverse nations, which though divided by time and place, agree in one common faith, and it is bound by the tie of the same religion; and wherever the word of God is sincerely preached, and the sacraments are duly administered, according to Christ's institute, there beyond doubt is a Church of the living God (bk. iv. ch. 1, sect. 7–11). Its permanent officers are pastors and teachers, to the former of whom it belongs to preside over the discipline of the Church, to administer the sacraments, and to admonish the members; while the latter expound the Scriptures. With them are to be joined for the government of the Church certain pious men as a senate in each church; and to others, as deacons, is to be entrusted the care of the poor. The election of the officers is to be with the people, and those duly chosen are to be ordained by the laying on of the hands of the pastors (ch. 3, sect. 4–16). The sacraments are two—Baptism and the Lord's Supper. Baptism is the sign of initiation into the Church; it serves both for the confirmation of faith and as a confession before men. The Holy Communion is a spiritual feast where Christ attests that He is the life-giving bread, by which our souls are fed. That sacred communication of His flesh and blood whereby Christ transfuses into us His life, He in the Supper attests and seals; and that not by an empty sign but there He puts forth the efficacy of His Spirit whereby He fulfils what He promises. In the mystery of the Supper Christ is truly exhibited by the symbols of bread and wine; and so His body and blood, in which He fulfilled all obedience for the obtaining of righteousness for us, are presented. Christ is not affixed to the bread or in any way circumscribed; but whatever can express the true and substantial communication of the body and blood of the Lord, which is exhibited to believers under the said symbols is to be received, and that not as merely mentally received, but as enjoyed for the aliment of the eternal life (bk. iv. ch. 15, 17).

The course of time has substantially modified many of Calvin's positions. Even the churches which trace their descent from him no longer hold in their entirety his views on the magistrate as the preserver of church purity, the utter depravity of human nature, the non-human character of the Bible, the dealing of God with man. But his system had great value in the history of Christian thought. It appealed to and evoked a high order of intelligence, and its insistence on personal individual salvation has borne worthy fruit. So also its insistence on the chief end of man, "to know and do the will of God," made for strenuous morality. Its effects are most clearly seen in Scotland, in Puritan England and in the New England States, but its influence was and is felt among peoples that have little desire or claim to be called Calvinist.

Bibliography.—The standard edition of Calvin's works is that of the Strasbourg scholars, J. W. Baum, E. Cunitz, E. Reuss, P. Lobstein, A. Erichson (59 vols., 1863-1900). The last of these contains an elaborate bibliography also published separately at Berlin in 1900. The bulk of the writings was published in English by the Calvin Translation Society (48 vols., Edinburgh, 1843–55); the *Institutes* have often been translated. The early lives by Beza and Collodon are given in the collected editions. Among modern biographies are those by P. Henry, *Das Leben J. Calvins* (3 vols., Hamburg, 1835–44; Eng. trans. by H. Stebbing, London and New York, 1849); V. Audin, *Histoire de la vie, des ouvrages, et des doctrines de Calvin* (2 vols., Paris, 1841; Eng. trans. by J. McGill, London, 1843 and 1850), unfairly antagonistic; T. H. Dyer, *Life of John Calvin* (London, 1850); E. Stähelin, *Joh. Calvin, Leben und ausgewählte Schriften* (2 vols., Elberfeld, 1863); F. W. Kampschulte, *Joh. Calvin, seine Kirche und sein Staat in Genf* (2 vols., 1869, 1899, unfinished); Abel Lefranc, *La Jeunesse de Calvin* (Paris, 1888); E. Choisy, *La Théocratie à Genève au temps de Calvin* (Geneva, 1897); E. Doumergue, *Jean Calvin; les hommes et les choses de son temps* (17 vols., 1899–1927). *See* also A. M. Fairbairn, "Calvin and the Reformed Church" in the *Cambridge Modern History*, vol. ii. (1904); P. Schaff's *History of the Christian Church*, vol. vii. (1892), and R. Stähelin's article in Hauck-Herzog's *Realencyk. für prot. Theologie und Kirche*. Each of these contains a useful bibliography, as also does the excellent life by Professor Williston Walker, *John Calvin, the Organizer of Reformed Protestantism*, "Heroes of the Reformation" series (1906). *See* also C. S. Horne in *Mansfield Coll. Essays* (1909); L. Penning, *Life and Times of Calvin*, Eng. trans. by B. S. Berrington (1912).

CALVINISTIC METHODISTS, a body of Christians forming a church of the Presbyterian order and claiming to be the only denomination in Wales which is of purely Welsh origin. Its beginnings may be traced to the labours of the Rev. Griffith Jones (1684–1761), of Llanddowror, Carmarthenshire, whose sympathy for the poor led him to set on foot a system of circulating charity schools for the education of poor children. Griffith Jones's zeal appealed to the public imagination, and his powerful preaching exercised a widespread influence. An impressive announcement of the Easter Communion Service, made by the Rev. Pryce Davies, vicar of Talgarth, March 30, 1735, was the means of awakening Howell Harris (1714–1773) of Trevecca, who became a fiery itinerant preacher. Jones, preaching at Llanddewi Brefi, Cardiganshire—the place at which the Welsh Patron Saint, David, first became famous—roused Daniel Rowlands (1713–1790), curate of Llangeitho, who became an ardent apostle of the new movement. Naturally a fine orator, his new-born zeal gave an edge to his eloquence, and his fame spread abroad. About 1739 another prominent figure appeared: this was Howell Davies of Pembrokeshire, whose ministry was modelled on that of his master, Griffith Jones.

In 1736 Harris opened a school, Griffith Jones supplying him with books from his charity. He also set up societies, in accordance with the recommendations in Josiah Wedgwood's little book on the subject; and these exercised a great influence on the religious life of the people. By far the most notable of Harris's converts was William Williams (1717–1791), of Pant y Celyn, the great hymn-writer of Wales. He had been ordained deacon in the Church of England, 1740, but Whitefield recommended him to leave his curacies and go into the highways and hedges. In Jan. 1743, the friends of aggressive Christianity in Wales met at Wadford, near Caerphilly, Glam., in order to organize their societies. The meeting is known as the first Methodist Association—held eighteen months before John Wesley's first conference (June 25, 1744). Monthly meetings covering smaller districts were organized to consider local matters, the transactions of which were to be reported to the Quarterly Association, to be confirmed, modified, or rejected. Exhorters were divided into two classes—public, who were allowed to itinerate as preachers and superintend a number of societies; private, who were confined to the charge of one or two societies. The societies were distinctly understood to be part of the established church, as Wedgwood's were, and every attempt at estranging them therefrom was sharply reproved; but persecution made their position anomalous. They did not accept the discipline of the Church of England, so the plea of conformity was a feeble defence; nor had they taken out licences, so as to claim the protection of the Toleration Act. Harris's ardent loyalty to the Church of England, after three refusals to ordain him, and his personal contempt for ill-treatment from persecutors, were the only things that prevented separation.

A controversy on a doctrinal point—"Did God die on Calvary?"—raged for some time, the principal disputants being Rowlands and Harris, and in 1751 it ended in an open rupture, which threw the Connexion first into confusion and then into a state of coma. The societies split up into Harrisites and Rowlandites, and it was only with the revival of 1762 that the breach was fairly repaired. This revival is a landmark in the history of the Connexion. Williams of Pant y Celyn had just published a little volume of hymns, the singing of which inflamed the people. This led the bishop of St. David's to suspend Rowlands' licence, and Rowlands had to confine himself to a meeting-house at Llangeitho. This place became the Jerusalem of Wales. A remarkable event in the history of Welsh Methodism was the publication in 1770 of an annotated Welsh Bible by the Rev. Peter Williams, a forceful preacher, and an indefatigable worker, who had joined the Methodists in 1746, after being driven from several curacies. It gave birth to a new interest in the Scriptures, being the first definite commentary in the language. The ignorance of the people of the north made it very difficult for Methodism to spread there, until the advent of the Rev. Thomas Charles (1755–1814), who, having spent five years in Somersetshire as curate of several parishes, returned to Bala and joined the Methodists in 1784. His circulating charity schools and then his Sunday schools gradually made the north a new country. In 1791 the Bala Association was disturbed by the proceedings which led to the expulsion of Peter Williams from the Connexion, in order to prevent him from selling among the Methodists Bibles with Sabellian marginal notes.

Separation from the Church of England.—About 1795, persecution led the Methodists to take the first step towards separation from the Church of England. Heavy fines made it impossible for preachers in poor circumstances to continue without claiming the protection of the Toleration Act, and the meeting-houses had to be registered as dissenting chapels. Moreover, until 1811 they had no ministers ordained by themselves; their growth in numbers and the scarcity of ministers to administer the Sacrament (three in north Wales) made the question of ordination a matter of urgency. The south Wales clergy who regularly itinerated were dying out; the majority of those remaining itinerated but irregularly, and were most of them against the change. The lay element, with the help of Charles and a few other stalwarts, carried the matter through—ordaining nine at Bala in June, and thirteen at Llandilo in August. In 1823, the *Confession of Faith* was published; it is based on the *Westminster Confession* as "Calvinistically construed," and contains 44 articles. The Connection's *Constitutional Deed* was formally completed in 1826.

The question of ministerial training then arose. Candidates for the Connectional ministry were compelled to shift for themselves until 1837, when Lewis Edwards (1809–1887) and David Charles (1812–1878) opened a school for young men at Bala. North and south alike adopted it as their college, the associations contributing 100 guineas each towards the education of their students. In 1842, the south Wales association opened a college at Trevecca, leaving Bala to the north. The latter was now a purely theological college, the students of which were sent to the university colleges for their classical training. In 1905 Mr. David Davies of Llandinam—one of the leading laymen in the Connection—offered a large building at Aberystwyth as a gift to the denomination for the purpose of uniting north and south in one theological college; but in the event of either association declining the proposal, the other was permitted to take possession, giving the association that should decline the option of joining at a later time. The association of the south accepted, and that of the north declined, the offer; Trevecca College was turned into a preparatory school on the lines of a similar institution set up at Bala in 1891.

Constitution and Doctrine.—The constitution of the denomination is a mixture of Presbyterianism and Congregationalism; each church manages its own affairs and reports to monthly meetings which are made up of all the officers of the churches comprised in each. The monthly meetings appoint delegates to the quarterly associations, of which all officers are members. The associations of north and south are distinct institutions. For the purpose of a fuller co-operation in matters common to both, a general assembly (meeting once a year) was established in 1864. This is a purely deliberative conclave, worked by committees, and all its legislation has to be confirmed by the two associations before it can have any force or be legal.

In doctrine the church is Calvinistic, but its preachers are far from being rigid in this particular, being warmly evangelical, and, in general, distinctly cultured. It is a remarkable fact that every Welsh revival, since 1735, has broken out among the Calvinistic Methodists. The ministerial system is quite anomalous. It started in pure itineracy; the pastorate came in very gradually, and is not yet in universal acceptance. The authority of the pulpit of any individual church is in the hands of the deacons; they ask the pastor to supply so many Sundays, filling the remainder with any preacher they choose. The pastor is paid for his pastoral work, and receives his Sunday fee just as a stranger does; his Sundays from home he fills up at the request of deacons of other churches.

The Calvinistic Methodist Church of Wales is in federation with the United Free Church of Scotland, and the Presbyterian Church of England and of Ireland. It is also a constituent of the Pan-Presbyterian Council or Alliance. In 1941 the body numbered: churches, 1,477; chapels and schools, 1,718; ministers and preachers, 1,068; Sunday school teachers and officers, 15,789; communicants, 175,036. Contributions for various religious purposes (including the ministry), amounted to £418,352 in that year. There were foreign missions in Assam, India, and in Brittany. The English branch of the Church had 390 chapels and preaching stations, with 35,647 communicants. All the rest were Welsh.

CALVISIUS, SETHUS (1556–1615), German musician and chronologer, was born at Gorschleben, in Thuringia, on Feb. 21, 1556, and died at Leipzig, where he was director of the school of music, on Nov. 24, 1615. In his *Opus Chronologicum* (Leipzig, 1605, 7th ed. 1685) he expounded a system based on the records of nearly 300 eclipses. He put forward an ingenious proposal for the reform of the calendar in his *Elenchus Calendarii Gregoriani* (Frankfort, 1612). His principal work in music is *Exercitationes musicae* (1600–11).

See K. Benndorf, *Sethus Calvisius als Musiktheoretiker* (1894).

CALVO, CARLOS (1824–1906), Argentine publicist and historian, was born at Buenos Aires on Feb. 26, 1824. He devoted himself to the study of the law, and in 1860 he was sent by the Paraguayan government on a special mission to London and Paris. Remaining in France, he published in 1863 his *Derecho internacional teorico y practico de Europa y America*, in two vols., and at the same time brought out a French version. The book immediately took rank as one of the highest modern authorities on the subject. Between 1862 and 1869 Calvo published in Spanish and French his great collection in 15 vols. of the treaties and other diplomatic acts of the South American republics, and between 1864 and 1875 his *Annales historiques de la révolution de l'Amérique latine*, in five vols. In 1884 he was one of the founders at the Ghent congress of *the Institut de Droit International*. In the following year he was Argentine minister at Berlin, and published his *Dictionnaire du droit international public et privé*, in that city. Calvo died in May 1906 at Paris.

CALVUS, GAIUS LICINIUS MACER: *see* LICINIUS MACER CALVUS, GAIUS.

CALW, a town of Germany, in the *Land* of Württemberg, on the Nagold, W.S.W. of Stuttgart. Population 5,480. The name of Calw appears first in 1037. In the middle ages the town was under the dominion of a powerful family of counts, whose possessions finally passed to Württemberg in 1345. In 1634 the town was taken by the Bavarians, and in 1692 by the French. The industries include spinning and weaving, etc., and the making of cigars and soap. It trades in wine. It is a health resort also.

CALYDON, an ancient town of Aetolia, according to Pliny, 7½ Roman mi. from the sea, on the river Euenus. It was said to have been founded by Calydon, son of Aetolus; to have been the scene of the hunting, by Meleager and other heroes, of the famous Calydonian boar; the Calydonians are said to have taken part in the Trojan war. In 391 B.C. it was in the possession of the Achaeans. After the battle of Leuctra (371 B.C.) it was restored by Epaminondas to the Aetolians. Augustus removed its inhabitants to Nicopolis, founded to commemorate his victory at Actium (31 B.C.). The walls of Calydon, now the Kastro of Kurtaga on the Euenus, have a circuit of over 2 mi. Large terraces outside the walls probably indicate the temple of Artemis Laphria, whose gold and ivory statue was transferred to Patras.

See W. M. Leake, *Travels in Northern Greece*, i, p. 109, iii, pp. 533 *sqq;* W. J. Woodhouse, *Aetolia*, pp. 95 *sqq*.

CALYPSO, in Greek mythology, daughter of Atlas (or Oceanus, or Nereus), a nymph of the mythical island of Ogygia She entertained Odysseus (*q.v.*) seven years, but could not overcome his longing for home even by a promise of immortality, at last Hermes was sent by Zeus to bid her release him. In several later (Italo-Greek) stories, she bore Odysseus a son Auson, or Latinus. (Homer, *Odyssey*, i, 50, v, 28, vii, 254.)

CALYSTEGIA, a section of the genus *Convolvulus*, including those species in which the calyx is subtended by two large bracts. (*See* CONVOLVULUS.)

CAM (CÃO), DIOGO (*fl.* 1480–1486), Portuguese discoverer, the first European known to sight and enter the Congo, and to explore the West African coast between Cape St. Catherine (2° S.) and Cape Cross (21° 50′ S.) almost from the equator to Walfish bay. When King John II of Portugal revived the work of Henry the Navigator, he sent out Cam (about midsummer [?] 1482) to open up the African coast still farther beyond the equator. The mouth of the Congo was now discovered (perhaps in Aug. 1482) and marked by a stone pillar (still existing, but only in fragments) erected on Shark point; the great river was also ascended for a short distance and intercourse was opened with the natives. Cam then coasted down along the present Angola (Portuguese West Africa) and erected a second pillar, probably marking the termination of this voyage, at Cape Santa

Maria (the Monte Negro of these first visitors) in 13° 26′ S. He certainly returned to Lisbon by the beginning of April 1484, when John II ennobled him, made him a *cavalleiro* of his household (he was already an *escudeiro* or esquire in the same), and granted him an annuity and a coat of arms (April 8 and 14, 1484). On his second voyage of 1485–86, the explorer revisited the Congo and erected two more pillars beyond the farthest of his previous voyage, the first at another "Monte Negro" in 15° 41′ S., the second at Cape Cross in 21° 50′, this last probably marking the end of his progress southward. According to one authority, Cam died off Cape Cross; but others make him return to the Congo, and take thence a native envoy to Portugal. The four pillars set up by Cam on his two voyages were all discovered *in situ,* and all but one were removed to museums.

See João de Barros, *Decadas da Asia*, Decade i bk. iii, esp. ch. 3; Ruy de Pina, *Chronica d' el Rei D. João II;* Garcia de Resende, *Chronica;* Luciano Cordeiro, "Diogo Cão," in *Boletim* of the Lisbon Geog. Soc., 1892; E. G. Ravenstein, "Voyages of Diogo Cão," etc., in *Geog. Jnl.*, vol. xvi (1900); also *Geog. Jnl.*, xxxi (1908).

(C. R. B.)

CAM, a portion of a machine used for converting rotary motion into reciprocating or intermittent motion, or vice versa. It consists of a disk usually mounted on a revolving shaft, the periphery of the disk having a varying radius so its motion is eccentric. Against this turning surface a rod or other shaped piece, called a "follower," slides or rolls. A simple type of cam would be an egg-shaped metal plate with a shaft attached at right angles to its surface and, lying against the periphery of the plate, a rod. If now the shaft, and therefore the plate, be made to revolve, the rod will rise and fall. For resetting the hand of a stop watch to zero, a small spring-restrained arm carrying a roller on its end presses against a heart shaped cam which revolves nearly around the re-entrant point of the heart. Cams are also used for making and breaking contacts suddenly, such as the double logarithmic spiral cams used *for sending out* impulses from master clocks. Cams are also used in connection with the valve gear of internal combustion engines.

CAMAGÜEY, a province and its capital city, in east-central Cuba. The city, formerly known as Puerto Principe, lies about 528 mi. E.S.E. of Havana. Pop. (1943 census) 80,509 (city); 487,701 (province). Area of the province, 10,172 sq.mi.

The city of Camagüey lies on a broad plain about equally distant from the north and south coasts of the island, and between two small rivers, the Tinima and Hatibonica. Many of the churches, convents and other ecclesiastical establishments were built in the second half of the 18th century, some in the first half; and parts of the original cathedral of 1617 have probably survived later alterations and additions. The city hall was begun in 1733.

Camagüey is connected with Havana and Santiago by the axis-railway of the island; and by a railway 47 mi. long, with its port, Nuevitas (pop. 11,303). This is on the north side of the island, has a spacious land-locked bay of good depth, and is connected by a railway line with Santa Cruz del Sur (pop. 2,571) on the south coast. Cabinet woods, fruit, tobacco, sugar, wax, honey and cattle products are the leading exports.

In 1514 Diego Velasquez founded, on Nuevitas bay (then known as the Puerto del Principe), a settlement that was moved in 1515 or 1516 to the site of the present city of Camagüey. From very early times the surrounding plains were given over to horse and cattle-raising. As early as the beginning of the 17th century Havana depended on Camagüey to re-victual the ships which monopolized trade between Spain and America. From very early times, too, a prosperous clandestine trade was maintained with Providence, the Bahamas, and especially with Curaçao and Jamaica. After the capital, Camagüey was the richest prize of the island when it was captured and plundered in 1668 by a force of Frenchmen and Englishmen under Henry Morgan, the buccaneer. In the 18th century land grants and illicit trade led to serious disturbances. In 1775 Nuevitas was resettled, and in 1780 was made a legal (*habilitado*) port. After the cession of Santo Domingo to France in 1800, the Real Audiencia, the supreme court of the Spanish West Indies, was removed to Camagüey.

CAMALDULIANS, a religious order founded by St. Romuald (also called CAMALDOLESE). Born of a noble family at Ravenna *c.* 950, he retired at the age of 20 to the Benedictine monastery of S. Apollinare in Classe; but being strongly drawn to the eremitical life, he went to live with a hermit in the neighbourhood of Venice and then again near Ravenna. Here a colony of hermits grew up around him and he became the superior. In this way during the course of his life Romuald formed a great number of colonies throughout central Italy. His chief foundation was at Camaldoli on the heights of the Tuscan Apennines. Romuald's idea was to reintroduce into the west the primitive eremitical form of monachism, as practised by the first Egyptian and Syrian monks. Disciples of St. Romuald went on missions to the still heathen parts of Russia, Poland and Prussia, where some of them suffered martyrdom. In his extreme old age St. Romuald with 25 of his monks started on a missionary expedition to Hungary, but he was unable to accomplish the journey. He died in 1027. After his death mitigations were gradually introduced into the rule and manner of life; and in the monastery of St. Michael in Murano, Venice, the life became cenobitical. From that time to the present day there have always been both eremitical and cenobitical Camaldolese, the latter approximating to ordinary Benedictine life.

See Max Heimbucher, *Orden und Kongregationen* (1896) i § 29; art. "Camaldulenser" in Wetzer and Welte, *Kirchenlexikon* (2nd ed.), and Herzog-Hauck, *Realencyklopädie* (3rd ed.); and art. "Camaldolese," *Catholic Encyclopaedia,* vol. iii.

CAMARGO, MARIE ANNE DE CUPIS DE (1710–1770), French dancer, of Spanish descent, was born in Brussels on April 15, 1710. At ten years of age she was given lessons by Mlle. Françoise Prévost (1680–1741), then the first dancer at the Paris Opéra, and at once obtained an engagement as *première danseuse*, first at Brussels and then at Rouen. Under her grandmother's family name of Camargo she made her Paris *début* in 1726, and at once became the vogue. She had many titled adorers, whom she nearly ruined by her extravagances, among others Louis de Bourbon, comte de Clermont. At his wish she retired from the stage from 1736 to 1741. In her time she appeared in 78 ballets or operas. She was the first ballet dancer to shorten the skirt to what afterwards became the regulation length. There is a charming portrait of her by Nicolas Lancret.

CAMARGUE, the thinly populated Rhône delta, department of Bouches-du-Rhône, France. It is a marshy alluvial plain between the Grand Rhône to the east and the Petit Rhône to the west. Its average elevation is from 6½ to 8 feet. The Camargue has a coast line some 30 mi. in length and an area of 290 square miles. About a quarter of this, along the river banks, is fertile and cultivated. The rest is rough pasture for sheep and the local black bulls and white horses, or marsh, stagnant water and salty areas.

It is a centre for sea birds, flamingoes and bustards. The Étang de Vaccarès, the largest of the numerous lagoons, covers about 23 sq.mi.; it receives three main drainage canals. Inlets in the protecting sea-dike let in water for the purposes of the lagoon fisheries and salt-pans; and the river water is used for irrigation and for the submersion of vines. Hard winters and scorching summers are the rule; the mistral, blowing from the north and northwest, is the prevailing wind.

Many details of the region are discussed in R. D. Oldham's "Portolan Maps of the Rhône Delta," *Geogr. Journ.* lxv, p. 403 (1925).

CAMARINA, an ancient city of Sicily, situated on the S. coast, about 17 mi. S.E. of Gela (Terranova). It was founded by Syracuse in 598 B.C., but defeated by the mother city in 553 in an attempt to assert its independence. Hippocrates of Gela received its territory from Syracuse and restored the town in 491, but it was destroyed by Gelon in 484 and its population transferred to Syracuse; the Geloans, however, founded it anew in 461.

It was abandoned by Dionysius's order in 405, restored by Timoleon in 339 but in 258 was destroyed by the Romans.

On the site of the ancient city nothing is visible but a small part of the temple of Athena and a few foundations of houses; remains of the harbour and portions of the city wall have been traced by excavation, and the cemeteries have been carefully explored and have yielded important objects. *See* B. Pace, *Camarina* (Catania, Tirelli, 1927).

CAMBACÉRÈS, JEAN JACQUES RÉGIS DE, DUKE OF PARMA (1753–1824), French statesman, was born at Montpellier on Oct. 18, 1753. In 1792 the newly organized department of Hérault sent him as one of its deputies to the Convention. Cambacérès took no decided part in party strife but occupied himself mainly with the legal and legislative work which went on almost without intermission even during the Terror. He had laid down conjointly with Merlin of Douai, the principles on which the legislation of the revolutionary epoch should be codified. At the close of 1794 he also urged the restoration of the surviving Girondins to the Convention, from which they had been driven by the *coup d'état* of May 31, 1793. In the course of the year 1795, as president of the Committee of Public Safety, and as responsible especially for foreign affairs, he helped to bring about peace with Spain. At the dissolution of the Convention Cambacérès was one of those on the list of candidates for the Directory, but was not elected. The moderation of his views brought him into opposition to the Directors after the *coup d'état* of Fructidor (Sept. 1797), and for a time he retired into private life. Owing, however, to the influence of Sieyès, he became minister of justice in July 1799. He gave a guarded support to Bonaparte and Sieyès in their enterprise of overthrowing the Directory (*coup d'état* of Brumaire 1799).

After a short interval Cambacérès was, by the constitution of Dec. 1799, appointed second consul of France. He undoubtedly helped very materially to ensure to Napoleon the consulship for life (Aug. 1, 1802); but the second consul is known to have disapproved of some of the events which followed, notably the execution of the duc d'Enghien, the rupture with England, and the proclamation of the empire (May 19, 1804). He then became arch-chancellor of the empire and president of the Senate in perpetuity. He also became a prince of the empire and received in 1808 the title duke of Parma. Apart from the important part which he took in helping to co-ordinate and draft the Civil Code, Cambacérès did the State good service by seeking to curb the impetuosity of the emperor, and to prevent enterprises so fatal as the intervention in Spanish affairs (1808) and the invasion of Russia (1812) proved to be. In 1815, during the Hundred Days, he took up his duties reluctantly at the bidding of Napoleon; and after the second downfall of his master, he was for a time exiled. A decree May 13, 1818 restored him to his civil rights as a citizen of France; but the last six years of his life he spent in retirement. In demeanour he was quiet, reserved and tactful, but when occasion called for it he proved himself a brilliant orator. He was a celebrated *gourmet*, and his dinners were utilized by Napoleon as a useful adjunct to the arts of statecraft.

See A. Aubriet, *Vie de Cambacérès* (2nd ed., 1825).

CAMBALUC, the name by which the city on the site of the present Peking in China became known to mediaeval Europe. The word represents the Mongol Khan-Balik, "the city of the Khan," and was often, as by Longfellow, inaccurately spelt Cambalu. A city had long stood on its site, but it did not become the capital of all China until Kublai Khan transferred the capital of the Mongol confederacy from Karakorum up on the Mongolian steppe to Khan-Balik in the conquered lowlands of China. It was not until the Mongol conquests temporarily united western with eastern Asia that mediaeval travellers reached China from Europe and the place-names they took back with them were those employed by the Mongols.

Kublai Khan built a new city, completed in 1267, across a brook from the old city of Yenking and all but the northern third of his city is now occupied by the present "Tartar" city of Peking. Kublai's Palace seems to have stood on the same site as the Imperial Palace of the late Manchu dynasty. According to Marco Polo's description, Cambaluc was laid out on a rectangular plan and had a circuit of 24 miles. Its walls, 50 ft. high and on top 15 ft. broad, were each pierced by three gates, the roadways connecting them running straight across the city. Cambaluc was not only the capital of the eastern Khanate (which comprised besides China the plateaux and steppes of Tibet, Mongolia and Manchuria) but was also the terminus of the overland trade-route from western Asia and so from Europe across high Central Asia, just as Zaiton on the south-east China coast was the terminus of the sea-route from India by way of the Spice Islands. The Polos reached China by the first route and returned by the second. The population participating in this overland commerce seems to have lived outside the walls of Cambaluc and in Marco Polo's time, the last quarter of the 13th century, the population outside was greater than that within. The name Cambaluc refers essentially to the city of the Mongol period and the succeeding Chinese Ming dynasty re-named the city Peking, the northern capital, as distinct from Nanking, the southern capital. (*See* also CATHAY and PEKING.)

CAMBAY, a native state (Kaira agency) of India, in the Gujarat division of Bombay. It has an area of 392 square miles. Pop. (1941) 96,592. The tribute is £1,337. Cambay is entirely an alluvial plain. As a separate state it dates only from about 1730, the time of the dismemberment of the Mogul empire. The present chiefs are descended from Momin Khan II., the last of the governors of Gujarat, who made himself governor of Cambay in 1742. Wheat and cotton are the chief crops. The nawab being a minor, the state was under British administration in 1928.

The town of Cambay had a population in 1941 of 34,941. It is supposed to be the *Camanes* of Ptolemy and was formerly the seat of an extensive trade and textile manufactures; but, owing principally to the rise of Surat and the silting up of the harbour, its commerce fell away, and the town became unimportant. The spring tides rise upwards of 30 ft. The town is celebrated for its manufacture of agate and carnelian ornaments, of reputation principally in China. There is a cotton mill. Many houses are built of stone (which indicates the former wealth of the city, as the material had to be brought from a distance); and remains of a brick wall, 3 m. in circumference, which formerly surrounded the town, enclose four large reservoirs and three bazaars. To the south-east there are extensive ruins of subterranean temples and other buildings half-buried in the sand by which the ancient town was overwhelmed. These temples belong to the Jains, and contain two massive statues of their deities. In 1780 Cambay was taken by the army of General Goddard, was restored to the Mahrattas in 1783, and was afterwards ceded to the British by the Peshwa under the treaty of 1803. It is connected through Petlad with the Bombay, Baroda and Central India railway.

CAMBAY, GULF OF, a trumpet-shaped inlet on the west coast of India, narrowing northwards between Kathiawar peninsula and Gujarat. Its shape and orientation in relation to the south-west monsoon winds explain its very high tides and the velocity with which they enter. But it shallows rapidly; the silt of flood torrents entering its head contributes to progressive deterioration, and shoals and sandbanks are everywhere treacherous. Broach is one of the oldest Indian ports; Surat is particularly identified with the rise of direct European contacts with India, and Bhaunagar is a noteworthy entry for Kathiawar, but the importance of the gulf ports is now only local.

CAMBER, in engineering, the upward convexity given to a beam or girder to allow for the load. If the camber is properly calculated, the cambered member becomes straight when loaded. The word camber is from Fr. *cambrer*, to arch, and is also used in other connections; *e.g.*, the curve given to a roadway and the curvature of the wing of an aeroplane in imitation of the camber of a bird's wing.

In architecture camber is a slight upward curve to correct the illusion of sagging which a straight unsupported line presents.

CAMBERT, ROBERT (1628-1677), French musician, was born in Paris in 1628 and is remembered as one of the first composers of opera in France, at first in conjunction with the Abbé Pierre Perrin and afterwards on his own account. In 1669 Perrin received a patent for the founding of the *Académie Nationale de musique*, the germ of the Grand Opéra, and Cambert had a share in the administration until both he and Perrin were discarded in the interests of Lulli. Displeased at his subsequent neglect, and jealous of the favour shown to Lulli, who was musical superintendent to the king, he went in 1673 to London, where soon after his arrival he is said to have been appointed master of the band to Charles II. He is supposed to have killed himself—according to another account he was murdered—in London in 1677.

CAMBERWELL, a southern metropolitan borough of London, England, bounded north by Southwark and Bermondsey, east by Deptford and Lewisham, west by Lambeth and extending south to the boundary of the county of London. Pop. (est. 1938) 222,400. Area 7 sq.mi. It appears in Domesday, but the derivation of the name is unknown. It includes the districts of Peckham and Nunhead, and Dulwich (*q.v.*) with its park, picture gallery and schools. Camberwell is mainly residential, and there are many good houses in Dulwich and southward towards the high ground of Sydenham. Dulwich park (72 acres) and Peckham Rye common and park (113 acres) are the largest of several public grounds, and Camberwell green was once celebrated for its fairs. The parliamentary borough of Camberwell has four divisions, North, North-West, Peckham and Dulwich, each returning one member.

CAMBIASI, LUCA (1527–1585), Genoese painter, familiarly known as Lucchetto da Genova (his surname is written also Cambiaso or Cangiagio), was born at Moneglia in the Genoese state, the son of a painter named Giovanni Cambiasi. At the age of 15 he painted, with his father, some subjects from Ovid's *Metamorphoses* on the front of a house in Genoa, and afterwards, in conjunction with Marcantonio Calvi, a ceiling showing great daring of execution in the Palazzo Doria. Lucchetto's best artistic period lasted for 12 years after his first successes. In 1583 he accepted an invitation from Philip II to continue in the Escorial a series of frescoes which had been begun by his friend Giambattista Castello. He died in the Escorial in the second year of his sojourn. Cambiasi painted sometimes with a brush in each hand, and with a certainty equalling or transcending that even of Tintoret. He made a vast number of drawings, and was also something of a sculptor, executing in this branch of art a figure of Faith. His son Orazio became likewise a painter, studying under Lucchetto.

The best works of Cambiasi are to be seen in Genoa. In the church of S. Giorgio, the martyrdom of that saint; in the Palazzo Imperiali Terralba, a Genoese suburb, a fresco of the "Rape of the Sabines"; in S. Maria da Carignano, a "Pietà" containing his own portrait and (according to tradition) that of his sister-in-law, whom he loved, and who after the death of his wife, had taken charge of his household. In the Escorial he executed several pictures; one is a Paradise on the vaulting of the church, with a multitude of figures. For this picture he received 12,000 ducats, probably the largest sum that had, up to that time, ever been given for a single work.

CAMBINI, GIOVANNI GIUSEPPE (1746–1825), Italian composer and violinist, was born in Leghorn, Feb. 13, 1746, and studied violin under Padre Martini at Bologna. He went to Paris in 1770 and gained some very favourable recognition when Gossec introduced some of his symphonies at the Concert Spirituel. Cambini thereafter wrote an enormous amount of mediocre instrumental music, producing, within 20 years, 60 symphonies, 144 string quartets, 29 *Symphonies concertantes*, 7 concertos, and more than 400 miscellaneous pieces. His best works were his quartets, and because of his ability with the viola, he was invited to play in the quartets of Manfredi, Nardini and Boccherini, the three outstanding quartet players of the time. He was conductor at the Théâtre des Beaujolais (1788–91) and at the Théâtre Louvois (1791–94).

Cambini is said to have dissipated a talent which might have earned him a place high among musicians. An invalid the last ten years of his life, he died in the hospital of the Bicêtre on Dec. 29, 1825.

CAMBIST, a shortened form of *cambista*, which is Italian for money-changer. A cambist is one who deals in foreign bills of exchange and bank notes.

The term is also applied to conversion tables of foreign money, weights, and measures. (*See* EXCHANGE, FOREIGN.)

CAMBODIA, a protectorate within French Indo-China, bounded on the north and west by Thailand (Siam) and on the southwest by the Gulf of Siam. Area was 69,884 sq.mi. until 1941, when 18,500 sq.mi. were ceded to Thailand. Pop. (1936) 3,046,000. Ceded areas had a population of 520,000. Chinese and Annamese were racial minorities. Surface features vary more than in Cochin-China. The Cardamone mountains in the west reach 4,900 ft., and their granite buttresses extend northeastwards to the lakes, with forests on their steep sides, while the calcareous Elephant mountains extend from them southwards to the Gulf of Siam. To the north the sandstone terraces of the Dangrek mountains fall abruptly to the Cambodian plain, the old Mekong (*q.v.*) delta. The Tonlé-Sap depression is a striking feature with the smaller and the larger lake, remnants of an old sea gulf. It is fed by several streams and links with the Mekong by a channel at Pnom-Penh, through which it receives Mekong flood waters. In June the waters of the Mekong rise to a height of 40 to 45 ft. and flow through the Bras du Lac towards the lake, which then covers an area of 770 sq.mi. and, like the river, inundates the marshes, forests and cultivated lands on its borders. During the dry season the current reverses, the lake shrinks to an area of 100 sq.mi., and its depth falls from 45–48 ft. to a maximum of 5 ft. Tonlé-Sap probably represents the chief wealth of Cambodia. It supports a fishing population of more than 30,000; the fish, taken in large nets at the end of the inundation, are either dried or fermented for the production of *nuoc-mam* sauce. West of the large lake, around Battambang, is the largest Cambodian rice area. The mountainous region east of the Mekong is traversed by affluents of the Mekong, the Se-khong and the Tonle-srepok, which unite to flow into the Mekong at Stungtreng. Small islands, with a fishing population, fringe the west coast.

Climate, Fauna and Flora.—From mid-October to mid-April the northeast monsoon gives dry weather; the rainy season (mid-April to mid-October) is due to the southwest monsoon. At Pnom-Penh there is little variation of temperature (average 82°)—January giving 79°, and April, the warmest month, 84°. Wild animals include the elephant, which is also domesticated, the rhinoceros, buffalo and some species of wild ox; also the tiger, panther, leopard and honey bear. The crocodile is found in the Mekong, and there are many reptiles, some venomous. Water buffaloes and oxen are the chief draught animals. After rice and fish the chief products are timber, cotton, sugar, rubber, nux vomica, gamboge, cardamoms and lac.

People.—The Cambodians are more closely akin to the Siamese than to the Annamese. The race is probably the result of a fusion of aborigines of Indo-China with the Aryan and Mongolian invaders of the country. The men are taller and more muscular than the Siamese and Annamese, while the women are small and inclined to stoutness. The face is flat and wide, the nose large, the mouth large and the eyes only slightly oblique; the skin is dark brown, the hair black. Both sexes wear the langouti or loincloth, which the men supplement with a short jacket, the women with a long scarf draped round the figure, or a long clinging robe. The wife enjoys a respected position and divorce may be demanded by either party. Polygamy is almost confined to the richer classes. The Cambodians make good hunters and woodsmen; many live on the borders of the Mekong and the great lake, in huts built upon piles or floating rafts. The religion is Buddhism, and involves great respect towards the dead; the worship of spirits or local genii is also widespread, and Brahmanism is still maintained at the court. Numerous monks or *bonzes* live by alms, and in return teach the young to read, and superintend coronations, marriages, funerals and the other ceremonials. As in the rest of Indo-China, there is no hereditary nobility, but superior castes founded on blood-relationship, as well as the mandarins, who form a class by themselves, are exempt from tax or forced service. The mandarins are nominated by the king and their children have a position at court, and are generally chosen to fill the vacant posts in the administration. Under the native regime the common people attached themselves to one or other of the mandarins, who in return granted them the protection of his influence. Under French rule, local government of the Annamese type supplanted this feudal system. Slavery was abolished by royal ordinance (1897).

Cambodian idiom is like some aboriginal dialects of south Indo-China; it is agglutinate and rich in vowel-sounds. The king's language and religious words are akin to Pali. The written language was formerly a modified Chinese system, later largely replaced by *quoc-ngu,* phonetic transcription with Latin alphabet.

Cambodian Economy.—Rice is the chief crop and export, but Battambang, richest producing area, was ceded to Thailand in 1941. Cambodia leads the five provinces in maize, cotton and timber, and stands second in rubber production. Minor crops include cotton, pepper, sugar cane, kapok, castor beans, coffee, tea and silk. The Tonlé-Sap and Grand Lac produce 100,000 tons of fish annually, in addition to a large catch in the Gulf of Siam near Koh Kong Island. Rubber yield per acre is the highest in the far east.

Chinese dominate wholesale and retail trade. Steamers ply between the capital, Pnom-Penh, and Saigon, in Cochin-China, Cambodia's foreign trade outlet. The excellent highway system is connected with Thailand, Saigon and northern Laos. Late in 1941 the Pnom-Penh-Mongkolborey railway was linked with the Thai State railways. Factories consist chiefly of rice mills, sawmills, distilleries and cotton gins. The only mineral production consists of jade and sapphires. There are also iron deposits.

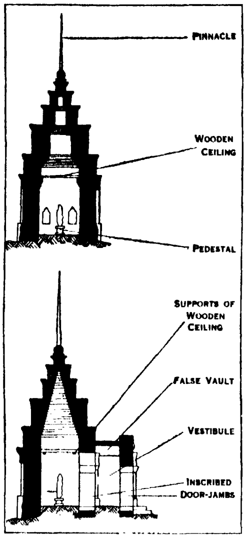
Administration.—The king (*rāj*) either nominates his successor, in which case he sometimes abdicates in his favour, or else is elected by the five chief mandarins from among the Brah Vansa, members of the royal family within the fifth degree. The king is advised by a council of five ministers, the superior mandarins; and there are about 50 provinces administered by mandarins. France has a resident superior, who presides over the ministerial council and is the real ruler of the country, and residents exercising supervision in districts. In each residential district there is a council of natives, presided over by the resident, which deliberates on questions affecting the district. The resident superior is assisted by the protectorate council, consisting of heads of French administrative departments (chief of the judicial service, of public works, etc.) and one native "notable," and the royal orders must receive its sanction before they can be executed. Control of foreign policy, public works, customs and the exchequer are in French hands, while management of police, collection of direct taxes and administration of justice between natives remain with the native government. A French tribunal alone is competent to settle disputes where one of the parties is not a native.

State-subsidized medical services were less developed than in other parts of Indo-China. In 1937 there was one large hospital, 14 medical centres and 40 infirmaries. Provincial revenue in 1936 was 7,457,000 piastres ($2,162,530), chiefly from poll and crop taxes. About half this sum was used for general administration, education receiving 526,000 piastres and public works 761,000 piastres. (*See* Indo-China, French.) (J. R. A.; X.)

ARCHAEOLOGY

The spread of Indian culture to this area, after the beginning of the Christian era, left no monuments of the first centuries, probably because at that time wood was the only building material known, but from the 6th and 7th centuries onwards temples and stone and bronze images are found. In the older forms the direct influence of the Indian tradition is perceptible. The monuments are small with great sobriety of sculpture. In the more recent period the native elements of the district in question assert themselves and the ornamentation becomes richer and more elaborate. Vast elaborately constructed groups of temple buildings arose in Java in the second half of the first period, while in Cambodia they belong to the more recent period. Finally, due principally to political circumstances, a period of degeneration set in, in Cambodia after the 12th century, in Champa after the 11th and in Java after the 14th century.

In the valley of the Mekong, the district around the great lake and the adjoining hills, the name of the oldest established kingdom, Fu-nan, gives place in the Chinese documents after the 6th century, to that of Chen-La, without evidence of the connection between the ancient kingdom and the two simultaneous Chen-La states, the northern and the southern. The art of the 6th to the 8th century may be termed primitive Khmer. In the course of the 8th century the northern Chen-La gained predominance, and from the 9th century union with the Khmers was an established fact. In regard to art the first part of this century is a blank, followed by a transition period, named after the reigning prince Indravarman, which has certain common features with the primitive style, but is in general nearly related to the classical Khmer art of the following centuries. Classical art flourished from the 10th to the 12th century, reaching its peak in the Angkor Vat temple of Sūryavarman II. Degeneration later rapidly set in.



LONGITUDINAL SECTIONS THROUGH CAMBODIAN TEMPLES. THESE ARE BUILT OF BRICK AND VAULTED. THE LOWER TEMPLE HAS A PORCH WITHIN THE ENTRANCE

The Primitive Khmer Style.—This yields usually small, solitary temples (pràsàt) rectangular or square constructed in brick. Horizontal lines predominate, the profiling is weak and the mouldings are furnished with niche-shaped antefixes, with human heads as ornamentation. The external roof, built in stories, does not correspond to the vaultings of the interior, because this style of building arose through the adaptation in stone of a style already using lighter materials. Probably a survival of the pre-Khmer style is to be found in the miniature buildings carved in relief, forming the decoration of the frontages and the space above the entrance, in the latter case enclosed in a wide arch. The entrance itself, flanked by round pillars, is covered by a lintel, a favourite theme for which is a depressed arch, often set with medallions, the extremities springing from the open mouths of *makaras* (sea-elephants).

In this primitive art two styles, a simpler and a more complicated, are recognizable. The latter is richer and lighter in decoration, the building is raised upon a considerable base, having projections on all four sides, one of which contains the entrance, the others bearing niches or blind doors. The roof, which in the first style is constructed of many stories, each of small height, is in the latter a few stories of great height, which lend to the whole a slender appearance. The first style has been regarded as being Hindu, and therefore in contrast to the later Khmer art.

The most important remains are those of Sambor Prei Kuk, to the east of the great lake, some 40 buildings, divided into different groups of both types. The stone cell of Asram Maha Rosei on the lower Mekong represents the older type and the lofty temple of Bayang the later one. In the lake district the simple Trapan Kuk contrasts with Damrei Krap and the group of Pra Srei; while on the upper Mekong at Han Cei both styles are found. At Boran is preserved the only complete example of a temple with two chambers. The sculpture of this period combines severity of design with delicacy of modelling; of which the images of Phnom Da and the Harihara of Andet are striking examples.

Indravarman Art.—In common with the primitive style the buildings are solitary, usually in brick, preferably, however, in the square ground plan. The form of the arch above the entrance persists, and the pillars flanking the entrance, though now almost always octagonal in place of round, are treated in the same spirit, the makara motive on both sides of the lintel being still frequently found.

The representation of buildings upon the façade has disappeared and given place to sculptured panels; mouldings and decoration have taken different forms, the technique is changed, the lintel has lost its architectural character and has become merely an ornament. In everything a tentative search for new forms is felt.

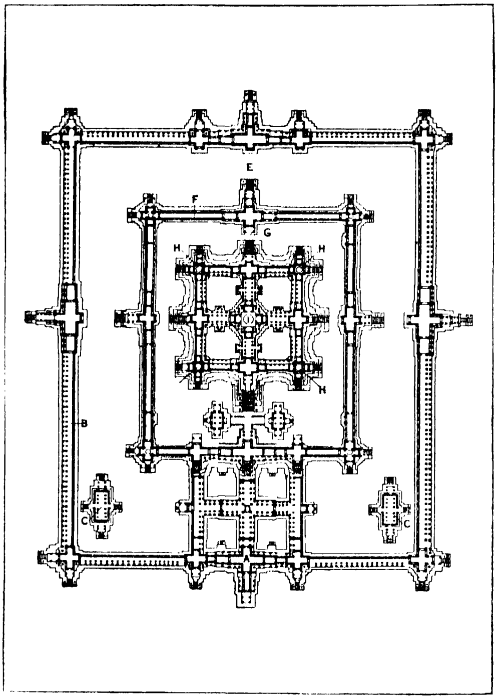
The group of sacred buildings at Roluoh, south east of Angkor, consisting of the shrines of Prah Ko, Bakong and Lolei, is characteristic of the Indravarman style. The first consists of two rows of three temples with a few outbuildings, contained within a double wall; Bakong is a tall pyramidal construction of six stories in stone, with two brick smaller temples on either side; Lolei is formed of four temples upon a vast terrace. With these, though of a somewhat later date, may be grouped Pre Rup, five temples raised upon a terrace, with twelve upon a lower level and a conglomeration of terraces, gateways and minor buildings; the (eastern) Mebon, also comprising five central temples, but with rather different surroundings; and Baksei Camkrong set alone upon a foundation raised in terraces. At Içvarapura, the present Bantay Srei, is a main temple between two others, in which the proportions of the stone buildings are small. They are conspicuous for the delicacy of their execution. This temple is typical of the Indravarman style in a number of particulars, although it was only built in the 14th century in what was then a very archaic style, to replace a 10th century sanctuary. The principal image is the representation of Śiva with Umā, almost naked, carved in bold lines, without ornamentation except for the head dress.

The oldest productions of the *classical style* are usually attributed to the 9th century (King Yaçovarman, 889–910). Certain characteristics are shared with the Indravarman style, which also produced groups of buildings with gateways and minor constructions, divine figures, often heavenly nymphs in niches, forming the principal decoration of the panels on the façade. The entrance, between octagonal pillars, is covered by a lintel, ornamented by garlands extending from the centre-piece, this centre-piece being frequently formed by the head of a monster. The *makaras* are replaced by *nagas* (snakes) which coil around the pointed-arch above the lintel, and other projecting parts and rear their heads on both sides; also the profiling is more animated.

The principal buildings, now almost invariably of stone, are connected by a more or less consecutive system of galleries. Great projections on each side transform the square into a cruciform plan. The layers of the roof repeat this form, succeeding each other in such a way that the whole roof, beneath the great lotus flower by which it is crowned, acquires an elongated cone shape, giving it the appearance of a tower.

Angkor Thom, founded by Yaçovarman about 900 A.D., was the centre of classical art. The nearby ruins of Banteai-chhmar, built by Jayavarman II (reigned 802–869) show the typical construction of a royal sanctuary. This king founded the "royal cult" religion, the ruler being deity, represented by the linga, symbol of procreation. The temples, of which the centre one has a portico, are combined and surrounded by a square gallery with four gateways; in front more passages and galleries join on, connected by side galleries; the whole, with other buildings at the side and back, is surrounded by another gallery, outside which again lie ponds and entrances with balustrades, the latter formed of huge snakes. The mountain of Kulen and perhaps Prah Khan, yield further examples of the older classical style; in the latter group there are twelve minor temples, excluding the outbuildings.

Angkor Thom itself, the ancient Yaçodharapura, is a square, surrounded by wall and moat, each side of which is three kilometers in extent. There are five gateways, from which roads with snake-balustrades lead to the centre of the city. In this centre stands the state temple Bayon. The chief building is surrounded by two galleries provided with portals and turrets and decorated with reliefs. These towers and the gates are cut in the form of four huge human faces, presumably representations of Śiva. The central tower, outside which a ring of small chapels are built, is provided with projections. In front there is a network of corridors and side passages; the inner chamber contained Śiva's Lingga, while in the chapels both Hindu and Buddhist sacred images are found. The latter, however, were probably introduced at a later date. North of Bayon lie the remains of the palace, in which the royal temple Phimeanakes still stands. Gallery and shrine here arise above three steep terraces. In front of the building runs a great terrace of honour ornamented with reliefs (elephants and others). All this is believed to belong to the most ancient plan of the city. Ta Prohm, to the east, dates from the same time, having a particularly intricate arrangement of projections against the inner gallery, large gateways and ponds. The neighbouring Banteai Kedei, attached to a great pond, while adhering to the leading principles, shows a very mixed ground plan.



FROM GARNIER, "ATLAS DU VOYAGE D'EXPLORATION EN INDO-CHINE," BY COURTESY OF THE LIBRAIRIE HACHETTE

ANGKOR VAT. GROUND PLAN SHOWING THE ARRANGEMENT OF BUILDINGS

A. Main Entrance
B. Gallery with reliefs
C. Libraries
D. Galleries of Vestibule
E. Outer Court
F. Second Court
G. Inner Court
H. Corner Towers
I. Central Tower, with sanctuary of Śiva

The group of Koh Ker, the remains of a new capital city, in the classical style but much simpler in construction, belongs to the second quarter of the 10th century. In the capital itself, Baphuon dates from this period, and is reared up high upon the topmost of three steep terraces, each of which is surrounded by a gallery and reached by a triple balustraded way. Ta Keo, just outside the city, is of the 11th century, with five towers on a high terrace, four at the corners and one in the middle. These great institutions are mostly Śivaitic; Buddhism is rather less conspicuous, although a great veneration for the Bodhisattva Lokeśvara is apparent everywhere. The same reign (Sūryavarman I. 1002–1050) saw Prah Vihear arise, on a high forepost of the Dangrek, a temple now ruinous with gallery porticos and a long approach with steps, portals and terraces. In Phnom Chiso(r) the same features can be recognized, the 200 sanctuaries of which are constructed of the old brick material. The culmination of classical art is reached in Angkor Vat, the magnificent Śivaitic sanctuary raised by Sūryavarman II. (1112–1152) to the south of the capital. The temple court, surrounded by a broad moat, contains two square cloisters rising one above the other and surrounding the central pile of four corner turrets and a central tower connected by galleries, with an elaborate approach. The celebrated reliefs in the first gallery represent scenes from the heroic epics, the contemporary royal court, priesthood and army.

Champa.—The history of Champa art, taken as a whole, shows a gradual process of degeneration, following the expulsion of the Chams from Annam, by the Annamites from Tonkin. The removal of the capital to Chaban in the south about A.D. 1000, divides the older (primary) period from the more recent (secondary). When stone came into favour for temple buildings (*kalan*) and replaced the lighter material—in Champa they have always gone on building in brick—we find, beside the small temples of the delicate form of the primitive art, another kind of building of a much more massive and heavy construction, to which the name of cubic art has been given. In the 10th century they fuse and form a hybrid style, though the pure primitive style still persists, and at the beginning of the secondary period, produces the so-called classical art, which follows the forms of the older style. In several buildings, an alteration in the form of the roofing leads to the pyramidal style, which survived to the 14th century. Classical art maintained itself up to the beginning of the 12th century. It then shows a rapid decline and after the fall of Chaban in 1471 is completely degenerate, although up to the 17th century it still produced buildings.

In sculpture, the oldest pieces are the best, some obviously dating from before the oldest monuments, *e.g.*, those from Tra-kieu. The primitive shrines are small square edifices, with a separate vestibule in front and projections for blind doors on the other sides. The plan of the temple building is repeated in the stories of the roof, which recede and leave space for small corner towers, the whole surmounted by an apex usually octagonal. The façades are decorated with slender pillars and floral or foliated scrolls. Divine nymphs, at the corners of the cornice with projecting motives at the foot of the buildings, form a typical characteristic of Cham art. The cubic style is much more artificial and conventional; the layers of the roof recede less and the corner towers disappear. The pilasters are broad and heavy. Mi-Son, south of Tourane contains the remains of some 60 small temples, dedicated to Śiva; which exemplify the whole development of the Cham style from the 7th century onwards. In the sculpture of the divine figures, the gradual deterioration is perceptible. In Po Nagar near Nhatrang, beside the style of the first period, pyramidal forms are found; the primitive style marks the temples of Khuong My and Binh Lam. As specimens of cubic style, Po Dam and Hoa Lai and the group of Dong Duong, south of Mi-Son, are the most important. The remains of the second period are necessarily in the south. In the *classical style* of the 11th century, descended from the primitive way everything that demands special skill is eliminated; decorative sculpture is replaced by a repetition of mouldings and edgings, terra-cotta ornaments take the place of sculpture; the roofs become higher and more clumsy, as at Binh Dinh, in the so-called Towers of Silver, Copper and Gold. The increase in number and the decrease in size of the stories of the roof which at the same time are less overlapping, lead to the pyramidal roof, running up in gentle curves, of Hung Thanh and Chanh Lo. The derivative style of Chien Dang, Klaung Garai and Po Rome was an attempt to revive the older style at the end of the 11th century.

(N. J. K.; X.)

HISTORY

The name *Kambuja*, whence the European form Cambodia, is derived from the Hindu *Kambu*, the name of the mythical founder of the Khmer race. Some centuries before the Christian era, immigrants from the east coast of India began to exert a powerful influence over Cambodia, introducing Brahminism and the Sanskrit language. This Hinduizing process became more marked about the 5th century A.D., when, under S'rutavarman, the Khmers as a nation rose into prominence. At the end of the 7th century the dynasty of S'rutavarman ceased to rule over the whole of Cambodia, which during the next century was ruled over by two sovereigns. About the beginning of the 9th century, with Jayavarman II, there began a dynasty which embraced the zenith of Khmer greatness. The royal city of Angkor-Thom (*see* ANGKOR) was completed under Yasovarman about A.D. 900. In the 10th century Buddhism, which had existed for centuries in Cambodia, began to become powerful and to rival Brahminism, the official religion. The construction of the temple of Angkor Vat dates probably from the first half of the 12th century. The conquest of the rival kingdom of Champa, which embraced modern Cochin-China and southern Annam, and in the later 15th century was absorbed by Annam, may probably be placed at the end of the 12th century in the reign of Jayavarman VII, the last of the great kings. In the later 13th century the Thai (Siamese) commenced a series of revolts which eventually drove their now-declining Khmer rulers from the whole Menam basin. The royal chronicles of Cambodia, the historical veracity of which has often to be questioned, begin about the middle of the 14th century, at which period the Thai assumed the offensive. These aggressions were continued in the 15th century, in the course of which the capital was finally abandoned by the Khmer kings. At the end of the 16th century, Lovek, which had succeeded Angkor-Thom as capital, was itself abandoned to the conquerors. During that century, the Portuguese had established some influence in the country, whither they were followed by the Dutch, but after the middle of the 17th century, Europeans counted for little in Cambodia till the arrival of the French. At the beginning of the 17th century the Nguyen, rulers of southern Annam, began to encroach on the territory of Cochin-China, and in the course of that and the 18th century, Cambodia, governed by two kings supported respectively by Siam and Annam, became a field for the conflicts of its two powerful neighbours. At the end of the 18th century the provinces of Battambang and Siem-reap were annexed by Siam. King Norodom came to the throne in 1854 and was in chronic danger of revolt. He could not assert independence of Siam, and soon the French, conquerors of the Annamites, threatened what remained of his sovereignty. Admiral Pierre de la Grandière, governor of Cochin-China, visited Norodom in 1863, in company with the vicar apostolic. In the following year, as Siam was about to crown King Norodom and establish its hegemony, Doudart de Lagrée, the admiral's representative, occupied the capital with marines and hoisted the French tricolour. Siam protested and reserved rights to Battambang and Angkor. In 1867 Siam renounced tribute and recognized the French protectorate in exchange for Battambang, Angkor and the Laos territory west of the Mekong. In 1884 a treaty reduced Norodom's power to a shadow. French pressure induced Siam to cede Battambang, Siem-reap (Angkor) and Sisiphon in 1907. In 1918, King Sisovath, although completely lacking in power, was so venerated by his people that he quelled an anti-French rebellion by simply telling his subjects to return home. Japanese encroachment on Indo-China in 1940 permitted Siam (renamed Thailand in 1939) to stage a small war, after which Japanese mediators awarded all of Battambang, most of Siem-reap (not including Angkor Vat) and parts of Kompong Thom and Stung Treng to Thailand. The treaty was signed May 9, 1941. King Norodom Sihanouk ascended the throne in 1941

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CAMBON, PIERRE JOSEPH (1756–1820), French revolutionary and financier, was born at Montpellier. As a member of the legislative assembly, he quickly attracted public attention by his able and sagacious speeches. An opponent of Marat, Danton and Dumouriez, Cambon nevertheless voted in favour of Louis XVI.'s execution. He opposed the creation of the Revolutionary Tribunal, and he incurred Robespierre's hatred by his outspoken criticism of his actions no less than by his intervention in favour of the Girondists on June 2, 1793. Cambon gave his valuable support to the Mountain, and it was due to his initiative and financial acumen that the *assignats* appreciated in value. Accused by Robespierre of reactionary and aristocratic leanings, Cambon replied so vehemently and effectively that his speech sounded the knell for Robespierre's own downfall. Under the Thermidor Cambon was violently attacked as a supporter of the Mountain and was accused of malversation. In April 1795 he was excluded from the committee of finance, and he soon afterwards sought safety from Tallien's attacks in flight to Switzerland. The amnesty of the 4th Brumaire enabled him to return to his estate at Terral, near Montpellier, where he lived in seclusion throughout the entire Napoleonic era. After Napoleon's downfall, and despite his advocacy of a Bourbon restoration, Cambon was exiled as a regicide. He retired to Belgium and died near Brussels on Feb. 15, 1820.

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CAMBON, PIERRE PAUL (1843–1924), French diplomatist, was born on Jan. 20, 1843, and educated at the Lycée Louis-le-Grand and the École de Droit. He was called to the Parisian bar, and became private secretary to Jules Ferry during the Commune. Thiers subsequently appointed him to administrative posts in the Alpes-Maritimes and at Marseilles. Later he became prefect of Lille. In 1882 he was appointed resident in Tunis, where he displayed his rare diplomatic talent. Four years later he was appointed ambassador to Madrid, and in 1890 was transferred to Constantinople, where he had an opportunity of watching German diplomacy at work in the Near East. In 1898 he became French ambassador in London immediately after the Fashoda incident had embittered Franco-British relations. Cambon at once set himself the task of improving those relations, and so successful was he that in 1904 he signed with Lansdowne the Anglo-French Agreement. He was very largely responsible for the promotion of the Anglo-Russian Agreement of 1907. In that year his brother, M. Jules Cambon, became French ambassador in Berlin, and thenceforth the two brothers worked in close accord to frustrate the designs of the military party in Germany. A believer in the doctrine expressed in the old French proverb "Tout vient a temps à qui sait attendre," Cambon pursued his policy of strengthening Franco-British relations with quiet skill. The culmination of his long years of work was reached in November 1912 with the exchange with Sir Edward Grey of the now famous letters regarding a naval and military co-operation between France and Great Britain in the possible event of war. Despite some anxious moments in the early days of Aug 1914, Cambon never wavered in his belief in Great Britain; and her participation in the war on the side of France fittingly crowned his life-work. During the war he laboured unceasingly to smooth away difficulties and allay irritations between the Allied commands, but when the peace had been signed at Versailles Cambon felt that the hour of his retirement had come. After 22 years of unremitting service to the interests of France and Great Britain, he left London in 1920 amid manifestations of regret rarely displayed to the ambassador of a foreign power. In 1903 he had been created G.C.V.O., and in 1917 the King accorded him the unusual distinction of the Grand Cross of the Bath. He died in Paris on May 29, 1924.

His brother, JULES MARTIN CAMBON (1845–1935), was called to the bar in 1866, served in the Franco-Prussian War and entered the civil service in 1871. He was prefect of the department of Nord (1882) and of the Rhone (1887–91), and in 1891 became governor-general of Algeria (*see* Guyot, *L'oeuvre de M. Jules Cambon*, Paris, 1897), where he had served in a minor position in 1874. He was nominated French ambassador at Washington in 1897, and in that capacity negotiated the preliminaries of peace on behalf of the Spanish Government after the war with the United States. He was transferred in 1902 to Madrid, and in 1907 to Berlin; in 1915 he became secretary to the Ministry of Foreign Affairs. (I. F. D. M.)

CAMBORNE, a market town of Cornwall, England, 13 mi. W.S.W. of Truro, on the G.W.R. The parish church of St. Martin contains an ancient stone altar bearing a Latin inscription. In Camborne is the important School of Metalliferous Mining, which has an associated school in Redruth. Practical mining is taught in South Condurrow mine. It was developed from classes initiated in 1859 by the Miners' association. Mining, engineering and stone-quarrying are the main industries. Camborne (*Cambron, Camron*) formed part of the manor of Tehidy, held at Domesday by the earl of Mortain and later by the Dunstanville and Basset families. In the early 18th century copper and tin began to be worked vigorously at Dolcoath; in 1788 ore worth £2,000,000 and in 1882 ore worth £5,500,000 was produced. It was the scene of the scientific labours of Richard Trevithick (1771–1833), the engineer, and of William Bickford, the inventor of the safety fuse. In 1934 the urban districts of Camborne and Redruth were united under the name Camborne-Redruth. Pop. (1938) 34,920. Area 34.5 sq.mi.

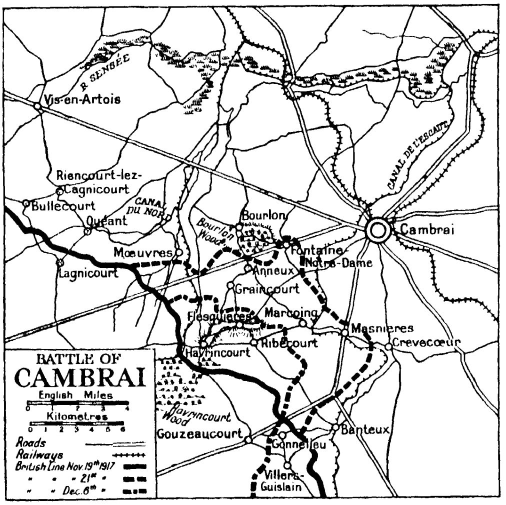
CAMBRAI, a town of northern France, the seat of an archbishop and capital of an arrondissement in the department of Nord, 37 mi. S.S.E. of Lille on the main line of the Northern railway. Pop. (1936) 29,246. Cambrai is situated on the right bank of the canalized Schelde, arms of which traverse the west of the town. Formerly strongly fortified, the ramparts had given way before the war of 1914–18, in which Cambrai figured prominently and was badly damaged, to handsome boulevards.

Cambrai is the ancient Nervian town of *Camaracum*, mentioned in the Antonine Itinerary. In the 5th century it was the capital of the Frankish king Raguacharius. Fortified by Charlemagne, it was captured and pillaged by the Normans in 870, and unsuccessfully besieged by the Hungarians in 953. During the 10th, 11th and 12th centuries it was the scene of frequent hostilities between the bishop and the citizens; but the latter ultimately effected their independence. In 1478 Louis XI., who had obtained the town on the death of Charles the Bold, handed it over to the emperor, and in the 16th century Charles V. built a strong citadel, for the erection of which the castles of Cavillers and Escaudoeuvres were demolished. From that date to the peace of Nijmwegen, 1678, which assigned it to France, it frequently changed hands by capture or treaty. The League of Cambrai is the name given to the alliance of Pope Julius II., Louis XII., Maximilian I. and Ferdinand the Catholic against the Venetians in 1508; and the peace of Cambrai (the Ladies' Peace) was concluded in the town in 1529 by Louise of Savoy, mother of Francis I., and Margaret of Austria, aunt of Charles V., in the names of these monarchs. The bishopric of Cambrai, dating from the 5th century, was raised in 1559 to the rank of an archbishopric which continued till the Revolution and was later restored. The bishops received the title of count from the emperor Henry I (919–936), and in 1510 were raised to the dignity of dukes, their territory including the town itself and its territory, called Cambrésis. In World War I, Cambrai was occupied by the Germans from August 26, 1914, to October 8, 1918. When they retired they left the town heavily mined, and the central portion was wrecked. (*See* CAMBRAI, BATTLE OF.)

The former cathedral of Cambrai was destroyed after the Revolution. The present cathedral of Notre-Dame is a church of the 19th century built on the site of the old abbey church of St. Sépulcre. It was severely damaged in 1918, but the façade is intact. Among other monuments it contains that of Fénelon, archbishop from 1695 to 1715. The church of St. Géry (18th century) contains, among other works of art, a marble Renaissance rood screen. The Place d'Armes, a large square in the centre of the town, is bordered on the north by the *hôtel de ville* (1863). The Tour St. Martin is an old church-tower of the 15th and 18th centuries transformed into a belfry. The triple stone portal, which gave entrance to the former archiepiscopal palace, is a work of the Renaissance period.

Cambrai has a sub-prefect, tribunals of first instance and of commerce, a board of trade-arbitrators and a chamber of commerce. There is a museum of antiquities and objects of art. Prior to 1914 it was a prosperous industrial town, its chief industry being the weaving of muslin (*batiste*) and other fine fabrics (*see* CAMBRIC); wool spinning and weaving, bleaching and dyeing were also carried on. The town has now regained its prewar position; there are large beet sugar works, and trade is in coal, cattle and grain.

CAMBRAI, BATTLE OF. In the history of the World War of 1914–18 this battle, fought in Nov.–Dec. 1917, stands out as a landmark in the history of warfare. On Nov. 20, 1917, the British 3rd Army launched an attack, based on a new method, with an initial success so striking that on the morrow the bells of London were rung in joyous acclaim of the "victory." Little more than a week later, on Nov. 30, after the hopes of exploiting the success had already faded, there came a German retort so full of menace that the public thereafter showed a strong distaste for premature celebrations. Yet if the battle in itself was a tragedy of error and missed opportunities, its eventual effect on the fortunes of the Allies was beneficent—it pointed the way to the victorious method of 1918.



Origin of the Battle.—The question of the origin of the Cambrai operations is of primary historical importance, both because of the outcome, and because of the method, of Nov. 20. The initial source is to be found in the third battle of Ypres, which opened on July 31, 1917, and died away three months later in the swamps of Passchendaele. The lesson of these operations was that the method of an overwhelming artillery bombardment stultified its own objects by rendering impassable the ground over which the advance was planned to follow. If the ultimate appreciation of this lesson by the High Command paved the way for the Cambrai method, the initial impulse came from another source, where the lesson had been absorbed within three days.

On Aug. 3, 1917, an alternative proposal was drawn up at Tank Corps headquarters by the chief general staff officer, Col. Fuller. The preface to it contained this significant example of prevision: " . . . from a tank point of view the third battle of Ypres may be considered dead. To go on using tanks in the present condition will not only lead to good machines and better personnel being thrown away, but also to a loss of *morale* in the infantry and tank crews through constant failure. From an infantry point of view the third battle of Ypres may be considered comatose. It can only be continued at colossal loss and little gain. . . ."

Then came the alternative proposal, to restore British prestige, before the winter set in, by a tank blow against St. Quentin, as a strategical prelude to an advance towards Valenciennes the following spring. Discussion of this project brought out the objection that it required a combined British and French operation, which might lack the simplicity and smooth working essential to a novel method. Therefore, on Aug. 4, a second project was framed, for a great tank raid south of Cambrai. The word raid should be stressed, for, as originally conceived, the object was "to destroy the enemy's personnel and guns, to demoralize and disorganize him, and not to capture ground." As the preliminary notes stated, "the duration of the raid must be short—eight to 12 hours—so that little or no concentration of the enemy may be effected for counter-attacks."

Had this plan been followed there would have been no need to lament Nov. 30. For the raid a force of six tank battalions, supported by "one, or better two," divisions with extra artillery, was suggested, operating on an 8,000yd. front. The object, as proposed, was "to raid the re-entrant formed by the L'Escaut canal between Ribécourt-Crèvecoeur-Banteux." The raiding force was to be divided into three groups, the main one to scour this canal-enclosed pocket, while the smaller groups formed offensive flanks on each side to protect the main operation.

The detailed project, from which the foregoing are extracts, was taken to Gen. Byng, commander of the 3rd Army, on Aug. 5. On Aug. 6 Byng went to G.H.Q., saw the commander-in-chief, and suggested an attack with tanks on Sept. 20. Sir Douglas Haig is understood to have been favourable to the idea, but counter-arguments, for concentrating every possible man in the Ypres area delayed its adoption. However, the continued lack of definite success at Ypres lent emphasis to an alternative, and on Sept. 7, as a result of a consultation at 3rd Army headquarters, a letter was addressed by Tanks Corps headquarters to G.H.Q. asking that the tanks might be withdrawn from the Ypres area, and suggesting two operations, one on the 1st Army front and one on the 3rd.

On Sept 11 G.H Q. approved the withdrawal of the bulk of the tanks and gave instructions to the Tank Corps to reconnoitre the Lens front (1st Army). After a report and project had been submitted to G.H.Q. the area was changed back to Cambrai, and on Oct. 25 the first general conference on the Cambrai operation was held. The date had been fixed for Nov. 20. Among the factors which induced the British command to approve the Cambrai scheme were the need of disarranging the enemy's plans of withdrawing troops from France to strengthen the Austro-German thrust against Italy, and the urgency of striking any such blow before the stream of German reinforcements released by the Russian revolution could swell to its full strength. Despite the heavy drain on British resources, caused by the Ypres offensive these arguments prevailed.

The Plan Adopted.—The basis of the tactical plan was the use of a mass of tanks in a surprise onslaught, to replace the customary method of an intense preparatory bombardment by artillery. The historical interest of the Cambrai scheme centres around two points, the general plan and the tank plan.

The 3rd Army plan was (*a*) to break the German defensive system, the famous Hindenburg line, in the neck of land between the Canal de L'Escaut and the Canal du Nord; (*b*) to seize Cambrai, Bourlon wood and the passages over the river Sensée; (*c*) to cut off the Germans in the area south of the Sensée and west of the Canal du Nord; and (*d*) to exploit the success towards Valenciennes. The force allotted for this ambitious plan was the 3rd and 4th Army Corps, comprising six divisions and part of another, the Cavalry Corps of two divisions, 381 fighting tanks and approximately 1,000 guns. They were to be employed on a front extending from Gonnelieu to Havrincourt wood. The German defences opposing them consisted of the Hindenburg line system, and behind this the Hindenburg reserve line and the unfinished Beaurevoir-Masnières line. Thus of the original project there remained only the fundamental idea—the massed tank surprise, the tank method and the locality.

In the alterations to the original plan lay the germ of disaster. The raid had been transformed into a large-scale offensive, with far-reaching aims. Instead of scouring a pocket and withdrawing, an organized advance was to be made up a narrow lane bounded by two canals. As protection to a raid, these became a danger to such an attack, circumscribing the action of the tanks and preventing the formation of tank offensive flanks. Otherwise the ground was good, and ideally chosen indeed for the original purpose, being mostly rolling downland, excellent for tank movement. It was marked by two features, the Flesquières-Havrincourt ridge and Bourlon hill.

The fundamental weakness of the plan was not topographical, but the almost complete lack of reserves. To undertake such an important operation in such a condition was surely a violation of one of the cardinal axioms of war. There were local reserves, naturally, in most divisions, but there was no general reserve, unless the two cavalry divisions can be considered such—and, apart from their limited strength, the futility of so regarding them was amply shown in their fresh inability, in face of modern weapons, to influence the action.

The six divisions employed in the initial attack were all that the 3rd Army commander had at his disposal, for a plan that visualized a penetration beyond Cambrai towards Valenciennes. It is difficult to understand what was in mind as to the future, for without reserves complete success could only mean the creation of an excessively deep and narrow salient, requiring many divisions to hold it. It is true that the Guards and one or two other divisions could be made available, and were ultimately brought to the scene, but they were too far away for prompt intervention. The situation, indeed, had some reminder of Loos. The French also moved a special force forward in readiness to co-operate, but their aid was not called upon.

If the excuse be that the third battle of Ypres had drained the British of reserves, then it surely reflects on the choice of that swamp-like area and the failure to try earlier the method that at Cambrai unlocked the doors to decisive success. On the other hand, it may be urged that G.H.Q. put an initial time-limit of 48 hours on the operation. To this the reply is that if the lack of resources was appreciated, the objectives were excessively ambitious, and that the powerful raid originally proposed was far more in accordance with the principle of security than an offensive involving occupation of newly consolidated positions.

Turning now to the tank plan, the problems were to gain surprise, to cross the wide and deep obstacle of the Hindenburg line and to ensure co-operation between the infantry and tanks for their common security. Careful organization and the absence of a preliminary bombardment contributed to the accomplishment of the first object. The difficulty presented by the Hindenburg line was overcome by devising super-fascine, huge bundles of brush wood, which were carried on the nose of each tank and released on reaching the edge of the Hindenburg trenches; the tanks, working in sections of three, had thus the power to cross three successive obstacles. Thirdly, a strictly drill attack was worked out and practised, by which in each section an advanced guard tank moved about 100yd. ahead of the two main body tanks, keeping down the enemy's fire and protecting the main body as they led the infantry forward. The infantry, moving in flexible file formations, followed immediately behind the main body tanks. While the tanks cleared a way for them through the deep belts of enemy wire and subdued the hostile machine-gun fire, the infantry acted as "moppers-up" to the tanks and were also ready to protect them from the enemy's guns at close quarters. The one fault of the tank plan was that, against expert advice, the tanks attacked on the whole frontage instead of against selected tactical points, with the result that no tank reserve was kept for use in the later stages.

The Battle.—The preparations for the battle were made with great skill and secrecy, while to mislead the enemy as to the scale and frontage of the attack, gas and smoke attacks, dummy attacks with dummy tanks, raids and feints, were carried out on a wide front both north and south of the real sector of attack.

At 6.20 A.M. on Nov. 20 the tanks and infantry moved forward to the attack on roughly a six-mile front, achieving complete surprise and a demoralizing initial success at all points, save in the left centre in front of Flesquières. The cause of this one serious check appears to have been that the 51st Division here adopted formations of its own instead of conforming to those devised by the Tank Corps and adopted in all the other divisions. Whatever the reason, the result was that the infantry fell too far behind the tanks, lost the gaps in the wire and were stopped by machine-gun fire. This loss of touch lay also at the root of the losses which befell the tanks when they came over the ridge and under the close fire of several German batteries, for infantry accompanying them could have picked off the gunners.

But the effect of this battlefield incident has been unduly magnified. On the right the 12th, 20th and 6th Divisions secured their objectives rapidly, though the 12th had severe fighting at Lateau wood. The 29th Division passed through and captured Masnières and Marcoing, securing the passage of the canal at both and even the bridge intact at the latter. On the left the 51st and 62nd Divisions made a brilliant advance, advancing by nightfall as far as Anneux, over 2m. in the rear of Flesquières. The Flesquières resistance was thus only an islet, cut off and overlapped by the waves which swept round its flanks and on to Marcoing, Anneux and even to the edge of Bourlon wood. A penetration of 5m. had been made—the equivalent of months of heavy fighting and heavier losses on the Somme and at the third battle at Ypres. Decisive success was within the grasp of the British forces, the enemy's main defence systems had been overrun, only a half-finished line and the open country lay beyond. But the original divisions and the tank crews were exhausted, and apart from one squadron of the Canadian Fort Garry Horse the two cavalry divisions could contribute nothing toward fulfilling their rôle of exploitation.

On Nov. 21 local reserves made some further progress. The village of Flesquières fell at 8 A.M., and the 51st and 62nd Divisions pressed rapidly on, clearing the German salient formed by this resistance on the first day and carrying the tide of the British advance as far as Fontaine-Notre-Dame, 1½m. beyond the high-water mark of Nov. 20. But on the right, little ground was gained—a relieving German division had arrived just in time to occupy the rear defence. The High Command's time-limit of 48 hours had expired, but owing to the menace of the uncaptured Bourlon hill, to the new British position, as well as to the hope of an enemy withdrawal and the desire to relieve the enemy pressure on Italy, the commander-in-chief decided to continue the offensive, placing a few fresh divisions at the disposal of the 3rd Army. But the Tank Corps, the essential cause of the early success, was tired out, men and machines—all had been staked on the first throw. The fresh attacks met with more failure than success against an enemy now braced to meet the danger.

The German Counter-Attack.—On Nov. 22 the Germans recaptured Fontaine-Notre-Dame; on the 23rd, the 40th Division with tanks captured the whole of Bourlon wood, but the attempts on Bourlon village and Fontaine-Notre-Dame failed. Bitter and fluctuating fighting followed; Bourlon and Fontaine-Notre Dame were won and lost again, and meanwhile there were signs of a strong German counter-thrust against the already over-strained attackers, most of whom had been kept in action unrelieved since Nov. 20. Unfortunately, moreover, warnings of the storm were received with scepticism in some of the higher commands. In the early morning of Nov. 30 the blow fell, the German army commander, von der Marwitz, making a convergent attack against the northern and southern flanks of the salient which the British advance had created. In the north, round Bourlon wood, the attack was stopped after bitter fighting, but in the south, where the blow fell on the joint of the salient and also on the weakly held front to the south, it broke right through. This was a finely planned surprise assault, unheralded by any preliminary bombardment, and made more effective by the cloud of gas and smoke shells. Villers Guislain and Gonnelieu soon fell, and the thrust penetrated deeply behind the old British front line as far as Gouzeaucourt, overrunning gun positions and headquarters. Disaster was only averted by the superb counter-attack of the Guards Division, which recaptured Gouzeaucourt, and later, of the 2nd Tank Brigade, which brought out the value of this arm for defence.

Fresh attacks on Bourlon and Masnières failed, but further German progress was made towards Villers Plouich The British position in the Masnières-Bourlon salient was thus rendered so precarious that on the night of Dec. 4–5 most of the salient was evacuated and the line drawn back roughly to the Flesquières ridge. Although the result left the British with a slight gain of ground on balance, and better still had a helpful influence on the Italian campaign, Cambrai would be remembered mainly as a tragedy of mistaken aims and lost opportunities, were it not for its revelation of a new key to victory, turned to effect in 1918.

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CAMBRIA, the M. Lat. name for Wales. After the end of the western Roman empire the Cymric Celts held for a while both Wales and the land round the Solway (now Cumberland and adjacent regions), and the former came to be called Cambria, the latter Cumbria, though the two names were sometimes interchanged by early mediaeval writers.

CAMBRIAN SYSTEM, in geology, is the name applied to the oldest group of rocks in which fossils have been found in any abundance. Organic remains have, indeed, been discovered in still older beds, but they are rare and obscure. The name was originally proposed by Sedgwick and, as used by him, it included the Lower Silurian of Murchison, which is now commonly recognized as a separate system under the name Ordovician. Thus the Cambrian of the present day is the Lower Cambrian of Sedgwick. Other terms which have been used with approximately the same significance are Primordial Silurian and Taconic, the latter in America only. The original Taconic of Emmons has, however, proved to be a complex of various ages and the name has dropped out of use. Although the term Cambrian is now universally accepted, there are still differences of usage with regard to its precise limits. In England the Tremadoc beds, which in their fauna are intermediate between the Cambrian and the succeeding system, are usually included in the Cambrian; on the Continent the corresponding beds are placed in the Ordovician.

In general the Cambrian period was a quiet one. No violent crustal disturbances can be assigned to it and manifestations of volcanic activity are insignificant. Considerable changes of level are indicated by the nature of the sediments and by local discontinuities, but these changes were not accompanied by folding. Even the most considerable gaps in the succession are usually not marked by any definite unconformity and have often been overlooked till the examination of the included fossils showed that a part of the system was missing. In many areas, however, the beds have since undergone great earth-movements and the muds and sands of the period have been converted, as in Wales, into slates and quartzites. Where, as in Estonia, they have been little disturbed, they may remain nearly as soft as when laid down.

At one time it was imagined that the Cambrian faunas throughout the world were more uniform in character than those of later periods. It was even supposed that there was a similar uniformity in the nature of the deposits and, in particular, a conspicuous deficiency in limestone. Hence it was argued that during the Cambrian period the ocean waters were more evenly spread over the globe than they have been since, and that climatic differences were less marked. Such views, however, can no longer be held. So great are the differences between the Cambrian faunas of western America and of northern Europe that the real difficulty is not to distinguish between them but to correlate them; and while limestone is absent from the Cambrian of Wales there are thousands of feet of limestone in the Cambrian of the Canadian Rockies.

Life of the Period.—Although the Cambrian fauna is the earliest of which we know more than traces, there is nothing primitive about it. It is very varied and includes many different classes of animals. The Protozoa are represented by radiolaria and sponges, the Coelentera by corals, by the earliest graptolites and even by casts of such delicate forms as medusae. The Echinoderma include crinoids, starfishes and cystideans. Annelids occur even in the oldest beds. Brachiopoda and Mollusca are locally numerous and various forms of Crustacea are found; but by far the most varied and abundant group is the Trilobita (*q.v.*), which includes a great variety of forms, ranging from the small and simple *Agnostus* to the large and many-segmented *Paradoxides*.

Classification.—Lithological divisions of a geological system have no more than a local value, and a grouping of the beds according to their fossil contents is much more widely applicable; but in the Cambrian there is nothing comparable, either in precision or in generality, with the graptolite zones of the Ordovician and Silurian or the ammonite zones of the Jurassic. It is true that many of the palaeontological zones established in Scandinavia can be recognized in Wales and even in Newfoundland, but in Western America and Eastern Asia the characteristic fossils of these zones are entirely absent. Even the broader palaeontological subdivisions of northern Europe cannot there be distinguished.

In Europe three divisions have long been recognized, each characterized by a special group of trilobites, after which it is named. These divisions are, in ascending order, the *Olenellus* series, the *Paradoxides* series, and the *Olenus* series. In this connection *Olenellus* and *Olenus* are used in a wide sense and must be understood to include allied forms. Neither *Olenellus* nor *Olenus* in the stricter sense ranges throughout the series named after it. The *Olenellus* group of trilobites seems to have been world-wide in its distribution, but through the greater part of America, Asia and Australia *Paradoxides* and *Olenus* and their allies are unknown, although the deposits of the period during which they lived are present. In America *Olenoides* series and *Dikelocephalus* series would be more appropriate terms; but it is not yet possible to establish any subdivision of the Cambrian system into series of universal applicability. We use such terms as Lower, Middle and Upper Cambrian: but it would be rash to assume, *e.g.*, that the Middle Cambrian of the Rockies corresponds in more than a general way with that of Wales or even of New Brunswick.

Atlantic and Pacific Faunas.—The Cambrian fauna of Wales is very like that of Scandinavia, many of the species being identical, and a similar fauna is also found in the extreme east of North America. But the Cambrian fossils of the north of Scotland are quite different and closely resemble those from the Appalachian region of Canada and the United States. There are, in fact, two distinct faunas which lived, no doubt, in separate seas. Between them lay a barrier of land which stretched from the Appalachian plateau across the Atlantic into Scotland.

In the Western Cordillera of Canada and the United States there is another abundant Cambrian fauna, very different from that of Wales but with a much closer affinity to that of the Appalachian area. A very similar fauna is found in China, and the Cambrian faunas of India and Australia are also closely related. It seems, therefore, that even in Cambrian times there was an Atlantic and a Pacific occupying part of their present sites and in some directions spreading far beyond.

It is not possible here to do more than indicate a few of the differences between the faunas of the two oceans. In the Atlantic fauna *Paradoxides*, *Olenus*, *Peltura*, *Parabolina*, *Leptoplastus* and several other allied genera play an important part; in the Pacific fauna they are unknown, though one or two species allied to *Olenus* have been found. The Pacific fauna includes a whole series of genera which are not found in the Atlantic area. There is a much greater variety of forms belonging to the same family as *Olenellus* (the Mesonacidae); but perhaps the most striking feature is the number of large-tailed genera, such as *Asaphiscus* and *Ogygopsis*, which closely resemble the Asaphids characteristic of the European Ordovician. To a certain extent the place of *Paradoxides* is taken by *Olenoides* and its allies, the place of *Olenus* by *Dikelocephalus* and similar genera. The latter are not altogether absent from the Atlantic fauna but are much less numerous and varied.

The *Atlantic fauna* of the Cambrian period stretched from the mouth of the St. Lawrence on the west to the Lena on the east. The western limit is sharply defined, for while the Cambrian of eastern Newfoundland, New Brunswick, and eastern Massachusetts belongs to the *Atlantic* type, *the* corresponding beds of western Newfoundland and the Appalachian region are of Pacific type. Northwards the Atlantic fauna did not reach the Scottish Highlands, for there we find the fauna of the Appalachian sea. In eastern Europe, however, it extended into Vaigach island and farther east it stretched beyond the present continent of Asia to the New Siberian islands. Southwards it reached the Mediterranean region, for the Cambrian of the Spanish peninsula, Sardinia and the Dead sea belongs to this type.

The whole of the area included within these limits was not a single broad expanse of sea. The Cambrian fauna of Sardinia is very different from that of Scandinavia. Probably an incomplete land-barrier lay between, but the differences may be partly due to differences of temperature, depth or other conditions. In some cases an apparent difference between the faunas of two regions has been brought about by the absence in one of them of the deposits belonging to a part of the period.

On the western side of the present Pacific the *Pacific fauna* of the Cambrian period has been found in Manchuria, China, Indo-China, the central Himalayas, the Indus Salt range, Australia and Tasmania. On the eastern side it is found in the Western Cordillera of North America, in the Appalachian region and in the north of Scotland. Much of the interior of the United States was also covered by seas for some part of the period. The Appalachian Cambrian, for example, seems to have been laid down in a comparatively narrow gulf which north-eastward stretched as far as Scotland and south-westward entered the open ocean. The Cordilleran Cambrian is believed to have been deposited in a trough running along the line of the present Cordillera and separated from the ocean by a land-mass which occupied the site of the Cascade range. This trough is supposed to have been connected with an Arctic ocean in the north and an open Pacific towards the south. For the greater part of the period the Appalachian gulf and the Cordilleran trough were separated by land occupying most of the interior of Canada and the United States, but towards the close much of this area was covered by the sea. The Cambrian faunas of China, India and Australia, although all of Pacific type, show sufficient individuality to suggest that the seas in which they lived were not always in free communication.

Europe.—The principal Cambrian areas of Europe are in the north-west of Scotland, in Wales and the neighbouring counties of England, in Scandinavia, Estonia, Bohemia, the Spanish peninsula and Sardinia. Beds also occur in the Ardennes, Brittany, the Montagne Noire S. France, and in Germany and Poland.

It has already been remarked that the Cambrian of the north of Scotland belongs to the Pacific type. The rocks are chiefly sandstones and dolomitic limestones, the former predominating in the lower part of the series and the latter in the upper part. *Olenellus* occurs in the Fucoid beds, towards the middle of the series, but the Durness limestone, which forms the upper part, contains a very different fauna. Trilobites occur, but the most striking feature is the dominance of cephalopods and gasteropods, most of the species being unknown elsewhere in Britain but occurring in Canada. Comparison with that area suggests that the limestone belongs to the Upper Cambrian. Palaeontologically there is no trace of the Middle Cambrian, but as yet no break has been detected in the succession.

The accompanying table gives many of the more important local names of subdivisions used in various parts of northern Europe and shows their approximate correlation. It should be remembered that the greater part of the "Passage Beds" of this table is placed by Continental geologists in the Ordovician. The *Dictyonema flabelliforme* zone, which in Wales occurs near the base of the Tremadoc, is usually taken as the line of demarcation.

	Wales	Shropshire	Malverns	Nuneaton	South Scandinavia	Estonia
Passage Beds	Tremadoc	Shineton shales	Bronsil shales	Merevale shales	Ceratopyge series	Glauconite sand
Olenus series	Lingula flags	Orusia shales	Malvern black shales	Oldbury shales	Alum shales	Ungulite grit
Paradoxides series	Menevian Harlech series: Solva Series	Upper Comley series		Purley shales		
Olenellus series	Harlech series: Caerfai Series	Lower Comley series Wrekin Quartzite	Hollybush Sandstone Malvern Quartzite	Hartshill Quartzite	Fucoid Sandstone Eophyton Sandstone	Blue clay

Note. The major gaps in the succession are indicated by the waved lines.

In the strip of northern Europe which includes the areas mentioned in the table, the Cambrian attains its greatest thickness in Wales, where it has been estimated to exceed 12,000 feet. Upon the Welsh borders the thickness is much reduced, partly because there was less deposition throughout the period and partly because there is a considerable gap in the succession. Probably there was land here during the middle of the period and shallow water during the remainder. At Nuneaton, in Warwickshire, no break in deposition has been detected, but the total thickness is still much less than in Wales.

In Scandinavia the Alum shales, which are black shales with dark calcareous nodules and bands, are only some 400ft. thick, but the succession is complete, except that there has been a certain amount of submarine erosion at the top of the shales. In Estonia, along the south shore of the Gulf of Finland, the total thickness of the Cambrian is not more than 100ft., though borings at Reval and Leningrad show as much as 600 feet. But the small thickness here is certainly due in part to the total absence of the *Paradoxides* series and the imperfect development of the *Olenus* series. The Ungulite grit is placed in the latter, but *Olenus* and its congeners are absent. In spite of this great gap there is no unconformity, and the gap is indicated chiefly by the fact that the base of this grit contains fragments of the underlying beds.

In Bohemia the Cambrian consists of sandstones and conglomerates below, with a few obscure fossils, followed by greenish thick-bedded slates containing an abundant fauna. Trilobites predominate, and amongst them are species of *Paradoxides*. The *Olenellus* series may perhaps be represented by the unfossiliferous sandstones, but the *Olenus* series is absent, for the *Paradoxides* beds are followed immediately by the Ordovician. Even in the *Paradoxides* series most of the fossils are so distinct from those of Scandinavia as to suggest the possibility of an intervening land barrier. The occurrence of a Tremadoc fauna near Hof, Bavaria, points to an extension of the sea at the close of the period.

In southern Europe Cambrian beds are found in the Montagne Noire, the Spanish provinces of Leon, Asturias, Aragon and Seville, the Portuguese province of Alemtejo, and in Sardinia. In all these areas *Paradoxides* occurs, and the discovery of that genus near the Dead sea seems to indicate that in Middle Cambrian times a southern sea extended as far as Palestine. Neither *Olenellus* nor *Olenus* has been found, but in Portugal and Sardinia there is a lower fauna suggestive of the *Olenellus* series. The wide distribution of *Archaeocyathus* limestones in southern Europe is noteworthy.

Asia.—Cambrian beds cover a wide area in Siberia and in Manchuria and northern China. They have also been found in Yunnan and Indo-China. In the central Himalayas there is an interesting development in Spiti, while south of the Himalayas a different type is found in the Salt range of the Indus. The occurrence of *Paradoxides* and other Cambrian fossils near the Dead sea, already referred to, suggests that the series of sandstones so widely spread in south-western Asia and northern Africa may include deposits of Cambrian age. So far as the fauna is concerned the Cambrian of the Dead sea and of Siberia belong to the Atlantic type, while in the remaining areas it is of Pacific type.

In Siberia the Cambrian covers a wide area extending from the Yenisei to the Lena. It has been found as far south as 56° N. Lat., and as far north as the New Siberian islands. In general the beds are nearly horizontal and consist of sandstones, shales and limestones. Much of it may certainly be referred to the *Paradoxides* series, though *Paradoxides* itself has not been recorded, but it is probable that the lower beds belong to the *Olenellus* series. In this lower division there is a considerable development of *Archaeocyathus* limestones containing *Dorypyge*.

In Manchuria and northern China, also, the Cambrian strata are in general horizontal, but along certain lines there has been very considerable disturbance, accompanied even by overthrusting. Two main divisions are recognized, the Man-t'o shale below and the Kiu-Lung group above. These are approximately the equivalents of the Lower Sinian and the Middle Sinian of Richthofen, who first described them. His Upper Sinian is Ordovician. The Man-t'o series has a thickness of 300–500ft., consisting chiefly of red shale with beds of sandstone and thin layers of limestone. Fossils are not abundant but Lower Cambrian and Middle Cambrian forms have been found. Amongst them is the trilobite *Redlichia*, a genus which has a wide distribution in Asia. It seems to belong to the same family as *Olenellus* although, unlike the other genera of that family, it has a distinct facial suture. It occurs chiefly in the Lower Cambrian but extends upwards into beds which are referred to the Middle Cambrian. The Kiu-Lung group, about 1,000ft. in thickness, consists of shales and limestones, the shales being green in colour. The fauna is very rich and includes a number of trilobite genera which have not yet been found elsewhere. There is, however, enough resemblance to the fauna of western North America to indicate that the lower part of the group belongs to the Middle Cambrian and the upper part to the Upper Cambrian.

In Yunnan and in the northern part of Indo-China the Cambrian beds are greatly disturbed but nevertheless have yielded an abundant fauna. In general it is very like that of northern China but includes one or two peculiar genera.

The Cambrian of Spiti consists of several thousand feet of slates and quartzites with thin bands of dolomite in the upper thousand feet. It is from this upper portion that fossils have been obtained. *Redlichia* has been found, and in the higher fossiliferous bands there are one or two forms which seem to be allied to *Olenus*, but no true *Olenus* has been discovered. The majority of the fossils seem to belong to the Middle Cambrian and have Pacific rather than Atlantic affinities.

The beds which are referred to the Cambrian in the Salt range consist chiefly of sandstone and shale with a very remarkable deposit of salt in the lower part of the series. Cambrian fossils occur in the *Neobolus* shales, which lie in the upper half of the series. Amongst them are *Redlichia* and other trilobites, brachiopods and mollusca.

Australia and Tasmania.—Cambrian beds occupy a wide area in Northern Territory, where they consist largely of limestones and attain a thickness of perhaps 7,000 feet. Thick sheets of basic lava below seem to belong to the period. In South Australia the system is found between Lake Eyre and Kangaroo island, and stretches across the Barrier range into New South Wales. In this southern area one of the most remarkable features is the presence of glacial deposits, fully 1,000ft. thick, towards the middle of the system. Higher up is a great development of *Archaeocyathus* limestones. The fauna of the Australian Cambrian is distinctly Pacific in type, including *Redlichia* and large-tailed trilobites of Asaphid aspect. In Tasmania the Cambrian beds have yielded well-preserved casts of *Dikelocephalus*.

North America.—In the eastern part of Newfoundland, in New Brunswick and Cape Breton, and in the eastern part of Massachusetts the Cambrian is of Atlantic type. Even the individual zones which have been distinguished in Wales or Scandinavia may sometimes be recognized. On the whole recent researches tend rather to reduce than to increase the differences which have been observed. The *Protolenus* zone, for example, with its peculiar fauna, which was first recognized in New Brunswick, has since been discovered in Shropshire.

With the exception of these most eastern parts the American Cambrian is of Pacific type, the system attaining its greatest development in the Appalachian and Cordilleran troughs. The intervening space is largely concealed by later beds and where the Cambrian is exposed the Lower and Middle divisions are often, but not always, absent.

In the Appalachian trough the deposits are thickest and most continuous in the south. They become more sandy and pebbly towards the east, that is, towards the land-barrier which separated the trough from the Cambrian Atlantic. The Middle Cambrian is poorly represented in the north of the region and it seems that at that time the sea had retreated towards the south. But in Upper Cambrian times it spread northward again, and also overflowed the land-mass that separated it from the Cordilleran trough.

The Cordilleran trough contains perhaps the finest development of the system in the world, and certainly it has yielded the most abundant fauna. The beds are often very little disturbed or altered and consequently the fossils are remarkably well preserved. A whole series of genera have been described which are as yet unknown elsewhere. Mt. Stephen in the Canadian Rockies is perhaps the most famous of all the fossil localities, but very fine sections are also to be seen in California, Utah and Nevada. Towards the west the deposits become sandy, indicating the existence of a land-mass in that direction, which has been called Cascadia. It included the site of the present Cascade range.

The terminology of the North American Cambrian has varied greatly and it may be convenient to mention here the names that have been applied at different times to the major subdivisions. The Lower Cambrian has sometimes been called the Georgian, sometimes the Waucobian; the Middle Cambrian is often named the Acadian; the Upper Cambrian has been called the Potsdamian, the Saratogan or the Croixan. The name Ozarkian has been applied to the passage beds between the Cambrian and the Ordovician, but Ulrich, who first proposed the name, considers the Ozarkian to form a separate system, which has not been definitely identified outside America.

South America.—Cambrian beds have been found in Argentina and Bolivia, but are still very imperfectly known. It is, indeed, scarcely possible to say from the recorded fauna whether it is more closely allied to the Atlantic or to the Pacific type. The Argentine fossils suggest the Middle Cambrian, but the occurrence of *Peltura* in Bolivia points to the upper division of the system and to an Atlantic connection.

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by C. D. Walcott in the *Smithsonian Miscellaneous Collections* (vols liii., lvii., lxiv., lxvii., lxxv.). (P. La.)

CAMBRIC. A word derived from *Kameryk* or *Kamerijk*, the Flemish name of Cambrai, a town in the department of Nord, France, where the cloth of this name is said to have been first made. It was originally made of fine linen. There is a record of a privy purse expenditure in 1530 for cambric for Henry VIII.'s shirts. Cambric has been used for many years in the manufacture of handkerchiefs, collars, cuffs, and for fine underclothing; also for the best shrouds, and for fine baby linen.

The yarns for this cloth are of very fine quality, and the number of threads and picks often reaches and sometimes exceeds 120 per inch. Embroidery cambric is a fine linen used for embroidery. Batiste, said to be called after Baptiste, a linen-weaver of Cambrai, is a kind of cambric frequently dyed or printed. All these fabrics are largely copied in cheaper materials, mixtures of tow and cotton, and in many cases cotton alone, taking the place of the original flax line yarns.

CAMBRIDGE, EARLS AND DUKES OF. Under the Norman and early Plantagenet kings of England the earldom of Cambridge was united with that of Huntingdon, which was held among others by David I., king of Scotland, as the husband of earl Waltheof's daughter, Matilda. As a separate dignity the earldom dates from about 1340, when William V., count (afterwards duke) of Juliers, was created earl of Cambridge by King Edward III.; and in 1362 (the year after William's death) Edward created his own son, Edmund of Langley, earl of Cambridge, the title being afterwards merged in that of duke of York, which was bestowed upon Edmund in 1385. Edmund's elder son, Edward, earl of Rutland, who succeeded his father as duke of York and earl of Cambridge in 1402, appears to have resigned the latter dignity in or before 1414, as in this year his younger brother, Richard, was made earl of Cambridge. In the following year Richard was executed for plotting against King Henry V., and his title was forfeited, but it was restored to his son, Richard, who in 1415 became duke of York in succession to his uncle Edward. Subsidiary to the dukedom of York the title was held by Richard, and after his death in 1460 by his son Edward, afterwards King Edward IV., becoming extinct on the fall of the Yorkist dynasty.

In 1619 King James I., anxious to bestow an English title upon James Hamilton, 2nd marquess of Hamilton (d. 1625), created him earl of Cambridge, a title which came to his son and successor James, 3rd marquess and first duke of Hamilton (d. 1649). In 1651 when William, 2nd duke of Hamilton, died, his English title became extinct.

Again bestowed upon a member of the royal house, the title of earl of Cambridge was granted in 1659 by Charles II. to his brother Henry, duke of Gloucester, only to become extinct on Henry's death in the following year. In 1661 Charles, the infant son of James, duke of York, afterwards King James II., was designated as marquess and duke of Cambridge, but the child died before the necessary formalities were completed. However, two of James's sons, James (d. 1667) and Edgar (d. 1671), were actually created in succession dukes of Cambridge, but both died in childhood. After the passing of the Act of Settlement in 1701 it was proposed to grant an English title to George Augustus, electoral prince of Hanover, who, after his grandmother, the electress Sophia, and his father, the elector George Louis, was heir to the throne of England; and to give effect to this proposal George Augustus was created marquess and duke of Cambridge in Nov. 1706. The title lapsed when he became king of Great Britain and Ireland in 1727, but it was revived in 1801 in favour of Adolphus Frederick, the seventh son of George III. He and his son are dealt with below.

Adolphus Frederick, duke of Cambridge (1774–1850), was born in London on Feb. 24, 1774. Having studied at the university of Göttingen, Adolphus Frederick served in the Hanoverian and British armies, and, in Nov. 1801, was created earl of Tipperary and duke of Cambridge, becoming a member of the privy council in the following year. The duke is chiefly known for his connection with Hanover. In 1815, on the conclusion of the war, the electorate of Hanover was raised to the rank of a kingdom, and in the following year the duke was appointed viceroy. He held this position until the separation of Great Britain and Hanover in 1837. He died in London on July 8, 1850. In 1818 he married Augusta (1797–1889), daughter of Frederick, landgrave of Hesse-Cassel. He left three children: his successor, George; Augusta Caroline (b. 1822), who married Frederick William, grand duke of Mecklenburg-Strelitz; and Mary Adelaide (1833–1897), who married Francis, duke of Teck.

George William Frederick Charles, duke of Cambridge (1819–1904), was born at Hanover on March 26, 1819. He was thus about two months older than his cousin, Queen Victoria, and was for that period in the line of succession to the British throne. In Nov. 1837, after he had served for a short time in the Hanoverian army, he became a colonel in the British army and was attached to the staff at Gibraltar from Oct. 1838 to April 1839. After serving in Ireland with the 12th Royal Lancers he was appointed in April 1842 colonel of the 17th Light Dragoons (now Lancers). From 1843 to 1845 he was colonel on the staff n the Ionian islands, and was then promoted major-general. In Oct. 1846 he took command of the Limerick district, and shortly afterwards of the Dublin district. In 1850 his father died and he succeeded to the dukedom. Being appointed inspector of avalry in 1852, he held that post until 1854, when, upon the outbreak of the Crimean War, he was placed in command of he 1st division (Guards and Highland brigades) of the British rmy in the East. In June of the same year he was promoted eutenant-general. He was present at the battles of the Alma, Balaklava, and Inkerman, and at the siege of Sevastopol. On uly 15, 1856, he was appointed general commanding-in-chief, on Nov. 9, 1862, field-marshal, and by letters patent, 1887, commander-in-chief. The long period during which he held the ommand of the army was marked by many changes. The Crimean War led to a regrouping of the departments, which, with the whole personnel of the army, were brought under the authority of the secretary of state for war. But only in 1870, after the successes of Prussia had created a profound impression, were drastic changes introduced by Cardwell into the entire fabric of the army. The objects of the reformers of 1870 were undoubtedly wise; but ome of the methods adopted were strongly resented by the duke of Cambridge, whose views were shared by the majority of officers. Further changes were inaugurated in 1880, and again he duke found much to criticize. His opinions stand recorded in he voluminous evidence taken by the numerous bodies appointed o inquire into the condition of the army. They show a sound ilitary judgment, and, as against innovations as such, a strong attachment to the old regimental system. That this judgment and this attachment were not so rigid as was generally supposed proved by his published correspondence. The duke invariably accepted and loyally endeavoured to carry out the measures on which the Government decided.

Throughout his long term of office the duke of Cambridge evinced a warm interest in the welfare of the soldier, and great xperience combined with a retentive memory made him a master f detail work. Belonging to the older generation of soldiers, he could not easily adapt himself to the new conditions; and in dispensing patronage he was somewhat distrustful of originality, while his position as a member of the royal family tended to arrow his scope for selection. He was thus inclined to be in-uenced by considerations of pure seniority, and to underrate he claims of special ability. He resigned the commandership-chief on Nov. 1, 1895, and was succeeded by Lord Wolseley, he duties of the office being considerably modified. He was at the same time gazetted honorary colonel-in-chief to the forces. He was made ranger of Hyde park and St. James's park in 1852, and of Richmond park in 1857; governor of the Royal military academy in 1862, and its president in 1870, and personal aide-de-camp to Queen Victoria in 1882. He died on March 17, 1904, at Gloucester house, London. The chief honours conferred upon him were: G.C.H., 1825; K.G., 1835; G.C.M.G., 1845; G.C.B., 1855; K.P., 1861; K.T., 1881. From 1854 he was president of Christ's hospital. The duke of Cambridge was married to Louisa Fairbrother, who took the name of FitzGeorge. She died in 1890.

See Rev. E. Sheppard, *George, Duke of Cambridge; a Memoir of his Private Life* (1906); and Willoughby Verner, *Military Life of the Duke of Cambridge* (1905). For the negotiations attending his resignation *see* J. A. Spender, *Life of Sir Henry Campbell-Bannerman* (1923), vol. i. ch. ix. pp. 148–154.

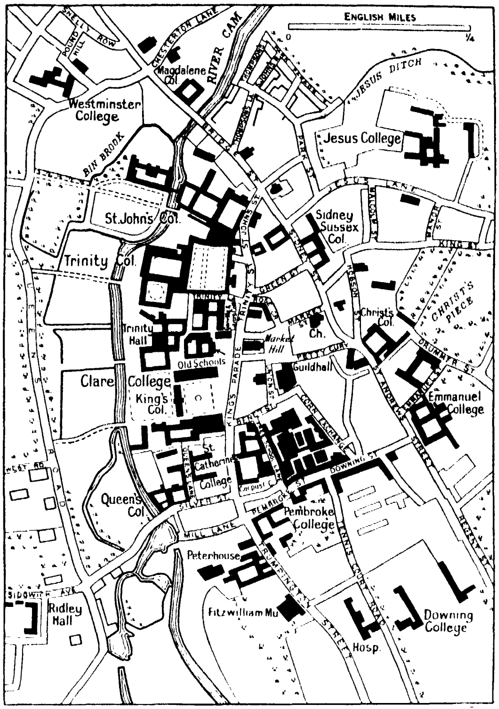
CAMBRIDGE, ADOLPHUS CHARLES, Marquess of (1868–1927), elder brother of Queen Mary, was born at Kensington Palace, London, on Aug. 13, 1868, the son of the Duke of Teck and his wife Princess Mary of Cambridge, and died on Oct. 24, 1927. He was educated at Wellington college, and entered the 17th Lancers at the age of 19, being transferred in 1910 to the 1st Life Guards, of which he became lieutenant-colonel. The public service of the marquess of Cambridge was varied and strenuous. He served in the South African War, was military attaché in Vienna (1904–09), and during World War I temporary assistant military secretary at the War Office and then military secretary to the Commander-in-chief in France. He had succeeded in 1900 to his father's title as duke of Teck, but in 1917 German titles in the British royal family were abandoned, and the duke was created marquess of Cambridge. He married, in 1894, Lady Margaret Grosvenor, daughter of the 1st duke of Westminster. He was succeeded in the marquessate by his elder son George Francis (born on Oct. 11, 1895).

CAMBRIDGE, RICHARD OWEN (1717–1802), English poet, was born in London on Feb. 14, 1717, and died at Twickenham on Sept. 17, 1802. He was educated at Eton and at St. John's college, Oxford, and went into residence at Lincoln's Inn in 1737. Four years later he married, and went to live at his country seat of Whitminster, Gloucestershire. In 1751 he removed to Twickenham, where he enjoyed the society of many notable persons. Horace Walpole in his letters makes many jesting allusions to Cambridge in the character of news-monger. His chief work is the *Scribleriad* (1751), a mock epic poem, the hero of which is the Martinus Scriblerus of Pope, Arbuthnot and Swift.

The Works of Richard Owen Cambridge, Esq., including several Pieces never before published, with an Account of his Life and Character by his Son, George Owen Cambridge (1803), includes, besides the *Scribleriad*, some narrative and satirical poems, and about 20 papers originally published in Edward Moore's paper called *The World*. His poems are included in A. Chalmers's *English Poets* (1810).

CAMBRIDGE, a municipal and parliamentary borough, the seat of a university, and the county town of Cambridgeshire, England, 56 mi. N. by E. of London by the L.N.E.R and served also by the L.M.S.R. Area 15.7 sq.mi. Pop. (est. 1938), 78,180. It lies at the southern border of the Fen country, at an elevation of only 30 to 50 ft. above sea-level. The greater part of the town is situated on the right bank of the Cam, a tributary of the Ouse, but suburbs extend across the river. To the south and west the slight hills bordering the fenland rise gently. The borough returns one member to parliament.

Cambridge owed its growth to its command of a ford over the River Cam on a natural line of communication between the east and the midlands of England, flanked on the one hand by the deep forests which covered the uplands, on the other by the unreclaimed fens. The importance of this highway may be judged from the number of early earthworks, including Castle Hill at the north side of the present town. Roman remains discovered in the same locality give evidence of the existence of a small town or village at the junction of roads; the name of *Camboritum* is usually attached to it, but without certainty. The modern name of Cambridge has usually been derived from a corruption of the original name Grantebrycge or Grantabridge (Skeat); but it has been suggested that the name Cantebrig was very early given to that quarter of the town near the Cante brig. Cambridge castle was built in this quarter, close to the bridge, by the Conqueror, as a base of operations against Hereward the Wake and the insurgents of the fenland, and the name spread to the whole town, the similarity between the names Grantebrig and Cantebrig playing some part in this extension (*see* A. Gray, *The Dual Origin of the Town of Cambridge*, p. 31). Granta is the earlier and still an alternative name of the river Cam, this more common form having been adopted in sympathy with the modern name of the town. Cambridge had a further importance from its position at the head of river navigation, and a charter of Henry I., in which the town is already referred to as a borough, grants it exclusive rights as a river-port, and regulates traffic and tolls. The wharves lay principally along that part of the river where are now the celebrated "backs" of some of the colleges. The great Sturbridge or Stourbridge fair at Barnwell, formerly one of the most important in England, is a further illustration of the ancient commercial importance of Cambridge; the oldest known charter concerning it dates from the opening of the 13th century, though its initiation may perhaps be placed a century before. From the 14th century onward materials were taken from the castle by the builders of colleges while the gatehouse, the last surviving portion, was removed in 1842. *See* Cambridge University.



Plan of Cambridge showing the situation of the principal colleges SEE CAMBRIDGE UNIVERSITY

CAMBRIDGE, a town on the "eastern shore" of Maryland, U.S.A., on the broad estuary of the Choptank river, near Chesapeake bay; a port of entry and the county seat of Dorchester county. It is served by the Pennsylvania railroad and by steamers. The population was 8,544 in 1930; 10,102 in 1940. It is the business centre of a prosperous farming region; a shipping point for fish, oysters and oyster-shells, and agricultural products, and has a large oyster-packing industry vegetable canneries and other factories. The commerce of its harbour (navigable through the year) is in excess of $5,500,000 annually. It is Maryland's second largest seaport. Cambridge was founded in 1684, and was chartered as a town in 1900.

CAMBRIDGE, a city of Massachusetts, U.S.A., on the Charles river, opposite Boston; the county seat of Middlesex county. It is served by the Boston and Maine railroad and the local transportation system of the Boston metropolitan area, and for freight by the Boston and Maine, the Boston and Albany and a belt line which connects with the New York ,New Haven and Hartford. The area of the city is 6.3 sq.mi. The population in 1930 was 113,643, of whom 32,300 were foreign-born white and 5,419 were Negroes; and was 110,879 in 1940.

Old Cambridge, centring at Harvard square, has been to Americans a symbol of culture ever since the founding of Harvard college (*q.v.*) in 1636. Adjoining it has developed in the 20th century a commercial and industrial centre which now ranks third among the manufacturing cities of the State. The first printing-press in America was set up here in 1639, and a publishing business flourished through the 17th century. As long ago as 1850 there were glassware factories employing 500 persons. In the early '70s was begun the reclamation of two square miles of tide-covered marshlands for a manufacturing district. Rapid expansion, however, began in 1912, when the opening of the underground railway brought the business section of Boston within three minutes of Cambridge, and it was further stimulated by the war-time boom and by the development of motor-trucking, which gave direct access (without encountering the heaviest traffic congestion of Boston) to all the steamship piers, to the freight-yards of all the railroads entering Boston and to the suburban district of the metropolitan area. In 1940 there were 500 manufacturing establishments, and their output for the year was valued at $138,000,000. The leading industries are printing and publishing and the manufacture of soap, candy, bakery products, electrical machinery and apparatus, foundry and machine-shop products and rubber goods. Most of the large New England industries are represented to some extent. The manufacturing as a whole is clean and unobjectionable in character. Slaughtering and meat-packing, formerly the principal industries, have almost disappeared with the rise of the packing centres of the middle west. The industrial growth has been advantageous as an offset to the large proportion of tax-exempt holdings in the city, while encroachment of manufacturing on the historic residential and educational sections has been obviated by zoning regulations. A city-planning board was created by ordinance in 1913. Modern transportation facilities have made Cambridge also an important distributing centre. Many national producers have established here their Boston headquarters; several Boston department stores have erected warehouses; and the Boston and Maine railroad in 1927 moved its general offices to Cambridge. The assessed valuation of property in 1940 was $171,000,000, about $1,542 per capita.

In addition to Harvard university (*q.v.*) the older educational institutions include Radcliffe college for women (1879), affiliated with Harvard; the Episcopal theological school (1867); and the New-Church (Church of the New Jerusalem) theological school (1866). Andover theological seminary (Congregational) moved to Cambridge in 1908, after a notable century in Andover. In 1915 the Massachusetts Institute of Technology (*q.v.*) moved from the site it had occupied in Boston for 50 years to a tract of 80ac. on the Cambridge side of the Charles river basin.

The shaded irregular streets around Harvard square are full of historic and literary associations. The site of Cambridge was selected by Governor Winthrop and others in 1630 for the capital of the Massachusetts Bay Colony, but Boston's position was seen to have the advantage both for commerce and for defence. The town records (published) are continuous since 1632. The settlement was at first called New Towne, but in 1638, after the founding of Harvard, was named after the English university town. General Synods of the New England churches met here in 1637 and 1647 to settle disputed points of doctrine and from here in 1636 Thomas Hooker's congregation left for Connecticut. Here camped the first American army at the outbreak of the Revolution, and from it went the detachment which entrenched on Bunker Hill. Under an elm which stood until 1923 Washington (according to tradition) took command of the Continental army on July 3, 1775. The convention which framed the Constitution of Massachusetts met here in 1779–80. In Apthorp House (1760) Gen. Burgoyne and his officers were lodged as prisoners of war in 1777. Vassall or Craigie House (1759) was occupied by Washington in 1775–76, and later was the home of Edward Everett, Joseph E. Worcester, Jared Sparks and (1837–82) Henry Wadsworth Longfellow. In "Elmwood" (1767) James Russell Lowell was born and lived all his life; and there are many associations with Oliver Wendell Holmes, Louis Agassiz, Charles Eliot Norton, John Fiske, Amy Lowell and many other men and women of note in the literary and scientific history of America.

The original town of Cambridge was very large. From it Newton was set off in 1691; Lexington in 1713; Brighton in 1837; and Arlington in 1846. The city was chartered in 1846. In 1850 the population was 15,215; in 1870, 39,634; in 1900, 91,886.

See Lucius R. Paige, *History of Cambridge, Massachusetts, 1630–1877* (Boston, 1877); T. W. Higginson, *Old Cambridge* (1899); *Historic Guide to Cambridge* (Cambridge, 1907); and Arthur Gilman (ed.), *The Cambridge of Eighteen Hundred and Ninety-Six* (Cambridge, 1907).

CAMBRIDGE, a city of eastern Ohio, U.S.A., on a hill 800 ft. above sea level; the county seat of Guernsey county. It is on federal highways 21, 22 and 40, and is served by the Baltimore and Ohio and the Pennsylvania railways. The population in 1920 was 13,104 (92·9% native white) and was 15,044 in 1940 by federal census. Coal, oil, natural gas, clay and salt are found in the vicinity, and the city has important manufactures of furniture, glass, plastics and pottery. The output of its factories in 1939 was valued at $6,353,052. The first settlers here came from Maryland and Virginia in 1798. A town was laid out in 1806 and the city was chartered in 1837.

CAMBRIDGE PLATONISTS, a school of philosophico-religious thinkers which flourished mainly at Cambridge University in the second half of the 17th century. The founder was Benjamin Whichcote and the chief members were Ralph Cudworth, Richard Cumberland, Joseph Glanvill, Henry More and John Norris (*see* separate articles). Other less important members were Nathanael Culverwel (d. 1651), Theophilus Gale (1628–1678), John Pordage (1607–1681), George Rust (d. 1670), John Smith (1618–1652) and John Worthington (1618–1671). They represented liberal thought at the time and were generally known as Latitudinarians. Their views were due to a reaction against three main tendencies in contemporary English thought: the sacerdotalism of Laud and his followers, the obscurantist sectaries and, most important of all, the doctrines of Hobbes. They consist chiefly of a reconciliation between reason and religion, resulting in a generally tolerant spirit. They tend always to mysticism and the contemplation of things transcendental. In spite of inaccuracy and the lack of critical capacity in dealing with their authorities both ancient and modern, the Cambridge Platonists exercised a valuable influence on English theology and thought in general. Their chief contributions to thought were Cudworth's theory of the "plastic nature" of God, More's elaborate mysticism, Norris's appreciation of Malebranche, Glanvill's conception of scepticism as an aid to Faith, and, in a less degree, the harmony of Faith and Reason elaborated by Culverwel. The one doctrine on which they all combined to lay especial emphasis was the absolute existence of right and wrong quite apart from the theory of divine authority. Their chief authorities were Plato and the Neo-platonists (between whom they made no adequate distinction), and among modern philosophers, Descartes, Malebranche and Boehme. From these sources they attempted to evolve a philosophy of religion, which would not only refute the views of Hobbes, but would also free theology finally from the errors of scholasticism, without plunging it in the newer dangers of unfettered rationalism (*see* ETHICS, HISTORY OF).

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CAMBRIDGESHIRE, an eastern county of England, bounded north by Lincolnshire, east by Norfolk and Suffolk, south by Essex and Hertfordshire, and west by Bedfordshire, Huntingdonshire and Northamptonshire. Area 492.5 sq.mi.; 867.4 sq.mi. with the Isle of Ely. The greater part of the county falls within the district of the Fens, and is flat, lying only a few feet above sea-level, and intersected with innumerable drainage channels. The physical characteristics of this district, and the history of its reclamation are more fully treated under the heading FENS. Except in the south of the county the scenery is very monotonous and open: such isolated elevations as the Gog Magog Hills, south-east of Cambridge, and the hillock on which the city of Ely stands, are very conspicuous. The principal rivers are the Ouse and its tributaries in the south and centre, and the Nene in the north: they flow for the most part in artificial channels, of which those for the Ouse, two great parallel cuts between Earith and Denver Sluice, in Norfolk, are called the Bedford Rivers. The old channel of the Ouse, from Ely to Denver (below which are tidal waters), is followed chiefly by the Cam or Granta, the Lark, which with its feeder, the Kennett, forms part of the boundary of the county with Suffolk, and the Little Ouse, forming part of the boundary with Norfolk.

In the south and south-east the chalk gives a continuous belt of dry uplands, clothed with scattered groves of beech. North of this, but best developed in the south-west, is a clay and greensand area; the rest of the county is alluvial Fenland. The general strike of the rocks is along a south-west and north-east line, and the dip is south-easterly. The oldest rock is the jurassic Oxford Clay, forming an irregular strip of rising ground west of Cambridge, reaching from Croxton by Conington and Fenny Drayton to Willingham and Rampton. Eastward and northward it forms the floor of the Fen country, and at Thorney and Whittlesea rises in "islands" through the level fen alluvium. The Coralline Oolite, with the Elsworth or St. Ives rock at the base, occurs as a small patch, covered by Greensand, at Upware. Elsewhere its place is taken by the Ampthill Clay passage beds between the Oxford and Kimmeridge Clays. The latter clay lies in a narrow strip by Papworth St. Agnes, Oakington and Cottenham; a large irregular outcrop surrounds Haddenham and Ely. Above the Kimmeridge Clay comes the Lower Greensand, sandy for the greater part, but here and there hardened into "Carstone" which has been used as an inferior building-stone. This formation extends from the border by Gamlingay, Cuxton and Cottenham, and appears again in outliers at Upware, Ely and Haddenham. The Gault forms a strip of flat ground, 4 to 6 m. wide, and 200 ft. thick in the south-west, running roughly parallel with the course of the river Cam, from Guilden Morden through Cambridge to Soham. At the bottom of the chalk is the Chalk Marl, 10 to 20 ft. thick, with a nodule-bearing layer at its base, known as the Cambridge Greensand. This bed has been largely worked for the nodules and for cement; it contains many fossils derived from the Gault below. Several outliers of Chalk Marl lie upon the Gault west of the Cam. Much glacial boulder clay covers all the higher ground of the county. Near Ely there is a remarkable mass of chalk, evidently transported by ice, resting on and surrounded by boulder clay. Plateau gravel caps some of the chalk hills, and old river gravels occur at lower levels with the bones of mammoth, rhinoceros and other extinct mammals. The low-lying Fen beds are marly silt with abundant peat beds and buried forests; at the bottom is a gravel layer of marine origin. *See* FENS.

Early Settlement.—Neolithic types of flint implements are very common in parts of the county, implying a prolonged period of occupation in the areas bordering on the fens, around Mildenhall (part of the East Anglian heathlands) and along the river Cam south-westwards. "Beakers," a type of pottery introduced from the continent after 2000 B.C., occur in the Anglian river valleys and on the edge of the fens. Throughout the bronze age, settlement seems to have been mainly concentrated in the strip east of the Cam from Royston north-eastwards to Soham, including the chalk escarpment. Hoards of the late bronze age come mainly from the borders of the fens and from the Cam valley; several have been found in the fens; inland waterways were evidently important. There is also evidence that raw material (copper and tin) was brought to the region from the south-west along the Icknield Way. The forested valleys in the chalk of the south-east had been penetrated to some extent. Invaders reached the region during the early iron age, in the La Tène and possibly in the preceding Hallstatt period. Penetration took place by the Wash and also from the south, and the La Tène culture profoundly influenced provincial Roman craftsmanship. Population was densest in the fertile valley of the Cam; the southern fens and the forests west of Cambridge were very barren. Several hill-forts were occupied in the south of the county and the present sites of villages and towns in many cases seem already to have been fixed. The coming of the Romans established the pre-eminence of Cambridge. A remarkable feature of the Romano-British period is the widespread occurrence of finds in what had been marshland as well as on the fen islands. That a good deal of drainage was done is probable (the Car dyke between Cam and Great Ouse is of Roman construction), and the forested claylands were also penetrated. Southern Cambridgeshire lay athwart the main Roman road to the north (Ermine street) whence Akeman street branched northeastwards, west of the Cam, to Cambridge and Norfolk.

The earliest English settlements were made in the 5th century. The Anglo-Saxon conquest was followed by a period of contraction but by the time of the Domesday survey, the range of settlement was in its essentials that of modern times. The districts corresponding to the counties of Huntingdonshire and Cambridgeshire were distinguished as the lands of the North Gyrwas and the South Gyrwas respectively. At this period the fen-district stretched southward as far as Cambridge, and the essential unity which it preserved is illustrated later by its inclusion under one sheriff, chosen in successive years from Cambridgeshire proper, the Isle of Ely and Huntingdonshire. After the treaty of Wedmore, the district became part of the Danelaw. On the expulsion of the Danes by Edward in the 10th century it was included in East Anglia, but in the 11th century was again overrun by the Danes, who burnt Cambridge. The Saxon Chronicle records the shire's valiant resistance to the invaders in 1010, when the rest of East Anglia had taken ignominious flight. The shire-system of East Anglia was not definitely settled before the Conquest, but during the Danish occupation of the 9th century the district possessed a certain military and political organization round Cambridge, its chief town, whence probably originated the constitution and demarcation of the shire. At the time of Domesday (1086) the county was divided as now, except that the Isle of Ely, which then formed two hundreds having their meeting place at Witchford, is now divided into the four hundreds of Ely, Wisbech, North Witchford and South Witchford, while Cambridge formed a hundred by itself. Cambridgeshire was formerly included in the diocese of Lincoln, until on the erection of Ely to a bishop's see in 1109, almost the whole county was placed in that diocese. The Isle of Ely formerly constituted an independent franchise but its privileges were abridged in the reign of Henry VIII, though the bishop still retains certain exceptional rights.

From the time of Hereward the Isle of Ely was intimately concerned with the great political struggles of the country. It was defended against Stephen by Bishop Nigellus of Ely, who fortified Ely and Aldreth, and the latter in 1144 was held for the empress Maud by Geoffrey de Mandeville. The Isle of Ely was seized by the followers of Simon de Montfort in 1266, but in 1267 was taken by Prince Edward. The county showed much sympathy with the Reformation. In the civil war of the 17th century Cambridgeshire was one of the associated counties in which the king had no party, but the university helped him with plate and money.

The county is rich architecturally. Norman buildings include Sturbridge chapel, near Cambridge, and the parish church of Thorney, a portion of the church of an abbey founded or re-founded by Ethelwold, bishop of Winchester, as a Benedictine monastery in 972. The lepers' hospital to which Sturbridge chapel belonged was granted a fair by King John which is still held in September. The magnificent cathedral of Ely (*q.v.*) and the rich college buildings and chapels of Cambridge (*q.v.*) are outstanding treasures. At Swaffham Prior there are remains of two churches in one churchyard, the tower of one being good Transitional Norman, of the other mainly Perpendicular. Among many Early English examples the church of Cherry Hinton near Cambridge may be mentioned. The churches of Trumpington and Bottisham are fine specimens of the Decorated style. Monastic remains are scanty. Excluding the town of Cambridge there are no domestic buildings of special note with the exception of Sawston hall (1557–1584) in the south.

Agriculture.—The Domesday survey mentions over 90 mills and numerous valuable fisheries, especially eel fisheries. The county had a flourishing wool industry in the 14th century, and became noted for its worsted cloths. The Black Death of 1349 and the Wars of the Roses brought severe depression, and in 1439 several Cambridgeshire towns obtained a remission of taxation on the plea of poverty. In the 16th century barley for malt was grown in large quantities in the south, and the manufacture of willow baskets was carried on in the fen districts. Saffron was extensively cultivated in the 18th century, and paper was manufactured near Sturbridge. Sturbridge fair was at this period reckoned the largest in Europe, the chief articles of merchandise being wool, hops and leather; and the Newmarket races and horse-trade were already famous. Large waste areas were brought under cultivation in the 17th century through the drainage of the fen district, completed about 1652 under Cornelius Vermuyden, a Dutchman. The coprolite industry was very profitable for a short period from 1850 to 1880, and its decline was accompanied by a general industrial and agricultural depression.

Cambridgeshire is one of the principal grain-producing counties in England. Cereal growth is favoured by the flat fertile lands. and by the dry climate. About 84½% (468,060 ac.) of the total area was under cultivation in 1939, and of this an unusually small proportion (about 22%) was under permanent pasture. Wheat is the chief grain crop (105,495 ac. in 1939) but large quantities of barley and oats (together 72,828 ac.) are also grown. Potatoes occupy a large area in the Isle of Ely, and sugar-beet is grown, occupying 40,075 ac., which makes the county the most important producer of this crop in the country, after Norfolk and Lincolnshire. Dairy farming is especially practised in the southwest, where the district of the Cam valley has long been known as the Dairies. Sheep are pastured on the higher ground. There are fruitgrowing, especially strawberries and gooseberries for the London markets, and market gardening. There is no large manufacturing industry. The National Trust owned 1 sq.mi. in Cambridgeshire in 1942.

Communications.—The principal railway serving the county is the L.N.E., which has numerous branch lines centring chiefly upon Cambridge, Ely and March. Communications are also maintained by the L.M.S.R. and by the M. and G.N.Jt.R. The artificial waterways provide the county with an extensive system of inland navigation.

Population and Administration.—The area of the administrative county, excluding that of the Isle of Ely, is 492.5 sq.mi. Pop. (1938) 149,650. The geographical county includes the two administrative counties. The liberty of the Isle of Ely was formerly of the independent nature of a county palatine, but ceased to be so under acts of 1836 and 1837. Its administrative area is 374.9 sq.mi. Pop. 81,480 Wartime evacuation from the eastern counties of England between Sept. 1939 and Feb. 1941 raised the population of the geographical county of Cambridge by 9%. Cambridgeshire contains 18 hundreds. The municipal boroughs are Cambridge, the county town, and Wisbech in the Isle of Ely. The urban districts are Chatteris, Ely, March and Whittlesey, all in the Isle of Ely. The town of Newmarket, which is wholly within the administrative county of West Suffolk, though the rural district of the same name is in Cambridgeshire, is famous for its race meetings. The county is in the southeastern circuit and assizes are held at Cambridge. Each administrative county and the town of Cambridge have a court of quarter sessions. Cambridgeshire is in the diocese of Ely, with the exception of the parish of Heydon, which is in that of Chelmsford, and forms the archdeaconry of Ely and part of that of Wisbech. The university of Cambridge returns two members to parliament. The administrative county, the borough of Cambridge and the Isle of Ely each return one member.

See C. C. Babington, *Ancient Cambridgeshire* (1883); R. Bowes, *Catalogue of Books printed at or relating to Cambridge* (Cambridge, 1891 *et seq.*); E. Conybeare, *History of Cambridgeshire* (London, 1897)*; also Cyril Fox, *The Archaeology of the Cambridge Region* (1923).

CAMBRIDGE UNIVERSITY. (*See* also UNIVERSITIES.) Schools of some sort certainly existed in Cambridge in the twelfth century, but we cannot speak of anything approaching a university in the technical sense, a *studium generale*, until the thirteenth. The reputation of Cambridge teaching was good enough to attract a number of Oxford students in 1209, when the lectures at their own university were suspended, and from this date Cambridge flourished. It had a chancellor, recognised by king and pope as early as 1226, and, before the end of the century, had a constitution modelled on that of Oxford and Paris. "Nations" appear in 1261, there were two proctors or "rectors," and the usual four faculties. The supreme authority lay in the "full" congregation of regents and non-regents; in 1401 the chancellor was dispensed from seeking confirmation from the bishop of Ely, and in 1432 he was made entirely independent of him. Throughout the middle ages, the town was kept, as far as possible, rigorously subject to the university. In 1318, a bull founding the university was obtained from Pope John XXII., although this meant nothing more than a formal recognition of its existence by Rome. Compared with Oxford, its history was insignificant until the fifteenth century, when it became the home of orthodoxy, the other having been left, by Wyclif's career, under a cloud of suspicion of heresy. By the fifteenth century, too, the Mendicant Orders had made Cambridge an important centre of their educational work in the east of England.

Colleges and Their Foundations.—Slowly the need for colleges and hostels became apparent. There were many of the latter, but the former, better endowed and equipped, have lasted and grown. The first college to be founded—after an abortive attempt at St. John's Hospital—was Peterhouse, 1284, on the model of Merton college, Oxford. University Hall, 1326, became Clare Hall in 1336; Pembroke was founded in 1347; Gonville Hall in 1349 (enlarged in 1558 into Gonville and Caius college); Trinity Hall, 1350; Corpus Christi, 1352; King's, 1441; Queens', originally St. Bernard's, 1446, re-founded in 1475; St. Catharine's, 1475; Jesus, 1497; Christ's, 1505 (absorbing God's House which had been founded in 1441); St. John's, 1511; Magdalene, on the site of an earlier foundation, 1542; Trinity, 1546 (absorbing several earlier foundations); Emmanuel, 1584; Sidney Sussex, 1588; Downing, 1800; Selwyn, 1882. Non-collegiate students possess a centre known as Fitzwilliam House.

Of the two women's colleges, Girton was established in 1873 and Newnham in 1875 (founded in 1873, as a hall of residence).

Cambridge at the Renaissance and After.—During the sixteenth century, the reputation of Cambridge grew steadily at the expense of Oxford. It claimed the Lady Margaret, Fisher and More as its patrons and officers, Erasmus, Cheke, Croke and Linacre as its teachers, and the New Learning found a more gracious welcome there than at Oxford. A little later it became the real centre of the Reformation in England, counting Bilney, Barnes, Tyndale, Cranmer and Bucer among its *alumni*. In the seventeenth century its reputation declined a little, its constitution became less liberal, its educational curriculum narrower. There was trouble with the town and trouble with the Puritans, even though Cambridge was something of a Puritan stronghold. But it recovered. By the end of the century it was the home of the Cambridge Platonists and of Sir Isaac Newton, Lucasian professor of mathematics from 1673 to 1702. It was favoured in the eighteenth century by the Hanoverian kings and by the duke of Newcastle as the Whig university, while the reputation of a man such as Bentley, master of Trinity, 1700–1742, proved that it still had scholars of merit. The first tripos, the mathematical, was established in the middle of the eighteenth century. In the early nineteenth century a wave of evangelicalism swept over Cambridge, comparable with, if less than, the Tractarian movement at Oxford.

During the same period the examinations were improved, written examinations were more and more employed and in 1824 the classical tripos was introduced. In 1858 the university was thrown open to dissenters who were allowed to take the B.A., and finally all tests were abolished in 1871. In 1877 further reforms were carried, one of which included the provisions for natural science. The effect of these reforms is shown from the fact that in 1862 the number of undergraduates was 1,526 and in 1887 2,979. A large number of colleges at home and abroad were affiliated to the university. From the later half of the 19th century onwards a series of new triposes were created: moral science (1851), natural

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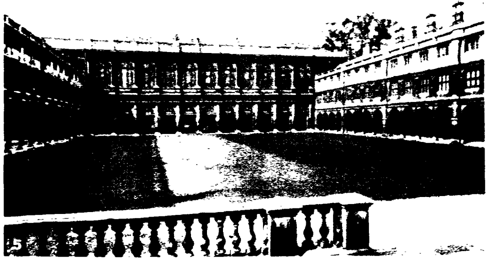

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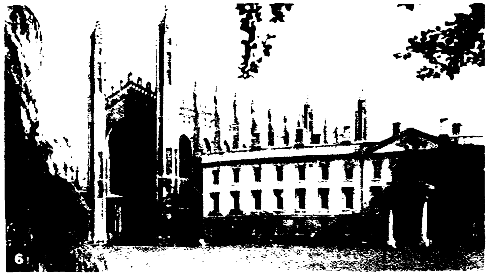

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VIEWS OF CAMBRIDGE COLLEGES

1. The river Cam and the library of Trinity college
2. Gateway of St. John's college with arms of foundress, Lady Mary Beaufort
3. "Bridge of Sighs," St. John's college
4. The main quadrangle of Trinity college, with fountain erected in 1602
5. Cloister court of Trinity college at Cambridge
6. King's college chapel, begun 1446. A noted example of the Perpendicular style
7. Corner of president's gallery at Queens' college, founded 1448
8. The senate house and Caius college

science (1851), theological (1856, examination theological tripos since 1874), law (1857, previously there had been civil law classes since 1816), Semitic language (1878, since 1895 Oriental languages), history (1875), Indian languages (1879), mediaeval and modern languages (1886), mechanical science (engineering, 1894), economics (1905) and most of the triposes were divided into two parts. A similar growth in the university professoriate took place. New creations were made in archaeology, divinity (Hulsean), pure mathematics, political economy, zoology, Sanskrit, international law, Latin, fine arts, experimental physics, mechanics and applied science, Anglo-Saxon, ecclesiastical history, physiology, pathology, divinity (Ely), mental philosophy and logic, Chinese, ancient history, agriculture, biology, agricultural botany, astrophysics, German, English literature, genetics. Readerships and college lectureships showed a like increase. A large number of important and often beautiful buildings were added to the university, increasing in the majority of cases the provision for scientific laboratory study. Among the more important are the famous Cavendish laboratory for physical research (1874), the chemical laboratory (1887), the law library erected from funds given in 1898 by Miss R. F. Squire, and the Sedgwick Geological museum (opened 1904).

War Period.—This period marks in one sense a stage of great moment in the history of the university. Sixteen thousand members of the university were engaged on active service; the contributions in research, invention, technical advice of every kind, rendered by the university, extended over the entire range of the activities provoked by the war over the whole of the British Empire; the university itself was empty of students and teachers; their places were taken for the time being by cadets, instructors, military staffs and troops, and to some extent by refugees, mainly from Belgium. Never, presumably, in the history of the university was the co-operation between university and State so close, so intense or so fruitful, not without leaving permanent traces on the development of the university during the post-war period. At the same time, few phenomena of social life, after the conclusion of the war, are so impressive as the ease and rapidity with which the historic traditions of the university, in teaching, in social intercourse, in collegiate life, were resumed.

The immediate effect of the conclusion of peace was a very great increase in the number of students, temporarily swelled in addition by the presence of over 1,500 men whose education had been interrupted by the war; assisted by Government grants, they were enabled to complete their courses by coming into residence for one, two, or in some cases three years. But the considerable increase (about 75%) in the number of students over pre-war numbers, which has continued even after 1922, would seem to be one of the several permanent features of the post-war history of the university, due to many causes such as the wide-spread redistribution of wealth in the country, the increase in facilities provided for education and the enhanced prestige of university training, both generally and professionally.

Meanwhile within the university one of the most outstanding events was the admission in 1923 of women to degrees but not to full membership of the body academic. In addition, the courses of study for honours, and more especially for pass men, underwent considerable revision. Greek, as a compulsory subject, was dropped from, and other noteworthy changes were effected in, the previous examination (1919); the regulations governing the pass degree were entirely remodelled (1920); several of the honours examinations, notably the classical tripos and the oriental languages tripos, were reconstituted with a division into two parts, the first of which does not normally carry the B.A. degree with it. New triposes were established in anthropology (1913) and geography (1919), while the mediaeval and modern languages tripos, greatly enlarged in scope and endowed with benefactions for Spanish and Scandinavian studies, was split into the modern and mediaeval languages tripos and the English tripos (1917). The university further recognized the value of graduate studies by establishing the degrees of Ph.D. (1919) and of M.Litt. and M.Sc. (1920).

New professorships, readerships and boards of studies were established beyond pre-war additions which have been listed above such as the professorships of Italian (1919), naval history (1919), French (1919), physics (1919), aeronautical engineering (1919), physical chemistry (1920), biochemistry (1921), animal pathology (1923), political science (1927); readerships in Spanish, modern history, geography, agriculture, agricultural physiology, physiology, morphology of vertebrates, petrology, pharmacology, electrical engineering, geodesy, biochemistry, preventive medicine and experimental psychology.

Aids to learning and research of a more material nature were provided by the erection of numerous new institutes or the extension of existing laboratories. The engineering laboratory on the north side of Downing street was twice enlarged and finally removed to a completely new site behind Scroope terrace, Trumpington road (1920–21). Part of the buildings thereby vacated, as well as new buildings erected close to them, were taken over by the neighbouring chemical laboratories. On the south side of Downing street sites had been found for the School of Agriculture (1910), which was further enlarged 1926–27, for the Museum of Archaeology and Ethnology (1910–15), the Psychological laboratory (1913), the Physiological laboratory (1914), the Forestry school (1914); the Molteno Institute of Animal Parasitology (1921), a low temperature station for research in biochemistry and biophysics (1922), the Sir William Dunn School of Biochemistry (1924) and the new Pathological laboratory (1928) form imposing additions to the institutes on the same Downing street site. The Examination Hall and the Arts school, off Benet street, a fine brick building faced with stone, designed by G. Hubbard, which contains a number of lecture-rooms and also houses several departmental libraries, dates back to 1911. In that year the university had accepted the Government's proposal to take charge of the Solar Physics observatory, then at South Kensington, and the necessary accommodation, in close proximity to the existing observatory on the Madingley road, was completed in 1913. Field laboratories in connection with the agricultural and other departments on the Milton road came into use in 1910–11. An important and handsome addition to the university buildings was Stuart House, the seat of the new "Board of extra-mural studies" (opened in 1927). In 1924 the university purchased further estate for an eventual extension of the Fitzwilliam museum: a gallery leading to the projected addition was built and opened in 1925 for the temporary housing of the "Marlay Bequest" and one side of the quadrangle which is ultimately to form the extension of the museum, has been so far erected (1928). In 1925 the university also bought the "Lensfield House" estate, for the building of further institutes; "Lensfield House" itself houses the "Captain Scott Polar Research Institute" (founded 1925) and an extension of the university school of architecture, which since 1923 also occupies No. 1, Scroope terrace. Another important site has been secured by the university in the "Backs" for the erection of the new university library.

Emmanuel, Queens', Sidney Sussex, Clare, King's and Jesus colleges and Peterhouse added to their fabric and the chapels of Sidney Sussex and Corpus Christi colleges were enlarged and redecorated. Wesley house, a post-graduate theological college for the training of accepted candidates for the ministry of the Wesleyan Methodist Church, was opened in 1925; and Cheshunt college, a theological seminary which was removed from Cheshunt to Cambridge in 1905, found permanent quarters at the end of Bateman street (1915).

The most serious after-effect of the war on the university, in addition to straining its resources and accommodation as well as its teaching powers to the utmost by the increased numbers of its students, was its financial position due to the serious rise in the cost of living and the depreciation in the value of money. Before the war and up to 1919 the university had never received any State aid, apart from small subventions of certain departments, like Agriculture or Medicine. But in 1919 the university was faced with the alternative of a considerable deficit or a reduction of its educational efficacy, and decided to apply to the Government for an annual grant. The result was the appointment of a royal commission, the first since 1877, to carry out "a comprehensive enquiry into the resources of the university and colleges and the uses made of them"; until the commission should be in a position to report, the Government made an annual grant of £3,000 without prejudice to any eventual decision reached as the result of the enquiry. While abstaining from interference with teaching or curricula, the commission were bound to comprise in their enquiry also matters of administration and government of the university. The report of the commission, presented in 1922, is a most interesting document, giving an historical survey of the universities of Oxford and Cambridge, a review of the present situation of the two universities and a detailed statement of the commission's recommendations. In 1922 a statutory commission was created to carry the recommendations into effect.

The main burden of the recommendations may be summarized as aiming (*a*) to effect a closer co-operation between the university and the colleges financially (revised system of college taxation; adjustment of university and college salaries, etc.); (*b*) to unify and centralize university finance; (*c*) to increase the number and to improve the status of university lecturers and demonstrators; (*d*) to introduce a pension scheme for university teachers; (*e*) to increase the accessibility of the university by a revision of the scholarship system, and to improve the provision made for research students, etc.; (*f*) to introduce certain changes in the administration of the university (such as the creation of a regent house) in order to simplify legislative machinery for the internal government of the university; and (*g*) to secure an annual grant (which was in 1925 fixed at £85,000).

The period from 1922 to 1927 saw the introduction of most of the changes decided on by the statutory commissioners, including the recasting of college statutes to bring them into harmony with the changes in university administration. It was a time of intense activity, carried on in the most friendly spirit of collaboration between the statutory commissioners, the university and the colleges, and destined to mark the beginning of a new era in the history of the university. Enjoying more than ever public confidence, fuller than ever, with a constantly increasing pressure of applicants for admission, advancing into the ever widening fields of study and research, more than ever generous in help to merit and intelligence, the university, as always conscious of its tradition, has also adapted itself to the exigencies of the new situation, created by post-war conditions, and to the call of further educational progress.

University Constitution and Administration.—The university is a corporate body, including all the colleges. These, however, are also corporations in themselves, and have their own statutes, but they are further subject to the paramount laws of the university. The head of the university is the chancellor. He is a member of the university, elected by the senate for life. The vice-chancellor, who is the head of a college, is elected for one year by the senate. The proctors (*q.v.*) have as their main duty that of disciplinary officers over the members of the university *in statu pupillari*. The public orator is the spokesman of the senate upon such public occasions as the conferring of honorary degrees. The librarian has charge of the university library. The registrary records the proceedings of the senate, etc., and has charge of documents. The assistant registraries act as secretaries to various boards. The treasurer is secretary to the financial board.

The senate in congregation is the legislative body. Those who have votes in it are the chancellor, vice-chancellor, doctors of divinity, law, medicine, science, letters and music, and masters of art, law, surgery and music. The council of the senate, consisting of the chancellor, vice-chancellor and sixteen members of the regent house, brings all proposals (called "graces") before the regent house or senate. The senate is the legislative body but the majority of its business is done by the regent house, the senate only acting as a court of appeal. The regent house consists of burgesses, university officers, heads of houses, members and secretaries of faculties, boards and syndicates and all fellows. The revenues of the university are derived chiefly from fees at matriculation, for certain examinations, and for degrees, from a tax upon all members of the university, and from contributions by the colleges. A board, consisting of the vice-chancellor *ex officio* and certain elected members, administers the finances of the university. There are boards for each of the various faculties, and a General Board of Studies, with the vice-chancellor at the head. There are 60 professors, 27 readers, the total staff with lecturers, demonstrators and teachers amounting to about 250. The oldest professorship is the Lady Margaret professorship of divinity, instituted by the founders of Christ's and St. John's colleges in 1502.

The head of a college generally bears the title of master. The foundation of each college includes a certain number of fellows and scholars. The affairs of the college are managed by a college council of the head and the fellows. The scholars and other members *in statu pupillari* are termed undergraduates. Those who receive no emoluments (and therefore pay the full fees) form the bulk of the undergraduates. As regards his work, the undergraduate is under a director of studies; the disciplinary officer in college is the dean.

The total number of students is over 5,000. The colleges cannot accommodate this number, so that a student commonly spends some part of his residence in lodgings, which are licensed by, and under the control of, the university authorities. Such residence implies no sacrifice of membership of a college. There are three terms—Michaelmas (October), Lent and Easter (summer). They include together not less than 227 days, though the actual period of residence for undergraduates is about 24 weeks annually. Undergraduates usually begin residence in Michaelmas term. An elementary examination or other evidence of qualification is required for admission to a college. After nine terms' (three years') residence an undergraduate may take the first degree, that of bachelor of arts (B.A.). Students from affiliated colleges are allowed to present themselves for the first degree after a shortened period of residence. The examinations required for the ordinary B.A. degree are (1) Previous examination or "Little-go," or its equivalent to the School Certificate with five "credits," one necessarily in Latin; (2) examinations in the main subject; and evidence of study in three subordinate ones. Candidates for honours are required to have passed the Previous examination with certain additional subjects or the equivalent School Examination; they then take a tripos examination in one of the following subjects—mathematics, classics, moral sciences, natural sciences, theology, law, history, oriental languages, mediaeval and modern languages, mechanical sciences, economics, anthropology, English, geography and archaeology. The mathematical tripos is divided into two parts, in the second of which the candidates are classed in the result as Wranglers, Senior Optimes and Junior Optimes. The classical tripos is also in two parts, to the second of which certain kindred subjects are added (ancient philosophy, history, etc.); other triposes are similarly divided with three classes in each part. A pass in the first part of some triposes does not ensure a degree and the candidate is obliged to take a further examination. The university also awards a certain number of diplomas in agriculture, etc., and also certificates in French, as well as research degrees which require one or two years of residence.

Bibliography.—For details of the administration of the university and colleges, regulations as to studies, prizes, scholarships, etc., *see* the annual *Cambridge University Calendar* and *The Students' Handbook to the University and Colleges of Cambridge; see* also R. Willis and J. W. Clark, *Architectural History of the University of Cambridge* (3 vols., Cambridge, 1886); J. Bass Mullinger, *History of the University of Cambridge from the Earliest Times to the Accession of Charles* (2 vols., 1873–84; third vol., 1909); *Report of Oxford and Cambridge University Commission* (1922). (E. Bu.; G. R. P.)

CAMBUSLANG, civil parish, Lanarkshire, Scotland. It is near the Clyde, 4½ mi. S.E. of Glasgow (of which it is a residential suburb) by the L.M.S.R. Pop (1931) 27,128. Its leading industry is coal-mining, and it contains one of the largest steel works in Great Britain. It was the birthplace of John Claudius London (1783–1843), landscape gardener and writer on horticulture. The mining villages of Hallside and Newton are in the parish.

CAMBYSES (Pers. *Kambujiya*), the name borne by the father and by the son of Cyrus the Great. When Cyrus conquered

Babylon in 539 B.C. he was employed in leading religious ceremonies (*Chronicle of Nabonidus*), and in the cylinder which contains Cyrus's proclamation to the Babylonians his name is joined with his father's in the prayers to Marduk. On a tablet dated from the first year of Cyrus, Cambyses is called king of Babel, but in reality it was only in 530 that Cyrus associated Cambyses with him on the throne, and numerous Babylonian tablets of this time are dated from the first year of Cambyses, when Cyrus was "king of the countries" (*i.e.*, of the world). After the death of his father in 528 Cambyses became sole king.

The traditions about Cambyses, preserved by Greek authors, come from two sources. The first, forming the main account of Herodotus (iii. 2; 4; 10–37), is of Egyptian origin. Here Cambyses is the son of Cyrus and a daughter of Apries (Herod. iii. 2, Dinon fr. II., Polyaen. viii. 29), whose death he avenges on the successor of the usurper Amasis. (In Herod. iii. I. and Ctesias *ap.* Athen. xiii. 560 D, this tradition is corrected by the Persians: Cambyses wants to marry a daughter of Amasis, who sends him instead a daughter of Apries, and by her Cambyses is led into war.) His great crime is the killing of the Apis, for which he is punished by madness.

In the Persian tradition the chief crime of Cambyses is the murder of his brother. With the exception of Babylonian dated tablets and some Egyptian inscriptions we possess no contemporary evidence for Cambyses except the short account of Darius in the Behistun inscription. Without doubt, he seems to have been a wild despot, committing many atrocities in his drunkenness.

Cyrus having conquered Asia, Cambyses undertook the conquest of Egypt, the only remaining independent State of the Eastern world. The war took place in 525, when Amasis had just been succeeded by his son Psammetichus III. The Persians, being supported by the Cyprian towns and the tyrant Polycrates of Samos, who possessed a large fleet, and the commander of the Greek troops, Phanes of Halicarnassus, defeated the Egyptians at Pelusium, and shortly afterwards Memphis was taken. The captive king Psammetichus was executed, having attempted a rebellion. From Egypt Cambyses attempted the conquest of Ethiopia (Cush), *i.e.*, the kingdom of Napata and Meroe, the modern Nubia, but the deserts forced him to return. In an inscription from Napata (in the Berlin museum) the Ethiopian king Nastesen relates that he had beaten the troops of Kembasuden, *i.e.* Cambyses, and taken all his ships (H. Schäfer, Die Aethiopische Königsinschrift des Berliner Museums, 1901). The plan of attacking Carthage was frustrated by the refusal of the Phoenicians to operate against their kindred. Meanwhile the Persian usurper, the Magian Gaumata, who in 522 pretended to be Cambyses's murdered brother, Bardiya (Smerdis), was acknowledged throughout Asia. After an unsuccessful march against him, Cambyses died by his own hand (March 521) according to the preferable account of Darius though the traditions of Herodotus and Ctesias ascribe his death to an accident.

See A. Lincke, *Kambyses in der Sage, Litteratur und Kunst des Mittelalters*, in *Aegyptiaca: Festschrift für Georg Ebers* (Leipzig, 1897), pp. 41–61; Strassmaier: *Inschriften von Cambyses*, No. 97; E. Meyer: *Gesch. der Altertums*, 3rd ed. (Berlin, 1921); J. V. Prásek: *Gesch. der Meder und Perser* (Gotha, 1906); and "Kambyses" in *Der Alte Oriente* (1913); also PERSIA: *Ancient History*.

CAMDEN, CHARLES PRATT, 1st EARL (1714–1794), lord chancellor of England, was born in Kensington in 1714. He was a descendant of an old Devonshire family, the third son of Sir John Pratt, chief-justice of the king's bench in the reign of George I. He was educated at Eton and King's college, Cambridge. In 1734 he became a fellow of his college, and in the following year obtained his degree of B.A. He entered the Middle Temple in 1738, and ten years later he was called to the bar. He practised at first in the courts of common law, travelling also the western circuit.

The first case which brought him into notice was his successful defence of a bookseller on a charge of libel. In this case he first maintained the principle for which he fought all his life, that in libel the jury is judge both of law and fact. He was appointed attorney general in 1787 and the same year entered the House of Commons as member for Downton in Wiltshire, sitting there for four years. One of the most noticeable incidents of his tenure of office as attorney-general was the prosecution of Dr. J. Shebbeare (1709–88), a violent party writer of the day, for a libel against the government contained in his notorious *Letters to the People of England*, which were published in the years 1756–58. This, in a period when State Trials were the chief weapon of party warfare, was the only official prosecution for libel he set on foot. In Jan. 1762 Pratt was raised to the bench as chief-justice of the common pleas. He was at the same time knighted. Soon after his elevation the nation was thrown into great excitement about the prosecution of John Wilkes, and the question involved in it of the legality of "general warrants." Chief-Justice Pratt pronounced, with decisive and almost passionate energy, against their legality, thus giving voice to the strong feeling of the nation and winning for himself an extraordinary degree of popularity in the country. In July 1765 he was raised to the peerage as Baron Camden, of Camden Place, in the county of Kent; and in the following year he was made lord chancellor (July 30, 1766). But though his excellence as a judge was such that only one of his decisions was reversed on appeal, his uncompromising hostility to the governments of the day on such questions as the treatment of the American colonies and the proceedings against Wilkes forced the government to ask him to resign. He retired from the court of chancery in Jan. 1770. He continued steadfastly to oppose the taxation of the American colonists, and signed in 1778, the protest of the Lords in favour of an address to the king on the subject of the manifesto of the commissioners to America. In 1782 he was appointed president of the council under the Rockingham administration, but retired in the following year. Within a few months he was reinstated in this office under the Pitt administration, and held it till his death. Lord Camden was a strenuous opponent of Fox's India Bill, took an animated part in the debates on important public matters till within two years of his death, introduced in 1786 the scheme of a regency on occasion of the king's insanity, and defended zealously and at last successfully his early views on the functions of juries, especially of their right to decide on all questions of libel. He was raised to the dignity of an earl in May 1786, and was at the same time created Viscount Bayham. Earl Camden died in London, on April 18, 1794. He was buried in Seale church, Kent.

See E. Foss, *Judges of England*, vol. viii. p. 375 (1848–64).

CAMDEN, JOHN JEFFREYS PRATT, 2ND EARL and 1ST MARQUESS (1759–1840), only son of the 1st earl, was born on Feb. 11, 1759, and was educated at Trinity College, Cambridge In the ministry of William Pitt, Pratt, who entered parliament as M.P. for Bath in 1780, was successively a lord of the admiralty and a lord of the treasury; then, having succeeded his father in the earldom in 1794, he was appointed lord-lieutenant of Ireland in 1795. Disliked in Ireland as an opponent of Roman Catholic emancipation, and as the exponent of an unpopular policy, Camden's term of office was one of commotion and alarm, culminating in the rebellion of 1798. Immediately after the suppression of the rising he resigned, and in 1804 became secretary for war and the colonies under Pitt, and in 1805 lord president of the council. He was again lord president from 1807–12, after which date he remained for some time in the cabinet without office. In 1812 he was created earl of Brecknock and Marquess Camden. He died on Oct. 8, 1840

CAMDEN, WILLIAM (1551–1623), English antiquary and historian, was born in London. His father, Sampson Camden, was a member of the company of painter-stainers. Young Camden received his early education at Christ's Hospital and St. Paul's school, and in 1566 went to Magdalen college, Oxford, probably as a servitor or chorister. He afterwards removed to Broadgates hall (Pembroke college), and later to Christ Church, where he was supported by his friend, Dr. Thomas Thornton, canon of Christ Church. In 1571 he went to London and devoted himself to antiquarian studies, for which he had already acquired a taste.

Camden spent some time in travelling in various parts of England collecting materials for his *Britannia, sive florentissimorum regnorum Angliae, Scotiae, Hiberniae et insularum adjacentium* *ex intima antiquitate chorographica Descriptio*, first published in 1586. He became second master of Westminster school in 1575, and succeeded Dr. Edward Grant as headmaster in 1593. During the vacations he travelled, and supervised the publication of three further editions of the *Britannia*. Although a layman he was granted the prebend of Ilfracombe in 1589, and in 1597 he resigned his position at Westminster on being made Clarenceux king-of-arms an appointment which caused some ill-feeling. The York herald, Ralph Brooke, led an attack on the genealogical accuracy of the *Britannia*, and accused its author of plagiarism. Camden replied to Brooke in an appendix to the fifth edition of the *Britannia*, published in 1600. Having brought out an enlarged and improved edition of the *Britannia* in 1607, he began to work on a history of the reign of Queen Elizabeth, which he had been urged to undertake by Lord Burghley in 1597. The first part of this history dealing with the reign down to 1588, was published in 1615 under the title *Annales rerum Anglicarum et Hibernicarum regnante Elizabetha*. Controversy at once arose over the author's treatment of Mary, Queen of Scots. It was asserted that Camden altered his original narrative in order to please James I., and, moreover, that the account which he is said to have given to his friend, the French historian, Jacques de Thou, differed substantially from his own. It seems doubtful if there is any truth in either of these charges. The second part of his work, finished in 1617, was published at Leyden in 1625 and in London in 1627. Selden spoke of the *Annales* and of Bacon's *History of Henry VII*. as the only two serious works on English history up to his day. In 1622 Camden founded the chair at Oxford known as the Camden professorship of ancient history, the first occupant of which was his friend, Degory Wheare. His later years were mainly spent at Chislehurst, where he had gone to live in 1600, and in spite of recurring illnesses he continued his antiquarian and historical studies. He died at Chislehurst on Nov. 9, 1623.

Camden, who refused a knighthood, was a man of enormous industry, and of a modest and friendly disposition. He had a large number of influential friends, among whom were Archbishop Ussher, Sir Robert Cotton, John Selden, the French jurist Brisson, and Isaac Casaubon. His correspondence was published in London in 1691 by Dr. Thomas Smith under the title *Vita Gulielmi Camdeni et Illustrium virorum ad G. Camdenum Epistolae* which, together with the notices in Bayle's *Dictionary* and in Wood's *Athenae Oxonienses*, is the chief authority for his biography. This volume contains Camden's *Memorabilia de seipso;* his notes of the reign of James I.; and other interesting matter. In 1838 the Camden Society was founded in his honour, and much valuable work has been done under its auspices.

BIBLIOGRAPHY.—The *Britannia* was first translated into English by Philemon Holland, in 1610, probably under the author's direction, and other translations have subsequently appeared, the best of which is an edition edited by Richard Gough and published in 3 vols. in 1789, and in 4 vols. in 1806. The best edition of the *Annales* is by Thomas Hearne (1717). The book was translated into French, and English translations appeared in 1635, 1675 and 1688. In addition to these works Camden compiled a Greek grammar, *Institutio Graecae Grammatices Compendiaria*, which became very popular, and he published an edition of the writings of Asser, Giraldus Cambrensis, Thomas Walsingham and others, under the title *Anglica, Hibernica, Normannica, Cambrica, a veteribus scripta*, (1602 and 1603). He also drew up a list of the epitaphs in Westminster Abbey, which was issued as *Reges, Reginae, Nobiles et alii in ecclesia collegiata Beati Petri Westmonasterii sepulti*. This was enlarged and published again in 1603 and 1606. In 1605 he published his *Remains concerning Britain*, a book of collections from the *Britannia*, which quickly passed through seven editions; and he wrote an official account of the trial of the Gunpowder Plot conspirators as *Actio in Henricum Garnetum, Societatis Jesuiticae in Anglia superiorem et caeteros*.

CAMDEN, a city of New Jersey, U.S.A., the county seat of Camden county, on the Delaware river, opposite Philadelphia, with which it is connected by a suspension bridge (opened 1926) which is 8,126ft. long, 135ft. above the water, and has a span of 1,750 feet. It is on Federal highways 30 and 130, and is served by the Pennsylvania and the Reading railways. The land area is 7·8sq miles.

The population in 1920 was 116,309, of whom 20,262 were foreign-born white and 8,500 were Negroes; and was 117,536 in 1940 by federal census.

The city has a water-front of 6·1 mi. on the Delaware and 6·2 along the Cooper river, which divides it into East and West Camden. A municipal pier with a floor area of 33,636 sq.ft. was built in 1920–21. A civic centre was developed as part of a comprehensive city plan. Bus and electric lines are co-ordinated in a unified service, operating out of a common terminal. The water supply is derived from 136 artesian wells, with a flow of 47,000,000 gal. a day. The city has a commission form of government (adopted 1923). The assessed valuation of property in 1940 was $133,860,415.

The manufacturing industries are numerous and important, with a varied output ranging from pen points to battleships. The aggregate output in 1937 was valued at $150,455,138. Among the products manufactured are: steel pens, talking machines, canned soups, and oilcloth and linoleum. During the war of 1914–18 the New York Shipbuilding corporation delivered more ships than any other yard in the country, and made a record for rapid construction in the collier "Tuckahoe," which was launched on the 27th day after work was begun on her keel. In 1941, the National Defence program greatly increased the activity of the shipbuilders.

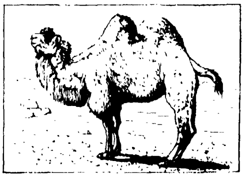
The early settlers were largely Quakers. William Cooper in 1681 built a home just below the mouth of the Cooper river, and called it Pyne Poynt. For a century the settlement consisted of a little group of houses around the ferry. In 1773 Jacob Cooper, a descendant of William, laid out a town, and named it after Lord Chancellor Camden, one of the strongest opponents of the Stamp Act Until 1828, when Camden was incorporated, with a population of 1,143, it was a part of the town of Newton, Gloucester county. During the British occupation of Philadelphia in the Revolutionary War a British force was stationed in Camden, and it was the scene of several skirmishes. Camden was the home of Walt Whitman from 1873 until his death. He was buried in Harley cemetery, and his house in Mickle street is kept as a memorial.

CAMDEN, a city of South Carolina, U.S.A., 30 mi. N.E. of Columbia, near the Wateree river; the county seat of Kershaw county. It is on Federal highway 1 and is served by the Seaboard Air Line and the Southern railways. The population in 1920 was 3,930 (47% Negroes); in 1940 it was 5,747. It is a winter resort, in the heart of the longleaf pine region. There are many examples of colonial architecture, including the old court-house, which is now a museum. The city has a hydro-electric power plant and several factories. It was settled in 1758; incorporated, 1791.

For a year during the Revolution, Camden was the centre of important military operations. It was occupied by the British under Cornwallis in June 1780, was well fortified and was garrisoned by a force under Lord Rawdon. On Aug. 16, Gen. Horatio Gates, with an American force of about 3,000, including some Virginia militia under Charles Porterfield and Gen. Edward Stevens, and North Carolina militia under Gen. Richard Caswell, was defeated here by the British, about 2,000 strong, under Lord Cornwallis, who had joined Rawdon in anticipation of an attack by Gates. Soon after the engagement began a large part of the Americans, mostly North Carolina and Virginia militia, fled precipitately, carrying Gates with them; but Baron De Kalb and the Maryland troops fought bravely until overwhelmed by numbers, De Kalb himself being mortally wounded. A monument was erected to his memory in 1825, Lafayette laying the corner-stone. The British loss in killed, wounded and missing was 324; the American loss was about 800 or 900 killed and 1,000 prisoners, besides arms and baggage. On Dec. 3, Gates was superseded by Greene, who after Cornwallis had left the Carolinas, advanced on Camden and arrived in the neighbourhood on April 19, 1781. Considering his force (about 1,450) insufficient for an attack on the fortifications, he withdrew a short distance north of Camden to an advantageous position on Hobkirk's Hill, where on April 25, Rawdon, with a force of only 950, took him somewhat by surprise and drove him from the field. The casualties on each side were nearly equal: American 271; British 258. On May 8, Rawdon evacuated the town, after burning most of it. On Feb. 24, 1865, during the Civil War, a part of Gen. Sherman's army entered Camden and burned stores of tobacco and cotton. (*See* AMERICAN REVOLUTION.)

See also T. J. Kirkland and R. M. Kennedy, *Historic Camden* (Columbia (S.C.), 1905).

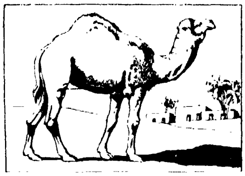
CAMEL, the name applied to the two species of the genus *Camelus* of the order Artiodactyla (*q.v.*). Of the two species, *C. dromedarius,* the Arabian camel, is larger and has only one hump, while the Bactrian camel, *C. bactrianus,* has two. The Bactrian camel is shorter legged and more ponderous and grows a long, thick winter coat, which it sheds in masses in the spring. Its native home was probably Central Asia, and there have been reports that wild camels occur in eastern Turkistan, but these are probably feral, originating from escaped domestic animals. The Bactrian camel is better suited for cold climates and rocky hill country than its Arabian cousin. It feeds on the thorny and bitter plants of the steppes, rejected by most mammals, and drinks brackish water readily. Throughout southern Siberia and in Mongolia it is an important beast of burden.



BY COURTESY OF THE NEW YORK ZOOLOGICAL SOCIETY

THE BACTRIAN CAMEL

The Arabian camel is unknown in the wild state and is one of the oldest of domestic animals. It will carry a load of 500 lb. 25 miles a day for three days without drinking. Water is stored in body tissues, chiefly in the hump; little is stored in the stomach. The wide-spreading, soft feet are adapted for walking on the sand.



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ARABIAN OR ONE-HUMPED CAMEL

During the rutting season the male camel is very savage, uttering a loud bubbling roar and fighting fiercely with its fellows. The tameness of the camel is essentially the tameness of stupidity. Sir F. Palgrave writes, "He is from first to last an undomesticated and savage animal, rendered serviceable by stupidity alone, without much skill on his master's part or any co-operation on his own, save that of an extreme passiveness. Neither attachment nor even habit impress him; never tame, though not wide-awake enough to be exactly wild."

The food of the camel consists of the leaves of trees and shrubs. The female produces one young at a birth, after 11 months' gestation. The mother suckles her offspring for a year and the latter does not reach maturity until its sixteenth or seventeenth year, living until it is forty or fifty. (*See* TYLOPODA.)

CAMEL CORPS, a military unit mounted on camels for service in the desert. The first Egyptian camel corps was formed in 1884 for the Gordon relief expedition, the personnel being drawn from British units; it was disbanded at the conclusion of the campaign. Later a new camel corps was recruited from Sudanese and Egyptian sources, and became a permanent part of the Egyptian army; it fought with credit in the campaigns against the Khalifa between 1896 and 1898. It now numbers about 1,100 strong and forms part of the Sudan defence force. The Bikanir Camel Corps is an imperial service unit raised and maintained by the maharaja of Bikanir, one of the native princes of India. It has seen much active service, taking part, without its camels, in the China expedition of 1900, and in the operations in Somaliland in 1903–04. When the World War broke out, it again volunteered to go overseas, and did valuable work in Egypt. The establishment of the corps, which is recruited on the Silladar system, is some 500 of all ranks. An imperial camel corps brigade, a composite British, Australian and New Zealand formation, served in Palestine from 1917 to June 1918, when it was reorganized as cavalry. It played a creditable part in the battles of Romani and Gaza, and shared in the attack on Beersheba and the subsequent advance to Jerusalem as well as in the Amman and Es Salt raids.

CAMELLIA, a genus of evergreen trees or shrubs belonging to the family Theaceae, with thick, dark shining leaves and calling those of the wild rose, but most of the cultivated forms are double. In the variety *anemoniflora* nearly all the stamens have become transformed into small petaloid structures, which give the flower the appearance of a double anemone. Another species, *C. reticulata,* a native of Hongkong, is also prized for its handsome flowers, larger than those of *C. japonica,* which are of a bright rose colour. Both *C. sasanqua* and *C. drupifera,* the former inhabiting Japan and China, the latter Cochin-China and the mountains of India, are oil-yielding plants. The oil of *C. Sasanqua* has an agreeable odour and is used for many domestic purposes. It is obtained from the seeds, the leaves in a dried state are mixed with tea on account of their pleasant flavour. The oil of *C. drupifera,* which is closely allied to *C. Sasanqua,* is used medicinally in Cochin-China. The flowers of these two species, unlike those of *C. japonica* and *C. reticulata,* are odoriferous.

Camellias, though generally grown in the cool greenhouse, are hardy in the south of England and the south-west of Scotland and Ireland and mild districts in the United States. They grow best in a rich compost of sandy peat and loam, and a liberal supply of water is necessary.

CAMELOT, the legendary seat of King Arthur's court (*see* ARTHURIAN LEGEND), variously identified with Caerleon-upon-Usk in Monmouthshire (*see* CAERLEON), with Queen's Camel in Somerset, with the little town of Camelford in Cornwall and with Winchester.

CAMEO, a term commonly applied to engraved work executed in relief on hard or precious stones, as well as to imitations of such stones in glass, called "pastes," and on the shells of molluscous animals. The cameo is therefore the converse of the intaglio (*q.v.*), which consists of an incised or sunk engraving in the same class of materials. (*See* GEM and GEMS IN ART.)

CAMERA, in law, is applied, in the phrase *in camera,* to cases heard in private, that is, in chambers. Originally the term was used for the English judges' chambers in Serjeants' Inn, as distinct from their bench in Westminster Hall. It was afterwards applied to the judges' private room behind the court.

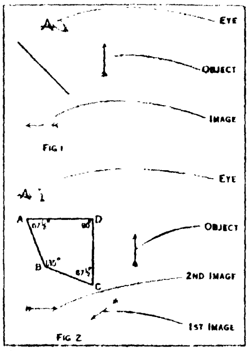
It has been said by Lord St. Heliers, Lord Haldane and Lord Reading that, given proper circumstances, there is an inherent right in all courts to sit *in camera.* In the chancery courts this has been the practice in cases affecting wards of court, lunatics, family disputes, and where a public trial would defeat the object of the action. The court of appeal has also exercised the right to sit *in camera* in a patent case involving a secret process. Under the Matrimonial Causes Act, 1857, nullity and judicial separation suits may be heard in private, and by the Children Act, 1908, the Defence of the Realm Act, 1914, the Official Secrets Act, 1920, and the Adoption of Children Act, 1926, the courts are empowered to sit *in camera.*

But apart from statutory provisions it is doubtful whether in civil or criminal proceedings the courts have power to sit in private or to order adults out of court.

CAMERA, PHOTOGRAPHIC: *see* PHOTOGRAPHY.

CAMERA LUCIDA, an optical instrument invented by Dr. William Hyde Wollaston for drawing in perspective. Closing one eye and looking vertically downwards with the other through a slip of plain glass, *e.g.,* a microscope cover-glass, held close to the eye and inclined at an angle of 45° to the horizon, one can see the images of objects in front, formed by reflection from the surface of the glass, and at the same time one can also see through the transparent glass. The virtual images of the objects appear projected on the surface of a sheet of paper placed beneath the slip of glass, and their outline can be accurately traced with a pencil. This is the simplest form of the camera lucida. The image (*see* fig. 1) is, however, inverted and changed from right to left and it is not very bright owing to the poor reflecting power of unsilvered glass. The brightness of the image is sometimes increased by silvering the glass; and on removing a small portion of the silver the observer can see the image with part of the pupil while he sees the paper through the unsilvered aperture with the remaining part. This form of the instrument is often used in conjunction with the microscope, the mirror being attached to the eye-piece and the tube of the microscope being placed horizontally.

About the beginning of the 19th century Dr. Wollaston invented a simple form of the camera lucida which gives bright and erect images. A four-sided prism of glass is constructed having one angle of 90°, the opposite angle of 135°, and the two remaining angles each of 67½°. This is represented in cross-section and in position in fig. 2. When the pupil of the eye is held half over the edge of the prism *a*, one sees the image of the object with one half of the pupil and the paper with the other half. The image is formed by successive total reflection at the surfaces *b c* and *a b*. In the first place an inverted image (first image) is formed in the face *b c*, and then an image of this image is formed in *a b*, and it is the outline of this second image seen projected on the paper that is traced by the pencil. It is desirable for two reasons that the image should lie in the plane of the paper, and this can be secured by placing a suitable lens between the object and the prism. If the image does not lie in the plane of the paper, it is impossible to see it and the pencil-point clearly at the same time. Moreover, any slight movement of the head will cause the image to appear to move relatively to the paper, and will render it difficult to obtain an accurate drawing.



CAMERA LUCIDA, AN OPTICAL INSTRUMENT FOR USE IN DRAWING IN PERSPECTIVE

Fig. 1.—Simple form using thin glass plate held at an angle of 45°

Fig. 2.—Wollaston's four-sided prism

Before the application of photography, the camera lucida was of considerable importance to draughtsmen. The advantages claimed for it were its cheapness, smallness and portability; that there was no appreciable distortion, and that its field was much larger than that of the camera obscura. It was used largely for copying, for reducing or for enlarging existing drawings. It will readily be understood, for example, that a copy will be half-size if the distance of the object from the instrument is double the distance of the instrument from the copy. (C. J. J.)

CAMERA OBSCURA, an optical apparatus consisting of a darkened chamber (for which its name is the Latin rendering) into which light is admitted through a convex lens fixed in one end of the chamber. This lens forms an image of external objects on the other end of the camera (fig. 1). The end of the camera on which the image is formed, the screen, may be made of translucent paper or ground glass, in which case the image is viewed from outside the camera, or it may be an opaque surface, the camera being sufficiently large to allow the head and shoulders, or even the whole body of the observer to be introduced into the chamber, in which case the image is viewed from inside the camera. The image formed on the screen is a real or actual image, not virtual as in camera lucida (*q.v.*). Frequently a sloping mirror (fig. 2, a) or 90° prism (fig. 2, b) is added to the simple optical system; but more generally the mirror and lens are combined into a single piece of worked glass represented in section in fig. 3. Rays from external objects are first refracted at the convex surface *a b*, then totally reflected at the plane surface *a c*, and finally refracted at the surface *b c* so as to form an image on the sheet of paper *d e*. The curved surface takes the place of the lens in fig. 2, a, and the plane surface performs the function of the mirror. The prism *a b c* is fixed at the top of a small tent furnished with opaque curtains so as to prevent the diffused daylight from overpowering the image on the paper, and in the darkened tent the images of external objects are seen very distinctly.

Other modifications of the optical system have been made (*see* PHOTOGRAPHY). The camera obscura has come into use with submarine vessels, the periscope (*q.v.*) being simply a camera obscura under a new name. The camera obscura was extensively used in sketching from nature before the introduction of photography.

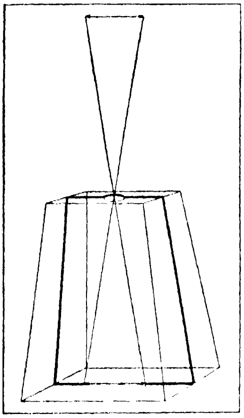


FIG. 1.—DIAGRAM ILLUSTRATING SINGLE CAMERA OBSCURA

History.—The inventor of this instrument is unknown, and the exact date of its invention is likewise unknown. Perhaps a crude form of it was known to the ancient Greeks, but there is no material evidence to substantiate such a point of view. Euclid's *Optics*, made available in a French translation by Paul Ver Eecke in 1938, contains no mention of this instrument nor any statement which would depend upon a knowledge of it. But in the book known as Aristotle's *Problems* (sect. xv, cap. 5), we find the problem of the image of the sun passing through a quadrilateral aperture yet always appearing round. Aristotle has further noted that the lunated image of the eclipsed sun projected in the same way through the interstices of foliage or latticework.

The first clear description of the camera obscura occurs in the great optical treatise of the Islamic scientist Alhazen (*q.v.*), who died at Cairo, Egypt, in A.D. 1038. His *Opticae Thesaurus* (Book of Optics) was rendered into Latin some time during the 12th or early part of the 13th century by an unknown translator. A Latin translation was published, together with Vitello's *Optics*, by F. Risner in 1572. In this printed version (cap. v, theor. 29) there is an account of the camera obscura. A description is given of how several candles may be arranged opposite the opening of the chamber, and how if one of the candles is shaded off only the image of that candle is seen to vanish. If the shade is removed, then the image reappears. Other observations with this instrument are recorded. This description is present not only in the printed version but also in one of the oldest known Latin manuscripts of the book, of the 13th century, in the possession of Trinity college, Cambridge university, England. Hence the claim to discovery of those who lived in the latter part of the middle ages or early Renaissance cannot be substantiated. Alhazen himself declares that he himself did not make the discovery of it (*Et nos non invenimus ita*), so that we are certain that the discovery was made prior to 1038, although it remains problematical as to whether or not the instrument was known to the Greeks.

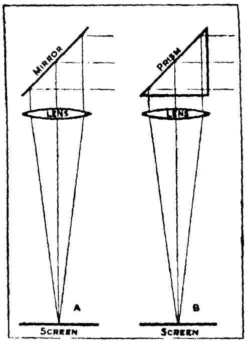


FIG. 2.—CAMERA OBSCURA WITH INCLINED MIRROR OR PRISM

The next writer to discuss the camera obscura is Vitello, a Polish physicist and philosopher who was born about A.D. 1230. His main work is a treatise on optics or perspective, composed between 1270 and 1278. This work is based almost entirely upon the treatise of Alhazen, whose materials he presents in a more logical form; its original materials are primarily in the field of the psychology of vision. He shows (II, prop. 39) that rays emanating from any kind of light or reproducing luminous images proceed in straight lines, and he also explains the rounding of light passing through angular apertures, evidencing familiarity with the camera obscura.

Contemporary with Vitello are two English writers who discussed the camera obscura, Roger Bacon and John Peckham, archbishop of Canterbury. Roger Bacon, born about A.D. 1214, a Franciscan scientist and philosopher, was particularly interested in the subject of optics, to which a major part of his writings is devoted. He not only described the camera obscura in his writings on perspective, but indicated a combination later used by both Girolamo Cardan and Giovanni Battista della Porta, who claimed it as their own invention. This combination of the camera obscura and specula was devised so that one could have an image within a darkened room of objects on the street below the window. His *Perspectiva*, published in Frankfurt, Germany, in 1614, was well-known in Italy in the time of Porta and Cardan.

Pierre M. Duhem has shown (*Système du monde*, 1915, vol. 3, p. 505) that Bacon also noticed that the image of the sun was round no matter what shape the aperture, that the image obtained by means of the camera obscura is always reversed, and that he recommended the use of the camera obscura for the observation of solar eclipses.

Bacon's writings on optics derive to a large degree from those of Alhazen and Vitello, which influenced him greatly. Similarly, Bacon himself influenced Peckham, as well as William of Saint Cloud, both of whom wrote on the camera obscura. Peckham, in his *Perspectiva Communis* (1279, Pt. I, prop. 5), describes the camera obscura, noting its applicability to eclipse observations, but adds nothing to what had already been known to Bacon. William of Saint Cloud (Guilelmus de Sancto Clodoaldo), who flourished in Paris, France, about A.D. 1292–1296, observed the sun by means of a camera obscura in 1285.

In the following century a description of the camera obscura was written by Levi ben Gerson, who died in A.D. 1344, in a book of his in Hebrew and translated into Latin in 1342 by Peter of Alexandria under the title *De Sinibus, Chordis et Arcubis*. Hence, prior to the time of two for whom the invention of this instrument is most often claimed (*i.e.*, Leonardo da Vinci and G. B. della Porta) there were at least six known writers who had written descriptions of it, and who had done so prior to A.D. 1400.

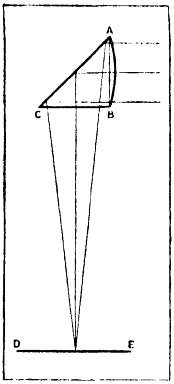


FIG. 3. — CAMERA OBSCURA WITH LENS AND PRISM COMBINED

The name of the famous painter and architect Leone Battista Alberti is usually associated with the development of the camera obscura. Yet Major General J Waterhouse (*Photographic Journal*, May 31, 1901) and Georges Potonniée (*Histoire de la découverte de la photographie*, 1925) both agree that the instrument invented by Alberti in 1437 was not a camera obscura at all, but probably was what the 19th century designated a panorama or diorama, a kind of show box. Alberti did not mention the use of the camera obscura for aiding in perspective drawing.

Leonardo da Vinci, some time before 1519, made accurate drawings of the camera obscura and seems to have fully understood the phenomena associated with its use. These, however, he did not publish. The first published account of this instrument occurs in a translation of the *Architecture* of Vitruvius with commentary by Cesare Caesariano, published at Como, Italy, in 1521, wherein is described the camera obscura used by a Benedictine monk, Dom Papnutio or Panuce.

About the same time Francesco Maurolico, or Maurolycus, the eminent mathematician of Messina, Italy, in his *Theoremata de Lumine et Umbra*, written in 1521, fully investigated the optical problems connected with vision and the passage of rays of light through small apertures with and without lenses, and made great advances in this direction over his predecessors. He was the first correctly to solve Aristotle's problem, stated above, and to apply it practically to solar observations in a darkened room (*Cosmographia*, 1535). Erasmus Reinhold has described the method in his edition of G. Purbach's *Theoricae Novae Planetarum* (1542), and probably got it from Maurolycus. He says it can also be applied to terrestrial objects, though he only used it for the sun. His pupil, Rainer Gemma-Frisius, used it for the observation of the solar eclipse of Jan. 1544 at Louvain, and fully described the methods he adopted for making measurements and drawings of the eclipsed sun in his *De Radio Astronomico et Geometrico* (1545). He says they can be used for observation of the moon and stars and also for longitudes. The same arrangement was used by Copernicus, Tycho Brahe, by M. Moestlin and his pupil Johann Kepler—the latter applying it in 1607 to the observation of a transit of Mercury—also by Johann Fabricius, in 1611, for the first observations of sunspots. It is interesting to note this early employment of the camera obscura in the field of astronomical research, in which its most recent achievements have been of such pre-eminent value. Girolamo Cardan, in his *De Subtilitate* (1550), describes a simple camera obscura with the addition of a mirror in the window, that he might see in the darkened room an image of what was going on outside. In this he had been anticipated by Roger Bacon.

We now come to Giovanni Battista della Porta, whose account of the camera obscura in the first edition of the *Magia Naturalis*, in four books (1558, lib. iv, cap. 2), is very similar to Caesariano's —a darkened room, a pyramidal aperture toward the sun, and a whitened wall or white paper screens, but no lens. He discloses as a great secret the use of a concave speculum in front of the aperture, to collect the rays passing through it, when the images would be seen reversed, but by prolonging them beyond the centre they would be seen larger and unreversed. This is much the same as Cardan's method published eight years earlier, but though more detailed is not very clear. He then notes the application to portraiture and to painting by laying colours on the projected images. Nothing is said about the use of a lens or of solar observations. The second edition, in which he in the same words discloses the use of a convex lens in the aperture as a secret he had intended to keep, was not published till 1589, 31 years after the first. In this interval the use of the lens was discovered and clearly described by Daniello Barbaro, a Venetian noble, patriarch of Aquileia, in his work *La Pratica della perspettiva* (p. 192), published in 1568, or 21 years before Porta's mention of it. The lens used by Barbaro was an ordinary convex or old man's spectacle glass; concave, he says, will not do. He shows how the paper must be moved till it is brought into the focus of the lens, the use of a diaphragm to make the image clearer, and also the application of the method for drawing in true perspective. That Barbaro was really the first to apply the lens to the camera obscura is supported by Marius Bettinus in his *Apiaria* (1645), and by Kaspar Schott in his *Magia Universalis* (1657), the former taunting Porta with the appropriation.

In an Italian translation of Euclid's *Optica*, with commentary, Egnacio Danti (1573), after discussing the effects of plane convex and concave reflectors, fully describes the method of showing reversed images passing through an aperture in a darkened room, and shows how, by placing a mirror behind the aperture, unreversed images might be obtained, both effects being illustrated by diagrams. F. Risner, who died in 1580, also in his *Opticae* (1606) very clearly explained the reversal of the images of the simple camera obscura. He notes the convenience of the method for solar observations and its previous use by some of the observers already mentioned, as well as its advantages for easily and accurately copying on an enlarged or reduced scale, especially for chorographical or topographical documents. This is probably the first notice of the application of the camera to cartography and the reproduction of drawings, which is one of its principal uses at the present time. In the *Diversarum Speculationum Mathematicarum et Physicarum* (1585), by the Venetian Giovanni Battista Benedetti, there is a letter in which he discusses the simple camera obscura and mentions the improvement someone had made in it by the use of a double convex lens in the aperture; he also says that the images could be made erect by reflection from any plane mirror.

Thus the use of the camera and of the lens with it was well known before Porta published his second edition of the *Magia Naturalis* in 1589. In this the description of the camera obscura is in lib. xvii, cap. 6. The use of the convex lens, which is given as a great secret, in place of the concave speculum of the first edition, is not so clearly described as by Barbaro; the addition of the concave speculum is proposed for making the images larger and clearer, and also for making them erect, but no details are given. He describes some entertaining peep-show arrangements, possibly similar to Alberti's, and indicates how the dark chamber with a concave speculum can be used for observing eclipses. There is no mention whatever of a portable box or construction beyond the darkened room, nor is there in his later work, *De Refractione Optices Parte* (1593), in which he discusses the analogy between vision and the simple dark room with an aperture, but incorrectly. Though Porta's merits were undoubtedly great, he did not invent or improve the camera obscura. His only novelty was the use of it as a peep-show; his descriptions of it are vague, but being published in a book of general reference, which became popular, he acquired credit for the invention.

The first to take up the camera obscura after Porta was Johann Kepler, who used it in the old way for solar observations in 1600, and in his *Ad Vitellionem Paralipomena* (1604) discusses the early problems of the passages of light through small apertures, and the rationale of the simple dark chamber. He was the first to describe an instrument fitted with a sight and paper screen for observing the diameters of the sun and moon in a dark room. In his later book, *Dioptrice* (1611), he fully discusses refraction and the use of lenses, showing the action of the double convex lens in the camera obscura, with the principles which regulate its use and the reason for the reversal of the image. He also demonstrates how enlarged images can be produced and projected on paper by using a concave lens at a suitable distance behind the convex, as in modern telephotographic lenses. He was the first to use the term *camera obscura*, and in a letter from Sir H. Wotton written to Lord Bacon in 1620 we learn that Kepler had made himself a portable dark tent fitted with a telescope lens and used for sketching landscapes. Further, he extended the work of Maurolycus, and demonstrated the exact analogy between the eye and the camera and the arrangement by which an inverted image is produced on the retina.

In 1609 the telescope came into use, and the danger of observing the sun with it was soon discovered. In 1611 Johann Fabricius published his observations of sunspots and describes how he and his father fell back upon the old method of projecting the sun's image in a darkened room, finding that they could observe the spots just as well as with the telescope. They do not seem to have used a lens, or thought of using the telescope for projecting an enlarged image on Kepler's principle. This was done in 1612 by Christoph Scheiner, who fully described his method of solar observation in the *Rosa Ursina* (1630), demonstrating very clearly and practically the advantages and disadvantages of using the camera, without a lens, with a single convex lens, and with a telescopic combination of convex object-glass and concave enlarging lens, the last arrangement being mounted with an adjustable screen or tablet on an equatorial stand. Most of the earlier astronomical work was done in a darkened room, but here we first find the dark chamber constructed of wooden rods covered with cloth or paper, and used separately to screen the observing tablet.

Various writers on optics in the 17th century discussed the principle of the simple dark chamber alone and with single or compound lenses, among them Jean Tarde (*Les Astres de Borbon*, 1623); Descartes, the pupil of Kepler (*Dioptrique*, 1637); Bettinus (*Apiaria*, 1645); A. Kircher (*Ars Magna Lucis et Umbrae*, 1646); J. Hevelius (*Selenographia*, 1647); Schott (*Magia Universalis Naturae et Artis*, 1674); C. F. M. Deschales (*Cursus, seu Mundus Mathematicus*, 1674); Z. Traber (*Nervus Opticus*, 1675); but their accounts are generally more interesting theoretically than as recording progress in the practical use and development of the instrument.

The camera obscura is mentioned in Francis Bacon's *De Augmentis Scientiarum*, where it is noted that projected images show better on a white screen than on a black one. Sir H. Wotton's letter of 1620 was published in 1651 (*Reliquiae Wottonianae*, p. 141), and in 1658 a description of Kepler's portable tent camera for sketching, taken from it, was published in a work called *Graphice, or the Most Excellent Art of Painting*, but no mention is made of Kepler. In W. Oughtred's English edition (1633) of the *Récréations mathématiques* (1627) of Jean Leurechon ("Henry van Etten") there is a quaint description, with figures, of the simple dark chamber with aperture, and also of a sort of tent with a lens in it and the projection on an inner wall of the face of a man standing outside. The English translation of Porta's *Natural Magick* was published in 1658.

Robert Boyle seems to have been the first to construct a box camera with lens for viewing landscapes. It is mentioned in his essay *On the Systematic or Cosmical Qualities of Things* (ch. vi), written about 1670, as having been made several years before and later imitated and improved. It could be extended or shortened like a telescope. At one end of it paper was stretched, and at the other a convex lens was fitted in a hole, the image being viewed through an aperture at the top of the box. Robert Hooke, who was some time Boyle's assistant, described (*Phil. Trans.*, 1668, 3, p. 741) a camera lucida on the principle of the magic lantern, in which the images of illuminated and inverted objects were projected on any desired scale by means of a broad convex lens through an aperture into a room where they were viewed by the spectators. If the objects could not be inverted another lens was used for erecting the images. From Hooke's *Posthumous Works* (1705), p. 127, we find that in one of the Cutlerian lectures on light delivered in 1680, he illustrated the phenomena of vision by a darkened room, or perspective box, of a peculiar pattern, the back part, with a concave white screen at the end of it, being cylindrical and capable of being moved in and out, while the fore part was conical, a double convex lens being fixed in a hole in front. The image was viewed through a large hole in the side. It was between 4 ft. and 5 ft. long.

Johann Zahn, in his *Oculus Artificialis Teledioptricus* (1685–1686), described and figured two forms of portable box cameras with lenses. One was a wooden box with a projecting tube in which a combination of a concave with a convex lens was fitted, for throwing an enlarged image upon the focusing screen, which in its proportions and application is very similar to our modern telephotographic objectives. The image was first thrown upon an inclined mirror and then reflected upward to a paper screen on the top of the box. In an earlier form the image is thrown upon a vertical thin paper screen and viewed through a hole in the back of the camera.

Most of the writers already noticed worked out the problems connected with the projection of images in the camera obscura more by actual practice than by calculation, but William Molyneux, of Dublin, Ireland, seems to have been the first to treat them mathematically in his *Dioptrica Nova* (1692), which was also the first work in English on the subject, and is otherwise an interesting book. He has fully discussed the optical theory of the dark chamber, with and without a lens, and its analogy to the eye. He does not, however, mention the camera obscura as an instrument in use, but in John Harris's *Lexicon Technicum* (1704), we find that the camera obscura with the arrangement called the "scioptric ball," and known as *scioptricks*, was on sale in London, England, and after this must have been in common use as a sketching instrument or as a show.

Sir Isaac Newton, in his *Opticks* (1704), explains the principle of the camera obscura with single convex lens and its analogy with vision in illustration of his seventh axiom, which aptly embodies the correct solution of Aristotle's old problem. He also made great use of the simple dark chamber for his optical experiments with prisms, etc. Joseph Priestley (1772) mentions the application of the solar microscope, both to the small and portable and the large camera obscura. Many patterns of these two forms for sketching and for viewing surrounding scenes are described in W. J. Gravesande's *Essai de perspective* (1711), Robert Smith's *Compleat System of Optics* (1738), Joseph Harris's *Treatise on Optics* (1775), Charles Hutton's *Philosophical and Mathematical Dictionary*, and other books on optics and physics of that period. The camera obscura was first applied to photography (*q.v.*) probably about 1794, by Thomas Wedgwood. His experiments with Sir Humphry Davy in endeavouring to fix the images of natural objects as seen in the camera were published in 1802. (I. B. C.)

CAMERARIUS, JOACHIM (1500–1574), German classical scholar, was born at Bamberg on April 12, 1500. In 1530 he was sent as deputy for Nuremberg to the diet of Augsburg, where he helped Melanchthon in drawing up the Confession of Augsburg. Five years later he was commissioned by Duke Ulrich of Württemberg to reorganize the university of Tübingen; and in 1541 he rendered a similar service at Leipzig, where he died on April 17, 1574. He played an important part in the Reformation movement, and his advice was sought by leading men. In 1535 he corresponded with Francis I. as to the possibility of a reconciliation between the Catholic and Protestant creeds; and in 1568 Maximilian II. sent for him to Vienna to consult him on the same subject. He translated into Latin Herodotus, Demosthenes, Xenophon, Homer, Theocritus, Sophocles, Lucian, Theodoretus, Nicephorus, and other Greek writers. He published upwards of 150 works, including a *Catalogue of the Bishops of the Principal Sees; Greek Epistles; Accounts of his Journeys*, in Latin verse; a commentary on Plautus; a treatise on Numismatics; *Euclid* in Latin; and the Lives of Helius Eobanus Hessus, George of Anhalt, and Philip Melanchthon. His *Epistolae Familiares* (published after his death) are a valuable contribution to the history of his time.

See article by A. Horawitz in *Allgemeine deutsche Biographie;* C. Bursian, *Die Geschichte der klassischen Philologie in Deutschland* (1883); J. E. Sandys, *Hist. Class. Schol.* (ed. 1908), ii. 206.

CAMERARIUS, RUDOLF JAKOB (1665–1721), German botanist and physician, was born in Tübingen on Feb. 12, 1665, and died there on Sept. 11, 1721. He became professor of medicine and director of the botanical gardens at Tübingen in 1687. He is chiefly known for his investigations on the reproductive organs of plants (*De sexu plantarum epistola,* 1694).

CAMERINO (anc. *Camerinum*), a city and episcopal see (since A.D. 465, if not earlier; Treia is now combined with it) of the Marches, Italy, in the province of Macerata, 6 mi. S. of the railway station of Castelraimondo (to which there is an electric tramway) which is 24 mi. W. of Macerata; 2,148 ft. above sea-level. Pop. (1936) 4,269 (town); 12,012 (commune). The cathedral is modern, the older building having fallen in 1799; the church of S. Venanzo suffered similarly, but preserves a portal of the 15th century. The citadel dates from 1502. There is a small university (about 500 students). Camerino occupies the site of the ancient Camerinum, the inhabitants of which (*Camertes Umbri*) became allies of the Romans in 310 B.C.

CAMERON, DONALD: *see* CAMERON OF LOCHIEL.

CAMERON, IRVING HEWARD (1855–1933), Canadian surgeon, son of Sir Matthew Crooks Cameron, one-time Chief Justice of the Common Pleas, was born in Toronto on July 17, 1855. He was educated at Upper Canada college and the University of Toronto of which he was Emeritus professor of Surgery. He founded and edited the *Canadian Journal of Medical Sciences*, and was formerly president of the Canadian Medical Association. He held honorary fellowships of the Royal College of Surgeons (Edinburgh, Ireland and England) and was an honorary LL.D. of Edinburgh university.

CAMERON, JOHN (*c.* 1579–1625), Scottish theologian, born at Glasgow about 1579, received his early education in his native city. After having taught Greek in the university for 12 months, he went to France, where he lectured at Bordeaux and Sedan. He then travelled in Germany and Switzerland with the sons of Calignon, chancellor of Navarre, and in 1618, was appointed professor of divinity at Saumur, the principal seminary of the French Protestants.

In 1620 the civil troubles in France drove Cameron to England. In 1622 the king appointed him principal of the University of Glasgow in the room of Robert Boyd. Cameron was prepared to accept Episcopacy, and was cordially disliked for his adherence to the doctrine of passive obedience. He resigned his office in less than a year.

He returned to France, and there again made many enemies by his doctrine of passive obedience. He was stabbed in the street at Montauban in 1625, and died of the wound. His collected works, which were written some in French, some in Latin, were collected (in Latin) and published at Geneva in 1642, with a memoir by Cappel.

Cameron has a distinct place in the development of Calvinistic theology. He and his followers maintained that the will of man is determined by the practical judgment of the mind; that the cause of men's doing good or evil proceeds from the knowledge which God infuses into them; and that God does not move the will physically, but only morally, by virtue of its dependence on the judgment of the mind. This peculiar doctrine of grace and free-will was adopted by Amyraut, Cappel, Bochart, Daillé and others of the more learned among the Reformed ministers, who dissented from Calvin's. The Cameronites (not to be confused with the Scottish sect called Cameronians) are moderate Calvinists, and approach to the opinion of the Arminians. They are also called Universalists, as holding the universal reference of Christ's death; and sometimes Amyraldists.

CAMERON, RICHARD (1648?–1680), founder of a Scottish religious sect of Cameronians, which formed the nucleus of the regiment of this name in the British army, was born at Falkland, Fife. He was the schoolmaster of his native village and then chaplain and tutor in the house of a Sir W. Scott of Harden. He was licensed as a field-preacher, and moved great crowds by his eloquence. With many others he sought refuge for a time in Holland, returning in 1680. He gathered together a small band of recalcitrants, among them David Cargill and Thomas Douglas, who issued the Sanquhar Declaration, calling for war against Charles II. and the exclusion of James, duke of York from the succession. A price was placed on the heads of Cameron and his chief supporters. On July 22, 1680, Cameron was slain in a skirmish at the Aird's, or Airs, Moss, fighting bravely at the head of the few troops which he had been able to collect. His prayer before going into battle became a tradition—"Lord spare the green and take the ripe." After the accession of William III. the survivors were amnestied, and the Cameronian regiment was formed from them.

See Herzog-Hauck, *Realencyklopädie* (1897), *s.v.* "Cameronianer"; Herkless, *Richard Cameron* (1897).

CAMERON, SIMON (1799–1889), American politician, was born in Lancaster county, Pa., on March 8, 1799. Left an orphan at the age of nine, he early entered journalism, and, in banking and railway enterprises, accumulated a considerable fortune. He became influential in Pennsylvania politics, and in 1845–49 served in the U.S. Senate, being elected by a combination of Democratic, Whig and "American" votes. In 1854 he became a leader of the "People's Party," as the Republican Party was at first called in Pennsylvania. In 1857 he was elected to the U.S. Senate as a Republican. His prominence as a candidate for the presidential nomination in the Republican national convention of 1860 led to his being selected by President Lincoln as secretary of war. His administration of this office at a critical time was marked by his accustomed energy, but unfortunately also by partiality in the letting of Government contracts, which brought about his resignation at Lincoln's request in Jan. 1862 and his subsequent censure by the House of Representatives. He again served in the Senate from 1867 until 1877, when he resigned to make room for his son, whose election he dictated. Cameron was one of the ablest political organizers the U.S.A. has ever known, and his long undisputed control of Pennsylvania politics was one of the most striking examples of "boss rule" in American history. The definition of an honest politician as "one who when he is bought will stay bought" has been attributed to him. He died on June 26, 1889.

His son JAMES DONALD CAMERON (1833–1918) was born at Middletown, Pa., on May 14, 1833, graduated at Princeton in 1852, and became actively interested in his father's banking and railway enterprises. Trained in the political school of his father, he developed into an astute politician. From June 1876 to March 1877 he was secretary of war in President Grant's cabinet. In the Republican national convention of 1876 he took an influential part in preventing the nomination of James G. Blaine, and later was one of those who directed the policy of the Republicans in the struggle for the presidency between Tilden and Hayes. From 1877 until 1897 he was a member of the U.S. Senate. He died on Aug. 30, 1918.

CAMERON, VERNEY LOVETT (1844–1894), British traveller in central Africa, was born at Radipole, near Weymouth, Dorsetshire, on July 1, 1844. He entered the navy in 1857, served in the Abyssinian campaign of 1868, and was employed for a considerable time in the suppression of the East African slave trade. He was selected to command an expedition sent by the Royal Geographical Society in 1873, to succour Dr. Livingstone and to make independent explorations. Not long after the expedition left Zanzibar, Livingstone's servants were met bearing the dead body of their master. Cameron's two European companions turned back, but he continued his march and reached Ujiji, on Lake Tanganyika, in Feb. 1874, where he found and sent to England Livingstone's papers. Cameron spent some time determining the true form of the south part of the lake, and solved the question of its outlet by the discovery of the Lukuga river. From Tanganyika he struck westward to Nyangwe, the Arab town on the Lualaba previously visited by Livingstone. This river Cameron rightly believed to be the main stream of the Congo, and could not procure canoes to follow it down, owing to his refusal to countenance slavery. He therefore turned south-west. After tracing the Congo-Zambezi watershed for hundreds of miles he reached Bihe and finally arrived at the coast on Nov. 28, 1875, being the first European to cross equatorial Africa from sea to sea. His book *Across Africa* (1877) contains valuable suggestions for the opening up of the continent, including the utilization of the great lakes as a "Cape to Cairo" connection. In recognition of his work he was promoted to the rank of commander, made a C.B., and received the gold medal of the Geographical Society. Cameron visited the Euphrates valley in 1878–1879, and accompanied Sir R. G. Burton in his West African journey of 1882, and was joint author with Burton of *To the Gold Coast for Gold* (1883). He was killed, near Leighton Buzzard (Bedford) by a fall from horseback on March 24, 1894.

A summary of Cameron's great journey, from his own pen, appears in Dr. Robert Brown's *The Story of Africa*, vol. ii. pp. 266–279 (1893).

CAMERON OF LOCHIEL, SIR EWEN (1629–1719), Scottish highland chieftain, passed part of his youth with the marquess of Argyll at Inverary, leaving his guardian about 1647 to succeed his grandfather as chief of the clan Cameron. In 1653 Lochiel joined the earl of Glencairn in his rising on behalf of Charles II. In July 1689 he was with Viscount Dundee at Killiecrankie. He was too old to share personally in the Jacobite rising of 1715, but his sympathies were with the Stuarts, and his son led the Camerons at Sheriffmuir. Lochiel, who died in Feb. 1719, is called by Macaulay the "Ulysses of the Highlands." He is said to have killed the last wolf in Scotland. An incident showing his strength and ferocity in single combat is used by Sir Walter Scott in *The Lady of the Lake* (canto v.). Lochiel's son and successor, John, who was attainted for sharing in the rebellion of 1715, died in Flanders in 1748. John's son Donald, sometimes called "gentle Lochiel," was wounded at Culloden, and escaped to France, dying in the same year as his father. The 79th regiment, or Cameron Highlanders, was raised from among the members of the clan in 1793 by Sir Alan Cameron (1753–1828).

See Memoirs of *Sir Ewen Cameron of Lochiel* (Bannatyne Club, 1842).

CAMERON, a city in the cotton region of central Texas, U.S.A., on federal highways 77 and 190; served by the Santa Fe and the Southern Pacific railways; the county seat of Milam county. Pop. in 1930, 4,565; in 1940, 5,040. It is on the edge of an oil field, and has an oil refinery, cotton gins and compresses, cottonseed-oil mills and other manufacturing industries.

CAMERONIANS, the name given to that section of the Scottish Covenanters (*q.v.*) who followed Richard Cameron (*q.v.*), and were devoted to the covenanting faith and the maintenance of the Presbyterian form of public worship. Refusing to take the oaths of allegiance to an "uncovenanted" ruler, or to exercise any civil function, they passed through a period of trial and found some difficulty in maintaining a regular ministry; but in 1706 they were reinforced by some converts from the established church, and in 1743 their first presbytery was constituted at Braehead, when they took the official title of Reformed Presbyterians. In 1863 the Cameronians, or Reformed Presbyterians, decided to inflict no penalties upon those members who had taken the oaths, or had exercised civil functions, and consequently a few congregations seceded. In 1876 the general body of the Reformed Presbyterians united with the Free Church of Scotland, leaving the few seceding congregations as the representatives of the principles of the Cameronians. In the British army the first battalion of the Cameronians (Scottish Rifles) is directly descended from the "Cameronian guard," which, composed of Cameronians, was embodied by the convention parliament in 1689, and was employed to restore order in the Highlands.

See J. H. Burton, *History of Scotland*, vols. vii. and viii. (Edinburgh, 1905); A. Lang, *History of Scotland*, vol. iv. (Edinburgh, 1907); Herkless, art. "Covenanters" in Hastings' *Encyclopaedia of Religion and Ethics*, vol. iv.

CAMEROONS, a region of West Africa, bounded west by the Atlantic, northwest by Nigeria, north by Lake Chad, south and east by French Equatorial Africa, and for a short distance southwest by Spanish Guinea; area about 197,000 sq.mi. The coast line begins at the great bend of Africa from east to south forming the Bight of Biafra and has a length of 220 mi. Its chief indentation is the large bay or estuary named by its Portuguese discoverers Rio das Camarões (river of prawns); hence the Cameroons in English usage; French, Cameroun; and German, Kamerun. From 1884 to 1919 it was a German protectorate. By the treaty of Versailles Germany relinquished sovereignty, a mandate to administer the country being given to France and Great Britain.

Physical Features.—The greater part of the south and centre of the country is a plateau with a general elevation of 2,000 ft., higher towards the west, where it descends in steps to the narrow coast belt, and to the southeast falling in terraces to the Congo basin. North and northwest the plateau is bounded by rugged, broken mountains, which stretch across the country in the form of an arc; north of them is the hilly region of Adamawa, traversed by the valley of the upper Benue (the great tributary of the Niger); and north again, beyond the Benue valley, are on the west the Mandara mountains (4,000 ft.) and the alluvial plains (800 to 1,000 ft.) which lead to Lake Chad and once formed part of its bed.

At the western end of the arc-like mountain ranges, but isolated, rises Mt. Cameroon, an active volcano. Its base covers 700 to 800 sq.mi. It has two well-defined peaks, Great Cameroon (13,370 ft.), in which are a number of craters, and Little Cameroon (5,820 ft.), from bottom to top covered with dense forest. Alone of the great mountains of Africa, Cameroon lies by the sea; its southwestern base is washed by the Atlantic. From any point of vantage, but especially from the sea, it presents a magnificent spectacle, while some 30 mi. westward Clarence peak, the highest point of Fernando Po island, rises from the ocean. Mt. Cameroon was in eruption in 1909 and again in 1922; its western side is one of the rainiest regions in the world, with 400 to 430 in. in the year. The Cameroons estuary, bay or river—all three terms are used—lies immediately south of the mountain. The estuary is 20 mi. wide; into it flow several rivers, the chief being the Mungo and Wuri. The largest of the rivers, the Sanaga (known in its upper course as the Lom) and the Nyong, rising in the central plateau, flow direct to the Atlantic, entering the ocean south of the estuary. These and other streams have their headwaters in the Jade massif, in the northeast of the plateau, where also rise the Logone and other rivers that flow north to the Shari (Lake Chad basin), as well as rivers which flow southeast to the Sanga, an affluent of the Congo. Thus the Cameroons has four distinct river systems. It is noteworthy that there is a connection between the Niger and Chad systems. From a marshy lake in Adamawa called Tubari there issues at its western end a tributary of the Benue and from its eastern end a tributary of the Logone.

Climate.—The Cameroons has a typically tropical climate and is unsuited for settlement by Europeans. Temperature everywhere is high, not being below 70° over the greater part of the country in the cool months, while it rises in the hot season to over 90° in the Lake Chad basin. The daily variation is fairly marked, especially in the central plateau, in some parts of which it is as low as 66° in the warmest month (April) and no higher than 62° in the coolest (August). With the sun in the south there is in the early part of the year a dry, cool, dust-laden wind from the Sahara; by July, when the sun is over the Sahara, the wind blows from the south, mainly southwesterly, rain-laden sea winds. Rain falls usually in every month of the year (except in the far north), chiefly in the second half; it is heaviest on the coast—155 in. yearly at Duala; is less on the plateau (Yaunde, 62 in.), and in parts of the Chad basin sinks to 18 to 13 in. In the south there are two wet and two dry seasons in the year. The special conditions on Mt. Cameroon have already been noted. Large areas of the country are malaria ridden, but malaria ceases above a height of 4,000 ft.

Flora and Fauna.—Very large areas both of plateau and mountain are covered by primeval forest with trees 200 and 250 ft. high, their trunks covered with parasitic growths, such as orchids and arums. In the north there are wide stretches of open savannahs; all the creeks and swamps are lined with mangroves and behind is dense jungle. The swamps are often rendered beautiful by the enormous red-purple Lissochilus orchid, which rises 10 to 15 ft. above the water. Part of the coast belt is grass-covered. The forest trees include mahogany, ebony, teak and other valuable timber, the *Funtumia elastic* (rubber tree) and the *Landolphia* (rubber vine), the kola tree, the bamboo palm and oil palm, the last named being very abundant. The coffee shrub and cotton plant (in the far north) are found wild, and there are fibre yielding plants such as *ceiba pentandra.* In the north there are gum-producing acacias. Tree ferns of great beauty are characteristic of the middle belt (4,000 to 7,000 ft) of Mt. Cameroon. Bananas are cultivated, and rice, maize, plantains, yams and cassava are native food crops.

Among the animals the gorilla and chimpanzee are notable. The carnivora include the lion and leopard, and large rodents like the porcupine and cane rat are very common. There are several species of venomous snakes. Large herds of antelope are found in the plains and the elephant, though now little seen in the Cameroons estuary region, still inhabits many districts. Buffalo live in the forests; ostriches are found in the Lake Chad region; and cattle and horses are reared in the north and centre. South of the Sanaga river the tsetse fly is common; and mosquitoes are abundant in all the river valleys, among the species being *glossina*, the carrier of sleeping sickness. Bees are found in most regions and the collection of honey is a regular industry.

Population.—Among the natives of the Cameroons, two main groups may be distinguished: the Bantu- and Sudan-speaking peoples. The former occupy the southern and central part of the country, while the latter inhabit the north. The Bantu, which form the bulk of the population, are divided into four ethnic groups, the Maka, Bakoko, Bakundu and the Fang (or Pangwe). The first three appear to be aboriginal, whereas the Fang invaded the Cameroons at the beginning of the 19th century. The Duala, inhabitants of the region around the town of Duala, and the Bakwiri are tribes belonging to the Bakoko group. Among the Fang such tribes as the Yaunde and Bule are noteworthy. The Sudan-speaking peoples are composed of numerous tribes, many of which are limited to the extent of a village. Most prominent among this group are the Tikar, Bamum, Wute, Bafut, Bali, Bafia, Baya. The oldest inhabitants of the Cameroons are the pygmies, inhabiting the forests of the Sanga river; they are known as Bagielli and Babinga.

Northern Cameroon has been invaded by Fulani, Hausa, Kanuri, and Arabs, known as Shua. During the 18th and 19th centuries Moslem Fulani conquered large sections of the country, forcing the non-Moslem Sudan tribes into submission, and establishing large states of which Adamawa (*q.v.*) was the most important. Not all Fulani became conquerors; some, such as the Bororo, came into northern Cameroon in search of grazing land for their cattle, and lived peacefully among the Sudanic peoples. Hausa and Kanuri form the class of merchants, living either in separate villages or in special quarters of the villages of others.

British Cameroons.—The area under British mandate covers 34,081 sq.mi. with a pop. (1938) of 857,227 Africans and 448 Europeans. It is a narrow strip extending along Nigeria's eastern border from the sea to Lake Chad, broken near Yola by a gap of about 40 mi. The territory consists of four parts which are, from south to north, Cameroons province, Kentu district, Adamawa district and Dikwa division. These different sections, which follow ethnic lines, are administered as part of the adjoining Nigerian provinces. Although the administrative union between Nigeria and the mandated areas is close, care has been taken to observe the mandate principle. Almost half of the mandate's area and more than half of its population is organized as the Cameroons province, administered by a resident (headquarters at Buea), who is directly responsible to the governor of Nigeria. The three small northern areas are more directly administered as subdivisions of the provinces of northern Nigeria. The Kentu district under a district officer forms part of the Wukari division (Benue province); the Adamawa district (separated by the Yola gap) is linked to the Adamawa emirate (Adamawa province); the Dikwa division is incorporated into Bornu emirate (Bornu province). In 1939 the British system of indirect rule, as applied in Nigeria, was introduced throughout the mandate with the exception of a small area in the Bameda division of the Cameroons province. The Adamawa and Dikwa regions were completely absorbed in the native emirates of Nigeria from which artificially drawn boundaries had formerly separated them. When in May 1937 the ruler (Shehu by title) of Bornu died, the Shehu of Dikwa was selected to succeed him.

Although the mandate is primarily administered in the interest of the native population, in the Victoria and Kumba divisions of the Cameroons province, particularly on the slopes of Mt. Cameroon, 523 sq.mi. of land were held by plantation companies in 1938. These companies, which are managed by Europeans, came into existence during the German period. During World War I, they were taken into the custody of the British government and sold by auction in London in 1924; many of the purchasers were Germans. Before the outbreak of World War II more than half of the European population was German. The plantations were responsible for the greatest part of Cameroons' export. The total export and import of the mandate cannot be listed, since the northern areas are completely in the economic orbit of Nigeria and a great deal of the native products of the Cameroons province is traded unchecked across the borders into Nigeria and French Cameroons. In 1938 the mandate's export which left via the ports of Victoria and Tiko amounted to £426,030, of which 82% went to Germany and only 7% to the United Kingdom. Bananas (dried and fresh) made up the chief export totalling 55,843 short tons and representing 68% of the total in value. Cocoa, rubber, palm oil and timber were of minor importance in the country's export. The imports via the same ports, were valued in 1938 as £296,520. Kerosene and cotton piece goods ranked first among the import articles.

Transportation in the north is less developed than in the south In 1939 there were 185 mi of motorable roads in addition to 400 usable miles during the dry season.

The northern territories are almost without educational facilities. The Adamawa district had one mission school but in 1930 one government school was opened. Cameroons province was better serviced. In 1938 there were 41 schools assisted by the government and some 215 non-assisted schools with a total enrolment of *c.* 10,000, or about 11% of children of school age; but the education offered in most of these schools was inadequate due to irregularity in attendance.

French Cameroons.—The area under French mandate is 162,892 sq mi. Pop. (1936 census) 2,389,489 (2,383 Europeans). Estimated pop. (1942) 2,606,273, excluding 3,227 Europeans, many of whom lived in Duala (pop 36,040 in 1944 [1,197 Europeans]), chief seaport and commercial centre of the country. The administration centre is Yaunde (Duala before 1921), a growing town (pop. 18,754 in 1944 [754 Europeans]) on the central plateau

In March 1921 the mandate, which had been closely affiliated with French West Africa since 1916, received political and financial autonomy under a commissioner of the French republic. He is nominally responsible to the French government, but, as a member of the administrative council of French Equatorial Africa, he is in close co-operation with that region. When French Cameroons joined the Free French movement of General de Gaulle on Aug. 27, 1940, the mandate's administration came more directly under the supervision of French Equatorial Africa. Since 1935 French Cameroons has been divided into 17 *régions* and 46 subdivisions. The native administration follows the French pattern of direct rule, but in each region exists a native council of native notables who are associated with administrative affairs. There are also native advisory committees on agriculture and public health.

The mandate's economy, which is based on agriculture and the exploitation of the forests, is largely in the hands of Africans; only small areas of land are cultivated by Europeans (*c.* 50,000 ac. in 1935). While the European estates primarily grow coffee and bananas, Africans produce, aside from their staples (such as millet), cocoa, coffee, palm oil. palm kernel and groundnuts for export. Of the total exports, amounting to 252,000,000 francs in 1938 (170,000,000 in 1929), the cocoa export was valued at 85,000,000 francs (36,000,000 francs in 1929). The mineral resources are still unknown; in 1938 small quantities of gold, tin and titanium ore were mined. Imports, mostly cotton and metal goods, amounted to 215,000,000 francs in 1938.

The transportation system has been improved since French control was introduced. During the German era two metre-gauge railway lines existed: the North Line from Banabéri (near Duala) to N'kongsamba (160 km.) and the Central Line from Duala to Esaka (181 km.). The French extended this line to Yaunde (127 km.) in 1927. The road system which was only 430 km. in 1922, had increased to almost 6,000 km. in 1937, most of it all-weather motor road connecting French Cameroons with the road system of French Equatorial Africa. Duala, the chief port, has a quay (18 ft. on bar on high water) which can accommodate three 15,000 ton ships simultaneously. The railroad runs right to the wharf. In 1938, 683 ships with a net tonnage of 164,000 tons cleared the harbour. The harbour of Kribi is of secondary importance only. In education and public health great improvements have been made since 1921. In 1939 French Cameroons had more than 3,000 elementary schools, most of them missionary schools, of which only 165 were fully or partially state-supported. Only 113,000 pupils (14% of the school-age group) attended school irregularly. There were only 1 high school at Yaunde and 2 domestic science schools in 1939.

HISTORY

The Cameroon estuary and the neighbouring coast were discovered towards the end of the 15th century by the Portuguese navigator Fernando Po. Not until the 17th century were European trading stations, called factories, established. The Duala and other coast tribes, who would not allow strangers to go inland, took goods on trust from the white merchants and bartered them with the forest tribes for ivory, rubber, and other produce—including slaves. This trust system worked well and continued until the German occupation of the country, when inland traders were allowed to come to the coast. Meanwhile the Duala, keen business men, had prospered and the "kings" of Akwa and Bell, the chief trading stations, were wealthy merchant princes. By the end of the 18th century the coast region had come politically under British influence and in 1837 the king of Bimbia made over a large part of the country round the estuary to Great Britain. No advantage appears to have been taken of this cession, but in 1845 British missionaries made a settlement in the estuary, at a time when there was still a flourishing trade in slaves between the Cameroons and America. In the year named, Alfred Saker (1814–80), of the Baptist Missionary society, obtained from the Akwa family the site of a mission station. Saker, whose headquarters were then on the island of Fernando Po, established another mission station at Bimbia in 1848. When in 1858 the Baptists were expelled from Fernando Po a colony of freed Negroes who then left the island was founded in Ambas bay, Saker naming the settlement Victoria. It was two years later that Messrs. Woermann, of Hamburg, established the first German factory in the estuary. Saker reduced the Duala language to writing and before he left the Cameroons in 1876 witnessed the final suppression of the oversea slave trade.

Although the British consul for the Oil Rivers during this period exercised a good deal of authority over the native chiefs, requests made by them—in particular by the Duala chiefs in 1882—for annexation by Great Britain were refused or neglected, with the result that when Germany started on her quest to pick up unappropriated parts of the African coast she was enabled to secure the Cameroons. A treaty with King Bell was negotiated by Dr. Gustav Nachtigal, the signature of the king and the other chiefs being obtained at midnight on July 15, 1884. Five days later E. H. Hewett, British consul, arrived with a mission to annex the country to Great Britain.[1] Though too late to secure King Bell's territory Mr. Hewett concluded treaties with all the neighbouring chiefs, but the British government decided to recognize the German claim not only to Bell town, but to the whole Cameroons region, which the Germans named Kamerun. Subsequent agreements with Great Britain and France gave the newly acquired territory an extension inland to Lake Chad, including parts of the Fulani states of Adamawa and Bornu. The Baptist settlement at Victoria, at first excluded from the German protectorate, passed to Germany in March 1887.

The extension of German authority inland was gradual and was not effected without severe opposition and a number of revolts. The shores of Lake Chad were first reached by a German military force on May 2, 1902. In the northern regions, with their strong Moslem and non-Negro elements, the Germans allowed the native chiefs to retain a good deal of authority. Most attention was paid to the development of the coast district around Mt. Cameroon, where many plantations were worked, and to the exploitation of the riches of the forests. Following risings in various districts in 1904 and 1905, the then governor, Herr von Puttkamer, was recalled in 1906. Administrative methods afterwards improved, to the benefit of the natives and of the plantations.

In 1912, 54,000 ac. were under plantation cultivation; of this total, 26,000 ac. were devoted to cocoa and 17,000 to rubber. Rubber, palm kernels, and palm oil, cocoa, and ivory were the chief exports, which in 1913, the last full year of German control, were valued at about £1,200,000. Rubber shipments were about half the total value of the exports. In 1943, however, exports were valued at $9,400,000 and imports $7,450,000.

In return for recognizing France's protectorate over Morocco in 1911, the Cameroons received additions of 107,000 sq.mi. of French Equatorial Africa (*q.v.*), bringing German territory to he Congo and Ubangi rivers. This territory, called New Cameroon, was returned to French Equatorial Africa by the Treaty of Versailles in 1919 (article 125).

During World War I British and French troops conquered he Cameroons and in 1916, after the German forces had been lefeated, France and Great Britain agreed upon a temporary livisioning of the territory, which gave the former about nineenths of the territory, whereas the section adjoining Nigeria ame under British control. In July 1919 the Cameroons was ormally divided by the London declaration signed by Great Britain and France. After the Treaty of Versailles established he Cameroons as a mandate, on July 20, 1922, the League of Nations conferred the mandate upon the two countries for the two egions upon which they had previously agreed. Until 1939 the French and British governments sent annual reports concerning he mandates to the League of Nations regarding the administration of their respective territories. These reports, as well as onditions in the mandate, are scrutinized by the Permanent Mandates Commission of the League of Nations. All mandates are required to observe the open door trade policy for league mbers. The same economic rights were secured for the United States by agreements of 1923.

Bibliography.—H. Meyer, *Das deutsche Kolonialreich* (1909); K. Ritter, *Neukamerun* (1912); E. M. Saker, *Alfred Saker, the pioneer of the Cameroons* (1929); F. J. Moberley, *Military Operations, Togoland and the Cameroons, 1914–16* (1931); R. Susset, *La vérité sur le Cameroun et l'Afrique Equatorial Française* (1934); H. Labouret, *Le Cameroun* (1937); R. Schober, *Kamerun* (1937); H. R. Rudin, *Germans in the Cameroons 1884–1914* (1938); *see* also Annual Reports to the League of Nations. (F. R. C.; H. A. Wf.)

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[1] On July 26 a French gunboat also entered the estuary on a belated annexation mission.

CAMEROONS, OPERATIONS IN. The German forces in the Protectorate at the outbreak of World War I were commanded by Colonel Zimmerman, an able and resolute soldier, and consisted of approximately 200 Europeans and 1,550 natives in the military force and 40 Europeans and 1,255 natives in the police force. Some hundreds of settlers were available, as were a number of sailors from ships which made for the Cameroons estuary when war was declared. Considerable numbers of natives were trained as *askaris* during the campaign, and to some extent local levies co-operated, though the natives generally were hostile to their German masters. These forces were scattered, the main portion of them being about Duala, the chief port.

The offensive was initiated by the Allies. Bonga and Singa, the most advanced enemy posts in the two salients, were captured by the French on Aug. 6 and 7, 1914, a German offensive being thus forestalled. Two French columns were then despatched: the on (Hutin) north along the Sanga, with Lomie as its objective, the other (Morrison) moving west on Dume from Singa along the Lobaye. These enemy posts were in the centre of the Cameroons On Sept. 21 General Largeau in the north occupied Kuseri in the Lake Chad region.

British Movements.—Meanwhile British forces had move from Nigeria, and a column under Captain Fox crossed the fron tier on Aug. 25, and unsuccessfully attacked Mora, a hill post i the north A French column (Brisset), sent to co-operate wit Fox, occupied Marua south of Mora on Dec. 12, with the resul that the Lake Chad region was cleared of the enemy, except th garrison of Mora, which gallantly held out through all the campaign, surrendering upon terms at its conclusion.

Two other British columns invaded the Cameroons on Aug. 2 only to meet with repulse.

Anglo-French Offensive.—About the middle of Septembe an Anglo-French expeditionary force, 4,300 strong, formed i equal proportions from British and French negro troops, and unde the British commander-in-chief, General Dobell, embarked a different ports, and, forcing the barrier at Duala, bombarded that port on Sept. 26. On the surrender of the port on the following day 400 Germans and 30,915 tons of shipping were captured Colonel Zimmerman withdrew to Edea, 40m. to the south-east Three columns were at once directed in pursuit of the enemy a Edea which, after continuous opposition, was occupied on Oct 26. A French garrison under Colonel Mayer was installed at Edea the German commander-in-chief having retired to Yaunde, 100m east, on a plateau beyond the forest belt.

Mayer, owing to the weakness of his force, being condemned to passive defence, the British forces proceeded to clear the country between the Cameroons estuary and Nigeria. By the end of 1914 the whole of the northern railway and Buea, the enemy administrative capital, had been occupied. On Jan. 5, 1915, Maye beat off an attack on Edea with heavy loss to the attackers. Else where the Allied offensive had almost ceased, Hutin's column alone had made some progress, and he had been joined by a small Belgian contingent. Reorganization was effected and Brig.-Gen. Cun liffe was appointed to command the Allied troops in the north where the enemy was taking the offensive. Reinforcements reached Gen. Dobell at Duala in February.

A concentric advance upon Yaunde was decided upon, but was begun prematurely, largely in consequence of the usual difficulties which beset allies who endeavour to co-operate for the first time. The force was strongly opposed in the dense bush and when Yaunde was still 40m. distant, dysentery became rife, leading to a withdrawal to the Edea district. On the same date, however, June 28, Cunliffe occupied Ngaundere, some 300m. north-east of Yaunde. Here, simultaneously with the withdrawal to Edea, a halt was called. Hutin occupied Lomie—150m. south-south-east of Yaunde—on June 25 and Morrison took Dume a month later.

The general Allied offensive was resumed, and by early October General Dobell was moving in from the west, Cunliffe from the north and Hutin and Morrison from the east. The maximum Allied strength, about 15,000, was now disposed against the enemy, whose forces were estimated at 10,000 (inclusive of 700 Europeans). The opposition was, as before, vigorous and protracted. The British force emerged first from the forest belt and on Dec. 7 were at Mangas in open country and about 50m. west of aunde. On Dec. 21 the French column, which had had severe ghting and many casualties, reached Mangele's 20m. south-east f Mangas. The British troops were instructed not to await the rench arrival at Mangele's, and accordingly pushed straight on or Yaunde, which Colonel Gorges entered unopposed on Jan. , 1916.

Conclusion of the Campaign.—From Dec. 22 opposition by the enemy had ceased. Colonel Zimmerman, as soon as he knew that the Allied columns were clear of the forest, decided to give up the contest. He evacuated Yaunde and, together with the governor and 823 Germans, including civilians and his troops and carriers, headed south-west for Spanish Guinea, of which the nearest point was 125m. distant. He was pursued, but although forced to fight a rear-guard action on Jan. 8, he eluded the columns which had been sent to the borders of Spanish Guinea and were waiting to bar his entry into neutral territory. The first part of his forces, quickly followed by the rest, entered Spanish territory on Feb. 4 and with the surrender of the gallant garrison at Mora on Feb. 18, the conquest of the Cameroons was complete.

See E. Dane, *British Campaigns in Africa* (1919); H. C. O'Neill, *The War in Africa* (1919); Maj.-Gen. Sir C. Dobell, *The Campaign in the Cameroons, 1914–16* (1922).

CAMILING, a municipality (with administrative centre and 44 *barrios* or districts) in the northwest part of the province of Tarlac, Luzon, Philippine Islands, on the Camiling river, about 80 mi. N.N.W. of Manila. Pop. (1939) 25,824, of whom 12,296 were males, and 5 were whites. The surrounding country produces palay (rice), maize (corn) and sugar, and the forests contain valuable timber. Of those inhabitants aged 6 to 19, inclusive, 41·9% attended school, and of those 10 years old and over 56·5% was literate. The vernacular is Pampango.

CAMILLUS, MARCUS FURIUS, Roman soldier and statesman, of patrician descent, censor in 403 B.C. He triumphed four times, was five times dictator, and was honoured with the title of Second Founder of Rome. Mommsen sums up his place in history by describing him as one who "first opened up to his fellow-countrymen the brilliant and perilous career of foreign conquest." When accused of having unfairly distributed the spoil taken at Veii, which was captured by him after a ten years' siege, he went into voluntary exile at Ardea. Subsequently the Romans, when besieged by the Gauls, created him dictator, he completely defeated the enemy (*see* BRENNUS and ROME: *Ancient History*). He afterwards fought successfully against the Aequi, Volsci, and Etruscans and repelled a fresh invasion of the Gauls in 367. Though patrician in sympathy, he saw the necessity of making concessions to the plebeians and was instrumental in passing the Licinian laws, 367 B.C. (*see* PATRICIANS). He died of the plague in 365. The story of Camillus is no doubt largely traditional.

See Livy, v. 10, vi. 4; Plutarch, *Camillus*. For the Gallic retreat, *see* Polybius ii. 18; T. Mommsen *History of Rome* (trans. Dickson, 1901) ii. chap. iv.

CAMISARDS, the name given to the Protestant peasantry of the Cévennes who, from 1702 to 1705, and for some years afterwards, carried on an organized military resistance to the revocation of the Edict of Nantes. The Camisards (from *camisade*, obs. Fr. for "a night attack," from the Ital. *camiciata*, formed from *camicia*, a shirt, from the shirt being worn over the armour to distinguish friends from foes), were also called Barbets ("water-dogs," a term also applied to the Waldenses), Vagabonds, Assemblers, Fanatics and the Children of God. They belonged to that romance-speaking people who made the South of France the most fertile nursing ground of mediaeval heresy (*see* CATHARS and ALBIGENSES). At the time of the Reformation the same causes produced like results.

In 1686 Pierre Jurieu published his work *L'Accomplissement des prophéties*, in which, speaking of the Apocalypse, he predicted the end of the persecution of the Huguenots and the fall of Babylon (that is to say of Roman Catholicism) for 1689. The revolution in England seemed to provide a striking corroboration of his prophecies, and the apocalyptic enthusiasm took so strong a hold on people's minds that Bossuet felt compelled to refute Jurieu's arguments in his *Apocalypse expliquée*, published in 1689. The *Lettres pastorales* of Jurieu (Rotterdam, 1686–87), a series of brief tracts which were secretly circulated in France, continued to narrate events and prodigies in which the author saw the intervention of God, and thus strengthened the courage of his adherents. This religious enthusiasm, under the influence of Du Serre, was manifested for the first time in the Dauphiné. Du Serre, who was a pupil of Jurieu, communicated his mystic faith to young children who were called the "petits prophètes," and went from village to village quoting the most obscure and terrible predictions.

The assassination of the Abbé du Chayla on July 23, 1702, at Ponte de Monvert, marks the beginning of the war of the Cévennes. The abbé, a veteran Catholic missionary from Siam, had been appointed inspector of missions in the Cévennes, where he introduced the "squeezers" (which resembled the Scottish "boot"). His murder was planned by Esprit Séguier, who at once began to carry out his idea of a general massacre of the Catholic priests. He soon fell, and was succeeded by Laporte, an old soldier, who, as his troop increased, assumed the title of "the colonel of the children of God," and named his camp the "camp of the Eternal." He used to lead his followers to the fight singing Clement Marot's grand version of the 68th Psalm, "Que Dieu se montre seulement," to the music of Goudimel. The movement was essentially a popular one; there were no noblemen among its leaders. Besides Laporte, the forest-ranger Castanet, the wool-carders Conderc and Mazel, the soldiers Catinat, Joany and Ravenel were selected as captains—all men whom the *théomanie* or prophetic malady had visited. The most important figures are those of Roland, who afterwards issued the following despatch to the inhabitants of St. André, "Nous, Comte et Seigneur Roland, généralissime des Protestants de France, nous ordonnons que vous ayez à congédier dans trois jours tous les prêtres et missionnaires qui sont chez vous, sous peine d'être brûlés tout vifs, vous et eux" (Court, i. p. 219); and Jean Cavalier, the baker's boy, who, at the age of 17, commanded the southern army of the Camisards, and who, after defeating successively the Comte de Broglie, Montrevel, Berwick and Villars, made an honourable peace. (*See* Cavalier, Jean.)

Cavalier for nearly two years continued to direct the war. Regular taxes were raised, arsenals were formed in the great limestone caves of the district, the Catholic churches and their decorations were burned and the clergy driven away. Occasionally routed in regular engagements, the Camisards, through their desperate valour and the rapidity of their movements, were constantly successful in skirmishes, night attacks and ambuscades. The rising was far from being general, and never extended to more than three or four thousand men, but it was rendered dangerous by the secret, and sometimes the open, support of the people in general. Their knowledge of a mountainous country clothed in forests and without roads, gave the insurgents an enormous advantage over the royal troops, and the rebellion was not finally suppressed until Baville had constructed roads throughout the country.

Montrevel adopted a policy of extermination, and 466 villages were burned in the Upper Cévennes alone, the population being for the most part put to the sword. Pope Clement XI. assisted in this work by issuing a bull against the "execrable race of the ancient Albigenses," and promising remission of sins to the holy militia which was now formed among the Catholic population, and called the Florentines, Cadets of the Cross, or White Camisards. Villars, the victor of Höchstädt and Friedlingen, saw that conciliation was necessary; he took advantage of the feelings of horror with which the quiet Protestants of Nîmes and other towns now regarded the war, and published an amnesty. In May 1704 a formal meeting between Cavalier and Villars took place at Nîmes, resulting in the despatch to the court of a document containing the requests of the Camisards. The three leading requests for liberty of conscience and the right of assembly outside walled towns, for the liberation of those sentenced to prison or the galleys under the revocation, and for the restitution to the emigrants of their property and civil rights, were all granted—the first on condition of no churches being built, and the third on condition of an oath of allegiance being taken. The greater part of the Camisard army under Roland, Ravenel, and Joany would not accept the terms which Cavalier had arranged, and, insisting that the Edict of Nantes must be restored, continued the war till Jan. 1705, by which time all their leaders were either killed or dispersed. In 1709 Mazel and Claris, with the aid of two preaching women, Marie Desubas and Elizabeth Catalon, made a serious effort to rekindle revolt in the Vivarais; but in 1711 all opposition and all signs of the reformed religion had disappeared. On March 8, 1715, by medals and a proclamation, Louis XIV. announced the entire extinction of heresy.

What we know of the spiritual manifestations in the Cévennes (which much resembled those of the Swedish Raestars of Smaland in 1844) is chiefly derived from *Le Théâtre sacré des Cévennes* (London, 1707), reprinted at Paris in 1847; *A Cry From the Desert*, etc., by John Lacy (1707); *La Clef des prophéties de M. Marion* (London, 1707); *Avertissements prophétiques d'Élie Marion*, etc. (London, 1707). The inspiration (of which there were four degrees, *avertissement, souffle, prophétie, dons*) was sometimes communicated by a kiss at the assembly. The patient, who had gone through several fasts three days in length, became pale and fell insensible to the ground. Violent agitations of the limbs and head followed, as Voltaire remarks, "quite according to the ancient custom of all nations, and the rules of madness transmitted from age to age." Finally the patient (who might be a little child, a woman, a half-witted person) began to speak in the good French of the Huguenot Bible words such as these: "Mes frères, amendez-vous, faites pénitence, la fin du monde approche; le jugement général sera dans trois mois; répentez-vous du grand péché que vous avez commis d'aller à la messe; c'est le Saint-Esprit qui parle par ma bouche," Brueys, *Histoire du fanatisme de notre temps* (Utrecht, 1737, vol. i. p. 153). The discourse might go on for two hours; after which the patient could only express himself in his native patois, and had no recollection of his "ecstacy." All kinds of miracles attended on the Camisards. Lights in the sky guided them to places of safety, voices sang encouragement to them, shots and wounds were often harmless. Those entranced fell from trees without hurting themselves; they shed tears of blood; and they subsisted without food or speech for nine days. The supernatural was part of their life. The publication of J. F. K. Hecker's work, *Die Volkskrankheiten des Mittelalters*, made it possible to consider the subject in its true relation. This was translated into English in 1844 by B. G. Babington as *The Epidemics of the Middle Ages*.

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CAMMAERTS, ÉMILE (1878–   ), Belgian poet, was born at Brussels on March 16, 1878. In 1908 he settled in England. His earlier works include four volumes of translations of

Ruskin into French, and *Les Bellini* (later ed. 1927), an essay in criticism; he has also written two plays, *Les Deux Bossus* (1917), and *La Veillée de Noel* (1917). He attained his widest popularity by poems written during the World War, including *Chants patriotiques et autres poèmes* (1915, trans. as *Belgian Poems*, 1915); *Les Trois Rois et autres poèmes* (1916, trans. as *New Belgian Poems*, 1916); and *Messines et autres poèmes* (Eng. trans. 1918). He also wrote *A Ma Patrie enchainée* (1918, trans. as *Through the Iron Bars*, 1918), an account of the sufferings of Belgium during the World War, and in 1922 a further collection of poems *Poèmes intimes* (Brussels, 1922). He married the daughter of the singer Marie Brema, Tita Brand, who was responsible for the translations of his poems mentioned above.

CAMOENS (CAMÕES), LUIS DE (1524–1580), Portugal's renowned epic poet and one of the greatest lyric poets of 16th century Europe, was born either at Coimbra or Lisbon about or in the year 1524. He came of Galician stock, owners of land near Finisterre; his ancestor, the soldier-poet Vasco Perez de Camões, fled to Portugal after the rout of Montiel in 1369, and in 1385 fought at Aljubarrota on the losing side of Castille. His grandson married Dona Guiomar Vaz da Gama, of an Algarvian family soon to be immortalized by the discovery of the sea-route to India. Their son Simão Vaz de Camões was born at Coimbra a few years before that world-shaking event; he married a lady of a Santarem family, Dona Anna de Sá e Macedo, and their son Luis Vaz de Camões, perhaps an only child, was born probably in the year of his great kinsman Vasco da Gama's death. The death of Simão Vaz at Goa, whither he had gone as captain of a ship in the hope of redressing the fortunes of a poor "cavaleiro fidalgo," left his widow and child in something like penury, and it is perhaps unlikely under these circumstances that the boy would have been sent from Lisbon to study at the famous university which had been transferred to Coimbra in 1537. This seems to incline the scales slightly in favour of Coimbra in the very evenly balanced claims of Coimbra and Lisbon to be the poet's birthplace. We only know that he studied at Coimbra university, then described as a second Athens, to which King João III. by lavish salaries enticed professors from many foreign countries; they included men of world-wide reputation from Salamanca, Paris and Bordeaux, among them George Buchanan. How thorough was the education of the young Camões is evidenced by the general scientific and literary culture shown in his work, and his constant classical allusions, a knowledge which he could not have acquired at any other time of his unquiet life and retained to the end. His acquaintance with Latin literature was extensive, and it is very probable, although not certain, that he also knew Greek. These were the years when the Renaissance was making its late appearance in Portugal; the old national school of poetry represented by Gil Vicente was dying out, while Sá de Miranda was fighting an uphill battle in favour of the "dolce stil nuovo" Camões was to excel in either school. A document recently unearthed shows that the poet's cousin, Bento Vaz, was not the powerful prior of the College of Santa Cruz but a poor canon; but, whatever assistance Camões may have received in his studies, there can be no doubt as to his brilliance. His early play, "Os Amphitriões," perhaps acted at Coimbra, and the beautiful canzone "Vam as serenas aguas," written there, testify to the depth and variety of his genius. The fervent humanism of the beautiful old city on the hill above the transparent waters of Mondego and the exquisite surrounding scenery had sunk deep into his spirit, and we may surmise that it was love rather than ambition that drove the poet from the university, where his learning and talent could not fail to be appreciated.

He had fallen in love with a lady described in his early poetry as having a snow-white face and hair of gold. If she belonged to the court and was first seen by the poet on one of the court's periodical visits to Coimbra, it was but natural that he should follow her to Lisbon. The year of his arrival in what had now become one of the most important as well as most interesting capitals in Europe, is uncertain, but it may have been 1545. For the next eight years of the poet's life we are confronted by a series of fluctuating and contradictory conjectures. It is best to abandon the widely held theory that he came to Lisbon in 1542 as tutor to the son of the second count of Linhares, the infant Dom Antonio de Noronha, who was killed in North Africa at the age of 17 in April 1553. The other tradition, that he fell in love with a lady of the court, Dona Caterina (Natercia) de Ataide, whom he is alleged to have seen for the first time in a Lisbon church on Good Friday of 1544, is older but scarcely less fragile. Camões sang of a dozen different loves; sometimes they may be the same under different names, sometimes the circumstances are different and make identity impossible. Apart from the charming verses to Barbara, the Indian slave-girl, his most inspired love poems seem to centre round two objects, the early "head of gold and snow," who may conveniently but perhaps incorrectly be called Caterina-Natercia, and secondly a lady who was drowned at sea and is sung under the name of Dinamene. To the latter, now generally assumed to be a Chinese slave-girl with whom he was returning from Macao on the occasion of his shipwreck, were addressed some of his loveliest sonnets, including the famous "Alma minha gentil." As to Natercia, she may have been the daughter of Dom Antonio de Lima, that Dona Caterina de Ataide who died at an early age in 1556; but there were two other Caterinas of the same surname, neither of whom can be summarily dismissed, while a more recent learned conjecture rejects all three and considers the object of the poet's love to have been King Manuel's daughter, the Infanta Maria, born in 1521. A further very real difficulty consists in attributing the evidently sincere and impassioned early love poems to two different passions, that for the Coimbra lady celebrated in "Vam as serenas aguas" and that for the Lisbon lady first seen in 1544. The attribution of this precocious fickleness seems an error in psychology on the part of the critics, and it is preferable to assume that the object of the poet's love between the years 1542 and 1553 was one and the same.

The years before the departure to India were spent at Lisbon, with the exception of two years' military service in North Africa. The poet and penniless fidalgo, after coming to the capital, continued to woo Natercia at court, where he wrote and produced his second play, "El Rei Seleuco." Either because the subject of this play was held to contain an allusion to the king or because the suit of the poor and indiscreet gentleman and scholar was less favourably received by Natercia's parents than by Natercia, all his hopes were suddenly dashed to earth, and he found himself wandering disconsolately in the Ribatejo country near Santarem, banished from the capital and court. Two years' service in Africa followed (1547–49), during which, either by an accident or under fire of the enemy, Camões lost the sight of his right eye. On returning to Lisbon he found his cousin, Simão Vaz de Camões, high in favour with the youthful Prince João (1537–53), to whom many men of letters looked as their patron, and he probably now made the acquaintance of another of the prince's friends, D. Antonio de Noronha. The poet's hopes again rose high, he had many friends at court, and, although still penniless, enjoyed himself with rowdy boon-companions while waiting to receive some reward for his services in Africa and to win recognition for his literary genius. He continued to write lyrics, probably now composed his play "Filodemo," later acted in India, and began to entertain thoughts of an elaborate epic of the recent glories of his country. The dreamy Coimbra boy had become a rash and generous youth of the world; ladies of the court might gibe at the "one-eyed devil," but were glad to receive his compliments in verse; his comrades dubbed him Trincafortes, the Swashbuckler; and beneath these superficial frivolities his love for Natercia continued. As suddenly and completely as in 1547 his hopes and prospects ended. During the Corpus procession on June 16, 1552, Camões wounded a certain Gonçalo Borges, a court official, in a street quarrel, and lay for eight months in the Lisbon gaol.

Within three weeks of his release on March 7, he set sail for India (March 26, 1553). He went as a common soldier bound for three years' service, and soon after his arrival at Goa took part in a punitive expedition against the King of Chembe on the coast of Malabar in November. Immediately after his return to Goa he served in an expedition to the Red sea. From Cape Guardafui the Portuguese fleet sailed to Ormuz on the Persian gulf, and after a successful engagement off Maskat, in which six Turkish ships were captured, returned to Goa in November 1554. Camões must certainly have received some of the spoils, and for some months was able to live quietly and happily at Goa, engaged in the composition of some of his noblest lyrics and of the first six books of the Lusiads. The new Viceroy, Pedro de Mascarenhas, had been chamberlain to Prince João at Lisbon, and is likely to have been an old friend of the poet, but he died in 1555 within a year of his appointment to India. Under his successor, the Governor Francisco de Barreto, Camões received an appointment at Macao as trustee for the property of dead or absent Portuguese. Posts of all kinds were eagerly coveted in India, the obscurest appointment disappointed a score of claimants, and there is no reason to consider Camões' appointment as a punishment, however little it may have corresponded to his hopes in 1555, and many as may have been the envious enemies which his favour with the viceroy and his own sharp satirical tongue brought him in that motley crowded Goa of gossip and intrigue. On his way to Macao, he may have gone to the Moluccas, but this is by no means certain. We know a little more about his return voyage. It would appear that his return was due to a quarrel with the captain of the "silver and silk ship" trading between Japan and Goa. Captain Leonel de Sousa, incensed at being deprived of jurisdiction as *provedor* at Macao (the post given to Camoes) is alleged to have arrested him and brought him back to Goa in chains. Much has been made of two words of the Lusiads referring to an "unjust order" (*injusto mando*), which it is perhaps preferable to take in a more general sense as alluding to the original exile to India in 1553. The poet's term of office at Macao was probably nearly up when Captain Sousa put in there at the end of 1558. The desire to give a dramatic cast to every step in the poet's career has been overdone; he may have embarked less picturesquely, without the chains, in the ordinary course of events after making a small fortune at Macao. The ship was wrecked on shoals off the coast of Cambodia near the river Mekong, and Sousa and 23 others were the sole survivors. It was here that Dinamene perished. Camoes is represented as swimming ashore holding the Lusiads above his head, like Caesar with his Commentaries. The survivors were taken by a passing ship to Malacca and Goa (1559). Camões at Goa addressed some octaves to the viceroy (1558–61) Dom Constantino de Braganza. By his successor, the Conde de Redondo (1561–64), Camões' poetical talent was appreciated, so much so that they could bandy familiar verse and the poet could beseech the viceroy to save him from a debtor's prison and the tender mercies of the usurer Miguel Roiz, the Skinflint (Fios Seccos). We find the poet inviting young fidalgos as his intimate friends to dinner, and another sign of his favour is the fact that when Garcia da Orta published his great work, the "Coloquios," at Goa, he invited Camões to write a prefatory poem. Redondo, like Mascarenhas, died before his term of office had expired, otherwise he might have made some substantial provision for his poet friend. The next three years are silence. Camões held the reversion to the post of factor at Chaul, but it might be 20 years before it became his. He preferred to return to Portugal.

The friendship of Pedro Barreto, who was proceeding to Sofala as governor, enabled him to leave Goa in Sept 1567 and go as far as Mozambique in his company. The poet's fortunes had now reached their lowest ebb; he was no longer young, the climate was bad, homeward ships were always overcrowded, and Camões was utterly penniless. He lived on the charity of friends, and was unable to buy himself a new suit of clothes. His spirit was not quite broken; as assets he had his lyrics, his "Parnasso" and his Lusiads, and that belief in itself which sometimes supports genius in extremity. He had shown himself very Portuguese in his impulsiveness and he was equally Portuguese in his stubborn persistency. He continued to work at his poems, trusting that they at least might survive. An alleged contemporary account alludes to his "difficult temper"; he had certainly been tried more than most men. In 1569 the historian Couto and some other friends of Camões were delayed at Mozambique by bad weather on their homeward voyage, and when they left they took the poet with them, providing for his food on the way.

He reached Cascaes and Lisbon in April 1570. He found the city stricken by the awful plague of 1569, but his aged mother was still alive. Through the friendly services of the influential Dom Manuel de Portugal he received the royal licence to print the Lusiads (Sept. 24, 1571). The poem appeared in 1572 (in two editions) and from March 12 its author was granted an official pension of 15,000 réis. Three and a half centuries later this sum would have been equivalent to half a crown, but in the 16th century, although not munificent, it sufficed to support life. The contrast after the squalor of Mozambique three years before was almost as dramatic as previous reversals in this romantic life. Unfortunately the pension was not always regularly paid, although under the stricter administration of Philip II. it was renewed in favour of the poet's mother, who survived him. A few complimentary verses are all that we know and probably all that were written during the last 10 years of his life. Misfortune had, as he said, frozen his genius. He was not chosen to accompany the young King Sebastian on that last rash and royal throw of the dice in Africa in 1578. The poet, weakened by his 17 years in the East, succumbed to the plague which was once more ravaging Lisbon. There are some reasons to assign his death to the summer of 1579, but the date now generally accepted is 1580, and June 10 is celebrated yearly as a public holiday in his honour in Portugal. On receiving the news of the rout of Alcacer-Kebir, he had written that he was content to die in and with his country. He appears to have died not in his mother's poor house in the Mouraria quarter but in a Lisbon hospital. A Spanish Carmelite friar, Fray José Indio, blessed his departing spirit and shed a tear over the death of "so great a genius without even so much as a sheet to cover him." Camões was buried with other victims of the plague in a common grave. His fame grew and spread gradually through the civilized world. At the third centenary of his death, in 1880, what were assumed to be his remains were removed from the church of Santa Anna and placed beside those of King Sebastian and Vasco da Gama in the national pantheon at Belem.

The life of Camões after his early years at Coimbra was of an unliterary complexion, and his achievement is one of the most extraordinary instances of the triumph of genius over circumstance. The Renaissance had fast hold of him, and, had he lived a life of ease in a library, might have turned him into a pedant instead of merely enriching his verse. The very title chosen for his epic, *Os Lusiadas* ("the Portuguese") was a piece of early pedantry. His world travels and adventures at a time when he had lost little of his first sensitiveness but was old enough to have a philosophical outlook enabled him to transfer his delicate subjectivity to the objects that confronted his eyes as they had confronted the heroes of the preceding century of whom he sang, and this made him a lyrico-epic poet, a great painter of the sea, capable of infusing his soul's intensity and personal fervour into objective descriptions. All his greatest poetry was written before he was 40; it is the lyrics composed between the ages of 18 and 32 that cause him to rank with the world's greatest poets, and the greater part of the *Lusiads* belongs to the same period. Some critics hold that he brought the idea of an epic poem on Portugal's achievements with him from Coimbra. The epic idea was indeed in the air in the 16th century and proved a thorn in the side of more than one lyric poet, who like Ronsard, would have preferred to sing quietly of his love without the importunate claims of a *Franciade*. Camões' exile, taking him over the ground of the maritime discoveries of two generations earlier, enabled him to harness his lyrical genius to the epic form and to make his poem of a nation a living work.

It is possible to judge the *Lusiads* by comparison with their model the Aeneid (for, although Camões had Homer also in his thoughts, his epic is mainly Virgilian) or by comparison with the "Araucana" of Ercilla and the multitude of lengthy epics that followed The latter comparison brings out the immeasurable superiority of the *Lusiads;* even Ercilla's epic by its side is a wooden narrative of historical fact, while the tedious and innumerable Portuguese epics which continued into the 19th century are an involuntary but emphatic tribute to the genius of Camões. By comparison with the epic of the ancients what must strike all critics is Camões's originality. He has made a new thing. If, in the words of Montesquieu, it contains something of the charm of the *Odyssey* and of the magnificence of the *Aeneid*, it was essentially an artificial Renaissance epic such as only genius and exceptional circumstances (lacking in Ronsard's case) could justify. Running counter to the precepts of Politian, Camões chose a recent historical subject, the voyage of Gama (1497–99). The Portuguese adventurers are revealed after they had rounded the Cape of Good Hope and were approaching Mozambique. They are favoured by Venus but have to count on the malignant hostility of Bacchus (for Camões, in the spirit of Renaissance poetry, introduced the pagan gods into his epic). It is not until the sixth stanza that they reach Calicut. In the meantime occasions have been devised to work in the earlier part of the voyage from Lisbon round the Cape, which is personified in the giant Adamastor, and much of the history of Portugal, including the romantic fate of Inés de Castro and the victory of Aljubarrota. The account of the return voyage to Portugal is varied by a sojourn in an imaginary island where the "Lusiads" are welcomed by the Nereids and Tethys foretells the deeds of the Portuguese during the next 50 years. It is this skilful working in of the contemporary and past history of the nation that gives to the poem its balance and unity. Vasco da Gama, the nominal hero, is less an individual than a representative of the Portuguese nation. The length of the Lusiads is less than a quarter of that of the epics of Ariosto and Balbuena. In this restraint the poet showed his wisdom, although an early Portuguese admirer of the poem complained that it was too long to be inscribed in gold and too short to be read for ever. Camões' lyric inspiration maintained the Lusiads, despite some minor blemishes, at a level attained by no other modern epic (if we except *Paradise Lost*).

A sensitive genius can only make pearls of the harsh strokes of destiny and build song out of sorrow at a cost; it burns itself out, and when Camões returned to Lisbon he seems to have been little more than a sack of ashes, with an occasional glow running through them. His first poems, one or two of them written before he left Coimbra, show that he early attained a perfection of form previously unknown and subsequently unsurpassed in the poetry of his countrymen, an astonishing mastery of the Italian metres; sorrow, suffering and exile gave the poems written during the first years at Goa, including the poem on the "Discontent of the World" and the 73 quintilhas (octosyllabic stanzas of five lines) beginning "Sobolos rios," a deeper thought and philosophy, while the early command of metre and musical rich transparent style were retained. This humanist's mind was of a national cast, and he excelled in the native "redondilhas" (octosyllabic verse). He embraces a wide range of poetry, from feathery light love lyrics to profound musings on change and destiny and the solemn accents of religion; from the satire of circumstance or passing compliments to the heroic sound and fury of patriotic enthusiasm. His poetry combines softness and vigour, thought and ecstasy, Platonic or neo-Platonic mysticism and the most realistic experience, spontaneous naturalness and technical perfection, rich latinization of language and a severe classical restraint. The diction of the *Lusiads* is marked by a flowing grace and majestic harmony. A few of the sonnets, canzoni, eclogues and elegies and half a score of poems written in the native octosyllabic metre have been surpassed by not more than six or seven poets since Homer sang, and are as enduring a title to fame as the composition of the *Lusiads* itself. No authentic contemporary portrait of Camões is extant, and implicit faith cannot be placed in that published by Severim de Faria in 1624. The fate of the lyrics has been unfortunate; they remained in manuscript during the poet's life, and no critical edition has yet been published.

Bibliography.—The immense bibliography of Camões is studied in vols. v., xiv. and xv. of Innocencio da Silva's *Diccionario Bibliographico* and in Theophilo Braga's *Bibliographia Camoniana* (Lisbon, 1880). The text remains that of the complete but uncritical edition in six volumes by the Visconde de Juromenha (Lisbon, 1860–69), but there is a critical edition of the *Lusiads* by Epiphanio Dias in 2 vols. (Porto, 1920). Valuable contributions to the study of the text were made by C. Michaëlis de Vasconcellos in the *Zeitschrift für romanische Philologie* and *Circulo Camoniano* (1890–92); and important but much discussed documents vitally affecting the biography have been published by Sr. Pedro de Azevedo in the *Boletim da Segunda Classe* of the Lisbon Academy of Sciences, vol. xi. (1917) pp. 24–25, Sr. Jordão de Freitas in *O Naufragio de Camões* (Lisbon, 1915) and Sr. João Grave in the *Boletim*, vol. xi. (1918) pp. 1041–48. These and other researches and conjectures make it now possible to rewrite in great part the lives by Burton, *Camoens: His Life and His Lusiadas* (1881), Storck, *Luis de Camoens Leben* (Paderborn, 1890, with Portuguese translation by C. Michaëlis de Vasconcellos, 1897), and Braga, *Camões. Epocha e Vida* (Porto, 1907). Among English translations of the poems, those by Aubertin, *The Lusiads*, 2nd ed. 1884, and seventy sonnets (1881); Burton (*The Lusiads*, 1880, and *The Lyricks*, 1884), and the earliest (1665) English version of the *Lusiads* by Sir Richard Fanshawe still hold the field. The fourth centenary of the poet's birth elicited no work of importance, but a short life of Camões was published by the Hispanic Society of America in 1923 In 1921 had appeared the Lisbon National Library facsimile edition of the *editio princeps* of *Os Lusiadas*, with an introduction by Dr. José Maria Rodrigues, whose important *As Fontes dos Lusiadas* and *Camões e a Infanta Maria* saw the light in the monthly *Instituto* (1908–13). To the Conde de Ficalho's *A Flora dos Lusiadas* (1880) was added Professor Pereira da Silva's study on *A Astronomia dos Lusiadas* (1918). (A. B.)

CAMORRA, a secret or quasi-secret society of South Italy, once of considerable dimensions, but now extinct. It became known publicly about 1820. The origin of the name is unknown, but possibly both the word and the association were introduced into Naples by the Spaniards. There is a Spanish word *camorra* (a quarrel), and similar societies seem to have existed in Spain a long time before the Camorra made its first appearance in Naples.

The society was primarily social, and originated in Neapolitan prisons filled with the victims of Bourbon misrule and oppression, its first purpose being the protection of prisoners. In or about 1830 the Camorra was carried into the city by prisoners who had served their terms. The members worked the streets in gangs. They had special methods of communicating with each other. They mewed like cats at the approach of the patrol, and crowed like cocks when a likely victim approached. A long sigh gave warning that the latter was not alone, a sneeze meant he was not "worth powder and shot," and so on. The society rapidly extended its power, and its operations included smuggling and blackmail of all kinds in addition to ordinary road-robberies Its influence grew to be considerable Princes were in league with and shared the profits of the smugglers; statesmen and dignitaries of the church, all classes in fact, were involved in the society's misdeeds. The general disorder of Naples was so great and the police so badly organized that merchants were glad to engage the Camorra to superintend the loading and unloading of merchandise. As it was non-political, the government did not interfere with the society; indeed its members were taken into the police service and the Camorra sometimes detected crimes which baffled the authorities.

Political Influence.—After 1848 the society became political In 1860, when the constitution was granted by Francis II, the *camorristi* then in gaol were liberated in great numbers. The association became all-powerful at elections, and general disorder reigned till 1862. Thereafter severe repressive measures were taken to curtail its power. In Sept. 1877 there was a determined effort to exterminate it: 57 of the most notorious camorristi being simultaneously arrested in the market-place. In 1900 revelations as to the Camorra's power were made in the course of a libel suit, and these led to the dissolution of the Naples municipality and the appointment of a royal commissioner. A government enquiry also took place. As the result of this investigation the Honest Government League was formed, which succeeded in 1901 in entirely defeating the Camorra candidates at the municipal elections

The Camorra Extinct.—In 1911 general interest was again aroused in the Camorra by a famous murder case the Cuocolo murder, in which some 20 persons were brought to trial, all accused of being affiliated to the society, among them the man reputed to be its chief, who was extradited from the United States. The case, which lasted over a year, was transferred from Naples to Viterbo to ensure an impartial verdict, and the severe sentences which were passed dealt a death-blow to the organization.

The term is now used in Naples, as *apaches* is in France or *thugs* in America, to signify that criminality which exists in all great cities.

CAMOUFLAGE. The word camouflage means military deception to mislead the enemy in his observation of troops, equipment and fieldworks. Camouflage is used as protection against aerial and ground observation.

MILITARY

The application to war of camouflage, as thus defined, is by no means novel; dummy guns were successfully employed in the past to mislead an opponent, and dummy aeroplanes were put to similar use with development of military aviation. Many historical instances could be brought forward in which camouflage was practised by individuals as an expedient. But it was not till the World War (1914–18) that it was practised by armies as a policy.

A transitional stage between the spasmodic use of camouflage in emergencies and its regular and systematic use is marked by the painting, or other treatment, of coast defence forts to blend with their surroundings, in order to render them less conspicuous from the sea. The well-known chequered black-and-white of the Spithead forts was an attempt to mislead the enemy as to the exact location of the gun embrasures.

A further stage was reached in the adoption of uniforms coloured to blend with the usual or typical colours of the countryside in a theatre of war. By 1899 the American army wore khaki uniforms in the Philippines; and after the South African War, when the importance of concealment came into great prominence, the British and most other armies adopted dust-coloured, light-blue, grey or grey-green uniforms.

Hitherto deception in war had been limited to the comparatively simple task of deceiving the human eye, at a considerable distance and for a short time. In the War (1914–18) its rôle was extended to circumventing the camera in addition to deceiving for long periods the eyes of observers armed with powerful glasses, and for the first time in history a military unit was organized for the definite purpose of practising scientific deception.

This policy was initiated by certain French artists serving in a French battery towards the end of 1914. The interest of a French commander was aroused and his sympathy enlisted, with the result that a "section de camouflage" was formed early in 1915, for the purpose of assisting units in the concealment of battery positions and other military works, and the construction of concealed posts of observation. The success attained by this section led to the organization of the British camouflage service, as a unit of Royal Engineers, early in 1916.

Principles and practice may be dealt with under three heads: (1) the concealment of gun positions and the like from the enemy's aeroplanes; (2) the concealment of observation posts and machine-gun emplacements from direct view; and (3) miscellaneous applications of camouflage.

PROTECTION AGAINST AIR OBSERVATION

The purpose of camouflage is to render objects indistinguishable or unrecognizable by means of imitation or disguise. Concealment in the limited sense of "hiding from view" is not the primary aim. The ideal is non-interference with the natural or normal aspect of the locality as viewed from the air, with which the enemy has become familiar through observation and photography, the latter being the more accurate. A photograph will always record something. The art of camouflage lies in conveying a misleading impression as to what that something signifies. The photograph records colours and accidents of ground (such as bare earth, vegetation, woods, etc.) in terms of light and shade, forming a patchwork or pattern of black and white meeting in varying intensities of grey. A cultivated district presents a regular chessboard pattern, with large rectangular expanses of monotone, the only accidents to break the monotony being large hedges, banks or houses, with their attendant shadows. Broken ground, such as demolished villages, shelled areas or patchy vegetation, presents a highly complex pattern, full of merging lights and shades.

Photographically, the effect of colour is not so marked or important as the effect of light and shade. Earth is toward the white end of the scale and grass or vegetation toward the black—not because of their respective colours but on account of the amount of contained shadows or "texture" (surface roughness). Texture affects reflection of light; and camouflage material must have texture like the material it represents, otherwise it absorbs more or less light than is desirable, its artificiality is obvious from the air, and deception fails. Contrasts are much accentuated on snow and the effects of shadows are more marked. Consequently it is essential, when judging the colours of a locality, to view it vertically and not obliquely as one is accustomed to see a flower bed.

Therefore the most practical method of planning the concealment of any work is to plan it with reference to a recent photograph which records the ground pattern, and the natural facilities for concealment which exist in the locality. Such facilities abound

prevailing complexity, because detection depends on comparison and comparison is made difficult by the intricacy of the pattern.

There are certain characteristic clues which betray new work to the reader of aerial photographs. They are disturbance of soil and vegetation, tracks, shadows, regularity and blast-marks of guns. These clues must be suppressed from the very beginning; conversely, if deception is to be achieved by the use of dummies, these clues must be supplied.

Shadows.—The form of any erection, or excavation, is revealed in a photograph by the shape of the shadow cast. Two intersecting planes, *e.g.*, the two sides of the roof of a building, will show differently on the photograph (except for a very brief period every day) because they receive light at different angles, and therefore reflect it differently. It follows that an artificial reproduction of locality must be erected parallel to the contours of that locality, or in other words the planes of the imitation and the real must not intersect. A mound must be imitated by a mound, and a flat surface by a flat surface.

Regularity.—No shape in nature is of regular outline; consequently anything of a regular shape in a photograph invites scrutiny because it must be the work of human hands. In a battery position, regularity is usually displayed in the geometric shape of the gun-pit and the regular spacing and alignment of the guns.

Summary.—To sum up the theoretical conditions which govern the concealment of gun positions, and other works, from the enemy in the air, the material of which the camouflage is composed must at all times appear on the photograph like the object or surface it represents, and likewise appear natural to the observer's eye. As to material, it must be light, strong, impervious to weather, fireproof and easily manufactured. Disturbances of soil, tracks, shadows, blast-marks and regularity must never seem associated with an active gun position or occupied work.

Natural materials such as branches, grass, etc., are of little use for camouflage purposes if protection from view is required for more than two or three days, for, when withered, they become very conspicuous. The most satisfactory cover is afforded by some form of net having an opaque centre of a boldly irregular shape, with a border becoming decreasingly opaque towards the edges. Nets are made opaque by weaving with strips of cloth, by placing foliage in upright, natural-appearing positions, or similar methods. The type of natural surroundings largely governs. The centre should be only so opaque as to prevent the object underneath (gun or excavation, as the case may be) being visible from the air and the border opaque enough to mask the shadow of the object without casting a shadow itself. Such a cover is erected at a suitable height above the object to be concealed, and parallel with the contour of the ground. It follows that the higher the erection the greater must be the area required to cover object and shadows. Evidence afforded by tracks is perhaps the most difficult of all to eliminate. Positions which are admirably concealed in every other way are betrayed by the tracks leading up to them, so much so that it is often possible to count the number of guns in a battery by the paths leading to each gun-pit and to distinguish between gun positions and other works.

The following afford good illustrations of methods of concealing approaches to positions in the open: (*a*) Leading the track close past the gun position and on to join an existing track, the connection to each pit being treated with camouflage material or cut grass, etc. (*b*) Similarly, but close in front of the gun-pits in order to use the track to hide blast marks. This method has the disadvantage of restricting traffic while the guns are in action. (*c*) Siting a battery in the midst of an existing network of tracks, taking precautions to reproduce on the camouflage any path interrupted by a gun-pit. It is not practicable to conceal long trenches. If a covering sags or differs materially in tone from its surroundings the mere length and regularity will betray its presence.

Material and Production.—The principal desiderata in camouflage material are durability and portability. It is almost inevitable that production must be standardised in the case of operations on a large scale. It is possible to deal individually only with a few special positions and the exterior of observation posts and the like. Square, woven, weather-proofed fish netting provides the most portable foundation. For a field gun 30 ft. x 30 ft. is sufficiently large, as larger sizes than this become unwieldy and difficult to erect. Wire netting is more durable and therefore best suited for large works. Small rolls—30 ft. x 6 ft.—are a convenient size. Open meshed canvas (scrim) is very suitable material for use on the ground and in conjunction with wire or fish netting. Fireproofing should be adopted wherever this is possible.

Sunproof dyes and water paints are preferred for coloration, in that order. Oil paints are a source of danger owing to their tendency to cause spontaneous combustion in stacked material. In order to achieve standardization it will probably be necessary to adopt four appropriate colorations, viz., all vegetation, all earth and two mixtures of vegetation and earth.

PROTECTION AGAINST DIRECT OBSERVATION

The concealment of observation posts, machine-gun nests, etc., is comparatively simple, being merely an adaptation of the craft of theatrical property-making. Natural features may be selected, in places from which good observation can be obtained, and these must be copied exactly. At night, the real is removed and replaced by the imitation, *e.g.*, trees, sand-bags, mile-stones, mounds of earth, chimney-stacks, walls. The copy is a thin outer shell containing a bullet-proof lining in order to give confidence to the occupier. The loopholes, when subject to scrutiny at short range, can be made quite invisible by the use of gauze, which though painted to resemble the exterior of the O.P., remains transparent from the inside. This method should only be adopted when absolutely necessary, because gauze interferes with vision—especially through glasses; in other cases care must be taken to give the loophole an irregular shape.

The following conditions govern the successful employment of such observation posts, particularly in the case of the more elaborate examples such as trees:

1. Concealed access is essential.
2. The works connected with installation must, like other works, be concealed from the air.
3. They should not be erected in places that are normally subject to heavy shelling, for the reason that careful observation will be prejudiced and accidental damage will probably reveal the observation post to the enemy.
4. Provision must always be made to prevent daylight showing behind the loophole, thus rendering it transparent to the enemy.
5. The comfort and security of the observer must always be studied, otherwise the full value of the observation will never be obtained.

Imitation trees can be designed either to accommodate an observer at a good height above the ground or to conceal a long periscope, the user of which is protected in a strong dug-out. In the former case the observer has a better view but is uncomfortably cramped. The periscope is limited in respect of magnification, field of view and clearness of vision, in proportion to its length (*see* PERISCOPE). On the other hand, advantage may be taken of its length to obtain high command with comparative security or increased security with low command.

MISCELLANEOUS APPLICATION

The following are examples from the war of 1914–18. In the dummy attack, series of painted silhouettes made of stout millboard representing the various postures of advancing troops, were mounted in frames, which could be raised or lowered from places of safety, so as to represent the waves of an attack. This was to draw fire off a real attack. Dummy heads made of papier mâché were used for location of enemy snipers, the exact position of whom could be gauged by producing the alignment of the holes of exit and entry of the sniper's bullet. Sniper costumes painted and garnished with local material enabled a skilful wearer in numerous cases to attain close proximity to the enemy without detection.

Roads may be shielded from enemy observation by lateral screens or by overhead vertical screens with lateral wings, placed at intervals. Concealment of roads from overhead aerial observation over any distance is obviously impracticable; overhead vertical screens are effective against observation from high ground stations.

A screen consisting of wire netting with two-thirds of the surface covered with interlaced strips of canvas is sufficient—especially if a chequered effect of black and white be adopted.

(F. J. C. W.; X.)

BIBLIOGRAPHY.—G. H. Addison, *The Work of the Royal Engineers in the European War, 1914–1918*, vol. viii., Miscellaneous, Sect. iii. (1927); S. J. Solomon, *Scientific Camouflage* (1920).

NAVAL

Camouflage both of large and small ships on various lines, but with the invariable idea of reducing visibility, had been attempted in the British navy for many years before the World War, but without success. The Board of Admiralty then adopted a partial form of camouflage by painting all vessels a light grey as opposed to the black hulls and light upper works previously in force. It was not until 1917, during the height of the submarine peril, that a practical scheme, having a definite end in view and formulated on scientific lines was put forward and officially adopted by the British authorities. It was called for distinction's sake in official documents "dazzle painting"; it embodied entirely new ideas on sea camouflage and was rescued from the early decease which had, in turn, been the fate of each of its predecessors by the fact that its originator was able to supply in large numbers designs to scale, each of which bore out a central idea.

Object.—The sole object of dazzle painting was so to distort the normal appearance of a vessel that her actual course became a matter of doubt in the mind of a submarine officer, the estimation of a vessel's true course being the prime factor required to ensure a successful attack.

Application.—Dazzle painting was intended primarily for application to merchant ships. These vessels were in far greater need of protection than warships owing to their slow speed and vulnerability and also to the fact that the enemy was making a concerted attack on England's supplies of food and materials essential to the conduct of the World War. A certain number of war vessels were, however, dazzle painted. These were chiefly ships engaged on convoy work, although a certain number detailed for special duties such as mine-laying and patrol service valued this special form of protection. At first sight it would appear impossible to treat a vessel with paint in such a way that an experienced seaman could be deceived as to her actual course, but dazzle-painted ships proved that this could be done. Juxtaposition of violently contrasted colours, black and white predominating, combined in accordance with the laws of perspective, could make it extremely difficult to judge the accurate inclination of a vessel even at a short distance.

Coloration.—In the early stages of dazzle painting, a large range of colours was employed to achieve the end in view. Experience showed that this could be attained by a much smaller number, and towards the end of the War, the principal colours in use were black, white and blue, these being employed in varying intensity. A factor which led to the simplification of the colours used was the knowledge that the German naval authorities had introduced the use of colour screens in their submarine periscopes with a view to reducing the camouflaged ship to a silhouette, and so neutralizing the effect of the colours used. These screens, however, had no effect whatever on a design depending solely on black, white and blue for its contrast. Shortly after its adoption by the Admiralty, dazzle painting was ordered under the Defence of the Realm Act and the whole merchant service was ordered to be painted. Numbers of war vessels operating with merchant ships were also painted; these comprised chiefly convoy cruisers, sloops and destroyers. Certain other naval vessels, engaged in blockade duties, were also painted. These vessels were specially liable to attack, being at sea for long periods and constantly under slow speed or altogether stopped.

On the introduction of the scheme a considerable volume of maritime opinion was directed against it from lack of a proper grasp of its objects, and because it appeared to render a vessel more conspicuous than it was when painted grey. In point of fact, at the date of the submission of the scheme the proposer, who was on patrol duty in the Channel, had noted that all transports were painted a dead black from water-line to truck. The opposition, however, rapidly disappeared as soon as the objects of the scheme were thoroughly grasped, and the rapidly increasing numbers enabled seamen to judge for themselves the difficulties of accurately estimating the exact courses of dazzle-painted ships met with at sea.

Extension of Use.—Soon after the establishment of the Dazzle Department, enquiries were made by the Allied maritime governments as to the efficacy of this new form of defence against the submarine. The French Ministry of Marine attached three officers for training under the new scheme and shortly afterwards set up a similar department in Paris. The U.S. Navy Department asked that an officer might be sent to Washington; shortly after his arrival a Dazzle Department was formed to deal with U.S. shipping. The Belgian Government arranged for all their merchant vessels to be dealt with directly in the British department. Complete sets of plans were forwarded to Italy and Japan.

The number of vessels saved by this device can never be definitely ascertained, but its rapid expansion in practice to all Allied merchant shipping showed that the authorities were satisfied that it played a great part. Approximately 4,000 merchant ships were painted, and upwards of 400 war vessels, engaged principally in convoy and patrol duties, were also painted. The total cost of painting amounted to some £2,500,000.

CAMOUFLET. A term used in military mining to designate a mine charge which, when exploded, does not break the surface of the earth. Derived from Latin "calamo flatus"—a blast through a reed or pipe—it came to mean a stifler. This form of mine is used by the defence to destroy the attackers' advancing mine-galleries without forming a crater on the surface, in which the assaulting infantry might make a lodgment. (*See* further FORTIFICATION AND SIEGECRAFT.)

CAMP (from Lat. *campus*, field), a term used more particularly in a military sense, but also generally for a temporarily organized place of food and shelter in open country, as opposed to ordinary housing (*see* CAMPING). The shelter of troops in the field has always been of the greatest importance to their well-being, and from the earliest times tents and other temporary shelters have been employed as much as possible when it is not feasible or advisable to quarter the troops in barracks or in houses. The applied sense of the word "camp" as a military post of any kind comes from the practice which prevailed in the Roman army of fortifying every encampment. In modern warfare the word is used in two ways. In the wider sense, "camp" is opposed to "billets," "cantonments" or "quarters," in which the troops are scattered amongst the houses of towns or villages for food and shelter. In a purely military camp the soldiers live and sleep in an area of open ground allotted for their sole use. They are thus kept in a state of concentration and readiness for immediate action, and are under better disciplinary control than when in quarters, but they suffer more from the weather and from the want of comfort and warmth. In the restricted sense "camp" implies tents for all ranks, and is thus opposed to "bivouac," in which the only shelter is that afforded by improvised screens, etc., or at most small *tentes d'abri* carried in sections by the men themselves. For training purposes in peace time, *standing camps* are formed. These may be considered simply as temporary barracks. An *entrenched camp* is an area of ground occupied by, or suitable for, the camps of large bodies of troops, and protected by fortifications.

Ancient Camps.—English writers use "camp" as a generic term for any remains of ancient military posts, irrespective of their special age, size, purpose, etc. Thus they include under it various dissimilar things. We may distinguish (1) Roman "camps" (*castra*) of three kinds, large permanent fortresses, small permanent forts (both usually built of stone) and temporary earthen encampments (*see* ROMAN ARMY); (2) pre-Roman and (3) post-Roman camps, such as occur on many English hilltops. We know far too little to be able to assign these to their special periods. Often we can say no more than that the "camp" is not Roman. But we know that enclosures fortified with earthen walls were thrown up as early as the bronze age and probably earlier still, and that they continued to be built down to Norman times. These consisted of hilltops or cliff-promontories or other suitable positions fortified with one or more lines of earthen ramparts with ditches, often attaining huge size. But the idea of an artificial elevation seems to have come in first with the Normans. Their *mottes* or earthen mounds crowned with wooden palisades or stone towers and surrounded by an enclosure on the flat constituted a new element in fortification and greatly aided the conquest of England. (*See* CASTLE.)

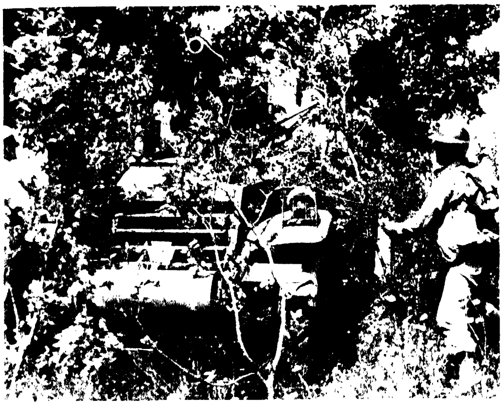
CAMPAGNA, GEROLAMO (*c.* 1549–after 1626), Italian sculptor, born at Verona, a pupil and assistant of Danese Cataneo, with whom he worked at Verona and Padua, and whose work in S. Antonio he completed after his master's death in 1573. He was one of the most distinguished sculptors of his age, his work being very decorative, filled with exuberant life and movement, his figures well modelled, his heads sensitive. Most of his work is in Venice. We may mention the bronze statue of St Anthony in S. Giacomo di Rialto; one of the two colossi at the Zecca (1580); statuary in S. Redentore, in particular a fine crucifix over the high altar (1588); the high altar of S. Giorgio Maggiore, executed in co-operation with his brother Giuseppe (1591–95); the monumental tomb of the doge, Pasquale Cicogna, in the Jesuit church (1595); the high relief of "Christ supported by Two Angels" in S. Giuliano (1606); the high altar of S. Lorenzo (1615–18).

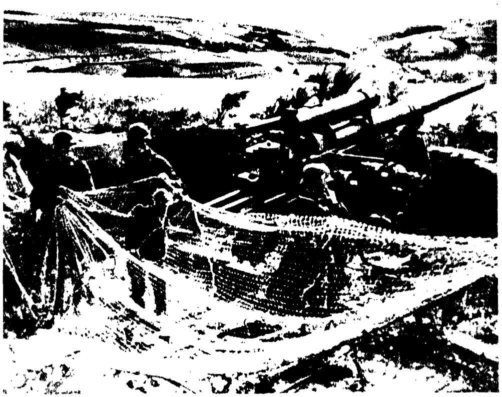
CAMPAGNA DI ROMA, the low country surrounding the city of Rome, bounded on the north-west by the hills surrounding the lake of Bracciano, on the north-east by the Sabine mountains, on the south-east by the Alban hills, and on the south-west by the sea. (*See* LATIUM and ROME: *Modern City;* and, for origin of the name, CAMPANIA.)

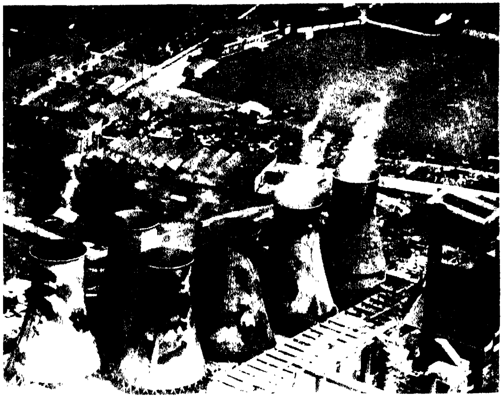
CAMPAGNOLA, DOMENICO, Italian painter and engraver, who worked during the first half of the 16th century at Padua. In conjunction with Titian he decorated the Scuola del Santo with a series of frescoes representing the life of St. Anthony. He was also employed on frescoes in the Scuola del Carmine and in palaces of Padua. His name occurs for the last time on Nov. 24, 1562, when he undertook the decoration of a wall in the sacristy of the cathedral. Among his first extant works are some engravings and woodcuts signed and dated 1517 and 1518. He is well known for his pen and ink drawings, many of which were at one time ascribed to Titian. These drawings are not merely sketches or preliminary studies for pictures, but are works complete in themselves. One of the finest examples is a landscape with two youths in the foreground, signed by the artist, in the Malcolm collection at the British Museum (388).

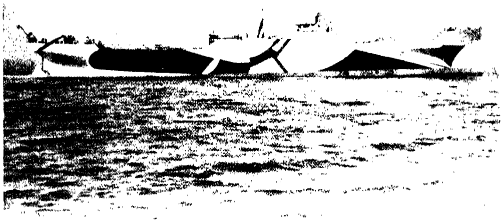
See G. Morelli, *Italian Masters in German Galleries.* For engravings *see* E. Gallichon, *Gaz. des B. Arts, xvii.* (1864).

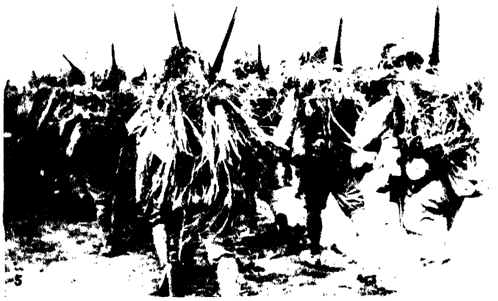
CAMPAGNOLA, GIULIO (*c.* 1482–1514), Italian engraver, born at Padua in 1482. He was a youth of great versatility and promise, and while still under 17 showed much skill at painting, engraving and music. He was influenced by Mantegna and Dürer and engraved subjects after Giorgione. His delicate modelling by flicks and dots anticipated stippling.











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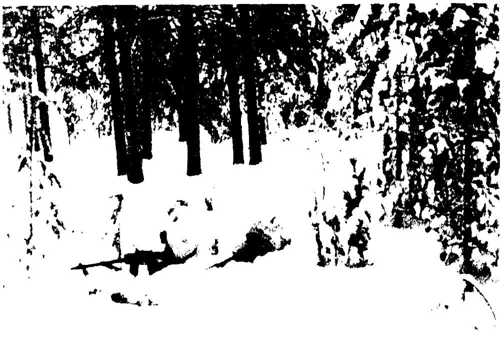

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BY COURTESY OF (3) THE IMPERIAL WAR MUSEUM (COPYRIGHT RESERVED); PHOTOGRAPHS, (1) ACME, (2, 6) PHOTO FROM EUROPEAN, (4) BRITISH COMBINE, (5) [illegible]

CAMOUFLAGE IN WORLD WARS I AND II

1. U.S. tank destroyer effectively camouflaged with limbs of saplings
2. German anti-aircraft gun about to be covered with netting to obscure the view from above
3. A *tramp steamer* of World War I dazzle painted to confuse hostile craft as to its size, outline and direction of travel. This type of camouflage was not widely used in World War II, being replaced by solid drab colours
4. Cooling towers of a British electricity plant painted to simulate landscape
5. Japanese infantry camouflaged against aircraft by stalks of sorghum corn
6. Finnish ski troops clothed in white to blend with snow, during the winter war with Russia, 1939–40

See Kristeller, *Giulio Campagnola,* Graph. Gesellsch., v. (1907); E. Gallichon, *Gaz. des B.-Arts,* xiii. (1862).

CAMPAIGN, a military term for the continuous operations of an army during a war or part of a war. The name refers to the time when armies went into quarters during the winter and literally "took the field" at the opening of summer. Its modern usage is, in contrast to a war on the one hand and a battle (*q.v.*) on the other, to cover the operations in a particular theatre of war and during a particular period. It thus constitutes a clearly defined phase of the war as a whole. The word is also used figuratively, especially in politics, of any continuous operations aimed at a definite object, as the "plan of campaign" in Ireland during 1886–87. The word is derived from the Latin *Campania,* the plain lying south-west of the Tiber, *cf.* Italian, *la Campagna di Roma,* from which came two French forms: (1) *Champagne,* the name given to the level province of that name, and hence the English "champaign," a level tract of country free from woods and hills; and (2) *Campagne,* and the English "campaign" with the restricted military meaning.

CAMPAN, JEANNE LOUISE HENRIETTE (1752–1822), French educator, the companion of Marie Antoinette, was born in Paris. She was appointed reader to the daughters of Louis XV., and after the sacking of the Tuileries in June 1792 supported herself by establishing a school at St. Germain. The patronage of Hortense de Beauharnais led to Mme. Campan's becoming directress of the academy founded by Napoleon at Écouen for the education of the daughters and sisters of members of the Legion of Honour. The post was abolished at the restoration of the Bourbons. The most noteworthy thing in Madame Campan's system was the place given to domestic economy. Among her writings are *Mémoires sur la vie privée de Marie Antoinette, suivis de souvenirs et anecdotes historiques sur les règnes de* Louis XIV.–XV. (1823), and *De l'Éducation des Femmes.*

See Jules Flammermont, *Les Mémoires de Madame de Campan* (1886).

CAMPANELLA, TOMMASO (1568–1639), Italian Renaissance philosopher, was born on Sept. 5, 1568, at Stilo in Calabria, and became a Dominican in 1582. A chance reading of the *De Rerum Natura* of Bernardino Telesio (d. 1588), which delighted him by its appeal to nature rather than to authority, led to his defence of Telesio in *Philosophia sensibus demonstrata* (1591). His own opposition to authority necessitated his departure from Naples for Rome and other Italian cities in the following year. On his return in 1598, his implication in a plot to free Naples from Spanish tyranny culminated in his imprisonment for 28 years, during which time he composed his sonnets and prepared most of his philosophical works. When released, Campanella found favour with the pope whose temporal power he had always supported; but on the outbreak of a new conspiracy headed by his pupil, Tommaso Pignatelli, he was persuaded by the pope to go to Paris (1634) where he was well received by Cardinal Richelieu. While preparing a complete edition of his works, he died in Paris on May 21, 1639.

Campanella was well versed in the sciences of his day. In philosophy, he was, like Giordano Bruno (*q.v.*), a follower of Nicholas of Cusa and Telesio. He rejected Aristotelianism for a direct study of man and nature, but he was never entirely free from the mediaeval spirit. Accepting the authority of faith in the sphere of revealed theology, he held that philosophy should be based on experience. The prime fact in philosophy was to him, as to Augustine and Descartes, the certainty of individual consciousness to which he assigned a threefold content—knowledge, will and love, the perfection of these powers, being true religion and union with God. The fact that consciousness contains the idea of God is the one sufficient proof of the divine existence, since the idea of the Infinite must be derived from the Infinite. God is a unity possessing the attributes of the rational soul in a pre-eminent manner. The more remote from God creatures are, the greater their degree of imperfection and not-being, which is characterized by ignorance, impotence and hatred. However, God is immanent in all finite natures and all, even inanimate beings, have a kind of sensibility. Of creatures, the highest are the angels and human beings, who, by virtue of their reason, are akin to the Divine. Next comes the mathematical world and then the corporeal world of animals, plants and inanimate things.

In natural philosophy, Campanella shakes off this neo-Platonic colouring and, following Telesio, advocates the experimental method and regards heat and cold as the dynamical principles in matter by the strife of which all life is explained. In political philosophy, he maintains the superiority of the Church to the State, and, therefore, the subjection of all temporal government to the pope as the representative of God. In the *Civitas Solis* of 1623 (Eng. trans. in Morley's "Universal Library"), Campanella, obviously under Platonic inspiration, sketches an ideal state based on communism of goods and of wives, and ruled by philosopher-priests who set forth wisdom, love and power as the highest virtues and command manual and military service from each citizen. Thus the ideal state is an artificial organism for the promotion of individual and collective good. On the view taken as to Campanella's alleged complicity in the conspiracy of 1599 depends the question as to whether this system was a philosophical dream, or a serious attempt to sketch a constitution for Naples in the event of her becoming a free city. The *De Monarchia Hispanica* of 1602 (Eng. trans. by E. Chilmead, 1654) contains an able account of contemporary politics, especially Spanish.

BIBLIOGRAPHY.—Campanella's chief works apart from those mentioned above are: *De sensu rerum* (1620); *Apologia pro Galileo* (1622); *Realis philosophiae epilogisticae partes iv.* (1623); *Atheismus triumphatus* (1631); *Monarchia Messiae* (1633); *Philos. realis* (1637); *Philos. rationalis* (1638); *Philos. universalis seu metaph.* (1638). His poems were edited by G. Gentile in *Scrittori d'Italia* (1915), 60 of the sonnets being translated from earlier editions by J. A. Symonds in 1878. *See* also Ancona, *Opere di T. Campanella, scelte, ordinate ed annotate* (2 vols., Turin, 1854) which contains Cypriano's *Vita Campanellae* (1705); Dom. Berti, *Lettere inedite di Campanella,* etc. (1878), and *Nuovi documenti di T. C.* (1881); V. Spampanato, *T. Campanella, Lettere* (Bari, 1927); L. Amabile, *Fra T. Campanella* (3 vols., Naples, 1882); G. Sante Felici, *Le Dottrine filosofico—religiose di Campanella* (Lanciano, 1895); J. Kvacala, *Campanella, ein Reformer der ausgehenden Renaissance* (Berlin, 1909); L. Blanchet, *Campanella* (1920) and E. G. Gardner, *Campanella and his Poetry* (Oxford, 1923).

CAMPANIA, a territorial division of Italy. The modern district (II. below) is of much greater extent than that known by the name in ancient times.

I. *Campani* was the Roman name for inhabitants first of the town of Capua and its district and then for inhabitants of the Campanian plain. The name is pre-Roman and appears with Oscan terminations on coins of the early 4th (or late 5th) century B.C. struck for or by the Samnite conquerors of Campania, whom the name properly denotes, a branch of the great Sabelline stock (*see* SABINI). We know from Strabo and others that the Samnites deprived the Etruscans of the mastery of Campania in the last quarter of the 5th century. Cumae was taken by them in 428 or 421, Nola about the same time, and the Samnite language they spoke, henceforward known as Oscan, spread over all Campania except the Greek cities, though Etruscans remained here and there for at least another century. The mountain warriors took over many Etruscan customs; the haughtiness and luxury of the men of Capua was proverbial at Rome. This town became the ally of Rome in 338 B.C. By the end of the 4th century Campania was completely Roman politically. Certain towns with their territories (Neapolis, Nola, Abella, Nuceria) were nominally independent in alliance with Rome. These towns were faithful to Rome throughout the Hannibalic war. But Capua and the towns dependent on it revolted; after its capture in 211 Capua was utterly destroyed. *See* R. S. Conway, *Italic Dialects* (1897); J. Beloch, *Campanien* (2nd ed. Breslau 1890).

The name Campania, first formed by Greeks from Campani, was not in common use until the middle of the 1st century A.D. Polybius and Diodorus avoid it entirely. Varro and Livy use it sparingly, preferring *Campanus ager.* Polybius (2nd century B.C.) uses the phrase τὰ πεδία τὰ κατὰ Καπύην to express the district bounded on the north by the mountains of the Aurunci, on the east by the Apennines of Samnium, on the south by the spur of these mountains which ends in the peninsula of Sorrento, and on the south and west by the sea, and this is what Campania meant to Pliny and Ptolemy. The geographers of the time of Augustus (in whose division of Italy Campania, with Latium, formed the first region) carried the north boundary of Campania as far south as Sinuessa, and even the river Volturnus, while farther inland the modern village of San Pietro in Fine preserves the memory of the north-east boundary which ran between Venafrum and Casinum. On the east the valley of Volturnus and the foot-hills of the Apennines as far as Abellinum formed the boundary; this town is sometimes reckoned as belonging to Campania, sometimes to Samnium. The south boundary remained unchanged. From the time of Diocletian onwards the name Campania was extended much farther north, and included the whole of Latium. This district was governed by a *corrector*, who about A.D. 333 received the title of *consularis*. It is for this reason that the district round Rome still bears the name of Campagna di Roma. Campania, consisting mainly of a very fertile plain with hills on the north, east and south, and the sea on the south and west, is traversed by two great rivers, the Liris (mod. Garigliano, 105 m. long) and Volturnus (mod. Volturno, 94 m. long) divided by the Mons Massicus, which comes right down to the sea at Sinuessa. The plain at the mouth of the former is comparatively small, while that traversed by the Volturnus is the main plain of Campania. Both of these rivers rise in the central Apennines, and only smaller streams, such as the Sarnus (mod Sarno) which waters the fertile plain south-east of Vesuvius, Sebethus, Savo, belong entirely to Campania.

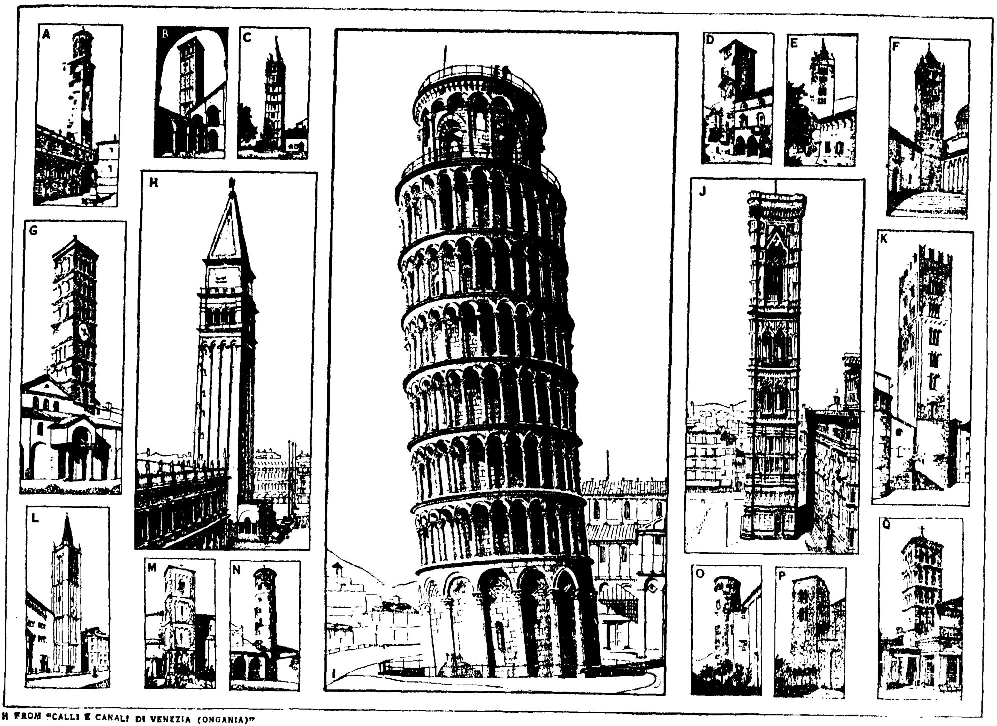
The road system of Campania was extremely well developed and touched all the important towns; it is now followed by railways. The most important road centre of Campania was Capua, at the east edge of the plain. At Casilinum, 3 m. to the north-west, was the only bridge over the Volturnus until the construction of the Via Domitiana; and here met the *Via Appia*, passing through Minturnae, Sinuessa and Pons Campanus (where it crossed the Savo) and the *Via Latina* which ran through Teanum, Sidicinum and Cales. At Calatia, 6 m. south-east of Capua, the *Via Appia* began to turn east and to approach the mountains on its way to Beneventum, while the *Via Popilia* went straight on to Nola (whence a road ran to Abella and Abellinum) and thence to Nuceria Alfaterna and the south, terminating at Regium. From Capua itself a road ran north to Vicus Dianae, Caiatia and Telesia, while to the south the so-called *Via Campana* (there is no ancient warrant for the name) led to Puteoli, with a branch to Cumae, Baiae and Misenum: there was also connection between Cumae, Puteoli and Neapolis, and another road to Atella and Neapolis. Neapolis could also be reached by a branch from the *Via Popilia* at Suessula, which passed through Acerrae. From Suessula, too, there was a short cut to the *Via Appia* before it actually entered the mountains. Domitian further improved the communications of this district with Rome, by the construction of the *Via Domitiana*, which diverged from the *Via Appia* at Sinuessa, and followed the low sandy coast; it crossed the river Volturnus at Volturnum, near its mouth, by a bridge, which must have been a considerable undertaking, and then ran, still along the shore, past Liternum to Cumae and thence to Puteoli. Here it fell into the existing roads to Neapolis, the older *Via Antiniana* over the hills, at the back, and the newer, dating from the time of Agrippa, through the tunnel of Pausilypon and along the coast. The mileage in both cases was reckoned from Puteoli. Beyond Naples a road led along the coast through Herculaneum to Pompeii, where there was a branch for Stabiae and Surrentum, and thence to Nuceria, where it joined the *Via Popilia*. From Nuceria, which was an important road centre, a direct road ran to Stabiae, while from Salernum, 11 m. farther south-east but outside the limits of Campania proper, a road ran due north to Abellinum and thence to Aeclanum or Beneventum. Teanum was another important centre: it lay at the point where the *Via Latina* was crossed at right angles by a road leaving the *Via Appia* at Minturnae, and passing through Suessa Aurunca, while east of Teanum it ran on to Allifae, and there fell into the road from Venafrum to Telesia. Five miles north of Teanum a road branched off to Venafrum from the straight course of the *Via Latina*, and rejoined it near Ad Flexum (San Pietro in Fine). It is, indeed, probable that the original road made the détour by Venafrum, in order to give a direct communication between Rome and the interior of Samnium (inasmuch as roads ran from Venafrum to Aesernia and to Telesia by way of Allifae), but it is difficult to believe that the short cut through Rufrae (San Felice a Ruvo) was not used in ancient times. The 4th and 3rd century coins of Telesia, Allifae and Aesernia are all of the Campanian type.

Puteoli, the chief ancient harbour, was most important in the 2nd–1st century B.C. The harbours constructed by Augustus by connecting the Lacus Avernus and Lacus Lucrinus with the sea, and that at Misenum (the latter the station of one of the chief divisions of the Roman navy, the other fleet being stationed at Ravenna), were mainly naval. Naples also had a considerable trade, but was less important than Puteoli.

The fertility of the Campanian plain was famous in ancient as in modern times; the best portion was the Campi Laborini or Leborini (called Phlegraei by the Greeks and Terra di Lavoro in modern times) between the roads from Capua to Puteoli and Cumae. The loose black volcanic earth (*terra pulla*) was easier to work than the stiffer Roman soil, and gave three or four crops a year. The spelt, wheat and millet are especially mentioned, as also fruit and vegetables; and the roses supplied the perfume factories of Capua. The wines of the Mons Massicus and of the Ager Falernus (the flat ground to the east and south-east of it) were the most sought after, though other districts also produced good wine; but the olive was better suited to the slopes than to the plain, though that of Venafrum was good. The Oscan language remained in use in the south of Campania (Pompeii, Nola, Nuceria) at all events until the Social War, but at some date soon after that Latin became general, except in Neapolis, where Greek was the official language during the whole of the imperial period.

II. Campania in the modern sense includes a considerably larger area than the ancient name, inasmuch as to the *compartimento* of Campania belong the four provinces of Benevento, Naples, Avellino and Salerno, that of Caserta having been absorbed partly by Naples and partly by Rome. It is bounded on the north by the provinces of Frosinone and Rome (Lazio), Aquila and Campobasso (Abruzzi e Molise), on the northeast by that of Foggia (Apulia), on the east by that of Potenza (Lucania) and on the south and west by the Tyrrhenian sea. The area is 5,213 square miles. It thus includes the whole of ancient Campania, a considerable portion of Samnium (with a part of the main chain of the Apennines) and of Lucania, while towards Lazio the boundary is now as it was in ancient times, consisting thus of a mountainous district, the greater part of which lies on the Mediterranean side of the watershed, with the extraordinarily fertile and populous Campanian plain between the mountains and the sea. The low sandy coast, with its lagoons, begins at the mouth of the Liris, and continues (interrupted only by the Monte Massico, which reaches the sea at Mondragone) past the mouth of the Volturno (where important schemes of drainage and reclamation are in progress, extending to Licola) as far as the volcanic district (no longer active) with its several extinct craters to the west of Naples, which forms the north-west extremity of the Bay of Naples. In consequence of the volcanic character of the district there are several important mineral springs which are used medicinally, especially at Pozzuoli, Castellammare di Stabia, and on the island of Ischia.

Pozzuoli (anc. Puteoli) the most important harbour of Italy in the 1st century B.C., is now of small consequence; while Naples is one of the most important harbours of modern Italy, and the cotton-spinning and weaving industry has taken firm root, as also the perfume industry. Beyond it, Torre del Greco and Torre Annunziata, at the foot of Vesuvius, are active trading ports for smaller vessels. Castellammare di Stabia, on the west coast of the gulf, has a large naval shipbuilding yard. Beyond Castellammare the promontory of Sorrento, ending in the Punta della Campanella (from which Capri is 3 m. south-west) forms the south-west extremity of the gulf. The highest point of this mountain ridge, which is connected with the main Apennine chain, is the Monte S. Angelo (4,735 ft.). It extends as far east as



H FROM "CALLI E CANALI DI VENEZIA (ONGANIA)"

A. VERONA; B. SAN AMBROGIO, MILAN; C. POMPOSA; D. AOSTA; E. COMO; F. MASSA MARITTIMA; G. STA. MARIA IN COSMEDIN, ROME; H. VENICE; I. PISA, "LEANING TOWER"; J. FLORENCE, DESIGNED BY GIOTTO AND HIS PUPILS; K. LUCCA; L. PARMA; M. SIENA; N. RAVENNA, S. APOLLINARE NUOVO; O. CHIENTI; P. LUCCA; Q. SAN GIORGIO IN VELABRO, ROME. N. IS THE MOST PRIMITIVE TYPE. G. AND Q. ARE TYPICAL OF ROME, H. AND L. OF VENETIA

Salerno, where the coast plain of the Sele begins. The south-east extremity of the Gulf of Salerno is formed by another mountain group, culminating in the Monte Cervati (6,229 ft.); and on the east side of this is the Gulf of Policastro, where the province of Salerno, and with it Campania, borders on the province of Potenza. The population (1936) was 3,698,695.

Naples is the chief railway centre: the main line from Rome runs by Formia and along the coast to Villa Literno, where it turns inland to Aversa, with a branch to Pozzuoli; while the older line runs from Rome through Roccasecca (whence there is a branch via Sora to Avezzano, on the railway from Rome to Castellammare Adriatico), Caianello (junction for Isernia, on the line between Sulmona and Campobasso or Benevento), Sparanise (branch to Formia and Gaeta) and Caserta to Naples. From Caserta, indeed, there are two independent lines to Naples, while a main line runs to Benevento and Foggia across the Apennines. From Benevento railways run north to Vinchiaturo (for Isernia or Campobasso) and south to Avellino. From Cancello, a station on one of the two lines from Caserta to Naples, a branch runs to Torre Annunziata, and another to Avellino. Naples, besides the two lines to Caserta (and thence either to Rome or Benevento), has local lines to Pozzuoli and Torregaveta (for Ischia) and two lines to Sarno, one via Ottaviano, the other via Pompeii, which together make up the circum-Vesuvian electric line and are in connection with the railway to the top of Vesuvius. The main line for southern Italy passes through Torre Annunziata (branch for Castellammare di Stabia and Gragnano), Nocera (branch for Codola), Salerno (branch for Mercato San Severino) and Battipaglia. Here it divides, one line going east-south-east to Sicignano (branch to Lagonegro), Potenza and Metaponto (for Taranto and Brindisi or the line along the east coast of Calabria to Reggio), the other south-southeast along the west coast of Calabria to Reggio. Industrial activity is mainly concentrated in Naples, Pozzuoli and between Naples and Castellammare di Stabia (including the latter) on the east shore of the Bay of Naples. This district was heavily bombed by the Allies in World War II.

CAMPANIFORM, in architecture, bell-shaped; most commonly used to describe a type of Egyptian capital (*q.v.*) shaped like an inverted bell.

CAMPANILE, a bell tower, used in connection with churches or town halls, especially in Italy. The campanile is sometimes attached to the building and sometimes free standing. The earliest campaniles are those of the churches of S. Apollinare in Classe and S. Apollinare Nuovo at Ravenna, variously dated from the 7th to the 10th century. These are simple round towers without decoration and with small, round, arched openings in pairs near the top. The more usual type of square campanile appears frequently from the 10th century onwards, and was apparently developed simultaneously in Rome and Lombardy. It is generally decorated by means of projecting vertical strips, known as pilaster strips, and ranges of arcaded cornice which divide the tower into several stages. Each stage has openings on all four faces, either single, double or triple-arched; where double or triple arches are used, there is frequently but a single column between the adjacent arches, even when the wall to be carried is of great thickness, so that a bracket capital, between the column and the arches, becomes necessary. The top of the campanile has an arcaded cornice, little, if any, larger than the cornices below. The roof, in early examples, is usually a pyramid of low pitch, invisible from the ground. This remained the Roman type throughout the Middle Ages, although many variations occurred. Cornices of pseudo-classic type are frequently used instead of the arcaded cornice, and the top cornice given greater importance by projecting the eaves of the roof. Openings are often large, completely filling the topmost stage with the exception of the supporting piers at the corners. In general, the tendency in Roman examples is towards horizontality rather than verticality of effect. In many instances the horizontal stages formed by the successive cornices are treated alike, with ranges of wall arcades, as in the campanile of S. Giorgio in Velabro (early 12th century). Greater richness was sometimes given by building in fragments of Roman ornament. Other important Roman examples are: S. Prassede, 1080, Santi Quattro Incoronati, 1123, and S. Maria in Trastevere, 1130.

The campanile reached its most highly organized forms in the north The Lombards were obviously a tower-building people and they found in the campanile a great opportunity. The early tower of S. Satiro in Milan, of the late 9th century, already shows an advanced composition of horizontal stages, arcaded cornices which connect the corner pilaster strips, and arched openings, single below and double above. In the later, and much larger, northern campanile of S. Ambrogio in Milan (early 12th century) semicircular projections like engaged columns break up the stages and give additional vertical lines. The top storey so developed that it gave the effect of a crown to the whole composition—an immense aesthetic advance—and was finally completed by a pyramidal (occasionally conical) spire, even when the tower below was square, in which case the tower was first capped by a balustrade.

The spired and crowned tower became a favourite in Venetia; by the elimination of horizontal cornices and large openings below the belfry stage, every effort was made to develop a sense of height. The Venetian campanile consists of a tall, square, slim shaft, frequently tapered or battered, which rises unbroken to the open belfry at the top. This belfry has one or two stages of arcade, and is often in stone, although the rest of the tower is brick Above the belfry cornice rises the spire, sometimes square, as in the famous campanile at Venice (lower portion 10th to 12th century, belfry storey 1510). The original building collapsed in 1902 but was rebuilt in 1908 in exact imitation of the old, or octagonal, with pinnacles and spirelets at the corners, as in the campanile of S. Zeno at Verona (12th century). The Venetian type, owing to its perfection, remained in constant use far into the Renaissance period.

Two campaniles of mediaeval Italy do not belong to any of these types That at Pisa—the famous leaning tower—is a circular structure of great beauty and richness, with a heavy wall surrounded by stages of arcaded galleries. The other is the great campanile of Florence, designed by Giotto, Taddeo Gaddi and others (early 14th century). This remarkable composition uses the Lombard tradition of horizontal stages, but attains a sense of lightness by the daring octagonal corner buttresses and the tremendous enlargement of the belfry stage, which is approximately twice as high as any other. Of unique beauty, also, are the decorative sheathings of coloured marble and the exquisite sculpture that ornaments the lower storeys.

The great height of many of these Italian campaniles is notable. The total height of that at Venice is 320 ft.; at Florence, 275 ft.; of the Palazzo del Comune, Verona, 273 ft.; and at Cremona, 396 feet. With the advent of the Renaissance, and the subsequent popularity of the dome, the use of campaniles, except in Venetia, diminished rapidly.

Interesting modern campaniles are that of the cathedral at Westminster by G. F. Boaley, that of the municipal building group at Springfield, Mass., by Pell and Corbett, and that of the University of California, Berkeley, Calif., by J. G. Howard.

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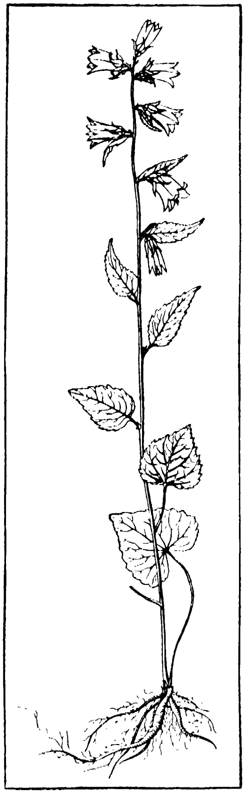
(T. F. H.)

CAMPANOLOGY, the art, or science, concerned with bells, bell-ringing, bell-founding, etc. (*See* Bell.)

CAMPANULA (bellflower), in botany, a genus of plants (family Campanulaceae) containing about 300 species, found in the temperate parts of the northern hemisphere, chiefly in the Mediterranean region. The name is taken from the Latin for a little bell. They are perennial, annual or biennial, herbs with spikes or racemes of white, blue or lilac flowers. Several are native in Great Britain; *Campanula rotundifolia* is the harebell (*q.v.*) or Scottish bluebell; a common plant on pastures and heaths, the delicate slender stem bears one or a few drooping, bell-shaped flowers. Many of the species are grown in gardens for their elegant flowers; the dwarf forms are excellent for pot culture, rockeries or fronts of borders. *C. Medium*, Canterbury bell, with large blue, purple and white flowers, is a handsome biennial, of which there are numerous varieties. *C. persicifolia*, the peach bell, is a perennial with more open flowers, and a well known border plant, with numerous forms. The Eurasian *C. glomerata*, which has crowded flower heads, is known in numerous, sometimes double-flowered, varieties as a border plant. There are also a number of alpine species suitable for rockeries. The plants are easily cultivated. The perennials are propagated by dividing the roots or by young cuttings in spring, or by seeds.



COVENTRY BELL (CAMPANULA TRACHELIUM), NATIVE TO EUROPE AND ASIA, FOUND IN GREAT BRITAIN, AND NATURALIZED IN NORTH AMERICA

In North America there are about 20 native species of bellflower, widely distributed throughout the continent. Among these are the tall bellflower (*C. americana*), found in moist woods from New Brunswick to South Dakota and southward to Florida and Arkansas, which grows 6 ft. high, with shallow, blue flowers, an inch across, borne in a dense spike often 2 ft. long; the harebell (*C. rotundifolia*) found from Labrador to Alaska and southward to New Jersey, Nebraska and California, and the California bellflower (*C. prenanthoides*), a delicately beautiful plant, native to wooded mountain slopes from Monterey to southern Oregon. In northeastern United States and adjacent Canada the creeping bellflower (*C. rapunculoides*), the Coventry bell (*C. Trachelium*) and the clustered beliflower (*C. glomerata*) have become widely naturalized.

CAMPBELL, ALEXANDER (1788–1866), U.S. religious leader, was born near Ballymena County Antrim, Ireland, on Sept. 12, 1788, and was the son of Thomas Campbell (1763–1854), a schoolmaster and clergyman of the Presbyterian "Seceders." Alexander in 1809 after a year at Glasgow university joined his father in Washington (Pa.) where the father had just formed an association "for the sole purpose of promoting simple evangelical Christianity" as a way to the union of the Church. With his father's desire for Church unity the son agreed. He began to preach in 1810, refusing any salary. In 1811 he settled in what is now Bethany (W.Va.) and was licensed by the Brush Run church.

On adopting baptism by immersion in 1812, his father, mother, wife, sister and others following him, he became the leader of the new society called Disciples of Christ or Christians, sometimes nicknamed Campbellites. The purpose of the society was to restore primitive Christianity as the way to the union of all Christians, which they contended was essential to the conversion of the world. He edited *The Christian Baptist*, later *The Millennial Harbinger*, and 60 volumes bear his name on their title pages. He held for days public debates with the Roman Catholic Archbishop J. B. Purcell, of Cincinnati, Robert Owen, Secularist, of Scotland, and others. Campbell was a member of the constitutional convention of Virginia in 1829. He founded Bethany College (W.Va.), being its president until his death, on March 4, 1866.

See R. Richardson, *Memoirs of Alexander Campbell* (1868); T. W. Grafton, *Alexander Campbell* (1897); W. E. Garrison, *The Sources of Alexander Campbell's Theology* (1900); Archibald McLean, *Alexander Campbell as a Preacher* (1908); W. T. Moore, *Comprehensive History of the Disciples of Christ* (1909); Peter Ainslie, *Yale Lectures: The Message of the Disciples of Christ for the Union of the Church* (1913).

CAMPBELL, BEATRICE STELLA (Mrs. Patrick Campbell) (1865–1940), English actress, was born in London, her maiden name being Tanner. In 1884 she married Captain Patrick Campbell (d. 1900), and in 1914 Major George Cornwallis-West. In 1893 her performance in Pinero's *Second Mrs. Tanqueray* at the St. James's at once put her in the first rank of English actresses. She played with Mr. (Sir Johnston) Forbes Robertson (*q.v.*) in Davidson's *For the Crown*, and in *Macbeth*. Other great parts of hers were in *Magda* and in Shaw's *Pygmalion*.

In 1922 Mrs. Patrick Campbell published an autobiography, *My Life and Some Letters*.

CAMPBELL, SIR COLIN: *see* Clyde, Colin Campbell, Baron.

CAMPBELL, GEORGE (1719–1796), Scottish theologian, was born at Aberdeen on Dec. 25, 1719, and died there on March 31, 1796. He was principal of Marischal college (1759), and professor of divinity (1771). He is remembered chiefly for his *Dissertation on Miracles* (1763), written in reply to Hume's essay His other more important works are *Philosophy of Rhetoric* (1776), and *A New Translation of the Gospels* (1778), with critical and explanatory notes.

See a memoir by G. S. Keith prefixed to the posthumous *Lectures on Ecclesiastical History* (1800).

CAMPBELL, JOHN (1708–1775), Scottish man of letters, was born at Edinburgh on March 8, 1708, and died on Dec. 28, 1775. He was the author of *Lives of the British Admirals* (4 vols., 1742 and 1744); the *Military History of Prince Eugène and the Duke of Marlborough* (1736); and a *Political Survey of Britain* (2 vols., 1744); and of many contributions to works of reference. Campbell was agent for Georgia (1765–75).

CAMPBELL, JOHN CAMPBELL, Baron (1779–1861), lord chancellor of England, the second son of the Rev. George Campbell, D.D., was born on Sept. 17, 1779, at Cupar, Fife. He studied at the United college, St. Andrews. In 1800 he was entered as a student at Lincoln's Inn, and, after a short connection with the *Morning Chronicle*, was called to the bar in 1806, and at once began to report cases decided at *nisi prius, i.e.*, on jury trial. Of these *Reports* he published altogether four volumes, with learned notes; they extend from Michaelmas 1807 to Hilary 1816. He changed his circuit from the home to the Oxford, and was made K.C. in 1827. He unsuccessfully contested the borough of Stafford in 1826, but was elected for it in 1830 and again in 1831. In the House he showed an extraordinary zeal for public business, speaking on all subjects with practical sense, but on none with eloquence or spirit. His main object was the amelioration of the law, more by the abolition of cumbrous technicalities than by the assertion of new and striking principles.

Thus his name is associated with the Fines and Recoveries Abolition Act, 1833; the Inheritance Act, 1833; the Dower Act, 1833; the Real Property Limitation Act, 1833; the Wills Act, 1837; one of the Copyhold Tenure Acts, 1841; and the Judgments Act, 1838. All these measures were important and were carefully drawn; but their merits cannot be explained in a biographical notice. His most important appearance as member for Stafford was in defence of Lord John Russell's first Reform Bill (1831). The following year (1832) found Campbell solicitor-general, a knight and member for Dudley, which he represented till 1834. In that year he became attorney-general and was returned by Edinburgh, for which he sat till 1841.

His political creed was that of a moderate Whig. In Parliament he continued to lend the most effective help to the Liberal party. At this time also he exerted himself for the reform of justice in the ecclesiastical courts, for the uniformity of the law of marriage (which he held should be a purely civil contract) and for giving prisoners charged with felony the benefit of counsel. His defence of *The Times* newspaper, which had accused Sir John Conroy, equerry to the duchess of Kent, of misappropriation of money (1838), is chiefly remarkable for the confession —"I despair of any definition of libel which shall exclude no publications which ought to be suppressed, and include none which ought to be permitted." His own definition of blasphemous libel was enforced in the prosecution which, as attorney-general, he raised against the bookseller H. Hetherington, and which he justified on the singular ground that "the vast bulk of the population believe that morality depends entirely on revelation; and if a doubt could be raised among them that the ten commandments were given by God from Mount Sinai, men would think they were at liberty to steal, and women would consider themselves absolved from the restraints of chastity." But his most distinguished effort at the bar was undoubtedly the speech for the House of Commons in the famous case of *Stockdale* v. *Hansard*, 1837, 7 C. and P. 731. The Commons had ordered to be printed, among other papers, a report of the inspectors of prisons on Newgate, which stated that an obscene book, published by Stockdale, was given to the prisoners to read. Stockdale sued the Commons' publisher, and was met by the plea of parliamentary privilege, to which, however, the judges did not give effect, on the ground that they were entitled to define the privileges of the Commons, and that publication of papers was not essential to the functions of Parliament. The matter was settled by an act of 1840.

In 1840 Campbell conducted the prosecution against John Frost, one of the three Chartist leaders who attacked the town of Newport, all of whom were found guilty of high treason. In Lord Cardigan's trial before the House of Lords for murder in a duel —in which he was acquitted on a technicality—Campbell made the extraordinary declaration that to engage in a duel which could not be declined without infamy, *i.e.*, social disgrace, was "an act free from moral turpitude," although the law properly held it to be wilful murder. Next year, as the Melbourne administration was near its close, Plunkett, the venerable chancellor of Ireland, was forced by discreditable pressure to resign, and the Whig attorney-general, who had never practised in equity, became chancellor of Ireland, and was raised to the peerage with the title of Baron Campbell of St. Andrews in the county of Fife. His wife, Mary Elizabeth Campbell, had in 1836 been created Baroness Stratheden in recognition of the withdrawal of his claim to the mastership of the rolls. The post of chancellor Campbell held for only sixteen days, and then resigned it to his successor, Sir Edward Sugden (Lord St. Leonards).

In 1842 he published *The Speeches of Lord Campbell at the Bar and in the House of Commons, with an Address to the Irish Bar as Lord Chancellor of Ireland* (Edinburgh). It was followed by the *Lives of the Chief Justices of England, from the Norman Conquest till the death of Lord Mansfield*, a book of similar construction but inferior merit. Meanwhile Campbell spoke frequently in the House of Lords. The 3rd volume of the *Protests of the Lords*, edited by Thorold Rogers (1875), contains no fewer than ten protests by Campbell, entered in the years 1842–45.

During the period 1841–49, when he sat in the House of Lords, he produced *The Lives of the Lord Chancellors and Keepers of the Great Seal of England, from the earliest times till the reign of King George IV.*, 7 vols., which was published in 1849.

On the resignation of Lord Denman in 1850, Campbell was appointed chief justice of the Queen's Bench. In 1859 he was made lord chancellor of Great Britain, probably on the understanding that Bethell should succeed as soon as he could be spared from the House of Commons. Campbell died on June 23, 1861.

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CAMPBELL, JOHN FRANCIS, of Islay (1822–1885), Gaelic scholar, was born on Dec. 20, 1822, and died at Cannes on Feb. 17, 1885. Educated at Eton and at Edinburgh university, he occupied minor government posts, and employed his leisure in collecting, translating and editing the folklore of the western Highlands, taken down from the lips of the natives. His *Popular Tales of the West Highlands* (4 vols., 1860–62) form a most important contribution to the subject. Campbell invented the sunshine recorder used in most of the British meteorological stations.

CAMPBELL, LEWIS (1830–1908), British classical scholar, was born at Edinburgh on Sept. 3, 1830, and died Oct. 25, 1908. He was fellow and tutor at Queen's college, Oxford (1855–58), vicar of Milford, Hants (1858–63), and professor of Greek and Gifford lecturer at the University of St. Andrews (1863–94). In 1894 he was elected an honorary fellow of Balliol. As a scholar he is best known by his work on Sophocles (2nd ed. 1879) and Plato (1867) and his *Life and Letters of B. Jowett* (1897–99).

CAMPBELL, REGINALD JOHN (1867–), British divine, son of a United Free Methodist minister of Scottish descent, was born in London, and educated at schools in Bolton and Nottingham and Belfast. He was already married when in 1891 he went to Christ Church, Oxford, where he graduated in 1895 in the honours school of modern history. He had gone to Oxford with the intention of becoming a clergyman in the Church of England, but decided to enter the Congregational ministry. He became minister of the Union Street Church, Brighton, and became famous there as a preacher. On Joseph Parker's death he was chosen as his successor (1903) at the City Temple, London. Here his weekly sermons attracted large congregations. At the end of 1906 he attracted widespread attention by his advocacy of what was called the "New Theology," a restatement of Christian beliefs to harmonize with modern critical views and beliefs, and published (1907) a book with this title which gave rise to considerable discussion. In 1915 he left the Congregational ministry, and was ordained priest in the Church of England in 1916. He was vicar of Christ Church, Westminster (1917–21), and of Holy Trinity, Brighton (1924–30). He was residentiary canon of Chichester (1930–36), and in 1930 became chancellor of Chichester cathedral.

CAMPBELL, ROY (1902–), South African poet, the son of Senator Campbell of Natal, was educated at Oxford. After roaming about at sea and wandering through Italy, Campbell published in 1924 his poem, *The Flaming Terrapin,* in which he exalts the instinctive vital force that brings forth intelligent human effort out of apathy and disillusionment. *The Wayzgoose* (1928) is a violent satire on an annual assembly of South-African would-be artists, poets, novelists and thinkers. Other publications include *Adamastor* and the *Georgiad.* Campbell has also distinguished himself as a bullfighter and steer-thrower, and won the steer-throwing contest of Provence in 1932 and 1933.

CAMPBELL, THOMAS (1777–1844), Scottish poet, eighth son of Alexander Campbell, was born at Glasgow on July 27 1777. His father, who was a cadet of the family of Campbell of Kirnan, Argyllshire, belonged to a Glasgow firm trading in Virginia, and lost his money in consequence of the American war. Campbell was educated at the grammar school and university of his native town. In May 1797 he went to Edinburgh to attend lectures on law. He supported himself by private teaching and by writing, towards which he was helped by Dr. Robert Anderson, the editor of the *British Poets.* In 1799, six months after the publication of the *Lyrical Ballads* of Wordsworth and Coleridge, *The Pleasures of Hope* was published. It is a rhetorical and didactic poem in the taste of his time, and owed much to the fact that it dealt with topics near to men's hearts, with the French Revolution, the partition of Poland and negro slavery. Its success was instantaneous, but Campbell did not follow it up. He went abroad in June 1800, visited Klopstock at Hamburg, and made his way to Regensburg, which was taken by the French three days after his arrival. He found refuge in a Scottish monastery. Some of his best poems, "Hohenlinden," "Ye Mariners of England," and "The Soldier's Dream," belong to his German tour. He spent the winter in Altona, where he met an Irish exile, Anthony McCann, whose history suggested "The Exile of Erin." On the outbreak of war between Denmark and England he hurried home, the "Battle of the Baltic" being drafted soon after. At Edinburgh he was introduced to the first Lord Minto, who took him in the next year to London as occasional secretary.

In 1803 Campbell married his second cousin, Matilda Sinclair, and settled in London. He was well received in Whig society, especially at Holland House. His prospects, however, were slight when in 1805 he received a government pension of £200. Campbell was at this time regularly employed on the *Star* newspaper, for which he translated the foreign news. In 1809 he published a narrative poem in the Spenserian stanza, "Gertrude of Wyoming," with which were printed some of his best lyrics. He was slow and fastidious in composition, and the poem suffered from over-elaboration. In 1812 he delivered a series of lectures on poetry in London at the Royal Institution; and he was urged by Sir Walter Scott to become a candidate for the chair of literature at Edinburgh university. In 1814 he went to Paris, making there the acquaintance of the elder Schlegel, of Baron Cuvier and others. His pecuniary anxieties were relieved in 1815 by a legacy of £4,000. He continued to occupy himself with his *Specimens of the British Poets,* published in 1819, an admirable selection with short lives of the poets; prefixed to it is an essay on poetry containing much valuable criticism. In 1820 he accepted the editorship of the *New Monthly Magazine,* and in the same year made another tour in Germany. Four years later appeared his "Theodoric," a not very successful poem of domestic life. He took an active share in the foundation of the University of London, visiting Berlin to inquire into the German system of education, and making recommendations which were adopted by Lord Brougham. He was elected lord rector of Glasgow university three times (1826–29). In the last election he had Sir Walter Scott for a rival. In 1834 he travelled to Paris and Algiers, where he wrote his *Letters from the South* (printed 1837).

The small production of Campbell may be partly explained by his domestic calamities. His wife died in 1828. Of his two sons, one died in infancy and the other became insane. His own health suffered, and he gradually withdrew from public life. He died at Boulogne on June 15 1844.

Campbell's other works include a *Life of Mrs. Siddons* (1842) and a narrative poem, "The Pilgrim of Glencoe" (1842).

See *The Life and Letters of Thomas Campbell* (1849), edited by William Beattie, M.D.; *Literary Reminiscences and Memoirs of Thomas Campbell* (1860) by Cyrus Redding; *The Poetical Works of Thomas Campbell* (1875), in the Aldine edition of the British poets, edited by the Rev. W. Alfred Hill, with a sketch of the poet's life by William Allingham; and the "Oxford Edition" of the *Complete Works of Thomas Campbell* (1908), edited by J. Logie Robertson. *See* also *Thomas Campbell* in the Famous Scots Series, by J. C. Hadden, and a selection by Lewis Campbell (1904) for the Golden Treasury Series.

CAMPBELL, WILLIAM WILFRED (1860–1919), Canadian poet, was born in Berlin (now Kitchener), West Ontario, the son of a Church of England clergyman, and was himself educated for the ministry, at Wycliffe college, Toronto, and at the Episcopal Divinity school, Cambridge, Massachusetts. In 1885 he was ordained to the priesthood of the Episcopal Church, and three years later was made rector of St. Stephen, New Brunswick; but in 1891 he gave up his parish, and settled in Ottawa, where he entered the Canadian Civil Service. In conjunction with some other young civil servants he conducted a section on literary criticism under the title of the "Mermaid Inn," in the Toronto *Globe,* and he published several volumes of poetry. He had already published *Lake Lyrics* (St. John, N.B., 1889); *Beyond the Hills of Dream* appeared in 1899, and *Collected Poems* in 1905. Three literary dramas, *Mordred and Hildebrand,* which appeared separately in

1895, *Daulac* and *Morning*, were collected under the title of *Poetic Tragedies* (1908). Campbell also edited the *Oxford Book of Canadian Verse* (1906). His work is characterized by an intense love of nature and by strong patriotic and imperialist sympathies.

Campbell's *Collected Poems* have been edited, with a memoir by W. J. Sykes (1923).

CAMPBELL, a city of Mahoning county, Ohio, U.S.A., on the Mahoning river, adjoining Youngstown on the southeast. The population was 11,237 in 1920 (50·9% foreign-born white); was 14,673 in 1930; and 13,785 in 1940 federal census. It is an industrial and residential suburb of Youngstown, manufacturing principally iron and steel, and was formerly called East Youngstown.

The city was incorporated in 1914.

CAMPBELL-BANNERMAN, SIR HENRY (1836–1908), British prime minister, was born on Sept. 7, 1836, being the second son of Sir James Campbell, of Stracathro, Forfarshire, lord provost of Glasgow. His elder brother James (1825–1908), was Conservative M.P. for Glasgow and Aberdeen universities from 1880 to 1906. He assumed the name of Bannerman in 1872, on inheriting a Kentish property from his maternal uncle, Henry Bannerman. He was educated at Glasgow university and at Trinity college, Cambridge (senior optime, and classical honours); was returned to parliament for Stirling Burghs (the constituency which he represented uninterruptedly until his death) as a Liberal in 1868 after an unsuccessful attempt at a by-election; and became financial secretary at the War Office (1871–74; 1880–82), secretary to the Admiralty (1882–84), and chief secretary for Ireland (1884–85). Campbell-Bannerman was one of the few chief secretaries who retired from that difficult office with an enhanced reputation. He had the wisdom, according to Parnell, of leaving things alone. When Gladstone suddenly adopted the cause of Home Rule for Ireland, he "found salvation," to use his own phrase, and followed his leader. In Gladstone's 1886 ministry he was secretary for war, and filled the same office in the Liberal ministry of 1892–95. In the latter year he was knighted (G.C.B.). His administration at the War Office was an excellent one; among other reforms was the establishment of a 48-hour week at Woolwich Arsenal. He arranged the delicate matter of the resignation of the duke of Cambridge as commander-in-chief with the minimum of friction with the court. On the very day on which the duke's retirement was announced the Rosebery government were defeated on a snap vote on a motion to reduce the salary of the secretary for war on account of inadequate reserves of cordite. Although he was nominally responsible for the fall of the Government, Sir Henry had earned the general respect of all parties, and in April 1895, when Mr. Speaker Peel retired, his name was suggested for the chair. He would have liked to have the post (he would have been an admirable Speaker), but his colleagues were averse from his retirement from active politics and he agreed to the selection of Mr. Gully.

The divisions among the parliamentary opposition were acute and notorious. Lord Rosebery had given as the reason for his resignation of the leadership of the Liberal Party (Oct. 6, 1896) the internal difficulties among his followers. No official party leader had been adopted, though Kimberley was leader of the opposition in the House of Lords, and Harcourt in the House of Commons. But the differences in the party were accentuated by a divergence of opinion about the policy of the Government in the Transvaal negotiations. On Dec. 14, 1898, Harcourt resigned from the leadership, and was succeeded in the House of Commons by Campbell-Bannerman. Two months later (Feb. 6, 1899) a party meeting of members of parliament held at the Reform club, confirmed the choice of Campbell-Bannerman, the names of Sir Henry Fowler and of Asquith, which had been suggested in some quarters, being withdrawn. In accepting the office, at that time a very ungrateful one, Campbell-Bannerman concentrated his efforts on keeping the party together in spite of the pronounced differences among its members. These differences were accentuated on the outbreak of the Boer War, to which Campbell-Bannerman himself was strongly opposed. In a speech made at Ilford (June 17, 1899), he had said that "he could see nothing in what had occurred to justify either war-like action or military preparation," and in speeches delivered later he criticized the diplomacy of the Government before the war. Nevertheless, on the outbreak of war, he at once offered to facilitate the grant of supplies, and after the Black Week of Dec. 10–19 he urged courage and new efforts for the prosecution of the war. From the beginning he maintained that peace must be based on the restoration to the conquered states of the rights of self-government and on the co-operation of the British and Boer races in South Africa. In the later stages of the war he denounced the methods employed against the Boers—"this stupid policy of farm-burning devastation and sweeping of women and children into camps." On June 14, 1901, he said at a banquet of the National Reform Union, "When was a war not a war? When it was carried on by methods of barbarism in South Africa." The use of this phrase brought about a crisis in the party, but nevertheless Campbell-Bannerman's leadership was confirmed at a meeting at the Reform club on July 9, which included Asquith and Sir Edward Grey, two of the principal leaders of the imperialist wing.

With the end of the war in 1902 the political conflict assumed a more normal form, and Campbell-Bannerman's difficulties within his own party were simplified by Joseph Chamberlain's adoption of the new fiscal policy, to which the Liberal Party were unanimous in their opposition. It was not, however, Campbell-Bannerman, but Asquith who led the free trade campaign in the country. Campbell-Bannerman, in developing the general Liberal programme with a view to the coming general election, advocated various measures of social reform, but made a special point of criticising the Government expenditure, and of the need of retrenchment. The other principal plank in his programme was the limitation of the veto of the House of Lords. On Home Rule opinion in the party was divided. Many prominent Liberals, including Sir Edward Grey and Asquith, said that the victory at the coming election would not be gained on Home Rule and that a Liberal Government would have no mandate for Home Rule. Campbell-Bannerman secured relative unity by restating his belief in Home Rule (Stirling, Nov. 23, 1905), but admitting that there would not be an immediate opportunity. The terms of this pronouncement had been previously agreed with some of the Liberal imperialists. On Dec. 4, 1905, the Unionist Government resigned, and the king sent for Campbell-Bannerman, who, in a few days, formed his cabinet with the support of all the Liberal leaders, with the exception of Lord Rosebery. The Liberal League (the imperialist section) were represented by Asquith (chancellor of the exchequer), Sir Edward Grey (foreign secretary), and Haldane (secretary of state for war). The Radical wing was represented by John Morley (secretary for India), Lloyd George (president of the Board of Trade), and others. It had been suggested in some quarters that Campbell-Bannerman should himself go to the House of Lords, but he determined to remain in the Commons, and thus maintain effective leadership of the party. The new Government was confirmed in office by an overwhelming majority at the general election of Jan. 1906; the Liberals numbered 377, Labour 53, Nationalists 83 and Unionists 157.

Once prime minister, Campbell-Bannerman's personal popularity proved to be a powerful unifying influence in a somewhat heterogeneous party; and though the illness and death (Aug. 30, 1906) of his wife (daughter of Gen. Sir Charles Bruce), whom he had married in 1860, made his constant attendance in the House of Commons impossible, his domestic sorrow excited widespread sympathy and appealed afresh to the affection of his political followers. This became all the more apparent as his own health failed during 1907; for, though he was obliged to leave much of the leadership in the Commons to Asquith, his possible resignation of the premiership was strongly deprecated; and even after November, when it became clear that his health was not equal to active work, four or five months elapsed before the necessary change was effected. Personal affection and political devotion had in these two years made him appear indispensable to the party, although nobody ever regarded him as in the front line of English statesmen so far as originality of ideas or brilliance of debating power were concerned. His strength lay in his sincerity and independence of judgment and in the courage which enabled him to take the unpopular side if he was convinced that it was the right one. From the beginning of the session of 1908 it was evident, however, that Asquith, who was acting as deputy prime minister, would before long succeed to the Liberal leadership; and on April 5, Campbell-Bannerman's resignation was formally announced. He died on the 22nd of the same month. He had spoken in the House of Commons on Feb. 13, but since then had been prostrated and unable to transact business, his illness dating really from a serious heart attack in the night of Nov. 13 at Bristol, after a speech at the Colston banquet.

For the history of the Campbell-Bannerman ministry, which saw the beginning of the struggle between the two houses of parliament and the passage of many useful domestic measures, *see* ENGLISH HISTORY. The policies in which the prime minister himself was most keenly interested and in which he was a prime mover were the grant of responsible government to the Transvaal and the Orange River colony, and the reversal of the Taff Vale decision by the passage of the Trades Disputes act (1906).

See J. A. Spender, ***The Life of the Rt. Hon. Sir H. Campbell-Bannerman, G.C.B.*** (1923).

CAMPBELTOWN, royal and small burgh and seaport, Argyllshire, Scotland. Pop. (est. 1938) 6,481. It is situated on a fine bay, toward the southeast extremity of the peninsula of Kintyre, 11 mi. N.E. of the Mull and 83 mi. S.W. of Glasgow by water, but by land 119 mi. The seat of the Dalriad monarchy in the 6th or 7th century, its importance declined when the capital was transferred to Forteviot. No memorial of its antiquity has survived, but the finely sculptured granite cross standing on a pedestal in the market place belongs to the 12th century, and there are ruins of old chapels and churches. It became a royal burgh in 1700. One of the churches occupies the site of a castle of the Macdonalds. The staple industries are whisky distilling and malting. The port is the head of a fishery district. Shipbuilding and netmaking are other industries, coal is mined in the vicinity, and limestone quarried. There are three piers and a safe harbour. On the Atlantic shore are the well-known golf links of Machrihanish, 5 mi. distant. Machrihanish is connected with Campbeltown by a light railway. On the rock of Dunaverty stood the castle of Macdonald of the Isles, who was dispossessed by the Campbells in the beginning of the 17th century At this place in 1647 General David Leslie is said to have ordered 300 of the Macdonalds to be slain after their surrender.

Of the ancient church founded here by Columba, only the walls remain.

CAMPE, JOACHIM HEINRICH (1746–1818), German educationalist, born at Deensen, Brunswick, became director of studies in the Philanthropin at Dessau (*see* BASEDOW). He started an educational establishment of his own near Hamburg, but in 1783 gave it up on account of ill-health. In 1787 he proceeded to Brunswick as counsellor of education, and purchased the Schulbuchhandlung. Among the most popular of his numerous educational works were the ***Kleine Kinderbibliothek*** (11th ed., 1815); ***Robinson der Jüngere*** (59th ed., 1861), translated into nearly every European language; and ***Sämmtliche Kinder- und Jugendschriften***, 37 vol.

CAMPECHE, a southern state of Mexico, comprising the western part of the peninsula of Yucatán, bounded north and northeast by Yucatán, east by Quintana Roo, south by Guatemala, southwest by Tabasco and northwest by the Gulf of Mexico. Pop. (1940) 90,460, mostly Indians and mestizos. Area, 19,667 sq.mi. The name is derived from its principal forest product, *palo de campeche* (logwood). The surface, like that of Yucatán, consists of a vast limestone plain, broken by a group of low elevations in the north, heavily forested in the south, but with open tracts in the north adapted to grazing. The northern part is insufficiently watered, the rains filtering quickly through the soil. In the south there are some large rivers, and the forest region is very humid. The climate is hot and unhealthful In the southwest of the state is the Laguna de Términos, a large tidewater lake, which receives the drainage of the southern districts. Among the products and exports are logwood, fustic, lignum vitae, mahogany, cedar, hides, tortoiseshell and chicle, the last extracted from the ***zapote chico*** trees (*Achras sapota*). Stock raising engages some attention. One railway crosses the state from the capital, Campeche, to Mérida, Yucatán, and there are several other short lines. The rivers of the south are much used in the transportation of products. The port of Ciudad del Carmen (pop. in 1940 about 7,600), on a sand key between the Laguna de Términos and the gulf, has an active trade in dyewoods and other forest products, and owing to its inland water communications with the forest areas of the interior is the principal port of the state

CAMPECHE or **CAMPECHE DE BARANDA,** a port of Mexico, and capital of a state of the same name, situated on the bay of Campeche, 825 mi. E. of Ciudad de México and 90 mi. S.W. of Mérida, in lat. 20° 5′ N., long. 90° 16′ W. Pop. (1910) 16,775; (1940) 23,277. Campeche was one of the three open ports of this coast under the Spanish regime, and its walls, general plan, fine public edifices, shady squares and comfortable stone residences are evidence of the wealth it once possessed. It is still one of the most attractive towns on the gulf coast of Mexico. It had a monopoly of the Yucatán trade and enjoyed large profits from its logwood exports, both of which were later largely lost to Progreso, the port of Mérida The harbour of Campeche is a shallow roadstead and vessels drawing more than 9 ft. are compelled to lie outside and discharge cargo into lighters. The exports include logwood, cotton, hides, wax, tobacco, salt and cigars of local manufacture. The principal public buildings are the old citadel, some old churches, the town hall, a handsome theatre, hospital and market. The streets are traversed by tramways, and a railway runs northeastward to Mérida. Campeche stands on the site of an old native town, of which there are interesting remains in the vicinity, and which was first visited by Hernández de Córdoba in 1517. The Spanish town was founded in 1540, and was sacked by the British in 1659 and by buccaneers in 1678 and 1685. During the revolution of 1842 Campeche was the scene of many engagements between the Mexicans and people of Yucatán.

CAMPEGGIO, LORENZO (1464–1539), Italian cardinal, was born at Milan. At first he followed a legal career at Pavia and Bologna. In 1510 he went into the church. For his services during the rebellion of Bologna, Julius II made him auditor of the Rota in 1511 and sent him to Maximilian and to Vienna as nuncio. Raised to the see of Feltre in 1512, he went on another embassy to Maximilian in 1513, and was created cardinal priest of San Tommaso in Pavione in 1517. Leo X, needing a subsidy from the English clergy, sent Campeggio to England in 1518, ostensibly to arrange a crusade against the Turks. Though his mission failed, on his return to Rome, Campeggio was received in Consistory in 1519 with the gift from the king of the palace of Cardinal Adriano Castellesi (*q.v.*), who had been deposed. He was made protector of England in the Roman curia; and in 1524 Henry VIII gave him the rich see of Salisbury, and the pope gave him the archbishopric of Bologna. After attending the diet of Regensburg, he shared the captivity of Clement VII during the sack of Rome in 1527, and did much to restore peace. On Oct 1, 1528, he arrived in England as co-legate with Wolsey in the matter of Henry's divorce. He brought with him a secret document, the Decretal, which defined the law and left the legates to decide the question of fact; but this important letter was to be shown only to Henry and Wolsey. "Owing to recent events," that is, the loss of the temporal power, Clement was in no way inclined to offend the victorious Charles V, Catherine's nephew, and Campeggio was instructed to divert the king from his purpose and protract the matter as long as possible. When the legatine court was opened at Blackfriars, on June 18, 1529, the result was certain Campeggio could not by the terms of his commission give sentence; so his only escape was to prorogue the court on July 23 on the plea of the Roman vacation. Having failed to satisfy the king, he left England on Oct. 26, 1529, after his baggage had been searched at Dover to find the Decretal, which, however, had been burned Returning to Bologna the cardinal assisted at the coronation of Charles V on Feb. 24, 1530, and went with him to the diet of

Augsburg. He was deprived by Henry of the English protectorate; and when sentence was finally given against the divorce, Campeggio lost the see of Salisbury as a non-resident alien, by act of parliament (March 11, 1535); in 1537 he became cardinal bishop of Sabina, and died in Rome on July 25, 1539.

CAMPEGNIS, SYMPHORIANUS (1472–1539), French physician, received his medical training at Pavia, practised at Lyons, and became physician to Charles VIII. and Louis XII. As one of the early humanists, he aimed to harmonize the best elements in Greek and Arabian medicine. Besides his history of medicine, entitled *De Claris Medicinae Scriptoribus* (Lyons, 1506) and his medical dictionary (Lyons, 1508), Campegnis wrote *Practica Nova* (1517) and *Hortus Gallicus* (1533).

CAMPER, PETER (1722–1789), Dutch anatomist and naturalist, was born at Leiden on May 11, 1722. He was educated at the university there, and in 1746 graduated in philosophy and medicine. He was successively professor at Franeker (1750), Amsterdam (1755) and Groningen (1763). In 1787 he was nominated to a seat in the council of state, and died at the Hague on April 7, 1789. The most important of Camper's works on comparative anatomy were published in 3 vols. at Paris in 1803, under the title *Œuvres de P. Camper qui ont pour objet l'histoire naturelle, la physiologie, et l'anatomie comparée.*

Camper's *Dissertation physique sur les différences réelles que présentent les traits du visage* etc. was published in 1781 both in Dutch and in French.

CAMP FIRE GIRLS: *see* GIRLS, CAMP FIRE.

CAMPHAUSEN, OTTO VON (1812–1896), Prussian statesman, born at Hünshoven on Oct. 21, 1812, was educated at Bonn, Heidelberg, Berlin and Munich. After a distinguished career in law, he became a councillor in the ministry of finance in 1845 and in 1869 was appointed minister. He had been a member of the second chamber of the Prussian diet since 1849 as a Moderate Liberal. His financial policy aided by the French war indemnity, was successful in restoring the Prussian finances to a flourishing condition, but his liberalism earned him Bismarck's hostility and he was forced to resign. He died in Berlin on May 18, 1896.

CAMPHAUSEN, WILHELM (1818–1885), German painter, was born in Düsseldorf on Feb. 8, 1818, and died there on June 18, 1885. He studied under A. Rethel and F. W. von Schadow. As a historical and battle painter he rapidly became popular, and in 1859 was made professor of painting at the Düsseldorf academy. His "Frederick the Great at Potsdam," "Frederick II. and the Bayreuth Dragoons at Hohenfriedburg," and pictures of the Schleswig-Holstein campaign and the war of 1866 (notably "Lines of Düppel after the Battle," in the Berlin National Gallery), made him famous in Germany as a representative of patriotic historical art. He also painted many portraits of German princes, soldiers, and statesmen. He wrote a diary of the Schleswig-Holstein campaign, *Der Maler auf dem Kriegsfeld* (1865), with illustrations.

CAMPHORS occur as components of the essential oils of many plants; and are extracted by distilling the plant material with steam; separation of the "camphors" is afterwards effected by fractional distillation, freezing or chemical treatment. The camphors are mainly alcohols and ketones of the hydrocarbons known as terpenes. Commercially, the term "camphor" is generally applied to any solid product so obtained, and hence includes the solid paraffin "stearoptenes" and sesquiterpene alcohols of essential oils. "Camphors" may thus be divided into two main groups, according to the nature of the corresponding hydrocarbon; chemically, however, the term should be reserved for the oxygenated derivatives of terpenes and sesquiterpenes, liquid as well as solid. The commercial camphors are mostly colourless crystalline solids, with characteristic odours; they are sparingly soluble in water, but dissolve readily in alcohol, ether and organic solvents generally. In this article only the chief camphors of technical interest will be mentioned; details as to their chemical structure, synthesis, and relations will be found in the article TERPENES.

Camphor, $C_{10}H_{16}O$, also known as *Japan* or *laurel camphor*, which constitutes the bulk of the camphor of commerce, is obtained from the camphor laurel (*Cinnamomum Camphora*), a tree flourishing in Japan, Formosa and central China. Camphor occurs also in various other essential oils, *e.g.*, lavender, rosemary, sage and spike. It is obtained by steam-distilling the chopped branches and twigs of the camphor laurel. The crude product, which amounts to about 3% of the wood used, consists of crystalline camphor and camphor oil; the latter, when distilled, yields camphor and other products, notably safrol. The crude camphor, which is refined by sublimation with quicklime and charcoal, then forms a translucent mass of hexagonal prisms, m.p. 175° C, b.p. 204° C. It has a characteristic odour, and it sublimes very readily. It is very slightly soluble in water, but it dissolves freely in alcohol, ether, etc. Japan camphor (*d*-camphor) is dextrorotatory, with $[\alpha]_D+44{\cdot}2^\circ$ in a 20% alcoholic solution. The rare laevo-camphor, or *matricaria camphor,* occurs in the oil of *Matricaria parthenium;* it may also be prepared by oxidizing *l*-borneol. The so-called "artificial camphor" is pinene hydrochloride (bornyl chloride); this substance is an intermediate product in the preparation of *dl*-camphor or *synthetic camphor,* which is optically inactive (m.p. 178·6° C), from pinene of turpentine oil (*see* TERPENES). The main use of camphor is in the manufacture of celluloid; it finds application also in making smokeless powders, and as a disinfectant and medicinal agent. Externally applied it acts as a counter-irritant, and, in some degree, as a local anaesthetic, being also a definite antiseptic. It is therefore used in liniments for the relief of myalgia, sciatica, lumbago, etc.

Borneol, Borneo camphor, or bornyl alcohol, $C_{10}H_{17}OH$, is the dextrorotatory secondary alcohol corresponding to Japan camphor, from which (in company with *l-iso*borneol) it is produced by reduction. It occurs in the wood of *Dryobalanops aromatica,* a majestic East Indian tree, and is known also as Malayan, Barus, or Dryobalanops camphor. *d*-Borneol melts at 204° and boils at 212° C. It has a camphor-like but somewhat peppery odour. *l*-Borneol, sometimes called *Ngai camphor,* or *baldrianic camphor* occurs in *Blumea balsamifera.*

Menthol, or *mint camphor,* $C_{10}H_{19}OH$, 5-methyl-2-*iso*propylhexahydrophenol, is obtained from the essential oils of the so-called peppermint (*Mentha piperita*) and its two varieties, the black mint (*M. piperita vulgaris*) and the white mint (*M. piperita officinalis*); in addition, Japanese and Chinese peppermint oils are distilled from *M. arvensis piperascens* and *M. arvensis glabrata.* Crystalline menthol, which was first mentioned by the Dutch botanist Gambius (1771), is obtained by submitting the cooled oil to centrifugalization, preferably after removing the terpenes, etc., by distillation under diminished pressure. Besides unremoved menthol, the residual "dementholized oil" contains *l*-menthone and many other substances. Peppermint menthol (*l*-menthol) is laevo-rotatory; it crystallizes in prisms (m.p. 43° C b.p. 212° C), having the odour and taste of peppermint. It is very slightly soluble in water, but dissolves freely in alcohol, ether etc. Menthol is used in medicine to relieve pain, as in rheumatism, neuralgia, throat affections and toothache. It acts also as a local anaesthetic, vascular stimulant and disinfectant. Natural *l*-menthol has been replaced to some extent by *dl*-menthol ("synthetic menthol"), prepared by the catalytic hydrogenation of piperitone (*q.v.*) and thymol; this substance is optically inactive and melts at 34° C when pure, but otherwise it is practically identical with *l*-menthol in its properties. Other stereoisomeric substances are *d*-menthol (m.p. 43° C), *d*- and *l-neo*menthol (oils), *dl-neo*menthol (m.p. 51° C), *d*- and *l-iso*menthol (m.p. 81·5° C), and *dl-iso*menthol (m.p. 53·5° C).

Thymol, or *thyme camphor,* $C_{10}H_{13}OH$, 5-methyl-2-*iso*propylphenol, occurs in the essential oils of ajowan (*Carum ajowan*), garden thyme (*Thymus vulgaris*), wild thyme (*T. serpyllum*), horse mint (*Monarda punctata*), etc. It is extracted from such oils by shaking them with an aqueous solution of a caustic alkali; it may also be prepared synthetically from *p*-cymene, piperitone, etc. Thymol forms large colourless plates, m.p. 44° C, b.p. 230° C. It has a strong odour of thyme, and is freely soluble in alcohol, chloroform, ether, olive oil or alkaline solutions. It is a more powerful antiseptic than phenol, but its slight solubility in water prevents its use for the same purposes. A saturated solution

(1 in 1,000 of warm water), thymol gauze, and an ointment are used. Externally it is antiparasitic, whilst internally it has been used as an intestinal antiseptic in typhoid fever. Its chief use is as an anthelmintic to destroy the *Ankylostoma duodenale*. With iodine and alkali it yields dithymol di-iodide (*aristol*), a substitute for iodoform. *Glycothymolin* is a proprietary preparation, used in the treatment of catarrhal conditions of mucous membranes, whilst a mixture of naphthalene, camphor and thymol is sold under the name of *thymolin*.

Buchu camphor, or *diosphenol*, $C_{10}H_{16}O_2$, Δ^1-menthen-2-ol-3-one, occurs in the leaf-oils of several species of South African *Barosma*, or "Buchu." It forms crystals (m.p. 83° C, b.p. 232° C) with an odour of mint. (J. Rd.)

CAMPHUYSEN, DIRK RAFELSZ (1586–1627), Dutch painter, poet, and theologian, was the son of a surgeon at Gorcum. As he manifested great artistic talent, his brother, in whose charge he was left on the death of his parents, placed him under the painter Govaerts. But at that time there was intense interest in theology, and Camphuysen, sharing in the prevailing enthusiasm, deserted the pursuit of art to become, first, a private tutor and afterwards minister of Vleuten near Utrecht (1616). He embraced the doctrines of Arminius and was deprived of this post and driven into exile (1619). He has left a translation of the Psalms and a number of short pieces, remarkable for their freshness and depth of poetic feeling; but his fame chiefly rests on his pictures, which, like his poems, are mostly small, but of great beauty. The best of his works are his sunset and moonlight scenes, and his views of the Rhine and other rivers. The close of his life was spent at Dokkum.

His nephew Raphael Camphuysen (1598–1657) is by some considered to have been the author of several of the works ascribed to his uncle; and his son Govaert (1624–74), a follower or imitator of Paul Potter, is similarly credited.

CAMPI, GIULIO (1502–1572), the founder of a school of Italian painters, was born at Cremona. He was son and pupil of a painter, Galeazzo Campi (1475–1536). He was later taught by Giulio Romano, and made a special study of Titian, Correggio and Raphael. His works are very numerous, and the church of St. Margaret in his native town owes all its frescoes to his hand. Among the earliest of his school are his brothers, Vincenzo and Antonio; the latter was also of some mark as a sculptor and as historian of Cremona.

Giulio's pupil, Bernardino Campi (1522–1592), in some respects superior to his master, began life as a goldsmith. After an education under Giulio Campi and Ippolito Corta, he attained such skill that when he added another to the 11 Caesars of Titian, it was impossible to say which was the master's and which the imitator's.

His principal work is seen in the frescoes of the cupola at San Sigismondo, at Cremona.

CAMPILLO, JOSÉ DEL (1605–1743), Spanish statesman. Under the protection of Patiño, who became prime minister in 1726, Campillo was constantly employed on naval administrative work both at home and in America. It was Patiño's policy to build up a navy quietly at home and in America, without attracting too much attention abroad, and particularly in England. In 1741, when Spain was entangled in a land war in Italy and a naval war with England, Campillo was made prime minister. His short tenure of power was chiefly notable for his vigorous attempt to sweep away the system of farming the taxes, which left the State at the mercy of contractors and financiers. He persuaded the king to allow him to establish a system of direct collection, by which waste and pilfering would be avoided. He died on April 11, 1743. Campillo wrote a treatise on a *New System of Government for America* printed at Madrid 1780. He also left a ms. treatise with the curious title, *What is superfluous and is wanting in Spain, in order that it may be what it ought to be, and not what it is.*

See D. Antonio Rodriguez Villa, *Patiño y Campillo* (1882).

CAMPIN, ROBERT (1375–1444), a painter of the School of Tournai, formerly known as the Maitre de Merode and the Maître de Flémalle. Campin's name appears in the records of Tournai between 1406 and 1444. It is there stated that he was entrusted with decorative work by the town council. Rogier van der Weyden and Jacques Daret are mentioned as entering his studio as pupils in 1427, though Rogier at that time must have been some 27 years old. Campin died on April 26, 1444. Most of the pictures now ascribed to this master were previously thought to be the early work of Rogier van der Weyden; and Campin's work has only recently been disentangled from that of his famous pupil. His masterpiece is the triptych of the Annunciation in the collection of the countess of Merode at Westerloo-Tongerloo. Another important work is at the Staedel in Frankfurt, consisting of three panels of an altar-piece said to have come from the Abbey of Flémalle. The master of this picture was provisionally called Maître de Flémalle until he was identified with Robert Campin by G. Hulin, who by documentary evidence also identified Campin's pupil, Jacques Daret, as the master of an altar-piece executed for the abbey of St. Vaast, panels of which have survived and are now at Berlin, in Paris and in the Pierpont Morgan collection. Other works which are generally ascribed to Campin are the "Virgin and Child in a Room," National gallery, London (Salting collection); a panel at Frankfurt, said to have formed part of a triptych representing the "Descent of the Cross"; a "Madonna" at the gallery of Aix in Provence; and two heads of "Christ and the Virgin," in the Johnson collection at Philadelphia. To the master's last period belong the wings of an altar-piece at Madrid dated 1438 and painted for Heinrich von Werl, a notable professor at Cologne, and a "Crucifixion" in the Berlin museum.

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(I. A. R.)

CAMPINAS, an inland city of the State of São Paulo, Brazil, 65m. by rail north west of the city of São Paulo and 114m. from the port of Santos, with which it is connected by the Paulista and São Paulo railway. In 1940 the population of the city was 79,494; municipality, 131,642. Campinas is the commercial centre of one of the oldest coffee-producing districts of the state and the outlet for a rich and extensive agricultural region lying farther inland. The Mogiana railway starts from this point and extends north to Uberaba, Minas Gerais, while the Paulista lines extend northwest into settled and very fertile regions. Since early in the 19th century, coffee has been the staple crop in the region surrounding Campinas. Sugar, cotton and cereals are also grown on a commercial scale, and sericulture is gaining rapidly in importance. Maize, mandioca and fruits are produced largely for local consumption. The city is on the central plateau at an altitude of 2,200 ft.

CAMPING is as old as the human race; for the term may be used not altogether ineptly to refer to the only form of living followed by the original representatives of the human race. For thousands of years they slept, ate, worked and carried on practically all functions of life under the free heavens.

The United States.—The American Indian was most successful in making this adaptation. He cherished a fraternal understanding with the elements and mingled in a fanciful, brotherly fellowship with the birds and animals, with the trees and flowers, with the waters and winds. He acquired a practical physical skill hunting, fishing, riding, paddling and fighting; a practical mental acuteness in knowing how to live in the woods or find his way through the forests where others might perish. Camping in its early sense was begun in America by these Indians hundreds of years before the landing of Columbus. It was adopted and altered by the white man during the colonial days and was continued down to the close of the first century after the founding of the republic. During that important century of upbuilding, the people of the United States consisted primarily of open-air men, of farmers in the East and of pioneers in the West. As late as 1880, almost three-fourths of the population was rural.

From this hasty summary of the history of camping, two outstanding facts immediately appear—(1) man's period of outdoor living extended over immeasurable aeons, his period of indoor living over a few brief centuries; hence the modern urge to get out into the unconfined spaces is an ancient racial heritage; indeed, a primeval, perhaps a biological, instinct; (2) man's physical vigour, mental acumen and moral power were developed largely as a result of his constant, direct and personal contact with nature in her various moods—moods sometimes friendly, often hostile.

When the modern apartment tenant therefore seeks to reestablish contacts with the outdoors, he may be responding knowingly and intentionally to a health-assuring, recreational and educational urge, but responding at the same time, perhaps unknowingly and unintentionally, to an even stronger and more irresistible racial, moral and religious instinct. Certain it is that the farmers and pioneers who constituted approximately 75% of the population of the United States prior to 1880 received the most effective part both of their general all-round training for the work of building up the country and also of their genuine education from the duties involved and from the lessons learned in blazing the trail and driving the covered wagon.

The sons and daughters of these open-air men secured their knowledge of and skill in the handicrafts, in nature lore, in manual training by using the loom in the home, by gathering the herbs and the plants for food or for medicinal purposes, by selecting and fashioning the red oak for their ox-bows or the ash for their basket splints. By living in the woods and mountains where distances are great, they were forced by sheer necessity to develop habits of resourcefulness and self-dependence, habits of economy and appreciation, habits of initiation and co-operation.

After the Civil War the United States changed from an open-air to a housed-in nation. The population was being converted from rural to urban, from agricultural to manufacturing and commercial. By the close of the first quarter of the 20th century, more than half the people lived in cities of 8,000 or over. A generation was growing up that knew not the birds, the trees, the flowers, nor the stars; that knew not how to carry a pack, how to blaze a trail, how to live off the country, how to keep the campfire burning; a generation that was allowing to atrophy the pioneer virtues that the human race had been evolving within itself so slowly and so painfully during its almost unceasing struggle against nature. Hardly, however, had the drift from the country to the city got under way when men associated primarily with the schools and colleges founded agricultural colleges with the purpose of making farm life more attractive. In the '70s, Louis Agassiz was urging his pupils to "study nature, not books"; in the '80s courses in nature lore were being offered in various educational institutions. Soon the back-to-nature movement was making an effective appeal to those interested in health, recreation and education. At the same time opportunities for them to get out into the woods and mountains were being created and multiplied. The increased and wider distribution of wealth afforded them leisure and financial means to travel away from the crowded streets. The growth of rapid and inexpensive transportation facilities, particularly of the through electric lines and the automobile, brought the theretofore distant country nearer. Then the improvement of the highways, the development of the county, state and national parks, the perfection of outdoor sleeping and cooking appliances made it comparatively safe and comfortable for the city dweller to transform himself at least temporarily into an amateur camper.

Private camps for adults began to come into existence during the first decade of the 20th century. They were established by directors of children's camps to provide nearby accommodations for the parents of their boys and girls, and by country boarding-housekeepers who gradually expanded their commercial ventures so as to include some of the health and recreational features of the regularly organized camps. Although a considerable number of these private open-air institutions survive for only a season or two, the growth of the movement has on the whole been rapid. While a very considerable number of them are in the New England states, particularly in Maine, New Hampshire and Vermont, the movement has spread both toward the west and toward the south until it extends from coast to coast. (E. H. L.; X.)

The fees range from about $300 to $450 for a period of nine weeks. The directors are frequently assisted by a staff of college trained men and women whose salaries vary from mere expenses to $600 or more. There is nearly always a physician or trained nurse on the staff; and the health departments of the various states exercise a fairly strict supervision over the sanitary appointments of the camps.

The social welfare and semipublic organizations were not slow in following the examples set by the private camp directors. Plainly if the sons and daughters of the well-to-do were profiting by their summers in the open air, it was even more important that these advantages be made available for the children of the moderately circumstanced. On favourable sites not too far removed from the more densely populated centres, there sprang up numerous inexpensive short-term camps that accept boys or girls usually in four or more shifts, each shift remaining for about two weeks. These camps are conducted by such organizations as the Y.M.C.A., the Y.W.C.A., the Y.M.H.A., the Boy Scouts of America, the Girl Scouts, the Camp Fire Girls, the Federation of Girls' Clubs, the Woodcraft League of America, Inc., the churches, Rotary and other service clubs, industrial and commercial enterprises, newspapers, magazines and public-spirited individuals. While no definite statistics are available, there are approximately 6,000 such camps in the United States with an annual population approaching 1,000,000.

Finally, the national, state, county and municipal authorities began to take cognizance of this mass migration out into the open. The 26 national parks and 160 national forests in the United States (1942) all provide facilities for the camper. Although firearms and dogs are barred from these national preserves, the fisherman and nature student are welcomed, as well as the tourist drawn by the many sites of historic and scenic interest. Automobile highways, trails, permanent and temporary shelters and camp grounds, complete with sanitary arrangements and cooking facilities, are maintained.

Wild life is protected, and these national parks and forests afford an unparalleled opportunity for the observation of various birds and animals which have become rare to the point of extinction in unprotected areas.

In the eastern Atlantic states, eight national forests and two national parks lie along the Appalachian trail, a marked route extending some 2,050 mi. and traversing 14 states from Mount Katahdin in Maine to Mount Oglethorpe in northern Georgia. Camp sites and simple shelters are provided throughout the length of the trail, and these trail markers and the trail itself are maintained by various outdoor organizations.

Guide books covering the entire trail are available at the office of the General Secretary, Appalachian Trail Club, 1624 H Street, N.W., Washington, D.C.

The state governments are blazing trails, setting aside areas for motor camping, constructing fireplaces, erecting shelters, providing police and sanitary supervision. The county governments are also creating extensive park systems partly for camping purposes.

It is impossible to estimate the number of millions of people who every year avail themselves of these opportunities.

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(J. Hr.)

HOW TO CAMP

A good camper may be likened to a good woodsman. He does not go with scanty outfit to endure as many hardships as he can stand—revelling in his stamina—but rather he makes the most of his equipment and the resources of nature and lives happily and comfortably in the woods. He goes camping to have a good time and returns to his work with increased health and vigour. This is possible only when he is dressed comfortably, sleeps well at night and eats properly.

The tent is the camper's logical shelter—light and portable—cool in summer and warm in winter. It may range from a simple three-pound lean-to or shelter cloth capable of sheltering from wind and rain one or two campers in brief overnight camps, to large wall tents divided by canvas partitions that accommodate whole families of outdoor enthusiasts. The proper size and style depends upon the number camping the nature of their trip and means of transportation.

The big game hunter who moves often and carries his outfit on his back prefers the light shelter cloth or a feather-weight silk tent just big enough to hold his sleeping bag. The shelter cloth is simply a waterproofed sheet 5 by 7 ft. for one and 8 by 12 ft. for two campers. Short pieces of tape are sewed on the long sides. These are tied to poles, one pole being staked to the ground and the other raised on forked stakes so the sheet stands at an angle of 45°. With the back upwind and a blazing fire at the front this simple device is quite comfortable in even cold weather.

The wall tent is a favourite for periods of one-spot camping. It can be supplied with a wooden floor and an extra fly that projects in front to form a shaded front porch. For short stays at one location, canoeists, fishermen and hunters use a large variety of quickly pitched tents like the tepee style, the miner's wedge tent and the Baker shelter tent.

Automobile campers, of whom, before the onset of World War II, there were some 20,000,000 following the highway trails in America, use tents built especially for their purpose, usually square and pyramidal in shape with waterproof floors and a wide front door closed by an awning which is stretched out in front to form a sheltered porch. These are practical and comfortable tents and are suitable for any style of camping where their weight of 50 to 70 lb. can be transported. The 7 by 9 ft. size is right for two campers and the 8 by 10 ft. size for four.

Tents should be absolutely waterproof or the camper will spend many hours in misery. Canvas fabric alone will not shed water unless pitched at an angle of at least 45°, and then it will leak readily when touched or rubbed from the inside. Make sure the tent has been treated with a waterproofing process. Good waterproofing compounds can be purchased ready-made from some tentmakers and outfitters, but it is possible for the individual to turn out a satisfactory job of waterproofing. One of the cheapest, simplest and most satisfactory methods is the paraffin process. Lay the tent on a table, and rub the outer side with either paraffin or cerasin until it has a good coating evenly distributed. Then, iron the cloth with a medium-hot flatiron, melting the wax and sending it into every pore of the cloth. The more closely woven the cloth, the less wax is necessary. Such tents do not mould even if packed damp. In mosquito-infested country the tent should have a sewed-in waterproof floor and close-mesh bobbinet screens to cover door and window. For hot weather camping ventilation is very important and is best secured by a fair size window opposite the door. Tent makers insert windows at any point on order.

Tents must be pitched so the sides and roof are square and tight. Loose wrinkled canvas will not shed water and snow, and a drooping, sagging tent warps from shape and leaks at the seams The guy ropes of unwaterproofed tents must be loosened in a rain or the canvas will pull the pegs when it starts shrinking. It is best to use steel tent pegs, for in some sections the ground is too hard for wood stakes to penetrate. If you camp on solid rock, and such camps are at times necessary in the upper Great Lakes region, cut four heavy poles, lash them in a square to fit the base of your tent and tie the bottom edges of it to them. To make guy ropes hold in loose sand, tie bundles of brush or sticks to the end and bury them a foot deep

A good camp site has convenient supplies of water and firewood, shade in the late afternoon, protection from severe storms and wind and good drainage. The water-supply should carry an assurance of being reasonably pure. If in doubt boil it before drinking. Contrary to popular belief running water does not purify itself and a fast flowing stream may be badly polluted, especially when in a flood stage. Small springs issuing from rock are usually safe. Sometimes subterranean springs are found near the edge of rivers and lakes which supply pure cold water. You can locate them with your hand trailing behind a boat. A sudden cold spot means a spring and then you dig ashore several feet back from the water's edge. Or a weighted canteen is lowered to the bottom with a string tied to the cork which is pulled when the vessel reaches the supply of fresh water. Impurities in running or still water are of animal origin and not vegetable. Rotting vegetation does not always mean impure water. Vinegar or lemon juice will neutralize the alkali water of semi-arid regions.

The summer camper requires only a small amount of fuel for camping but the cold weather camper needs considerable for keeping his tent warm and he should camp where good fuel is available. Dead standing timber makes the best firewood. If dry wood is unavailable remember that hickory burns the best of any green wood. White, gray, black and yellow birch and white and mountain ash will all burn freely in a green state. Green pine and spruce are worthless.

In warm weather stand the tent so it is shaded from two to four o'clock in the afternoon—the hottest period of the day. In cold weather observe the directions of prevailing winds as shown by standing timber which bends away from the seasonal blow and camp with a windbreak of woods or rock at the rear. Keep away from thickets and dense woods. These are damp and unwholesome and thronged with insect pests. The tent should stand on a gentle slope to carry off surface water in heavy rains. Aid this drainage by digging a 6 in. trench around the bottom of the tent. Never camp in a depression where water will gather and stand.

In camping along a river observe the high flood mark as shown by the bits of dead grass, leaves and mud along the brush on the water front and camp well above it. Avoid the deep dry washes of western States, for sudden rains will fill them dangerously full in a few minutes. Do not camp under trees with dead limbs. Rather camp in the open where your tent will dry quickly after rain or dew and there is no danger of falling trees.

The simplest and cheapest form of camp bed and one fairly satisfactory is a tick or bag of stout waterproof material 30 by 76 in. in size. The camper fills this at his camp site with dry material—leaves, dead grass or pine needles and pins the edge shut with safety pins. With two medium weight blankets this makes a comfortable summer bed. Canvas cots are standard camp furniture when their weight and bulk can be carried, but they are quite cold underneath and the sleeper should have at least twice as many blankets under him as on top. Paper blankets or even newspapers are good insulation for cots. Where light weight and the most comfort are desired there are two camp beds built on the pneumatic principle. These are the air mattress used with separate blankets and the sleeping bag or pocket which incorporates eiderdown quilting for warmth. The air mattress is made of rubber with an outside canvas cover and when properly inflated rivals the old-fashioned feather tick for comfort. When deflated it occupies a very small space and weighs but a few pounds. These beds are spread directly upon the tent floor. Camp blankets should be of light wool; two light blankets are better than one heavy one. Big game hunters usually prefer the sleeping bag which is a combination of air mattress and down quilts. They are the warmest beds in existence for their weight and bulk. The only drawback is their expense.

Camp cookery has undergone a substantial change in the past years. Formerly the camp cook's cuisine was limited to the standbys of bacon, beans and flapjacks and campers' stomachs were frequently upset with rich heavy foods. Now the experienced camp cook carries a wider variety of foods and handles his limited cooking equipment in a more effective manner. The light reflecting oven purchased at any outdoor goods store bakes biscuits, cakes and meats without the trouble of digging a bean hole or packing the sooty Dutch oven. The overworked frying pan is getting a much needed vacation. And dried milk, dried eggs and dehydrated vegetables prepared by adding water are nearly equal to the fresh products. The camper's grub bag should contain bacon, beans, cornmeal, oatmeal, rice, flour, baking powder, sweet chocolate, an assortment of dehydrated vegetables, dried or condensed milk, sugar, lard, butter in hermetically sealed tins, dried or fresh eggs, dried fruits, salt, pepper, coffee or tea and a few tit-bits like jams, jellies and cheese. This sounds like an extensive list but the secret of successful camp provisioning is to carry small quantities of a large variety. For example, in place of 15 lb. of flour take three 5 lb. sacks of flour, oatmeal and cornmeal. Dry foods are packed in small 3 and 5 lb. waterproof bags sold by camp outfitters. These are stacked in a larger 50 lb. duffle bag. Bacon, butter and lard can be carried in friction top tins procurable from the same source. Do not carry flour in its regular sack. It will collect moisture and spoil. For short trips it is a good idea to mix the flour with salt and baking powder in the proper proportions for quick bread before starting. One can open the top of the sack, punch a hole down in the flour with his fist, pour in a cup of water and mix a ball of dough which is lifted directly into the oven or baking pan. This saves soiled utensils, and dish washing is a big bugaboo of camping. To clean a greasy frying pan boil up water and a handful of ashes from the camp fire in it. Knives are scoured by sticking them in sandy earth.

A man will eat slightly over 4 lb. of food per day or 29 lb. per week. Men living an outdoor life feel an increased craving for food rich in protein and sugar and this must be remembered when the supplies are chosen.

Campers usually find fish or small game to vary the menu. Fish are at their best when eaten fresh, but game improves by hanging one or two days to bleed and tender. It should be protected from flies by a sack of netting. Amateur cooks should remember that most varieties of game are strong with a characteristic odour and the taste is improved by parboiling.

The best camp utensils are aluminium. Regular cook kits may be purchased which nest together in a compact canvas bag and are very light. When the outfit is small the camper uses his ingenuity. A flat rock heated by building a fire on it makes an excellent baking stand. Brush off the coals and ashes, set the bread on the hot stone and invert a pan over it. Bread is baked, by timber cruisers who carry only a frying pan and small kettle, by twisting the thick dough about a green club of sweet wood which has been previously heated over the fire. It is then stood in the ground leaning to the heat and bakes delicious browned bread.

Every region has some material provided by nature for building quick fires. If the woods are wet birch bark always flares when touched by a match. Dead cedar roots in the West and rich pine knots in the South aid the camp fire builder. If none of these are handy, search for a dry squirrel nest in some hollow limb. To find dry fuel after a rain, cut into a tree that has died standing, or locate limbs on a fallen log which have not touched the ground. A short chunk of thick candle is fine to start damp wood and saves many matches. Candles also make good camp light and may be set in a tin can filled with earth.

The cooking fire should be small. Lay two 5 ft. logs close together and build the fire between them. Set your utensils on their tops. When gasolene can be obtained, the small gas stoves used by auto campers are the last word for camp cooking—clean and easy to control. Coals are better for cooking than a blaze. As a rule hardwoods burn to coals and softwoods burn to ashes. Always remember the fire hazard. Clear the ground of inflammable material—leaves and dry mould—before building the camp fire. Never leave a spark when you break camp. Soak the ashes with water or cover them with fresh earth.

Stout khaki is standard for summer camping-clothes. Cool weather calls for light-weight wool underwear as wool does not absorb perspiration and become clammy. The wool-dressed camper can strip after a wetting, wring out his garments, put them on again, walk briskly a half hour and feel dry with little risk of catching cold. A partly worn business suit is very comfortable for camping, but be sure the material is stout enough to stand the hard wear it will receive. Shoes should be well broken in before you leave for camp. Foot misery will spoil the vacation completely. A light raincoat and a wool sweater for cool evenings are necessary.

Every camper should take such few simple remedies as experience tells him might be necessary and a first-aid kit for wounds. Red Cross outfits may be purchased ready assembled. Keep your camp site clean and sanitary. Enjoy nature but respect her domain and leave it unspoiled for the next camper to enjoy.

(M. H. De.; J. Hr.)

CAMPION, EDMUND (1540–1581), English Jesuit, was born in London and educated at Christ's hospital and St. John's college, Oxford. About 1564 religious difficulties began to beset him, but at the persuasion of Edward Cheyney, bishop of Gloucester, although holding Catholic doctrines, he took deacon's orders in the English Church. Inwardly "he took a remorse of conscience and detestation of mind," and in 1569 left Oxford to take part in a proposed restoration of Dublin university. Followed by suspicion, he at last escaped to Douai, where he joined William Allen (*q.v.*) and was reconciled to the Roman Church. After being ordained sub-deacon, he became a Jesuit at Rome in 1573. In 1580 the Jesuit mission to England was begun, and he accompanied Robert Parsons (*q.v.*) who, as superior, was intended to counterbalance Campion's impetuous zeal. In England he led a hunted life, preaching and ministering to Catholics in Berkshire, Oxfordshire, Northamptonshire and Lancashire. His *Decem Rationes* against the Anglican Church was privately printed and 400 copies were found on the benches of St. Mary's, Oxford, at the Commencement, on June 27, 1581. The sensation was immense, and the pursuit became keener. When preaching at Lyford, in Berkshire, on July 14 he was captured by a spy and taken to London, bearing on his hat a paper with the inscription, "Campion, the Seditious Jesuit." Committed to the Tower, he was examined in the presence of Elizabeth, who asked him if he acknowledged her as queen of England, and on his affirmative reply she made him offers of life, wealth and dignities on conditions which his conscience could not allow. He was kept a long time in prison, twice racked by order of the council, and every effort was made to shake his constancy. Despite the effect of a false rumour of retraction and a forged confession, his adversaries in despair summoned him to four public conferences (1st, 18th, 23rd and 27th of September), where his ease won the admiration of the audience. Racked again on Oct. 31, he was indicted at Westminster that he with others had conspired at Rome and Reims to dethrone the queen. On Nov. 20, when found guilty, he remarked: "If our religion do make traitors we are worthy to be condemned, but otherwise are and have been true subjects as ever the queen had." He received the sentence of the traitor's death with the *Te Deum laudamus*, and suffered the barbarous penalty on Dec. 1, 1581. Of all the Jesuit missionaries who suffered for their allegiance to the ancient religion Campion stands the highest. His life and his aspirations were pure, his zeal true and his loyalty unquestionable. He was beatified by Leo XIII. in 1886.

The last of the forty-seven editions of the *Decem Rationes* appeared with an Eng. trans. in vol. 6 of "The Catholic Library." *See* R. Simpson, *Edmund Campion* (1867); H. Foley, *Records of the English Province of the Society of Jesus* (1877).

CAMPION, THOMAS (1567–1620) English poet and musician, was born in London on Feb. 12, 1507, and christened at St. Andrew's, Holborn. He was the son of John Campion of the Middle Temple, who was by profession one of the cursitors of the chancery court, the clerks "of course," whose duties were to draft the various writs and legal instruments in correct form. His mother was Lucy Searle, daughter of Laurence Searle, one of the queen's sergeants-at-arms. Upon the death of Campion's father in 1576, his mother married Augustine Steward and died herself soon after. Steward sent him in 1581 to Peterhouse, Cambridge, as a gentleman pensioner. He left the university, it would appear, without a degree, but strongly imbued with those tastes for classical literature which exercised such powerful influence upon his subsequent work. In April 1586 he was admitted to Gray's Inn, but he does not appear to have been called to the bar. In 1501 he seems to have taken part in the French expedition under Essex, sent for the assistance of Henry IV. against the League; and in 1006 he first appears with the degree of doctor of physic. He practised as a physician until his death in London on March 1, 1620. A group of five anonymous poems by Campion was included in the *Songs of Divers Noblemen and Gentlemen*, appended to Newman's surreptitious edition of Sidney's *Astrophel and Stella*, which appeared in 1591. In 1595 appeared under his own name the *Poemata*, a collection of Latin panegyrics, elegies and epigrams. This was followed in 1601 by *A Booke of Ayres*, the music of which was contributed in equal proportions by himself and Philip Rosseter, while the words were almost certainly all written by him. The following year he published his *Observations in the Art of English Poesie*, "against the vulgar and unartificial custom of riming," in favour of rhymeless verse on the model of classical quantitative poetry. The challenge thus thrown down was accepted by Daniel whose *Defence of Ryme* was published in the same year.

In 1607 he wrote and published a masque for the occasion of the marriage of Lord Hayes, and in 1613 he issued a volume of *Songs of Mourning* (set to music by Coperario or John Cooper) for the loss of Prince Henry. The same year he wrote and arranged three masques, the *Lords' Masque* for the marriage of Princess Elizabeth, an entertainment for the amusement of Queen Anne at Caversham House, and a third for the marriage of the earl of Somerset to Frances Howard, countess of Essex. If, moreover, as appears likely, his *Two Bookes of Ayres* (both words and music written by himself) belongs also to this year, it was indeed his *annus mirabilis*.

Some time in or after 1617 appeared his *Third and Fourth Booke of Ayres;* while to that year probably also belongs his *New Way of making Foure Parts in Counter-point*, a technical treatise which was for many years the standard text-book on the subject. It was included, with annotations by Christopher Sympson, in Playfair's *Brief Introduction to the Skill of Musick*, and two editions appear to have been bought up by 1660. In 1618 appeared *The Ayres that were sung and played at Brougham Castle* on the occasion of the king's entertainment there, the music by Mason and Earsden, while the words were almost certainly by Campion; and in 1619 he published his *Epigrammatum Libri II. Umbra Elegiarum liber unus*, a reprint of his 1595 collection with considerable omissions, additions (in the form of another book of epigrams) and corrections.

While Campion had attained a considerable reputation in his own day, in the years that followed his death his works were forgotten. The masque was practically extinguished by the Puritan revolution, which also, with its distaste for all secular music, put an end to the madrigal. Its loss involved that of many hundreds of dainty lyrics, including those of Campion, and it was only when Mr. A. H. Bullen published a collection of the poet's works in 1889, that his genius was again recognized.

Campion set little store by his English lyrics; they were to him "the superfluous blossoms of his deeper studies," but we may thank the fates that his precepts of rhymeless versification so little affected his practice. His rhymeless experiments are certainly better conceived than many others, but they lack the spontaneous grace and freshness of his other poetry. Not one of his songs is unmusical; moreover, the fact of his composing both words and music gave rise to a metrical fluidity which is one of his most characteristic features. Rarely indeed are his rhythms uniform, while they frequently shift from line to line. His range was very great both in feeling and expression, and whether he attempts an elaborate epithalamium or a simple country ditty, the result is always full of unstudied freshness and tuneful charm. In some of his sacred pieces he is particularly successful, combining real poetry with genuine religious fervour.

Bibliography.—*Works*, etc. (1880), excluding *A New Way*, etc.; *Songs and Masques* (1903), with an introduction on Campion's music by Janet Dodge; *Poems*, etc. (1907); *Complete Works* (1908). The "Observations in the Art of English Poesie" are also published in Haslewood's *Ancient Critical Essays* and Gregory Smith's *Elizabethan Critical Essays*, vol. ii. (1903). (S. P. V.)

CAMPISTRON, JEAN GALBERT DE (1656–1723), French dramatist, was born at Toulouse of noble family. At the age of 17 he was wounded in a duel and sent to Paris, where he became an ardent disciple of Racine. In 1685 he scored his first success with *Andronic*, which disguised under other names the tragic story of Don Carlos and Elizabeth of France. Racine was asked by Louis Joseph, duc de Vendôme, to write the book of an opera to be performed at a fête given in honour of the Dauphin. He handed on the commission to Campistron, who produced *Acis et Galathée* for Lulli's music. He wrote many tragedies and two comedies, one of which, *Le Jaloux désabusé*, has been considered by some judges to be his best work. In 1686 he had been made intendant to the duc de Vendôme and followed him to Italy and Spain, accompanying him on all his campaigns. If he was not a good poet he was an honest man under circumstances in which corruption was easy and usual. Many honours were conferred on him, and in 1701 he was received into the Academy.

CAMPOAMOR Y CAMPOOSORIO, RAMON DE (1819–1901), Spanish poet, born at Navia (Asturias). Abandoning his first intention of entering the Jesuit order, he studied medicine at Madrid, found an opening in politics as a supporter of the Moderate party, and became governor of Castellón de la Plana, of Alicante and of Valencia. His conservative tendencies grew more pronounced with time, and his *Polémicas con la Democracia* (1862) may be taken as the definitive expression of his political opinions. His first appearance as a poet dated from 1840, when he published his *Ternezas y flores*, a collection of idyllic verses, remarkable for their technical excellence. These were followed by *Ayes del Alma* (1842) and *Fábulas morales y politicas* (1842). Campoamor's theatrical pieces, such as *El Palacio de la Verdad* (1871), *Dies Irae* (1873), *El Honor* (1874) and *Glorias Humanas* (1885), are interesting experiments; but they are totally lacking in dramatic spirit. He always showed a keen interest in metaphysical and philosophic questions, and defined his position in *La Filosofia de las leyes* (1846), *El Personalismo* (1855), *Lo Absoluto* (1865) and *El Ideismo* (1883). These studies are chiefly valuable as embodying fragments of self-revelation, and as having led to the composition of those *doloras, humoradas* and *pequeños poemas*, which the poet's admirers regard as a new poetic species. The first collection of *Doloras*, philosophic epigrams, was printed in 1846, and it cannot be denied that the poet's special gifts of irony, grace and pathos find their best expression in them. Taking a commonplace theme, he presents in four, eight or twelve lines a perfect miniature of condensed emotion, and by his choice of a vehicle he has avoided the fatal facility and copiousness which have led many Spanish poets to destruction. But his influence has not been always for good. His formula is too easily mastered, and to his example is due a plague of *doloras* and *humoradas* by poetasters who have caricatured their model. Though the title of a philosophic poet will be denied to him, he will survive, at least in extract, as a distinguished humorist, an expert in epigrammatic and sententious aphorism, and an artist of extremely finished execution.

(J. F.-K.)

CAMPOBASSO, a city of Molise (*see* Abruzzi e Molise), Italy, the capital of the province of Campobasso, 172m. E.S.E. of Rome by rail, situated 2,132ft. above sea-level. Pop. (1936) town 17,043; commune 29,573. The town itself has some fine modern edifices and a museum of Samnite antiquities. Its chief industry is the manufacture of arms and cutlery. Above the town are the picturesque ruins of a castle of 1458. The town, with the territory surrounding it, was under the feudal rule of counts until 1739.

CAMPODEA, a small whitish, wingless insect of the order Thysanura, sub-class Apterygota (*q.v.*), with long flexible antennae, and a pair of elongated caudal filaments. The best known species (*Campodea staphylinus*) is widely distributed in Europe and North America where it occurs under stones and logs, or in rotting leaves and soil.

CAMPOMANES, PEDRO RODRÍGUEZ, Conde de (1723–1802), Spanish statesman and writer, was born at Santa Eulalia de Sorribia, Asturias. From 1788 to 1793 he was president of the council of Castile; but on the accession of Charles IV. he retired from public life, regretted by the true friends of his country. During his tenure of office he had sought to reform taxation, to promote industry and trade, and to improve education. His principal works are two admirable essays, *Discurso sobre el fomento de la industria popular*, 1774, and *Discurso sobre la educación popular de los artesanos y su fomento*, 1775.

See the notice by A. Rodriguez Villa prefixed to the first edition of his *Cartas politico-economicas* (1878).

CAMPOS, ARSENIO MARTINEZ DE (1831–1900), Spanish marshal, senator and knight of the Golden Fleece, was born at Segovia. He took part in the Morocco campaign of 1859–60, and in the expedition to Mexico under Prim. In 1869 he was sent to Cuba, where he was promoted to the rank of general in 1872. On his return to Spain he distinguished himself against the Cantonal Republicans and the Carlists. About that time he began to conspire with a view to restore the son of Queen Isabella. He joined Gen. Daban at Sagunto on Dec. 29, 1874, where he proclaimed Alphonso XII king of Spain. From that date he was considered as a sort of supreme counsellor, being consulted by King Alphonso, and later by his widow, the queen-regent, in every important political crisis, and on every international or colonial question, especially when other generals or the army itself became troublesome. He took an important part in the military operations against the Carlists, and in the negotiations with their leaders, which put an end to the civil war in 1876. In the same way he pacified Cuba in 1878. On his return he was prime minister for a few months, but soon made way for Canovas. In 1881, with other discontented generals, he assisted Sagasta in obtaining office. After the death of King Alphonso, Campos steadily supported the regency of Queen Christina. In 1893 he commanded the Spanish army at Melilla, and negotiated with the court of Morocco a treaty which averted a war. He was sent out by the Conservative cabinet of Canovas to cope with the rebellion in Cuba in 1895, but he failed in the field, as well as in his efforts to win over the Creoles. After the war with America, and the loss of the colonies in 1899, when Señor Silvela formed a new Conservative party and cabinet, the old marshal accepted the presidency of the senate, though his health was failing fast. He died at Zarauz, a village on the coast of Guipuzcoa.

CAMPOS, an inland city of the state of Rio de Janeiro, Brazil, on the Paraiba river, 30 mi. from the sea, and about 175 mi. N.E. of the city of Rio de Janeiro. In 1940 the population of Campos was 52,677 and the *municipio* 225,443. The river is navigable for small steamers above and below the city but is closed to coastwise navigation by dangerous sandbars at its mouth. The shipping port for Campos is Imbetiba (near Macaé), 60 mi. southwest, with which it is connected by rail. There is also water communication between the two places by means of coastal lakes united by canals. The elevation of the city is only 69 ft. above sea level, and it stands near the western margin of a highly fertile alluvial plain devoted to the production of sugar. The climate is hot and humid, and many kinds of tropical fruit are produced in abundance.

CAMPRA, ANDRÉ, (1660–1744), French composer, was born in Aix, in 1660. He was considered to link the period of Lulli and that of Rameau. The works which heralded his career are his two first contributions to opera: *l'Europe galante*, and *le Carnaval de Venise*. He was successively director of the chapels at Toulon, Arles, Toulouse, in Paris the church of the Jesuits, and finally at Notre Dame. Besides operas, he wrote cantatas, and five books of religious anthems for the king's chapel, of which he became director in 1722. He died in Paris in 1744.

CÂMPULUNG, the capital of the department of Muscel, Rumania, and seat of a suffragan bishop; situated among the outlying hills of the Carpathian mountains on the river Tîrgului, a tributary of the Argeş. Pop. (1930), 13,454. Câmpulung is a popular summer resort. The Tîrgului supplies water power for several paper-mills; annual fairs are held on July 20 and Oct. 20; and there is a considerable traffic with Transylvania and with the south by a branch railway to Ploeşti. A German colony was established at Câmpulung in the 12th century but could not be maintained. Afterwards it was for a short time the first capital of Walachia. The monastery and cathedral claim to have been founded by the Voivode Radu Negru in the 13th century.

CAMPUS, a Latin word meaning level plain. By the Romans the name was given to a number of open grassy spaces in and about the city. Of these the most famous was the Campus Martius on the northwest which became the property of the state after the expulsion of the Tarquins. It was the site of the comitia curiata, of the horse races in honour of Mars, of athletic and military events, a place of reception for foreign ambassadors and a recreational centre.

American colleges, fond of classic terminology and richer in land than they were in buildings, early used the word campus to describe their grounds. Although yard is the term in vogue at Harvard and although yard and green long dominated at Yale, in common usage campus has prevailed over all others as a term describing the land owned by a college or university and used for its purposes. A large and often beautiful campus forms frequently the most attractive feature of many American colleges and has become the centre of college traditions and the site of many distinctive customs. The connotations of the term gradually widened until in the second decade of the 20th century it tended to become synonymous for the nonscholastic life of an American college and descriptive of the athletic, social, dramatic and other extracurricular activities. A man is spoken of, for instance, as a "campus leader"; "campus politics" form a training school for many a budding legislator; "campus activities" are those not concerned with books or study.

See Albert Matthews, "The Use at American Colleges of the Word Campus" (*Mass. Hist. Soc. Pub.*, vol. 3) and the *Nation* (vol. 66, 1898).

CAMUCCINI, VINCENZO (1773–1844), Italian historical painter, was born at Rome. He was educated by his brother Pietro, a picture-restorer, and Borubelli, an engraver. Camuccini belonged to the school of the French artist David. His works are rather the fruits of great cleverness and patient care than of fresh and original genius.

He was appointed director of the Academy of San Luca and of the Neapolitan academy at Rome, and conservator of the pictures of the Vatican. His chief works are the classical paintings of the "Assassination of Caesar," the "Death of Virginia," the "Devotion of the Roman Women," "Young Romulus and Remus," "Horatius Cocles," the "St. Thomas," which was copied in mosaic for St. Peter's, the "Presentation of Christ in the Temple," and a number of excellent portraits.

CAMULODUNUM: *see* COLCHESTER.

CAMUS, ARMAND GASTON (1740–1804), French revolutionist, was born in Paris. In 1789 he was elected by the third estate of Paris to the states general, and attracted attention by his speeches against social inequalities. Camus was a Jansenist and a member of the ecclesiastical committee which presented the Civil Constitution of the Clergy to the assembly in May 1790. Elected to the national convention by the department of Haute Loire, he was named member of the committee of general safety, and then sent as one of the commissioners charged with the surveillance of General C. F. Dumouriez. Delivered with his colleagues to the Austrians on April 3, 1793, he was exchanged for the daughter of Louis XVI in Nov. 1795. He played an inconspicuous rôle in the Council of the Five Hundred. On Aug. 14, 1789, the constituent assembly made Camus its archivist, and in that capacity he organized the national archives, classified the papers of the different assemblies of the Revolution and drew up analytical tables of the *procès verbaux*. He was restored to the office in 1796. He remained an austere republican, refusing to take part in the Napoleonic regime. His principal work is *Code judiciaire, ou Recueil des décrets de l'Assemblée nationale et constituante sur l'ordre judiciaire* (1792).

CAMUS DE MEZIERES, NICOLAS LE (1721–1789), French architect, was born at Paris on March 26, 1721 and died there on July 27, 1789. He published several works on architectural and related subjects, including *Dissertation . . . en réponse au Mémoire de M. Paris du Verney, sur la Théorie et la Pratique des gras bois de charpente* (in collaboration with A. Babuty Desgodetz, 1763), and *Traité de la force des bois* (1782).

CANA, of Galilee, the scene of Christ's first miracle (John ii), and an act of healing (John iv); also the home of Nathanael (John xxi 2). The evidence favours identification with *Kefr Kenna* about 4 mi. N.N.E. of Nazareth on the road to Tiberias; pop. 1,175 (682 Moslems). There are Latin and Greek churches, the former occupying the site of an ancient basilica claimed to be of the age of Constantine. Mosaic paving with an early Hebrew inscription has been discovered below its floor. The alternative identification, *Khirbet Kānā*, is a ruined site 9 m. N. of Nazareth with rock-cut tombs and cisterns but possessing no spring.

CANAAN, CANAANITES. Canaan is, in the view of the biblical writers the "Promised Land" which God had allotted to Abraham and his seed (Gen. xii. 7; xiii. 15, etc.); the holy land of the representatives of the three great monotheistic religions. This hilly country, poor for purposes of cultivation, seemed to the Israelites coming out of the wilderness, to be a land "flowing with milk and honey" (Exod. iii. 8; Deut. xi. 9, *sqq.*, etc.). If grape-honey is to be understood, this term is connected with two chief activities of the country, cattle breeding and wine-growing. But the mythological explanation is more likely: Canaan is as a Paradise, and "milk and honey" then means something similar to "Nectar and Ambrosia" (*cf.* Deut. xxxii. 13 *sqq.*, also Is. vii. 15). Actually, in view of the conquered but still feared former inhabitants, Canaan signifies for the Israelites the temptation to fall back into Nature-worship (*cf.* Ezek. xvi. 29; xvii. 4; Ps. cvi. 38, and Gen. ix. 25).

The Land.—Canaan in spite of its small area, is of remarkable variety in geographical and climatic character. Natural conditions necessitated its cleavage, both politically and otherwise, into more or less independent cities and peoples. As a "hinterland," of the Phoenician ports especially, west Jordan was always receptive of foreign influences, but although, without any marked cultural stamp, it was (especially in the South) capable of independent development. Comparatively seldom do we find Canaan as the name of a country in non-biblical writings. Nowhere, as far as yet known, is the name older than the time of the Egyptian New Kingdom (*i.e.*, after 1600 B.C.). In the Hittite cuneiform texts from Boghaz-keui, we find Canaan (Kinaḫḫe, the same form in the Amarna texts), in a record concerning Mitanni and several (non-Semitic) north Syrian kingdoms (Kinza, Dunip, Ugarit, Kaṭna, etc.). Probably the name originally denoted the plains on the coast, including the Phoenician commercial cities, the lowlands and plains of the interior (*cf.* Num. xiii. 29), and eventually the whole of west Jordan. The etymology is unknown: the meaning "Lowland" must be rejected. In the Egyptian inscriptions (after Seti I., about 1300 B.C.) we find the name invariably with the definite article, "the Canaan."

The Inhabitants.—The Canaanites are often mentioned in the Old Testament, as one of the peoples of the country, by the side of Hittites, Amorites, Perezites, Hivvites and Jebusites (*e.g.*, Exod. iii. 8; Deut. vii. 1). Behind this enumeration lurks a true recollection of racial blending in pre-Israelite times. In the "table of nations," Gen. x. 6, *sqq.*, Canaan does not appear with the Semites, but as a son of Ham (*cf.* ix. 18 *sqq.*). This may be attributed to the fact that geographical and ethnical considerations have been crossed by ethico-religious ones: with Ham were classified (in addition to the despised negroes), all those who were inimical and dangerous to the chosen people. It may be that there is historical ground for this belief. Palestine must have been settled by a people from the north about 1600 B.C.; with this people were mixed the Mitanni and Harri, and all were under the dominion of an Aryan population. We find in Amarna times (*see* below) Indo-Aryan names among the rulers of Canaan. It is possible, though not demonstrable, that the Canaanites were connected with these conquerors who may be historically regarded as the forerunners of the Philistines. Thus, the two commonly-used names of the Holy Land, Canaan and Palestine (*i.e.*, "land of Philistines"), originate with non-Semitic peoples who were merely temporary rulers there (*see* PHILISTINES).

Archaeology.—When the Israelites entered Canaan (probably in two divisions, 1400 and 1200 B.C.), the civilization, as far as it had been influenced by Egypt and Babylon, was already in decay. The invasion of the Israelites does not fall at the dawn of history, but in the dusk of a stormy evening. About 1200 B.C. the aspect changed. The peoples of youthful Europe overran Asia Minor and Syria, and even menaced Egypt. Out of the Syro-Arabian desert came a young people of Semitic stock, the Aramaeans. Israel stood on the border between two ages. The religion of Sinai and the culture of Canaan were the two conflicting factors in its history. The culture of Canaan, however, is itself a complicated structure, the fruit of a long history.

In the Old Testament we find little about this; the biblical authors paid more attention to the ways of God with His chosen people than to the hated and accursed aborigines. Excavation, on the other hand comes to our aid. As early as 1865 the "Palestine Excavation Fund" had been founded, and subsequently noteworthy preliminary work in Jerusalem was done. Systematical excavations in the Holy Land began in 1890 with the uncovering of Tell el-Hesy Lachish (or preferably Eglon). Since Palestine became mandated territory, a friendly rivalry has existed between the nations. Archaeological methods have been improved, the courses of old city walls have been followed, and the ruins within are uncovered layer by layer. So we gain an impression of this culture from the latest to the earliest stratum. The vessels and potsherds serve as a norm for the chronology. Excavations, such as those of Gezer, Megiddo, Beth Shan, Shechem, Gibeon (or Mizpah?) and Kirjath-Sepher, supply much interesting material. But ancient Canaan is a "dumb" country: there are no inscriptions. This is due to the perishable nature of their writing material. Papyrus, wood and leather disappeared in the wet soil. Some few pieces of clay tablets in cuneiform script have been found at Taanach and most recently at Shechem; but from these it would seem that the Canaanites wrote in this more permanent form only during the period 1400–1200 B.C. But history-writing is impossible without written records. Therefore the basis of the following historical sketch must be the references to Canaan in Egyptian, Babylonian and (cuneiform) Hittite sources, and above all (for the period 1400–1350 B.C.) the very important Canaanite cuneiform records found at el-Amarna in Egypt (*see* below).

The Oldest Period (Up to 2500 B.C.).—Human settlements and culture go back as far as the beginning of the history of mankind. In caves near Tabgha—north of the sea of Gennesaret—was found a fragment of a skull of Neanderthal type (*Homo primigenius*). Traces of early Palaeolithic flint-implements were found at Balata (Shechem) and elsewhere, as also in the extreme south of the country at Ain Kuseime (in the region of the biblical Kadesh-Barnea). Surprisingly enough we find at different places (at Jerusalem, Askalon, Gaza) a mixture of implements and weapons of the earliest and later types; this can only be explained by the mixture of different racial elements. All this, however, is of so remote an age as to be beyond our reach. Not until about 3000 B.C. does the dawn of history begin. The majority of the megalithic monuments (barrows, cromlechs, dolmens, etc.) must be synchronous with the Old Kingdom of Egypt, as also must the oldest city-foundations. The fact that the Old Testament (*e.g.*, Num. xiii., 32 *sq.*, Amos ii. 9) describes the aborigines as giants may be ascribed to these monuments. Only giants, it was imagined, could have raised these huge boulders. But the skeletal remains of the first layer of Gezer definitely belong to a small race, smaller than the Semites, who differed from the Semites by their use of cremation.

The immigration of the Semites (from the south and southwest) must have taken place before 3000 B.C. These oldest Semitic peoples of Canaan must have been (in speech also) closely akin to the oldest Semitic dwellers in north Babylonia (the Akkadians). From this source also came the Canaanites' knowledge of metals (copper and bronze), of vegetables, domestic animals and many other cultural and spiritual acquisitions which had been much earlier developed and improved by the Sumerians in Mesopotamia and the Egyptians of the Old Kingdom. Egyptian influence was stronger in Byblos, the ancient trading port of Lebanon's export of cedar-wood. Copper came from the mines at Wadi Maghara of Sinai. Thus culture developed rapidly in the territory between these two areas.

The Old Canaanite Period (First Bronze Age, 2600–2000 B.C.).—In the tomb of Inti (Deshasheh, Upper Egypt), we find the first representations of the conquest of Canaanite cities by Egyptians. Neither in arms nor in clothes were the Canaanites much inferior to the victorious Egyptians. About 100 years later (6th dynasty; according to the shortest reckoning, 2450 B.C.), the Egyptian Uni, recorded in his tomb his victorious campaigns against the "sand-dwellers," who occupied the country of Canaan. The inscription recounts a struggle against sturdy nomads, who invaded Canaan, so keenly coveted by the Egyptians. Only after the intervention of the Egyptian fleet was the decisive battle fought, probably near the promontory of Carmel (in the plain of Megiddo). It may be supposed that these struggles are connected with the advance of the Amorites (*q.v.*) from their original territory on the middle course of the Euphrates. These invasions did not mean, however, much retrogression in civilization. The Amorites had a great capacity for adaptation and wherever they came, they spread the Mesopotamian culture, which they had themselves absorbed. Subsequently, they too were subjugated. Sargon I. of Akkad seized the "upper land," that is, as far as the Amanus and Taurus (?). Soon, however, the Amorites pressed forward to the coveted cultivated lands near the mouth of the great rivers: Euphrates, Tigris and the Nile. Of this first intermediate period (between the Old and Middle kingdom) we have little information concerning Egypt (*cf.* H. Frankfort, *Journal of Egypt. Archaeol.* vol. xii. 1926, pp. 80–99).

The classical period of the Middle kingdom shows a national Egyptian reaction against the Canaanite (Amorite) influence. We obtain an invaluable glimpse of the condition of Canaan at this time (*c.* 2000 B.C.) in the (romantic) story of Sinuhe, an Egyptian fugitive of high rank, who describes his experiences and exploits in Upper Retenu (*i.e.*, the mountains of Canaan). We gain the impression of well-regulated conditions, although without any central government. Mention is indeed made of the Egyptian claims, but the Canaanite chiefs did not concern themselves much about these. The peaceful relations between the two lands were of much greater importance.

The Middle Canaanite Period (Second Bronze Age, 2000 to 1600 B.C.).—The above-mentioned "kingdom of Retenu" was then (according to the hypothesis of A. Alt) an independent territory, with the later Lod-Lydda, west of Jerusalem, as its capital; according to another view, the name is preserved in that of Lot or Lotan (*Camb. Anc. Hist.* i. 235). Independent of it was, probably, the "land of Shechem" in the heart of the mountains of Samaria, which was conquered about 1850 B.C. by Sesostris III. It is probable that the country then already consisted of several political territories, with scattered township centres. Unfortunately, thenceforth no written information exists for nearly 300 years; and this is all the more to be regretted as it is just these centuries—as excavations show—which formed the first great period in the culture of this country. The Hyksos stand out as a new power which ruled over Egypt and the surrounding lands. The ground-stock of its population must have been Amorite; the heads of the ruling classes were probably already Indo-Iranian. For the first time, Syria and Canaan formed the centre of a mighty kingdom which stretched, in all probability, over a part of Asia Minor and the Aegean islands.

Using strategic methods hitherto unknown—the introduction of horses and chariots—these knightly warriors conquered a great part of the world then known, and a feudal nobility shared the sovereignty over the conquered peoples. This explains how, even after the fall of the great kingdom, there existed in Canaan an aristocracy composed of many varied elements—Semitic, Indo-Aryan and Hittite. Their leaders (just as they did in Homeric Greece) claimed the title of "king." Everywhere in the country there arose circular or square fortresses, with double walls of mud. This is the period in Canaan in which we may expect to find palaces and temples with colonnaded halls, while the terraced constructions discovered in 1926–27 at Shechem (Tell el-Balata) appear to belong to the next period.

The Late Canaanite Period (Third Bronze Age, 1600–1200 B.C.).—The Theban kings of the 17th and 18th dynasties regarded themselves as the heirs to the Hyksos kingdom in Asia. For three years the conqueror of the Hyksos, Ahmose (Amosis) besieged the town of Sharuhen (present Tell el-Khueilf). With the fall of this fortress, South Palestine was at the mercy of the Egyptian conquerors, but the work was completed by Thutmose III. (1555–1501 B.C.). In 16 campaigns, culminating in the capture of Megiddo (Tell el-Mutesellim), the key position of north Canaan, and Kadesh on the Orontes (Tell Nebi Mendi), the capital of the Amorites, Canaan was completely subjected to Egypt. In this "New Kingdom" Egypt was the dominant power, but Asiatic influences were then progressing in Egypt with more vigour than Egyptian influences in Asia. Probably in the period of Amenhotep III., "the Magnificent," Canaan was also covered with palaces and temples. The foundations of these have recently been discovered in Beth-Shan, and, perhaps, in Shechem. The "kings of Canaan" became the loyal servants of Pharaoh. In the north, however, the Hittite empire became a dangerous rival of Egypt.

The diplomatic language in which the rulers of Canaan communicated with the Egyptian sovereign and officials, and even occasionally among themselves, was still Babylonian. The discovery of the Tell el-Amarna tablets came as a flash-light in the obscurity of the history and culture of Canaan in the first half of the 14th century B.C. These tablets, which were found in 1889 on the site of the residence of the "heretic" king, Amenhotep IV. (Akhnaton), are in the Babylonian language and written in cuneiform, on clay. The reign of this philosopher on the throne of the Pharaohs was for Canaan a time of internal and external troubles. Egyptian supremacy (which, in the Old Testament, is not even mentioned) was approaching its end. However, the great Pharaohs of the 19th dynasty once again tightened the loosened bonds. Hor-em-heb received (even at the time of his ascending the throne) an oath of allegiance from the Asiatics. Seti I. and Rameses II. erected their steles of victory at Beth-Shan. The first made a treaty of peace with the Hittite king, Mutallish, which secured the possession of Canaan once again to the Egyptians. The latter made a similar treaty with Khattushilish III., but this was less favourable to the Egyptians, as he himself had with difficulty escaped defeat at the battle of Kadesh on the Orontes (autumn, 1288 B.C.). From the 12th century B.C. onwards, Egyptian claims to Canaan were brought to an end by the new immigrations from both sides: the Israelites and, subsequently, the Philistines.

Israel.—The problem of the exodus of the Israelites from Egypt and their entry into Canaan is chronologically one of the most difficult, and agreement on this point has not yet been reached. Many scholars identify the Children of Israel with the "Khabiri," the people who invaded Canaan in the Amarna Age. It was against these people that rulers of Canaan vainly appealed to the Pharaoh. This identification is the more convincing as the word "Khabiri" may, philologically, be identified with the word for "Hebrew" (*'ibri*). Moreover, Pharaoh Mernephtha mentions, only 150 years later (*c.* 1220), the people of Israel in conjunction with the peoples and cities of Canaan. Other difficulties, however, stand in the way of this identification.

Probably, two invasions of Hebrew tribes must be distinguished (Burney, Sellin and others). A considerable movement of tribes is described in the patriarchal narratives in Genesis xxxi.–xxxv. in the form of more or less idyllic family history. The older Hebrew group, with which may be reckoned Edom, Moab and Ammon, and, above all, the Leah-tribes with Jacob as representative), may be identified with the "Khabiri" of the Amarna letters, and the Leah-tribes, in particular, with the "Israel" of Mernephtah. The invasion of the younger group, on the other hand (the Rachel-tribes, Ephraim, Manasseh and Benjamin), which attacked Canaan with fire and sword under Joshua, in league with the older tribes, cannot be placed before 1200 B.C. Archaeological research confirms this view; from the strata of ashes and other indications of the excavations it appears (according to W. F. Albright), that Canaan in the third Bronze age, that is, during the period 1600–1200 B.C., suffered two conquests: the second of which was more violent and complete, the first at the beginning and the second at the end of this period. For us the most important age in the long eventful history of the land of Canaan begins with the entry of the Israelites. (*See* JEWS; PALESTINE: *History.*)

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CANACHUS, a sculptor of Sicyon of the latter part of the 6th century B.C. He made two great statues of Apollo with a stag and a bow, one in bronze for the temple at Miletus, and one in cedar wood for Thebes. The former is represented on coins of Miletus.

CANADA. The Dominion of Canada comprises the northern half of the continent of North America and its adjacent islands, excepting Alaska, which belongs to the United States, and Newfoundland, which is a separate dominion of the British empire. The north-eastern coast of Labrador belongs to Newfoundland. Its boundary on the south is the parallel of latitude 49°, between the Pacific Ocean and Lake-of-the-Woods, then a chain of small lakes and rivers eastward to the mouth of Pigeon river on the north-west side of Lake Superior, and the Great Lakes with their connecting rivers to Cornwall, on the St. Lawrence. From this eastward to the state of Maine the boundary is an artificial line nearly corresponding to latitude 45°; then an irregular line partly determined by watersheds and rivers divides Canada from Maine, coming out on the Bay of Fundy. The western boundary is the Pacific on the south, an irregular line a few miles inland from the coast along the "pan handle" of Alaska to Mount St. Elias, and the meridian of 141° to the Arctic Ocean. For much additional information concerning Canada, *see* BRITISH EMPIRE.

GEOGRAPHY AND GEOLOGY

Physical Geography.—In spite of these restrictions of its natural coast line on both the Atlantic and the Pacific, Canada is admirably provided with harbours on both oceans. The Gulf of St. Lawrence with its much indented shores and the coast of Nova Scotia and New Brunswick supply endless harbours, the northern ones closed by ice in the winter, but the southern ones open all the year round; and on the Pacific British Columbia is deeply fringed with islands and fjords with well-sheltered harbours everywhere, in strong contrast with the unbroken shore of the United States to the south. The long stretches of sheltered navigation from the Straits of Belle Isle north of Newfoundland to Quebec, and for 600 m. on the British Columbian coast, are of great advantage for the coasting trade. To the North Hudson Bay, an inland sea 850 m. long from north to south and 600 m. wide, with its outlet Hudson Strait, has long been navigated by trading ships and whalers, and may become an outlet for the wheat of western Canada, though closed by ice except for four months in the summer. Of the nine provinces of Canada only two have no coast line on salt water, Alberta and Saskatchewan. Ontario and Manitoba have a seaboard only on Hudson Bay, where Churchill Harbour on the west side may become an important grain port. What Ontario lacks in salt water navigation is, however, made up by the busy traffic of the Great Lakes.

More than half Canada's surface slopes gently inwards towards the shallow Hudson Bay, with higher margins to the south-east and south-west. In the main it is a broad trough, wider towards the north than towards the south and unsymmetrical, Hudson Bay occupying much of its north-eastern part, while to the west broad plains rise gradually to the foot-hills of the Rocky Mountains.

Geology.—The mountain structures originated in three great orogenic periods, the earliest in the Archaean, the second at the end of the Palaeozoic and the third at the end of the Mesozoic. The Archaean mountain chains, which enclosed the present region of Hudson Bay, are so ancient that they had already been worn down almost to a plain before the early Palaeozoic sediments were laid down. This ruling geological and physical feature of the North American continent has been named the "Canadian Shield." Round it the Palaeozoic sands and clays, largely derived from its own waste, were deposited as nearly horizontal beds, in many places still almost undisturbed. Later the sediments lying to the south-east of this "protaxis," or nucleus of the continent, were pushed against its edge and raised into the Appalachian chain of mountains. The Mesozoic sediments were almost entirely laid down to the west and south-west of the protaxis, upon the flat-lying Palaeozoic rocks, and in the prairie region they are still almost horizontal; but in the Cordillera they have been thrust up into the series of mountain chains characterizing the Pacific coast region. The youngest of these mountain chains is naturally the highest, and the oldest one in most places no longer rises to heights deserving the name of mountains. Owing to this unsymmetric development of North America the main structural watershed is towards its western side, on the south coinciding with the Rocky Mountains proper, but to the northward falling back to ranges situated farther west in the same mountain region. The central area of Canada is drained towards Hudson Bay, but the two largest Canadian rivers have separate watersheds, the Mackenzie flowing north-west to the Arctic Ocean and the St. Lawrence north-east towards the Atlantic, the one to the south-west and the other to the south-east of the Archaean protaxis. While these ancient events shaped the topography in a broad way its final development took place during the glacial period, when the loose materials were scoured from some regions and spread out as boulder clay, or piled up as moraines in others; and the original water-ways were blocked in many places. The retreat of the ice left Canada much in its present condition and the region has a very youthful topography with innumerable lakes and waterfalls as evidence that the rivers have not long been at work.

Lakes and Rivers.—As a result of the geological causes just mentioned many parts of Canada are lavishly strewn with lakes of all sizes, from bodies of water hundreds of miles long and a thousand feet deep to ponds lost to sight in the forest. The largest and most thickly strewn lakes occur within five hundred or a thousand miles of Hudson Bay, and belong to the Archaean protaxis or project beyond its edges into the Palaeozoic sedimentary rocks which lean against it. The most famous are those of the St. Lawrence system, which form part of the southern boundary of Canada and are shared with the United States; but many others have the right to be called "Great Lakes" from their magnitude. There are nine others which have a length of more than 100 m., and 35 which are more than 50 m. long. Within the Archaean protaxis they are of the most varied shapes, since they represent merely portions of the irregular surface inundated by some morainic dam at the lowest point. They often contain islands, sometimes even thousands in number, as in Georgian Bay and Lake-of-the-Woods.

In the Cordilleran region on the other hand the lakes are long, narrow and deep, in reality sections of mountain valleys occupied by fresh water, just as the fjords of the adjoining coast are valleys occupied by the sea. The smaller lakes are often rimmed with marshes and are slowly filling up with vegetable matter, ultimately becoming peat bogs, the *muskegs* of the Indian. Most of Canada is so well watered that the lakes have outlets and are kept fresh, but there are a few small lakes in southern Saskatchewan, *e.g.*, the Quill and Old Wives lakes, in regions arid enough to require no outlets. In such cases the waters are alkaline, and contain various salts in solution which are deposited as a white rim round the basin towards the end of the summer when the amount of water has been greatly reduced by evaporation. It is interesting to find maritime plants, such as the samphire, growing on their shores a thousand miles from the sea and more than a thousand feet above it. In many cases the lakes of Canada simply spill over at the lowest point from one basin into the next below, so that canoe navigation may be carried on for hundreds of miles, with here and there a waterfall or rapid requiring a portage.

The river systems are in many cases complex and tortuous, and very often the successive connecting links between the lakes receive different names, well illustrated by the St. Lawrence, which may be said to begin as Nipigon river and to take the names St. Mary's, St. Clair, Detroit and Niagara, before finally flowing from Lake Ontario to the sea under its proper name. As these lakes are great reservoirs and settling basins, the rivers which empty them are unusually steady in level and contain clear water. The St. Lawrence varies only a few feet in the year and always has pellucid bluish-green water, while the Mississippi, whose tributaries begin only a short distance south of the Great Lakes, varies 40 ft. or more between high- and low-water and is loaded with mud. The St. Lawrence has provided the main artery of exploration and with its canals past rapids and between lakes serves as a great highway of trade between the interior of the continent and the seaports of Montreal and Quebec. It is probable that politically Canada would have followed the course of the States to the south but for the planting of a French colony with widely extended trading posts along the easily ascended channel of the St. Lawrence and the Great Lakes, so that this river was the ultimate bond of union between Canada and the empire.

North of the divide between the St. Lawrence system and Hudson Bay there are many large rivers converging on that inland sea, such as Whale river, Big river, East Main, Rupert and Nottaway rivers coming in from northern Quebec; Moose and Albany rivers with important tributaries from northern Ontario; and Severn, Nelson and Churchill rivers from the south-west. They are rapid and shallow, but the largest of them, Nelson river, drains the great Manitoban lakes, Winnipeg, Winnipegosis and Manitoba, which are frequented by steamers, and receive the waters of Lake-of-the-Woods, Lake Seul and many others emptying into Winnipeg river from Ontario; of Red river coming in from the United States to the south; and of the southern parts of the Rocky Mountains and the western prairie provinces drained by the great Saskatchewan river.

The northern part of Alberta and Saskatchewan and much of northern British Columbia are drained through the Athabasca and Peace rivers, first north-eastwards towards Athabasca Lake, then north through Slave river to Great Slave Lake, and finally north-west through Mackenzie river to the Arctic Ocean. If measured to the head of Peace river the Mackenzie has a length of more than 2,000 m., and it provides more than 1,000 m. of navigation for stern-wheel steamers, serving the northern fur-trading posts.

Second among the great north-western rivers is the Yukon, which begins its course about 18 m. from tide-water on an arm of the Pacific, 2,800 ft. above the sea and just within the Canadian border. It flows first to the north, then to the north-west, passing out of the Yukon territory into Alaska, and ending in Bering Sea, 2,000 m. from its head-waters. The rest of the rivers flowing into the Pacific pass through British Columbia and are much shorter. The Columbia is the largest, but after flowing north-west and then south for about 400 m., it passes into the United States. The Fraser, next in size but farther north, follows a similar course, entering the sea at Vancouver; while the Skeena and Stikine in northern British Columbia are much shorter and smaller, owing to the encroachments of Peace and Liard rivers, tributaries of the Nelson, on the Cordilleran territory. In most cases these rivers reach the coast through deep valleys or profound canyons, and the transcontinental railways find their way beside them, the Canadian Pacific following at first tributaries of the Columbia near its great bend, and afterwards Thompson river and the Fraser; while the Canadian National makes use of the valley of the Skeena and its tributaries.

The divide between the rivers flowing west and those flowing east and north is very sharp in the southern Rocky Mountains, but there are two lakes, the Committee's Punch Bowl and the Fortress Lake, right astride of it, sending their waters both east and west; and the melting snows of the Columbia ice-field drain in three directions into tributaries of the Columbia, the Saskatchewan and the Athabasca, so that they are distributed between the Pacific, the Atlantic (Hudson Bay) and the Arctic Oceans. The divide between the St. Lawrence and Hudson Bay in eastern Canada is flat and boggy instead of being a lofty range of mountains.

As most of the Canadian rivers have waterfalls on their courses, they are of much importance as sources of power. The St. Lawrence system, for instance, generates many thousand horse-power at Sault Ste. Marie, Niagara and the Lachine rapids. All the larger cities of Canada make use of hydro-electric power, and many enterprises of the kind have been carried out in eastern Canada, especially in Quebec.

The Archaean Protaxis.—The broad geological and geographical relationships of the country have already been outlined, but the more important sub-divisions may now be taken up with more detail, and for that purpose five areas may be distinguished, much the largest being the Archaean protaxis, covering 1,825,000 square m. It includes Labrador and most of Quebec on the east, northern Ontario on the south; and the western boundary runs from Lake-of-the-Woods north-west to the Arctic Ocean near the mouth of Mackenzie river. The southern parts of the Arctic islands, especially Banksland, belong to it also. This vast area, shaped like a broad-limbed V or U, with Hudson Bay in the centre, is made up chiefly of Laurentian gneiss and granite; but scattered through it are important stretches of Keewatin, Timiskaming and Huronian rocks intricately folded as synclines in the gneiss. The Keewatin, Timiskaming and Huronian, consisting of greenstones, schists and more or less metamorphosed sedimentary rocks, are of special interest for their ore deposits, which include most of the important metals, particularly nickel, copper, silver and gold. The southern portion of the protaxis is opened up by railways, but the far greater northern part is known only along the lakes and rivers which are navigable by canoe. Though once consisting of great mountain ranges there are now no lofty elevations in the region except along the Atlantic border in Labrador, where summits of the Nachvak Mountains reach 5,500 ft. In other parts the surface is hilly, the harder rocks, rising as rounded knobs, or ridges, while the softer parts form valleys generally floored with lakes.

From the summit of any of the higher hills one sees that the region is really a somewhat dissected plain, for all the hills rise to about the same level with a uniform skyline at the horizon. The Archaean protaxis is sometimes spoken of as a plateau, but probably half of it falls below 1,000 ft. The lowland part extends from 100 to 500 m. round the shore of Hudson Bay, and reaches south-west to the edge of the Palaeozoic rocks on Lake Winnipeg. Outwards from the bay the level rises slowly to an average of about 1,500 ft., but seldom reaches 2,000 ft. except on the eastern and southern coasts of Labrador. In most parts the Laurentian hills are bare *roches moutonnées* scoured by the glaciers of the Ice age, but a broad band of clay land extends across northern Quebec and Ontario just north of the divide. The edges of the protaxis are in general its highest parts, and the rivers flowing outwards often have a descent of several hundred feet in a few miles towards the Great Lakes, the St. Lawrence or the Atlantic, and in some cases they have cut back deep gorges or canyons into the tableland. The waterfalls are utilized at many points to work up into wood pulp the forests of spruce which cover much of Labrador, Quebec and Ontario.

As one advances northward the timber grows smaller and includes fewer species of trees, and finally the timber line is reached near Churchill on the west coast of Hudson Bay and somewhat farther south on the Labrador side. Beyond this are the "barren grounds" on which herds of caribou (reindeer) and musk ox pasture, migrating from north to south according to the season. There are no permanent ice sheets known on the mainland of north-eastern Canada, but some of the larger islands to the north of Hudson Bay and Straits are partially covered with glaciers on their higher points. Unless there are mineral resources the barren grounds can never support a white population and have little to tempt even the Indian or Eskimo, who visit it in summer to hunt the deer in their migrations.

The Acadian Region.—The "maritime provinces" of eastern Canada, including Nova Scotia, New Brunswick and Prince Edward Island, may be considered together; and to these provinces may be added, from a physical point of view, the analogous south-eastern part of Quebec—the entire area being designated the Acadian region. Taken as a whole, this eastern part of Canada, with a very irregular and extended coast-line on the Gulf of St. Lawrence and the Atlantic, may be regarded as a northern continuation of the Appalachian mountain system that runs parallel to the Atlantic coast of the United States. The rocks underlying it have been subjected to successive foldings and crumplings by forces acting chiefly from the direction of the Atlantic Ocean, with alternating prolonged periods of waste and denudation. The main axis of disturbance and the highest remaining land runs through the south-eastern part of Quebec, forming the Notre Dame Mountains, and terminates in the Gaspé peninsula as the Shickshock Mountains, some of which rise above 4,000 ft.

The province of New Brunswick exhibits approximately parallel but subordinate ridges, with wide intervening areas of nearly flat Silurian and Carboniferous rocks. The peninsula of Nova Scotia, connected by a narrow neck with New Brunswick, is formed by still another system of parallel ridges, deeply fretted on all sides by bays and harbours. Valuable coal-fields occur in Cape Breton and other parts of the province. Gypsum is quarried on a large scale in both provinces. Asbestos is the principal mineral product of that part of Quebec included in the region now under consideration. Extensive tracts of good arable land exist in many parts of the Acadian region. Its surface was originally almost entirely wooded, and the products of the forest continue to hold a prominent place. Prince Edward Island, the smallest province of Canada, is low and undulating, based on Permo-Carboniferous and Triassic rocks affording a red and very fertile soil, much of which is under cultivation.

The St. Lawrence Plain.—As the St. Lawrence invited the earliest settlers to Canada and gave the easiest communication with the Old World, it is not surprising to find the wealthiest and most populous part of the country on its shores and near the Great Lakes to which it leads; and this early development was greatly helped by the flat and fertile plain which follows it inland for over 600 m. from the city of Quebec to Lake Huron. This affords the largest stretch of arable land in eastern Canada, including the southern parts of Ontario and Quebec with an area of some 38,000 sq. m. The whole region is underlain by nearly horizontal and undisturbed rocks of the Palaeozoic from the Devonian downward. Superimposed on these rocks are Pleistocene boulder clay, and clay and sand deposited in post-glacial lakes or an extension of the Gulf of St. Lawrence. Though petroleum and salt occur in the south-west peninsula of Ontario, metalliferous deposits are wanting, and the real wealth of this district lies in its soil and climate, which permit the growth of all the products of temperate regions. To the north the Laurentian plateau rises directly from the upper Great Lakes; so that the fertile lands of the east with their numerous cities and largely-developed manufactures were at one time cut off by a rocky and forest-covered Archaean region from the far more extensive farm lands of the west. The development of mines and the spread of settlement on the clay belt have now filled the gap between east and west.

The Interior Continental Plain.—Passing westward by rail from the forest-covered Archaean with its rugged granite hills, the flat prairie of Manitoba with its rich grasses and multitude of flowers comes as a very striking contrast, introducing the Interior Continental plain in its most typical development. This great plain runs north-westward between the border of the Archaean protaxis and the Rocky Mountains, including the southern parts of Manitoba and Saskatchewan and most of Alberta. At the international boundary in latitude 49° it is 800 m. wide, but in latitude 56° it has narrowed to 400 m. in width, and to the north of latitude 62° it is still narrower and somewhat interrupted, but preserves its main physical features to the Arctic Ocean about the mouth of the Mackenzie. Most of the plains are underlain by Cretaceous and early Tertiary shales and sandstones lying nearly unaltered and undisturbed although now raised far above sea-level, particularly along the border of the Rocky Mountains where they were thrust up into foot-hills when the range itself was raised. Coal and lignite are the principal economic minerals met with in this central plain, though natural gas occurs and is greatly used, and there are important oilwells in the southern foothill region. Its chief value lies in its vast tracts of fertile soil suitable for growing wheat. The very flat and rich prairie near Winnipeg is the former bed of the glacial Lake Agassiz; but most of the prairie to the west is of a gently rolling character and there are two rather abrupt breaks in the plain, the most westerly one receiving the name of the Missouri Coteau. The first step represents a rise to 1,600 ft., and the second to 3,000 ft. on an average. In so flat a country elevation of a few hundred feet is remarkable and is called a mountain, so that Manitoba has its Duck and Riding mountains. The treeless part of the plains, the prairie proper, has a triangular shape with an area twice as large as that of Great Britain. North of the Saskatchewan river groves of trees begin, and somewhat farther north the plains are generally wooded, because of the slightly more humid climate. It has been proved, however, that trees if protected will grow well on the prairie, as may be seen around the older farmsteads.

The Cordilleran Belt.—The Rocky Mountain region as a whole, best named the Cordillera or Cordilleran belt, includes several parallel ranges of mountains of different structures and ages, the eastern one constituting the Rocky Mountains proper. The Cordillera is 400 m. wide and covers towards the south almost all of British Columbia and a strip of Alberta east of the watershed, and towards the north forms the whole of the Yukon Territory. Two principal mountain axes form its ruling features—the Rocky Mountains proper, above referred to, and the Coast Ranges. Between them are many other ranges shorter and less regular in trend, such as the Selkirk Mountains, the Gold Ranges, and the Cariboo Mountains. There is also in the southern inland region an interior plateau, once probably a peneplain, but now elevated and greatly dissected by river valleys, which extends northwestward for 500 m. with a width of about 100 m. and affords the largest areas of arable and pasture land in British Columbia. Similar wide tracts of less broken country occur in northern British Columbia and to some extent in the Yukon Territory, where wide valleys and rolling hills alternate with short mountain ranges of no great altitude. The Pacific border of the coast range of British Columbia is ragged with fjords and channels, where large steamers may go 50 or 100 m. inland between mountain walls as on the coast of Norway; and there is also a bordering mountain system partly submerged forming Vancouver Island and the Queen Charlotte Islands.

The highest mountains of the Cordillera in Canada are near the southern end of the boundary separating Alaska from the Yukon Territory, the meridian of 141° and they include Mount Logan (19,850 ft.) and Mount St. Elias (18,008 ft.), while the highest peak in North America, Mount McKinley (20,300 ft.) is not far to the north-west in Alaska. Near the height of land between British Columbia and Alberta there are many peaks which rise from 10,000 to 12,000 ft. above sea-level, the highest being Mount Robson (12,975 ft.). The next range to the east, the Selkirks, has summits that reach 11,000 ft. or over, while the Coast Ranges sometimes reach 13,000 ft. The snow line in the south is from 7,500 to 9,000 ft. above sea-level, being lower on the Pacific side where the heaviest snowfall comes in winter than on the drier north-eastern side. It gradually sinks as one advances north-west, reaching only 3,000 ft. on the Alaskan coast. The Rockies and Selkirks support hundreds of glaciers, mostly not very large, but some having 100 sq m. of snowfield.

All the glaciers are now in retreat, with old tree-covered moraines, hundreds or thousands of feet lower down the valley. The timber line is at about 7,500 ft. in southern British Columbia and 4,000 ft. in the interior of the Yukon Territory. On the westward slopes, especially of the Selkirks and Coast Ranges, vegetation is almost tropical in its density and luxuriance, the giant cedar and the Douglas fir sometimes having diameters of 10 ft. or more and rising to the height of 250 ft. On the eastern flanks of the ranges the forest is much thinner, and on the interior plateau and in many of the valleys largely gives way to open grass land. The Coast Range was formed by a great upwelling of granite and diorite as batholiths along the margin of the continent in the Jurassic. The Rocky Mountains were raised after the close of the Cretaceous by tremendous thrusts from the Pacific side, crumpling and folding the ancient sedimentary rocks, and faulting them along overturned folds. The outer ranges in Alberta have usually the form

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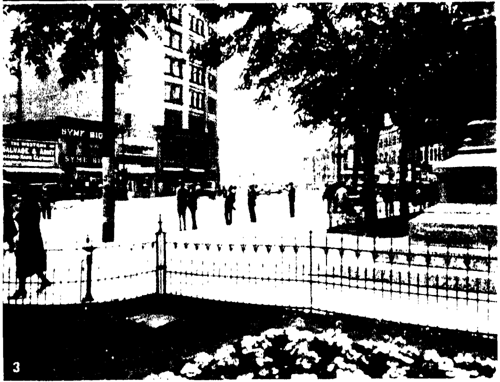
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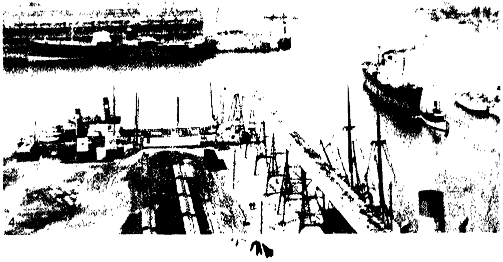
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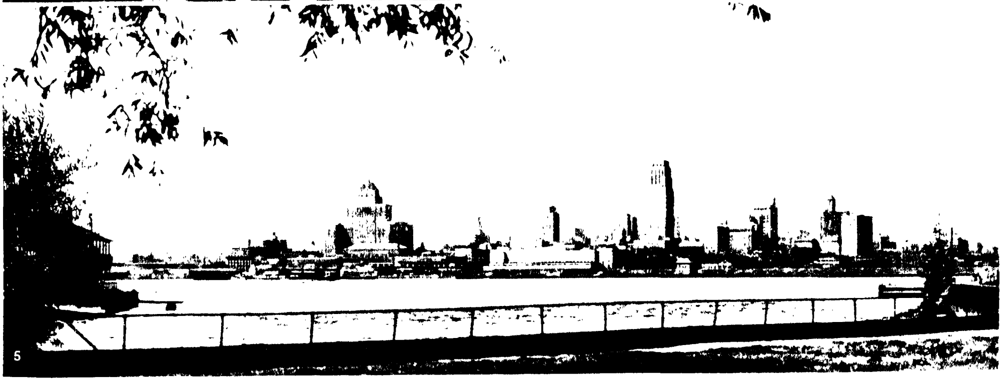
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[illegible] THE CANADIAN PACIFIC RAILWAY [illegible] MENT OF WORKS, TORONTO

SCENES FROM FIVE PROVINCES OF CANADA

1. View of the harbour at Saint John, chief commercial centre of New Brunswick
2. A saw mill at Coal Creek, British Columbia
3. Main Street, Winnipeg, Manitoba
4. View of the harbour at Montreal, Quebec, situated at the confluence of the St. Lawrence and Ottawa rivers. Some of the wharves and docks, which are built of solid masonry and extend for miles, are shown
5. Central section of waterfront, Toronto, Ontario, from across the harbour

of tilted blocks with a steep cliff towards the north-east and a gentler slope, corresponding to the dip of the beds, towards the south-west. Near the centre of the range there are broader foldings, carved into castle and cathedral shapes. The most easterly range was pushed 7 m. out upon the prairies.

In the Rocky Mountains proper no ore deposits are known, but in the Cretaceous synclines which they enclose, valuable coal basins exist. The coking coals of the Fernie region supply the fuel of the great metal mining districts of the Kootenays in British Columbia, and of Montana and other states to the south. In the Coast and Gold Ranges there are important mines of gold, silver, copper and lead and in early days the placer gold mines of the Columbia, Fraser and Cariboo attracted miners from everywhere, but these have declined, and lode mines supply most of the gold as well as the other metals. The Atlin and White Horse regions in northern British Columbia and southern Yukon have attracted much attention, and the Klondike placers still farther north have furnished many millions of dollars' worth of gold, but are now almost worked out.

Climate.—In a country like Canada ranging from latitude 42° to the Arctic regions and touching three oceans, there must be great variations of climate. If placed upon Europe it would extend from Rome to the North Cape, but latitude is of course only one of the factors influencing climate, the arrangement of the ocean currents and of the areas of high and low pressure making a very wide difference between the climates of the two sides of the Atlantic. The Pacific coast of Canada, rather than the Atlantic coast, should be compared with western Europe, the south-west corner of British Columbia, in latitude 48° to 50°, having a climate very similar to the southern coast of England.

In Canada the isotherms by no means follow parallels of latitude, especially in summer when in the western half of the country they run nearly north-west and south-east, so that the average temperature of 55° is found about on the Arctic circle in the Mackenzie river valley, in latitude 50° near the Lake-of-the-Woods, in latitude 55° at the northern end of James Bay, and in latitude 49° on Anticosti in the Gulf of St. Lawrence. It is impossible to describe even the climate of a single province, like Ontario or British Columbia, as a unit, as it varies so greatly in different parts. Details should therefore be sought in articles on the separate provinces. South of the Gulf of St. Lawrence the maritime provinces average 40° for the year and over 60° for the summer months. The amount of rain is naturally high so near the sea, 40 to 56 in., but the snowfall is not usually excessive. In Quebec and northern Ontario the rainfall is diminished, ranging from 20 to 40 in., while the snows of winter are deep and generally cover the ground from the beginning of December to the end of March. The winters are brilliant but cold, and the summers average from 60° to 65°, with clear skies and a bracing atmosphere which makes these regions favourite summer resorts for the people of the cities to the south. The winter storms often sweep a little to the north of southern Ontario, so that what falls as snow in the north is rain in the south, giving a much more variable winter, often with little snow. The summers are warm, with an average temperature of 65° and an occasional rise to 90°.

As one goes westward the precipitation diminishes, most of it, however, coming opportunely from May to August, the months when the growing grain most requires moisture. There is a much lighter snowfall than in northern Ontario and Quebec, with somewhat lower winter temperatures. The precipitation in southern Saskatchewan and Alberta is much more variable than farther east and north, so that in some seasons crops have been a failure through drought, but large areas are now being brought under irrigation to avoid such losses. The prairie provinces have a distinctly continental climate with comparatively short, warm summers and long, cold winters, but with much sunshine in both seasons. In southern Alberta the winter cold is often interrupted by chinooks, westerly winds which have lost their moisture by crossing the mountains and become warmed by plunging down to the plains, where they blow strongly, licking up the snow and raising the temperature, sometimes in a few hours from 20° to 40°. In this region cattle and horses can generally winter on the grass of the ranges without being fed. With sunshine for twenty hours out of twenty-four in June, growth is almost the same in the north as for hundreds of miles to the south, so that wheat and vegetables ripen in the Peace river valley in latitude 56°.

The climate of the Cordilleran region presents even more variety than that of the other provinces because of the ranges of mountains which run parallel to the Pacific. Along the coast itself the climate is insular, with little frost in winter and mild heat in summer, and with a very heavy rainfall amounting to 100 in. on the south-west side of Vancouver Island and near Prince Rupert. Beyond the Coast Range the precipitation and general climate are comparatively mild and with moderate snowfall towards the south, but with keen winters farther north. The interior plateau may be described as arid, so that irrigation is required if crops are to be raised.

The Selkirk Mountains have a heavy rainfall and a tremendous snowfall on their western flanks, but very much less precipitation on their eastern side. The Rocky Mountains have the same relationships but the whole precipitation is much less than in the Selkirks. The temperature depends largely, of course, on altitude, so that one may quickly pass from perpetual snow above 8,000 ft. in the mountains to the mild, moist climate of Vancouver or Victoria. North-west and north-east of Hudson Bay the climate becomes too severe for the growth of trees, and there may be perpetual ice beneath the coating of moss which serves as a non-conducting covering for the "tundras." Leaving out the maritime provinces, southern Ontario, southern Alberta and the Pacific coast region on the one hand, and the Arctic north on the other, Canada has snowy and severe winters, a very short spring with a sudden rise of temperature, short, warm summers and a delightful autumn with its "Indian summer." There is much sunshine, and the atmosphere is bracing and exhilarating. (A. P. Co.)

Flora.—The general flora of the Maritime Provinces, Quebec and Eastern Ontario is much the same, except that in Nova Scotia a number of species are found common also to Newfoundland that are not apparent inland. In New Brunswick the western flora begins to appear as well as immigrants from the south, while in the next eastern province, Quebec, the flora varies considerably. In the lower St. Lawrence country and about the Gulf many Arctic and sub-Arctic species are found. From the city of Quebec westwards there is a constantly increasing ratio of southern forms, and when Montreal is reached the representative Ontario flora begins. In Ontario the flora of the northern part is much the same as that of the Gulf of St. Lawrence, but from Montreal along the Ottawa and St. Lawrence valleys the flora takes a more southern aspect, and trees, shrubs and herbaceous plants not found in the eastern parts of the Dominion become common.

In the forest regions north of the lakes the vegetation on the shores of Lake Erie requires a high winter temperature, while the east and north shores of Lake Superior have a boreal vegetation that shows the summer temperature of this enormous water-stretch to be quite low. Beyond the forest country of Ontario come the prairies of Manitoba and the North-West Territories. In the ravines the eastern flora continues for some distance, and then disappearing gives place to that of the prairie, which is found everywhere between the Red river and the Rocky Mountains except in wooded and damp localities. Northwards, the flora of the forest and that of the prairies intermingle. On the prairies and the foot-hills of the Rocky Mountains a great variety of grasses is found. Besides the grasses there are many leguminous plants valuable for pasture.

About the saline lakes and marshes of the prairie country are found *Ruppia maritima*, *Heliotropium curassavicum*, natives of the Atlantic coast, and numerous species of *Chenopodium*, *Atriplex* and allied genera. The flora of the forest belt of the North-West Territories differs little from that of northern Ontario. At the beginning of the elevation of the Rocky Mountains there is a luxurious growth of herbaceous plants, including a number of rare umbellifers. At the higher levels the vegetation becomes more Arctic. Northwards the valleys of the Peace and other rivers differ little from those of Quebec and the northern prairies. On the western slope of the mountains, that is, the Selkirk and Coast ranges as distinguished from the eastern or Rocky mountain range, the flora differs, the climate being damp instead of dry. In some of the valleys having an outlet to the south the flora is partly peculiar to the American desert, and such species as *Purshia tridentata* and *Artemisia tridentata*, and endemic species of *Gilia, Aster* and *Erigonum* are found. Above Yale, in the drier part of the Fraser valley, the absence of rain results in the same character of flora, while in the rainy districts of the lower Fraser the vegetation is so luxuriant that it resembles that of the tropics. So in various parts of the mountainous country of British Columbia, the flora varies according to climatic conditions. Nearer the Pacific coast the woods and open spaces are filled with flowers and shrubs. Liliaceous flowers are abundant, including various species of *Erythronium, Trillium, Allium, Brodeaea, Fritillaria, Lilium* and *Camassia*. (X.)

Fauna.—The larger animals of Canada are the musk ox and the caribou of the barren lands, both having their habitat in the far north; the caribou of the woods, found in all the provinces except Prince Edward Island; the moose, with an equally wide range in the wooded country; the Virginia deer, in one or other of its varietal forms, common to all the southern parts; the black-tailed or mule deer and allied forms, on the western edge of the plains and in British Columbia; the pronghorn antelope on the plains, and a small remnant of the once plentiful bison in northern Alberta and Mackenzie. The wapiti or American elk at one time abounded from Quebec to the Pacific, ranging as far north as the Peace river, but is now found only in small numbers from Manitoba westward.

In the mountains of the west are the grizzly bear and the black bear. The black bear is also common to most other parts of Canada; the polar bear everywhere along the arctic littoral. The large or timber wolf is found in the wooded districts of all the provinces, and on the plains there is also a smaller wolf called the coyote. In British Columbia the puma or cougar still frequently occurs; and generally distributed in wooded areas are the common fox and its variety, the silver fox, the lynx, beaver, otter, marten, fisher, mink, skunk and other fur-bearing animals. The wolverene is largely confined to the barren lands, which are also inhabited by the arctic fox. Mountain and plain and arctic hares and rabbits are plentiful or scarce in localities, according to seasons or other circumstances. In the mountains of British Columbia are the bighorn or Rocky Mountain sheep and the Rocky Mountain goat, while sheep of two or three other species are also found from nearly pure white in the north to black in certain areas in the southern Canadian Rockies.

The birds of Canada are mostly migratory, and are those common to the northern and central states of the United States. The wildfowl are, particularly in the west, in great numbers; their breeding grounds extending from Manitoba and the western prairies up to Hudson bay and the barren lands and arctic coasts. The several kinds of geese—including the Canada goose, the arctic goose or wavey, the laughing goose, the brant and others all breed in the northern regions, but are found in great numbers throughout the several provinces, passing north in the spring and south in the autumn. There are several species of grouse, including the ruffed grouse, ptarmigan and sharp-tailed grouse of the plains. In certain parts of Ontario the wild turkey formerly occurred, and the so-called "quail" or "bob-white" still inhabits the southern part of the province.

The golden eagle, bald eagle, osprey, and a large variety of hawks are common in Canada, as are the snowy owl, the horned owl and other owls. The raven is found only in the less populated districts, but the crow is common everywhere. Songbirds are plentiful, especially in the wooded regions, and include the American robin, oriole, thrushes, the catbird and various sparrows; while the introduced English sparrow has multiplied excessively and become a nuisance in the towns. More recently introduced but spreading rapidly are the European starling in the east and the Japanese starling in British Columbia. The smallest of the birds, the ruby-throated hummingbird, is found everywhere, even up to timber line in the mountains. The sea birds include a variety of gulls, terns, guillemots, cormorants and ducks, and in the Gulf of St. Lawrence the gannet is very abundant. Nearly all the sea birds of Great Britain are found in Canadian waters or are represented by closely allied species.

The Migratory Birds Convention Act of 1923 involved an agreement between the United States and Canada for the protection of bird life. (E. M. W.; J. R. Dy.)

AREA AND POPULATION

The land and fresh water area of Canada was given by official figures for 1941 as 3,695,189 sq.mi., being about 3% larger than that of the continental United States with Alaska (3,564,658 sq.mi.) and about 2% smaller than that of the continent of Europe (3,776,700 sq.mi.).

Population.—Table I below shows the land and water areas of the provinces and territories as of 1941, and the population as enumerated in the censuses of 1911, 1921, 1931 and 1941.

TABLE I.—*Area and Population*

Provinces and Territories	Area: Land	Area: Water	Area: Total
Prince Edward Island	2,184		2,184
Nova Scotia	20,743	325	21,068
New Brunswick	27,473	512	27,985
Quebec	523,860	71,000	594,860*
Ontario	363,282	49,300	412,582
Manitoba	219,723	26,789	246,512
Saskatchewan	237,975	13,725	251,700
Alberta	248,800	6,485	255,285
British Columbia	359,279	6,976	366,255
Yukon	205,346	1,730	207,076
Northwest Territories:			
Franklin	546,532	7,500	554,032
Keewatin	218,460	9,700	228,160
Mackenzie	493,225	34,265	527,490
Total	3,466,882	228,307	3,695,189

Population	Population 1911	Population 1921	Population 1931	Population 1941	Population per sq. mile of land area, 1941
Prince Edward Island	93,728	88,615	88,038	95,047	43.52
Nova Scotia	492,338	523,837	512,846	577,962	27.86
New Brunswick	351,889	387,876	408,219	457,401	16.65
Quebec	2,005,776	2,360,510†	2,874,662	3,331,882	6.36
Ontario	2,527,292	2,933,662	3,431,683	3,787,655	10.43
Manitoba	461,394	610,118	700,139	729,744	3.32
Saskatchewan	492,432	757,510	921,785	895,992	3.77
Alberta	374,295	588,454	731,605	796,169	3.20
British Columbia	392,480	524,582	694,263	817,861	2.28
Yukon	8,512	4,157	4,230	4,914	0.02
Northwest Territories:					
Franklin Keewatin Mackenzie	6,507	8,143	9,316	12,028	0.01
Total	7,206,643	8,787,949‡	10,376,786	11,506,655	3.32

*The area assigned to Quebec was reduced from 706,834 to 594,534 sq mi.—nearly one-sixth—by a decision of the judicial committee of the Privy Council, announced on March 1, 1927, which awarded 112,400 sq mi. of disputed territory to Newfoundland.

†Adjusted to 1927 boundary change.

‡Includes Royal Canadian Navy, 485 men.

With regard to natural increase, only approximate figures were available prior to 1921. For the intercensal period 1901–1911 the surplus of births over deaths was estimated at 853,566 and for 1911–1921 at 1,150,659.

TABLE II.—*Racial Distribution of Population of Canada*

Principal Races—Census of 1941	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.
English	27,383	221,142	147,681	10,518	1,456,068	168,017	186,053	101,034	321,048
Irish	18,159	65,300	68,801	109,804	665,330	76,156	95,852	83,876	83,460
Scottish	32,666	154,846	62,859	90,582	578,127	100,619	108,019	112,549	152,677
Other British	203	3,590	2,417	2,863	20,396	5,868	7,081	11,082	13,251
French	11,790	66,260	163,934	2,695,032	373,990	52,996	50,530	42,979	21,876
German	172	15,038	1,304	8,880	167,102	41,479	130,258	77,721	22,407
Italian	33	2,363	455	28,051	60,085	2,482	1,014	4,872	13,292
Jewish	25	2,282	1,228	66,277	60,875	18,879	4,149	4,164	3,350
Dutch	494	23,834	4,539	2,045	73,001	39,204	35,894	20,429	12,737
Polish	1	2,266	233	10,036	54,893	36,550	27,902	26,845	8,744
Russian	2	534	109	3,433	11,218	6,571	25,033	10,316	16,474
Scandinavian	152	2,353	2,026	4,840	27,225	32,620	68,806	63,494	41,560
Ukrainian	2	711	22	8,006	48,158	89,762	79,777	71,868	7,563
Chinese	45	372	152	2,378	6,143	1,248	2,545	3,122	18,619
Japanese	0	2	3	48	234	42	105	578	22,096
Indians and Eskimos	258	2,067	1,030	13,641	30,330	15,474	13,388	12,569	24,882
TOTAL with Minor Elements	95,047	577,962	457,401	3,331,882	3,787,655	729,744	895,992	796,169	817,861

Migration.—The movement reached its climax in 1913, when 402,432 immigrants were enumerated. During the World War I period the stream of British immigration was practically cut off, and a large proportion of the non-British immigrants who had come in during the prewar boom returned to their native countries or emigrated to the United States. Hence, of the total population in 1931, 77.76% were Canadian-born, 11.42% were born in other parts of the British empire, and only 10.82% (1,122,695) were born in other countries including the United States. Of the 1,122,695 foreign born, 618,298 were naturalized, leaving only 504,397 alien residents. In point of their mother tongue, children under five being classed with their parents, 57% of the people spoke English, 27% French, the rest scattering.

As is natural in a population recruited by immigration, males predominate over females in Canada (1941: 5,900,148 to 5,605,750). Compare the Yukon (1941: 3,008 to 1,679). The distribution of the population according to racial origin when classified in 1931 showed people of British origin (direct or via the United States, there being no "American" racial origin in the Canadian census) as 50%, those of French origin 27%, German 4%, Ukrainian 2%, Hebrew 1½% and the rest scattered.

Religious Denominations.—Of the total population of 1931, 42% were Roman Catholics, 19% United Church, 15% Anglican, 8% Presbyterian, 4% Baptist and the rest various denominations.

Urban Population.—The Canadian census of 1941 gives Montreal 903,007 (proper); Toronto 667,457; Vancouver 275,353; Winnipeg 221,960; Hamilton 166,337; Quebec 150,757; Ottawa 154,951; Edmonton 93,817; Calgary 88,904; London 78,264; Windsor (as amalgamated with Walkerville, East Windsor and Sandwich in 1935) 105,311.

(S. Lea.)

POLITICAL ORGANIZATION

Government.—Canada is one of the five self-governing dominions of the British empire. At the Imperial conference of 1926, Canada and the other dominions were declared to be "equal in status" with the mother country; and in 1931 the seal of legislative enactment was placed on this equality of status when the British parliament passed the Statute of Westminster. This act described the British crown as "the symbol of the free association of the members of the British Commonwealth of Nations"; it removed a number of disabilities in legislation from which dominion parliaments had suffered; and in general it purported to remove from the dominions imperial sovereignty. It did not, however, completely abolish all vestiges of Canada's former colonial status; for the appointment of the governor-general remained in the hands of the British government, and no provision was made for the amendment of the British North America act (which is the fundamental law of the Canadian constitution), save by enactment of the British parliament.

The many unwritten conventions of the British constitution hold good in Canada; but there is an important difference between the British and Canadian constitutions, in that the Canadian is federal. The federal agreement of 1867 is embodied in the British North America act; and this act lays down, in sections 91–93, the subjects of legislation which are assigned respectively to the dominion and the provinces. The former has exclusive legislative authority in all matters relating to the regulation of trade and commerce, military and naval defense, navigation and shipping, banking and currency, marriage and divorce, etc.; the latter in all matters relating to education, municipal government, property and civil rights within the province, licences, etc. It seems to have been the original intention of the framers of the constitution to invest the dominion parliament with an overriding legislative authority; but the judicial interpretation of the act has to some extent nullified this intention, and the provincial legislatures have been pronounced to be sovereign within the sphere assigned to them. As a result, federal control of social welfare, for example, has been rendered difficult by the decisions of the judicial committee of the Privy Council, which in 1935–36 declared invalid several statutes aiming at such control.

Executive Power.—In the dominion, executive power rests in the hands of the governor-general, who represents the king of Great Britain, and is appointed by the British government, on the recommendation of, or with the concurrence of, the Canadian government. The governor-general, however, acts only on the advice of the prime minister and his colleagues in the cabinet, who are at the same time members of the King's Privy Council for Canada and sit in the dominion parliament.

Legislative Power.—The dominion legislature is bicameral: it is composed, in addition to the representative of the crown, of a senate numbering 96 members, who are appointed for life by the governor-general in council; and a house of commons, numbering 245 members in 1942, who are elected by the people for the duration of parliament, which may not be longer than five years. In the provinces, the crown is represented by a lieutenant-governor, appointed by the dominion government. He is advised by an executive council, composed of a prime minister and a varying number of ministers, all of whom sit in the legislature. In eight out of the nine provinces, the legislature is unicameral, being composed of a legislative assembly, elected by the people for a term of four years. Only in Quebec is there a second chamber, styled a legislative council, and composed of nominees of the provincial government.

Justice.—Under the B.N.A. act, the administration of justice, including the constitution of the provincial courts, comes within the jurisdiction of the provincial legislatures; with this exception, that the criminal law comes within the jurisdiction of the dominion parliament. The judges of the provincial courts are, however, appointed by the dominion government; and are removable by the governor-general only on address of the senate and the house of commons. Since 1875 Canada has had a supreme court; and both from this court and from the provincial courts there may be, in certain cases, an appeal to the judicial committee of the privy council in England.

(W. S. Wa.)

DEFENSE

After confederation, imperial troops remained long enough to take part in the suppression of the Red River rebellion (1869–70), and in repelling the Fenian raids. The last garrison troops left in 1871. To replace them, the dominion government instituted a permanent force, avoiding the official word "army," which consisted of schools of infantry, and units of artillery and cavalry at various points. In 1873, the North West Mounted Police was organized, and in 1876 the Royal Military college was established at Kingston with an annual allotment of commissions in the imperial army. The officer commanding the Canadian militia continued to be drawn from the British army till 1904. The naval establishment remained at Halifax and Esquimalt till 1903. It was supplemented by Canadian revenue cutters and fishery patrol boats. In the year 1910 the Canadian government created a separate naval force of two permanent vessels.

The expansion of this defense organization into the Canadian overseas force, and the army in training at the time of World War I is described below (see *History*). After the war, the military policy of Canada turned on the demobilization of the expeditionary force, and on the reorganization of the permanent force in the light of war experience. In view of the increasing European tension after 1937, further expansion and reorganization was carried out to meet the immediate threat of war.

Rearmament 1936–39.—Recurring European crises in the later 1930s produced a marked change. The budget of 1936 appropriated $11,161,016 for defense purposes as against the $9,334,602 appropriation for the previous year. Thereafter, the defense estimates were progressively advanced, reaching over $19,000,000 in 1938. Considerable internal change was introduced into the nonpermanent militia by disbanding or amalgamating certain units in order to secure a better balance between the various arms. Attention was likewise given to modernizing the coastal defenses. A rearmament program, properly so-called, was begun in 1937, when Canada brought her forces into line with the principles laid down at the imperial conference, whereby each dominion assumed the responsibility for its local defense. Most of the new equipment needed was produced in Canada, although some of it, notably aircraft, was purchased abroad. In 1937 the defense policy of the government was clearly defined, emphasis being laid on the air force, navy and army, in that order. At the same time tentative discussions were opened with Great Britain which developed, in 1939, into the Commonwealth Air Training plan. In 1938 and 1939 a joint scheme of operations among the land, sea and air forces was drawn up for the defense of Canadian coastal areas, the protection of vulnerable points within

Canada, and the mobilization of a reserve army which might supply men for an overseas expeditionary force. Such was the situation on the declaration of war in 1939. (J. I. C.)

Banking and Finance.—The commercial banking of Canada is carried on by ten chartered banks having a total, at the end of Dec. 1940, of 2,846 branches (excluding 601 sub-agencies) of which 132 were outside Canada. At Confederation 1867 there were 28 banks; the maximum number reached was 41 in 1886, but afterward the number was reduced, chiefly by amalgamations, to 10. Savings banks also exist, usually post office savings banks run by the dominion government, though the provinces of Alberta and Ontario have provincial savings banks, and in Montreal there is the Montreal City and District Savings bank founded in 1846 and chartered in 1871. Les Caisses Populaires or People's banks of Quebec province, some 400 in number, which accept savings deposits, are co-operative agencies for extending credit.

The incorporation of a chartered bank requires an act of parliament and the conditions, including a minimum capital of $500,000, to which the applicant for a charter must conform, are laid down in the Bank act. The Bank act of 1871 was the original act and provided for a decennial revision of banking law, the latest revision being in 1934. The average for the monthly figures of 1939 showed, for the ten chartered banks, an aggregate total of assets of $3,591,000,000, of liabilities to the public in Canada of $2,440,000,000, and to the shareholders (*i.e.* capital and reserve fund) of $270,000,000 From 1923–43 there were no bank failures.

In 1934 the banking system of Canada was completed by the establishment of the Bank of Canada to perform all the usual functions of a central bank. The Bank of Canada, which began operations on March 11, 1935, was at first privately owned and given a reasonable degree of independence, but in 1938 the government bought out the shareholders and nationalized the bank. Bank of Canada notes are the chief currency of the country, over $129,000,000 being in circulation in the hands of the public in 1939 when the minted coinage of silver, nickel and bronze amounted to $38,000,000 or $3.44 per capita. Before the bank was established both the dominion government and the chartered banks issued notes, but the dominion note issue was discontinued and the chartered banks had to reduce their issue gradually to 25% of their paid-up capital of March 1935. The Bank of Canada can issue notes to any aggregate amount, subject to the condition, suspended in wartime, that it maintains a gold reserve equal to one-quarter of its note and deposit liabilities in Canada. The chartered banks, which formerly were not required to keep any specific reserve against their deposit liabilities in Canada have now (1943) to keep 5% of such either on deposit with the Bank of Canada or in Bank of Canada notes. When the Canadian gold holdings were revalued in 1935, the government established an exchange fund for the purpose of aiding the stabilization of the foreign exchange.

Under the British North America acts, the provinces of Canada receive statutory subsidies from the dominion treasury. Other sources of income are taxation—mainly gasoline tax, succession duties and corporation taxes—licences, and profits from the control of the liquor traffic or from provincially owned public utilities. Changing conditions in Canadian economic life, amongst which were the slowing down of frontier expansion, the effect of war on the debt burden, the repercussions of the collapse of international trade and the world depression after 1929, and the growth of government expenditure on social and administrative services, rendered the structure of provincial public finance less satisfactory. In 1939 a Royal Commission on Dominion-Provincial relations advocated considerable changes which lack of agreement and the outbreak of World War II postponed.

The national income of the people of Canada in current dollars was estimated for 1938 at $4,246,000,000, which represents in terms of the 1926 dollar an income of $417 per capita or $1,266 per gainfully occupied person. The average annual increment of the real national income was estimated at $24,900,000 during the inter-war period 1919–38.

The net national debt of Canada was $336,000,000 in March 1914; it had increased to $3,152,000,000 by March 1939, but the debt, which in 1914 was almost entirely repayable in London, is now (1943) payable, to nearly 90%, in Canada. The interest charge on the debt amounted for the fiscal year ending March 31, 1939 to $129,000,000. In addition to this debt, the dominion government has large indirect obligations, through its guarantee of railway and other securities valued at $1,378,000,000 in 1939.

The principal items of dominion revenue for the fiscal year ending March 31, 1939 were: income tax $142,000,000, sales and other excise taxes $161,000,000, customs duties $78,000,000, excise duties $51,000,000; the total revenue amounting to $502,000,000 of which $435,000,000 came from taxation. Some 293,097 individuals, less than 3% of the population, were assessed for income tax in 1938. Of these individuals, 80%, who were in receipt of net annual incomes of $4,000 or less, contributed only slightly more than 8% of the amount levied.

The principal items of dominion expenditure for the fiscal year ending March 31, 1939 were: interest on debt $128,000,000, pensions, war, military and civil $42,000,000, post office $35,000,000, national defense $34,000,000, old age pensions $29,000,000, public works $15,000,000, subsidies to provinces $13,000,000, capital expenditure $5,000,000, and other charges, mainly unemployment relief $46,000,000, and losses on government-owned enterprises $55,000,000. The total dominion expenditure amounted to $553,000,000 or $48 88 per capita. (J. P. Dy.)

Communication and Transport.—Canada has been primarily a new country with a small population exporting such bulky raw materials as wheat, lumber, pulp and paper and minerals to densely populated industrial countries. Cheap water transportation has been fundamental. Canadian ports are seriously affected by geographic considerations. Montreal is closed in the winter season and Halifax and St. John are too far distant from the interior to compete with United States Atlantic ports. Vancouver has benefited as an export centre by the opening of the Panama canal. The export of wheat from the prairie provinces intensified the transport problem since it produced a peak load for Great Lakes shipping. The handling of great quantities of wheat during the rush season involved the use of specially constructed boats, "lakers," and of elaborate loading and unloading facilities at Port Arthur and Fort William, Port Colborne, Buffalo and the Georgian bay ports. The Canadian canal at Sault Ste. Marie has a depth of 19 ft. and the American canal 25 ft. The Welland canal is 30 ft. and permits lake vessels to continue to the foot of Lake Ontario. Deepening of the St. Lawrence waterways from 14 to 30 ft. would permit ocean-going boats to proceed to the head of the lakes. After confederation, Canada expended $243,849,900, chiefly on canals facilitating Great Lakes traffic.

Railway facilities have been improved in relation to the export of wheat from the prairie provinces. Especially after 1900 railways were rapidly extended for the development of traffic in western Canada, and the marked increase in the export of wheat led to the construction of new lines from Winnipeg to Fort William and Port Arthur and from Georgian bay ports to Montreal as well as to the construction of a line from Winnipeg to Cochrane and Quebec. An additional outlet for trade of the prairie provinces was completed with a railway to Churchill on Hudson bay in 1929. The development of the mineral industry and of pulp and paper mills in the Precambrian territory of Canada was followed by the construction of numerous lines in northern Ontario and in northern Quebec, including the Temiskaming and Northern Ontario railway and lines to the Saguenay country, and in northern Manitoba. As in the case of canals, railway construction involved heavy expenditures on the part of the federal and of the provincial governments. Land grants up to 1940 of the federal government totalled 31,881,642 ac., and of provincial governments 15,758,367, cash subsidies of the federal government $172,200,223, of provincial governments $33,391,669, and of municipalities $13,301,691, railway bonds guaranteed by the federal government $826,398,499 and by provincial governments $58,911,740. Capital expenditures on government railways to 1940, totalled $854,328,212. In 1940 the total capitalization of all Canadian railways was $3,380,033,172, operating expenses amounted to $335,287,503 and gross earnings to $429,142,659.

Almost 90% of Canadian railway mileage (42,565 mi.) is under the control of two systems, the Canadian National (23,763 mi.) and the Canadian Pacific (17,153 mi.). The Canadian Pacific was incorporated in 1881 and the company built up a strong organization with low fixed charges and a large proportion of capital in the form of common stock on which it paid 10% to 1930. The Canadian National is government-owned and the result of the amalgamation of several companies including the Intercolonial, Canadian Northern, Grand Trunk, Grand Trunk Pacific and National Transcontinental which found themselves in difficulties through dependence on government-guaranteed bonds and high costs of operation during World War I. Various units were joined up and the organization rounded out as a system. Both systems have connections with U.S. roads and substantial mileage there.

The transcontinental main lines with termini at the Canadian ports are supplied with traffic by numerous branch lines or feeders. In new territory further extension was made with river steamboats, as on the Mackenzie and the Yukon, and with the organization of air transport systems in these and in newly opened mining districts. Aircraft were used in new districts chiefly for passenger and mail service and in government work of surveying, mapping and the prevention of forest fires. Trans-Canada Airways was developed to provide continuous service from the Atlantic to the Pacific. In 1940 there were 473 licensed aircraft which carried 149,025 passengers, 14,430,571 lb. of freight or express and 2,710,995 lb. of mail. The railway companies have their own organizations for handling of express traffic.

The financial position of these two important systems is closely dependent on railway rates. In Eastern Canada water competition has an important influence in lowering rates which have been increased in turn in the prairie provinces. This discrimination has gradually diminished with growing settlement and the increasing political power of western Canada. Rates are under the jurisdiction of the board of transport commissioners formed in 1903. It also regulates telephone, telegraph and express rates, and deals with problems of location, construction and operation of the railways and of Great Lakes shipping and air routes.

Transport facilities were vastly extended with the introduction of the automobile and the construction of roads. In 1940 Canada had 560,147 mi. of road, of which 443,955 mi. were earth, and 116,192 mi. surfaced. The federal, provincial and municipal governments were engaged in the construction of roads on a large scale. Motor vehicles had increased to 1,500,829 in 1940. Each province has its own system of regulations, and in 1940 $85,479,893 were collected in taxes on motor vehicles. For short haul traffic in densely populated sections of Canada the motor vehicle became a serious competitor of the railroads, but it was also important in providing traffic for long distance railroad hauls. In 1942 the Alcan highway was constructed as a military measure from railhead at Dawson Creek, B.C., to Fairbanks, Alaska.

Electric railways have tended to decline with the competition of motor transport in urban communities. In 1940 electric railways totalled 1,535 mi. and car mileage 128,254,433, passengers 691,737,901, freight 2,599,007 tons.

Improvement of inland transportation facilities was responsible for a rapid growth of ocean shipping. In 1941 the total tonnage entered at Canadian ports was 79,563,482. Several steamship lines run between Canada and Great Britain and Europe on the Atlantic, and Canada and Asia and Australia on the Pacific. The Canadian Pacific operates an important subsidiary ocean steamship company and the Canadian National has minor steamship lines under its control. Ports, lighting facilities and harbour equipment were improved to handle the increased shipping.

Increase in transport facilities was accompanied by improved communications. In 1940 telegraph wire mileage totalled 380,318, of which the Canadian National Telegraph owned 167,325 and the Canadian Pacific 185,877. Canada in 1943 had 16 transoceanic cables, 14 on the Atlantic and 2 on the Pacific. The telegraph was rapidly extended with wireless and radio stations. In 1941 there was a total of 1,454,717 radio stations. In 1940 a total of 1,461,038 telephones was in use or 12 8 per 100 of population with 5,681,594 mi. of wire. Post office facilities also increased rapidly. In 1941 12,477 post offices were in operation with 4,841 rural mail routes and a total of 280,610 mail boxes. The postal revenue of the offices totalled $45,091,021.

(H. A. I.)

PRODUCTS AND INDUSTRY

Extent.—Of the land area (3,466,556 sq.mi.), 549,660 sq.mi., or 15.8% consists of agricultural land. But this calculation includes the vast extent of arctic Canada (Yukon and Northwest Territories), 1,463,563 sq.mi., of which only 14,070 sq.mi. are classified as agricultural land, and of this only 4 sq.mi. of land under cultivation and use. Of the 2,002,993 sq.mi. of the provinces, agricultural land represents therefore 26.7%. Of this again only 211,234 sq.mi. are included as land occupied and improved.

TABLE III.—*Acreage of Field Crops in Canada, by Provinces, 1936–41*

Province	1936 Acres	1937 Acres	1938 Acres	1939 Acres	1940 Acres	1941 Acres
Prince Edward Is.	483,200	400,300	484,400	470,300	505,500	494,100
Nova Scotia	551,400	518,100	549,200	551,900	556,700	551,600
New Brunswick	921,300	907,300	903,600	901,000	908,000	878,800
Quebec	6,018,400	6,012,300	6,103,300	6,142,100	6,088,100	5,995,400
Ontario	9,118,900	9,037,000	9,077,300	9,084,500	9,158,700	9,129,400
Manitoba	6,081,100	6,421,600	6,897,500	6,863,300	6,999,900	7,342,100
Saskatchewan	21,757,350	20,483,600	19,960,300	20,749,200	21,919,700	20,314,800
Alberta	12,743,150	13,400,000	13,582,500	13,942,600	14,238,800	13,250,500
British Columbia	472,050	487,700	501,400	510,100	520,500	514,400
Totals	58,146,850	57,826,900	58,959,500	59,224,600	60,805,900	58,480,100

TABLE IV.—*Value of Field Crops in Canada, by Provinces, 1936–41*

Province	1936 (add 000)	1937 (add 000)	1938 (add 000)	1939 (add 000)	1940 (add 000)	1941 (add 000)
Prince Edward Is	$ 10,693	$ 7,706	$ 9,113	$ 10,708	$ 8,874	$ 9,484
Nova Scotia	13,593	10,811	11,129	13,118	13,778	10,056
New Brunswick	18,306	14,149	17,064	20,641	21,336	24,318
Quebec	91,276	81,626	86,177	92,710	95,071	119,412
Ontario	166,284	140,100	131,569	156,118	149,479	172,470
Manitoba	50,401	90,112	54,208	60,283	61,067	81,105
Saskatchewan	141,703	51,850	104,757	190,827	176,078	117,117
Alberta	103,663	131,129	122,148	126,947	136,572	93,630
British Columbia	16,261	16,130	13,669	14,316	14,427	14,231
Totals	$612,306	$556,222	$550,069	$685,839	$676,682	$647,850

Agriculture, including horticulture, fruit-growing and the raising of stock and poultry, is the largest single industry in Canada, employing according to the classified returns (1931) 28.7% of the total gainfully occupied population, and 33.9% of gainfully occupied males. Reckoned in terms of value of product, agriculture, as seen in the tables below, ranked first in the primary production of 1939, but was surpassed by manufacture in the class of secondary production. The increase of farm livestock and poultry in Canada is shown in Table VI. The number of horses reached its maximum in 1921 with 3,610,494.

In horticulture, apple growing is the chief feature in Canada, with an annual value of some $10,000,000 Nova Scotia, especially the Annapolis valley, southern Quebec and central Ontario are the apple districts of eastern Canada. Other commercial fruits are pears, plums and cherries. The Niagara and Lake Erie districts grow also peaches and grapes, melons and strawberries. British Columbia has large fruit-growing districts, especially the Okanagan valley. The root crops of Canada, a feature of farm life since its beginnings, are classified in Table V. Specially to be noted is the relatively recent sugar-beet crop and industry. This arose after the turn of the century out of experiments favoured by dominion bounties. Four beet sugar companies began operations in western Ontario in 1902 with a bounty from Ontario till 1907 of one-half cent a pound on beets, and municipal bounties from Dresden ($40,000) and Wallaceburg ($30,000) and tariff concessions on machinery. In 1940, 825,344 tons of beets made 213,602,511 lb. of sugar worth 5.1 cents per lb.

The dairy industry grew greatly after 1920 The farm milk supply of 1941 was 16,752,823,400 lb., an increase of 500,000,000 lb. over 1940. Creamery butter reached a record in 1941 with 286,109,500 lb. and made with dairy butter a total of 380,447,500 lb. Ontario and Quebec produced over 50% of Canadian butter. The increased production of Canadian cheese was a special feature of Canadian agriculture at the opening of the 20th century and amounted annually to over 200,000,000 lb. During World

TABLE V.—*Chief Agricultural Products of Canada Five-Year Average 1935–39*

Province and field crop	Area acres	Total Production	Gross farm value
CANADA			
Fall wheat	632,000	17,171,000 bu	$13,625,000
Spring wheat	24,943,000	295,229,000 ,,	197,669,000
All wheat	25,595,000	312,400,000 ,,	211,294,000
Oats	13,247,000	338,072,000 ,,	105,580,000
Barley	4,291,000	88,882,000 ,,	35,074,000
Fall rye	635,000	7,102,000 ,,	3,010,000
Spring rye	181,000	1,999,000 ,,	858,000
All rye	816,000	9,100,000 ,,	3,866,000
Peas	85,000	1,339,000 ,,	2,031,000
Beans	68,000	1,282,000 ,,	1,087,000
Buckwheat	377,000	7,043,000 ,,	4,780,000
Mixed grain	1,166,000	38,507,000 ,,	17,072,000
Flaxseed	307,000	1,500,000 ,,	2,006,000
Corn, for husking	172,000	7,010,000 ,,	3,857,000
Potatoes	516,000	38,031,000 cwt.	35,357,000
Turnips	187,000	37,083,000 ,,	12,638,000
Hay and clover	8,766,000	13,615,000 tons	105,561,000
Alfalfa	854,000	2,052,000 ,,	17,180,000
Fodder corn	457,000	4,512,000 ,,	12,458,000
Grain hay	1,098,000	1,583,000 ,,	8,323,000
Sugar beets	34,000	301,000 ,,	1,814,000
PRINCE EDWARD ISLAND			
Spring wheat	10,000	243,000 bu.	$256,000
Oats	151,000	4,667,000 ,,	2,116,000
Barley	6,000	165,000 ,,	116,000
Buckwheat	1,000	65,000 ,,	41,000
Hay and clover	220,000	319,000 tons	2,765,000
Potatoes	35,000	3,748,000 cwt.	2,737,000
NOVA SCOTIA			
Spring wheat	4,000	59,000 bu	$68,000
Oats	62,000	3,012,000 ,,	1,740,000
Barley	9,000	243,000 ,,	195,000
Potatoes	31,000	1,807,000 cwt.	1,960,000
Turnips	12,000	5,258,000 ,,	1,408,000
Hay and clover	402,000	675,000 tons	6,463,000
NEW BRUNSWICK			
Spring wheat	14,000	220,000 bu.	$253,000
Oats	211,000	6,241,000 ,,	3,243,000
Barley	14,000	356,000 ,,	259,000
Buckwheat	32,000	651,000 ,,	409,000
Potatoes	48,000	4,000,000 cwt.	4,474,000
Turnips	12,000	2,632,000 ,,	1,105,000
Hay and clover	569,000	818,000 tons	6,094,000
QUEBEC			
Spring wheat	51,000	855,000 bu.	$809,000
Oats	1,678,000	42,396,000 ,,	21,147,000
Barley	162,000	3,872,000 ,,	2,507,000
Peas	19,000	280,000 ,,	545,000
Buckwheat	144,000	3,000,000 ,,	2,057,000
Potatoes	136,000	11,365,000 cwt.	10,742,000
Turnips	38,000	6,836,000 ,,	3,147,000
Hay and clover	3,595,000	5,120,000 tons	40,097,000
ONTARIO			
Fall wheat	632,000	17,171,000 bu.	$13,625,000
Spring wheat	92,000	1,671,000 ,,	1,382,000
Oats	2,305,000	70,962,000 ,,	28,670,000
Barley	533,000	16,023,000 ,,	8,438,000
Fall rye	67,000	1,209,000 ,,	727,000
Peas	59,000	997,000 ,,	1,208,000
Beans	59,000	1,117,000 ,,	1,658,000
Buckwheat	180,000	3,735,000 ,,	2,041,000
Flaxseed	6,000	53,000 ,,	74,000
Corn, for husking	172,000	7,010,000 ,,	3,857,000
Potatoes	147,000	8,390,000 cwt.	8,502,000
Turnips	98,000	10,491,000 ,,	4,902,000
Sugar beets	34,000	301,000 tons	1,814,000
Hay and clover	2,798,000	4,820,000 ,,	35,415,000
MANITOBA			
Spring wheat	2,880,000	41,130,000 bu.	$29,612,000
Oats	1,427,000	33,035,000 ,,	9,164,000
Barley	1,327,000	27,178,000 ,,	10,163,000
Fall rye	123,000	1,816,000 ,,	771,000
Spring rye	20,000	277,000 ,,	115,000
Flaxseed	52,000	331,000 ,,	451,000
Corn, for husking	95,000	2,565,000 ,,	1,590,000
Potatoes	33,000	2,003,000 cwt.	1,387,000
SASKATCHEWAN			
Spring wheat	13,074,000	130,460,000 bu.	$90,140,000
Oats	4,464,000	84,350,000 ,,	18,798,000
Barley	1,196,000	18,250,000 ,,	6,287,000
Fall rye	343,000	3,030,000 ,,	1,094,000
Spring rye	90,000	970,000 ,,	341,000
Flaxseed	226,000	933,000 ,,	1,220,000
Potatoes	40,000	2,297,000 cwt	1,707,000
ALBERTA			
Spring wheat	7,844,000	109,900,000 bu.	$73,509,000
Oats	2,894,000	79,041,000 ,,	18,290,000
Barley	1,031,000	22,335,000 ,,	7,052,000
Fall rye	102,000	1,128,000 ,,	418,000
Spring rye	60,000	601,000 ,,	251,000
Flaxseed	21,000	158,000 ,,	205,000
Potatoes	29,000	1,064,000 cwt.	1,051,000
Sugar beets	10,000	218,000 tons	1,455,000
BRITISH COLUMBIA			
Spring wheat	66,000	1,601,000 bu.	$1,451,000
Oats	112,000	5,428,000 ,,	2,112,000
Potatoes	18,000	1,977,000 cwt.	2,147,000
Hay and clover	154,000	300,000 tons	3,025,000

TABLE VI.—*Livestock and Poultry on Farms in Canada (Census Figures)*

Item	1871	1901	1931	1941
Horses	836,743	1,577,493	3,113,909	2,881,000
Cattle	2,624,290	5,576,451	7,973,031	8,798,000
Sheep	3,155,509	2,510,239	3,627,116	3,551,000
Swine	1,366,083	2,353,828	4,699,831	5,994,000
	1891			
Hens and chickens	12,696,701	16,651,337	61,277,229	67,533,000
Turkeys	458,306	584,560	2,223,107	2,556,000
Ducks	320,169	299,755	749,930	630,000
Geese	537,932	395,997	902,251	802,000

War I the larger part was exported to Great Britain (87% in 1917). Increased consumption of milk and increased production of butter lowered cheese figures but after 1939 output was increased and in 1941 reached 149,926,600 lb., highest for 15 years.

Tobacco for home use has been grown on Canadian farms since earliest times. In the 20th century it became a large commercial crop. In 1941 Ontario, chiefly the district from London to Windsor, especially Essex county, had 57,390 ac. of tobacco; Quebec 12,470 ac.; British Columbia 640 ac. The farm price before World War II ran from 11.5 cents in 1932 to 18 cents in 1939 (20.4 cents in 1941). Before the war Canada produced about 30,000,000 lb. of honey annually (Ontario about 12,000,000, Manitoba 8,000,000, Quebec 5,000,000). Maple sugar in Canada dates from 1690 and represents (1943) a product of some 3,000,000 lb. ($500,000) a year; syrup nearly 3,000,000 gal. valued at nearly $4,000,000. Canadian farming is almost entirely based on relatively small individual holdings. All historical attempts, as in the settlement of Upper Canada, to create large holdings, 1,000 or more acres, broke down under the natural conditions of cheap land and (relatively) dear labour.

The statistics, as classified from the census of 1931, showed that the total number of occupied farms in Canada was 728,623, divided into classes as occupied by owner, part owner and tenant, and cross divided among the provinces as in Table VII. In 1931 the farm population of Canada, equal to 31% of the total population, numbered 3,289,140 or 4.51 persons to a farm. The farm workers included 1,003,763 males and 89,620 females and hired help (other than temporary) 64,130.

TABLE VII.—*Tenure of Canadian Farms, 1931*

Province	No. of Occupied Farms	No. of Farms Occupied by owner	No. of Farms occupied by part owner or part tenant	No. of Farms occupied by tenant
Prince Edward Island	12,865	12,001	540	324
Nova Scotia	39,444	37,176	1,213	1,055
New Brunswick	34,025	31,933	1,164	928
Quebec	135,957	126,503	4,305	5,089
Ontario	192,174	157,427	13,233	21,514
Manitoba	54,199	37,973	6,369	9,857
Saskatchewan	136,472	90,691	24,737	21,044
Alberta	97,408	71,060	14,540	11,808
British Columbia	26,079	21,385	1,841	2,853
Total	728,623	586,290	67,942	74,382

Marketing.—Hard times and the fall of prices (1929) made it impossible for the co-operative pools to find the financial strength to handle crops and left the general Canadian Co-operative Wheat Producers Ltd. with large unsalable carry-overs. This led to the substitution of government aid to marketing as under the Canadian Wheat Board Act of 1935. This did not obliterate the provincial pools which still operated elevators for their members. The government, through the wheat board, fixes and guarantees a minimum price, but individuals can lawfully buy and sell above it as they like. The government issues to producers participation certificates (part payment) on delivery. Shippers and exporters buy from the board at terminal points. The Winnipeg grain exchange remains open to the board and to the trade. The system functioned thus till the outbreak of World War II, when overseas trade passed under government control.

Jurisdiction over agriculture is concurrent as between the dominion and the provinces, with dominion legislation supreme in case of conflict (B.N.A. Act 1867 §95). On the outbreak of war the dominion has the supreme powers conferred under the War Measures act and can control acreage, prices, etc., at will. Both the dominion and the provinces have departments of agriculture and experimental stations. The provinces carry on various lines of educative field work and maintain colleges. Specially notable are the Ontario Agricultural college at Guelph (dating from 1874) and the Macdonald college (St. Anne de Bellevue) affiliated with

McGill university. The depressed years after World War I led to the adoption of a system of long-term mortgage loans advanced by the dominion government to farmers in occupation.

BIBLIOGRAPHY.—*Annual Reports* of the department of agriculture (Ottawa) and of the provincial departments; for summaries see *Canada Year Book* (annual) and the special articles: "The Development of Agriculture in Canada," by J. H. Grisdale (1924); "Provincial Departments of Agriculture" (1939), etc. (S. LEA.)

Minerals and Mining.—Most of the economic minerals occur in Canada, as might be expected from its great area and varied geology, and more than 60 products are annually reported by the Dominion Bureau of Statistics; but only the more important need be referred to. Coal for many years stood first in value until in 1931 it was overtaken by gold. The estimated value of its output in 1939 was $48,315,224. Nova Scotia has bituminous coal of the Carboniferous age, more than half of which lies under the sea. Coke made from it and hematite, also mined beneath the sea in Newfoundland, make the basis of the important steel industry of Sydney. Alberta produces nearly as much coal, but of Cretaceous age and largely lignitic, though the quality improves towards the mountains. British Columbia mines less than half as much as Alberta, most of it Cretaceous, but some of it making excellent coke for the smelters.

Gold has been obtained in part from placer mines in British Columbia and Yukon territory; but all but 2% comes from lode mines (1943). Total production for 1939 was estimated at 5,094,379 fine oz., valued in Canadian funds at $184,115,951. Governmental restriction reduced output in wartime, no statistics of production being disclosed. The Porcupine and Kirkland Lake districts in northern Ontario are the greatest producers, the Hollinger mine in the former region being the third largest gold mine in the world. Northern Ontario produced gold to the value of $111,533,784 in 1939. In that same year Canada stood second only to South Africa and produced 12.9% of the world's gold. The silver mines of Cobalt, at one time the richest in the world, are becoming exhausted, so that British Columbia now leads in silver, which is obtained from ores containing other metals. Copper is mined in large amounts in Ontario and British Columbia, usually in association with some gold and silver or lead and zinc in complex ores, which require elaborate plants for separating and smelting them. 80% of the world's nickel comes from Sudbury district, Ontario, where it is associated with copper ore.

Metalliferous Regions.—The metals mined in Canada come mainly from two widely separated regions, the first being the Coast and Gold ranges of the Pacific coast, where batholithic intrusions have acted upon sedimentary rocks during mountain building in Jurassic times; and the second the Pre-cambrian area of Ontario, where Algoman granite has invaded very ancient volcanic and sedimentary rocks. Similar rocks are widely distributed through the Canadian Shield and extend into Quebec on the east and Manitoba and Saskatchewan to the north-west. Great deposits of copper ores are being opened up on the Rouyn region of Quebec and the Flinflon region of Manitoba; and gold, as well as lead and zinc ores, occur also on a large scale. The Cordilleran and Archaean regions of Canada have been comparatively little explored and there is reason to believe that many other ore deposits will be found in the future. Asbestos is obtained from Serpentine areas in the Eastern Townships of Quebec, which provide over half the world's supply. (A. P. Co.)

Mineral Production.—The outbreak of war in 1939 naturally altered the scope and direction of mineral production. In particular the government endeavoured to stimulate the production of basic and strategic metals, molybdenum, chromite, magnesium metal, etc. This led to a rapid increase in the production of steel and to the reduction of all nonessential products such as gold. Detailed information in regard to many important minerals (copper, nickel, etc.) were withheld. The most significant statistics, therefore, are those of the period immediately before the war, as in Table VIII.

TABLE VIII.—*Mineral Production of Canada, 1939*

Principal minerals	Quantity	Value in Canadian $	Chief provincial producers
Metallics:			
Copper	608,825,570 lb.	$60,934,850	Ontario $32,037,305 Quebec $11,831,740 Manitoba $7,110,711
Nickel	226,105,865 lb.	50,920,305	All from Ontario
Lead	388,569,550 lb.	12,312,768	British Columbia $11,002,784
Zinc	391,333,860 lb.	12,108,244	British Columbia $8,503,784
Gold	5,094,379 fine oz.	184,115,951	Ontario $111,533,873 Quebec $34,455,098 British Columbia $22,059,323
Silver	23,163,629 fine oz.	9,378,490	British Columbia $4,311,170
Total metallics		$343,506,122	
Principal Fuels:			
Coal	15,537,493 short tons	$48,315,224	Nova Scotia $25,611,271 Alberta $14,415,281
Natural gas	35,185,140 M cu.ft.	12,507,307	Ontario $7,261,928 Alberta $4,015,821
Petroleum, crude	7,820,301 bbl	9,846,352	Alberta $9,302,363
Total Fuels		$70,671,328	
Other Non Metallics (chief items)			
Asbestos	364,472 short tons	$15,859,212	Quebec $15,858,492
Sulphur	211,278 „ „	1,068,025	Various (from pyrites and smelter gases)
Gypsum	1,421,034 „ „	1,935,127	Nova Scotia $1,310,830
Salt	423,500 „ „	2,486,632	Ontario $2,200,189
Total Non-Metallics (excluding fuels)		$25,061,849	
Clay Products and Structural Material		$35,362,750	
Grand Total		$474,602,059	

Forest Industries.—Official statistics show that of the total land area of Canada (3,466,556 sq.mi.) 35% of the whole (1,220,405 sq.mi.) is forested. In a sense this is an understatement, or a misleading statement, since the total includes the vast treeless arctic archipelago and the barren grounds of the sub-arctics. The Yukon and Northwest Territories in which these islands and treeless areas are included cover 1,463,563 sq.mi. with only 60,000 mi. of forest land. The only other treeless region in Canada is that extending over the southern portion of the western provinces where, of a total area for the three of 700,000 sq.mi., 300,000 are forest land. Thus of the 2,002,093 sq.mi. of the Canadian provinces, an area of 1,160,405 sq.mi. or 58% of the total is forest land. Land classed as agricultural in the provinces covers 535,590 sq.mi. but of this again 251,660 sq.mi. is forested and would only be agricultural if cleared. It is estimated that Canada has 770,565 sq.mi. (all of it in the provinces except 10,000) of productive forest land. Even the unproductive forest plays a part in conserving water supply and harbouring game.

The wide variations in the latitude, climate and soil of Canada occasion corresponding differences in forest growth. The dominion is therefore divided in this aspect into the (1) Acadian forest region of the Maritime provinces characterized mainly by coniferous trees (especially red spruce and balsam) interspersed with deciduous growth and in places with "hardwood ridges" as in Nova Scotia. (2) The Great Lakes-St. Lawrence forest region, corresponding to the old Lower and Upper Canada (along the river and the Great Lakes and back to the watershed), the area of the famous lumbering and of the timber trade of earlier days. Here were originally rich forests of white and red pine, now largely cleared. With the pine went hemlock, maple, birch, ash and elm as still seen in the countryside of today. A small, most southerly portion of the area (along Lake Erie, Niagara to Sarnia) may be placed separately as, (3) the Deciduous forest region, where deciduous trees predominate as in the adjacent areas of the United States. (4) North of these areas and sweeping right across Canada from the Atlantic to Alaska is the Boreal forest region which covers the larger part of all the forest land of Canada ending on the north only at the limit of tree growth. The more southern trees, the maple, the elm, etc., here give place to white and black spruce, jack pine, balsam, poplar and white birch. The trees of this region are [illegible] of value as pulpwood. The main forest area of the Boreal region passes into the northern transition section that borders its edge where the severity of the climate more and more checks growth till it ends at the barren lands. On the southerly side another transition area, the Aspen Grove section, is distinguished as [illegible] the boreal forest proper and the prairies. The aspen is the dominant tree with bur oak and ash in the river bottoms. (5) The Sub-Alpine forest region (3,500 to 6,000 ft. above sea level), essentially coniferous, covers the eastern slopes of the Rockies. (6) The Columbia forest region, often called the interior wet belt of British Columbia, occupies the elevated (2,500–4,000 ft.) valleys of the Columbia and other rivers. The trees are spruce, cedar, western hemlock and Douglas fir, with some white pine. (7) The Montane forest region is in lower, drier country in interior British Columbia with ponderosa pine, aspen and Douglas fir. (8) The Coast forest region includes Vancouver island and all the indented coast above it to Alaska, together with the forests of the Yukon. Here grow the huge coniferous trees—western hemlock, red cedar and Douglas fir. In favoured spots the timber stands 100,000 ft. board measure to the acre. Less important commercially are the deciduous alders, oaks and broadleaved maples.

The productive forests of Canada cover thus 770,000 sq.mi., all but 10,000 mi. of which are in the provinces as opposed to the territories. An area of about 430,000 sq.mi. of productive forest is at present (1943) accessible. The total stand of merchantable timber is estimated at 313,000,000,000 cu.ft. of which 212,000,000,000 is accessible; of this total, trees fit to make lumber represent 252,000 million board feet, and trees for pulpwood, posts, fuel, mining timber, etc., 1,500,000,000 cords.

The forests, apart from the Yukon and the territories, are under provincial control. But the dominion reserved, or obtained from the provinces, various national parks (12,404 sq.mi.) and experimental stations (227 sq.mi.). Provincial parks (none in the Maritimes, Manitoba and only 2 mi. in Alberta) cover in all 20,640 sq.mi., British Columbia alone with 9,994 sq.mi. For all Canada, the privately owned forest land amounts to 102,212 sq. mi. as against 1,118,193 sq.mi. of crown land (9%).

TABLE IX.—*Lumber Production in Canada, 1939*

Province	M.ft b m	Province	M.ft b m
Prince Edward Island	4,014	Manitoba	60,748
Nova Scotia	152,721	Saskatchewan	37,074
New Brunswick	210,019	Alberta	95,642
Quebec	656,371	British Columbia	2,276,033
Ontario	481,527	All Canada	3,976,882

Commercially the forests are represented by the lumber and the pulp and paper industries. The manufacture of sawn lumber ranks sixth (classification of 1940) among Canadian industries, but first in width of distribution with 4,675 plants. It employs 39,501 men with a gross output of $134,000,000. Lumber production reached its maximum, in quantity of product, with 5,000,000 M.ft.b.m. in 1911. The minimum cut was 1,809,000 M.ft.b.m. in 1932, that of 1940, 4,628,000 M.ft.b.m. The export of Canadian lumber for most of the 19th century was in the form of hewn square timber. This declined after 1860 and presently disappeared in favour of the export of sawn lumber. From 1900 to 1929 about 2,000,000 M.ft.b.m. were exported yearly, declining till 1932 since which date the export has greatly increased, 2,300,000 M.ft.b.m. in 1941. Before World War II more than 50% commonly went to the United Kingdom and nearly 30% to the United States.

The latest official classification (1940) shows the pulp and paper industry ranking second in output value among the 40 leading industries of Canada, having 103 establishments, 34,719 employees and a gross value of the year's output of over $298,000,000. Paper was made in Canada as far back as 1813 (Crooks Hollow, Ont.) but pulp paper began in 1866 with a grinding mill at Valleyfield, Que.; the first sulphide mill dates from 1887. The annual output at the beginning of the 20th century was worth $8,000,000. Of the Canadian pulpwood trees cut some are exported as pulpwood, some as wood pulp and others made into paper in Canada. Latest classified returns show (1940) a cut of 8,449,922 cords of which 81.7% passed through Canadian pulp mills and 18.3% was exported as pulpwood. The export of wood pulp in 1940 was 1,068,517 tons. In the same year the 76 paper mills of Canada produced 4,319,414 tons of paper. Newsprint represents over 80% of the Canadian paper output. Before World War II the world production of newsprint was 7,679,000 short tons, of which Canada produced 38%. Great pulp and paper centres in Canada are Shawinigan Falls, Three Rivers, Cornwall, Port Arthur, Fort William, Quebec City, Grand'Mere, St. John's, N.B., and Vancouver. Quebec and Ontario are the leading provinces. Of the 5,290,762 tons of wood pulp produced in Canada in 1940, 2,794,384 were produced in Quebec and 1,369,389 in Ontario. In 1940 Quebec produced 52.9% of the total Canadian paper production and Ontario 29.6%, British Columbia 7.7% and Nova Scotia, New Brunswick and Manitoba the remaining 9.8%.

Fur Farms.—Since the beginning of the century prices of the more valuable furs have increased with great rapidity as a result of a decrease in supply and an increase in demand. This has been the cause of numerous regulations on the part of the provinces and the dominion, leading to the conservation of fur-bearing animals. Fur-farming, especially with silver and black fox in Prince Edward Island, has become an important industry since 1910. During World War I the European market was shut off and North America developed its own marketing system. In Canada auction sales are held at Montreal, Winnipeg, Edmonton and Vancouver. Manufacturing of fur goods also received an impetus from the war. Provinces of Quebec and Ontario have surpassed Prince Edward Island in the value of their fur farms.

The growth of fox farming in eastern Canada appears as follows: In the season 1920–21 the number of silver and black fox pelts produced in Canada was 4,979, of which 2,082 came from Prince Edward Island with Nova Scotia in second rank, 517. In the season 1938–39 the total was 319,693 with 70,420 from P.E.I., 60,020 from New Brunswick, 55,203 from Quebec, 38,000 from Ontario and 29,000 from Nova Scotia.

Fishing is Canada's oldest industry, but its importance on the Atlantic coast, in the inland lakes and on the Pacific coast increased materially after 1890. On the Atlantic the deep sea fishery and the inshore fishery expanded rapidly through the growing use of steam trawlers and motor-boats. The improvement in fishing technique led to the depletion of the fishery, especially of fish which spawn in the rivers as in the salmon of British Columbia. Depletion of the inland fisheries was also pronounced, as with the white fish. Measures to offset the decline include closed seasons, regulation of fishing operations, prohibition of obstructions in streams and the establishment of hatcheries and stations for biological research. The effectiveness of these measures depends upon co-operation by the United States government as in the treaty of 1923 "For the Protection of the Pacific Halibut" and the Ottawa convention of 1931. The fishing rights of the United States in Canadian waters involved a long series of disputes and treaties.

To encourage the Atlantic sea fisheries the dominion of Canada pays bounties to sea fishermen in Quebec and the Maritime provinces. The policy began with a statute of 1882 (14 Vict., c. 18) distributing in bounties the yearly interest on the money received from the United States under the Halifax award which arose out of the treaty of Washington of 1871. An act of 1891 (54-55 Vict., c. 42) settled the annual bounty, which is $160,000. The Deep Seas Fisheries act (R.S.C. 1927, c. 74) established bounties among owners of vessels, fishermen employees and boat fishermen. In 1940 $159,929 was paid out. The value of the products of the Canadian fisheries stood in 1870 at $6,577,391, in 1900 at $21,557,639, in 1918 (maximum) at $60,259,744 and in 1940 at $45,118,887. At the time of the outbreak of war in 1939 the number of Canadian sea fishermen was 55,205, and inland fishermen 13,736. In earlier years the cod on the Atlantic rivalled the Pacific salmon for first place in the fisheries. The value of the product of inland fisheries (whitefish, pickerel, trout, etc.) represents from 13% to 17% of the total. After 1895 salmon ranked first, with lobster (till World War II cut export) in second place. The Pacific herring catch greatly expanded and put herring in second place. Halibut is important on both coasts. Statistics of fish export show a value of some $8,000,000 in 1890, $40,000,000 in 1920 and $30,000,000 in 1930. (S. LEA.)

Manufactures and Water Power.—In manufacturing, Canada steadily becomes more prominent and important. Among the states of the British empire its output of manufactures is second only to that of Great Britain and the major portion of its exports to other dominions consists of such commodities. Canadian manufactures depend mainly upon domestic raw materials of the forest, the farm and the mine. For some years prior to 1939 the wood pulp and paper industry led in the amount of capital employed, wages and salaries distributed and net value of production. It is geared to the export trade, producing ten times the amount of newsprint consumed within the country. The remarkable progress of this industry within the 20th century was made possible by exploiting the abundant forests and ample hydro power of the northern hinterland, especially in Ontario and Quebec. The other leading industries which utilize mainly domestic raw materials are the smelting and refining of nonferrous metals, which in 1939 led pulp and paper in gross but not net value of production, slaughtering and meat packing, flour milling, and the production of butter and cheese. Some important industries which rely upon materials imported largely in a raw or semi-finished state are the manufacture of automobiles, sugar and rubber goods. Notable also is an iron and steel industry in Nova Scotia, Quebec and Ontario dependent upon imported ore from Newfoundland and the United States.

After 1879 the state fostered manufacturing by protective tariffs and sometimes by bounties and subsidies. On occasion also the municipalities assisted manufacturers by exempting them from taxation or by granting loans and bonuses, a practice once common in Ontario. The Canadian protective tariff has never been relatively high. The average *ad valorem* rate of duty on dutiable imports reached a peak in 1889, when it was 31.9%; in 1939 it was 24.2%. The precise influence of the tariff is difficult to assess, but, tariff or no tariff, secondary industry in the 20th century would have grown, owing to the opening of the Canadian west, the extending railways, the rapidly growing population, the development of mineral and forest resources, and above all the utilization of the vast power in the country's extensive waters. To a remarkable degree the Canadian economy is a hydroelectric economy, as might be expected in a state which contains a larger freshwater area at a fair altitude than that of any other country in the world. The many small secondary industries in Ontario and Quebec rely on hydro power, for this region is without coal except what it obtains from the United States and Nova Scotia.

The dominion has, in minimum figures, more than 20,000,000 potential horsepower at ordinary minimum stream flow, rising to over 33,000,000 h.p. for six months of the year. The total turbine installation in 1939 was over 8,500,000 h.p., which in actual operating hydro power places Canada, as compared with other countries, next to the United States and next to Norway in the output of such power *per capita*. Significantly the *per capita* consumption of electricity in Canada is twice that in the United States, and continues to develop rapidly. The top amount of power generated in 1939 was over 400% greater than that generated in 1919, and the capacity of electric power motors had come to represent 79% of the capacity in the total power equipment of all kinds throughout the country. The manufacture of pulp and paper is the largest industrial consumer of electric power, but all the important secondary industries utilize it.

Manufactures are not evenly distributed among the provinces. Those in Ontario and Quebec account for over 80% of the gross value of Canadian manufactured products. Ontario alone accounts for over 50% of that gross value, and dominates the production in certain important industries, such as, automobiles, agricultural implements, leather tanneries, rubber goods, and electrical apparatus and supplies. Quebec dominates in the manufacture of textiles. This industrial concentration in central Canada, creating the metropolitan areas of Montreal and Toronto, is due to abundant water and mineral resources, cheap transport on the St. Lawrence waterways, nearness to the coal and iron ore of the United States, general proximity to the American industrial belt, and the possession of fertile lands capable from early times of maintaining a large population.

Trade and Commerce.—Canada is one of the great trading nations of the world. At the end of the first quarter of the 20th century it held sixth place in the aggregate volume of trade, excelled by Great Britain, the United States, Germany, France and British India. In 1939 it ranked fifth, being then fourth in exports and eighth in imports. Its trade *per capita* is less than that of some smaller countries, notably New Zealand, but exceeds that of the large trading nations, such as Great Britain and the United States. The bulk of Canadian trade is in raw or semi-finished products. Twelve leading exports in the order of their importance in 1939 were newsprint, wheat, nickel, planks and boards, copper, meats, wood pulp, fish, aluminum, automobiles, wheat flour, asbestos. The order in importance of these exported commodities varied greatly from 1914 on, but throughout wheat was a dominant export, and in the late '30s Canada was supplying between 30% and 40% of the total wheat which entered into world trade. The export in newsprint underwent the most remarkable development in the last quarter of a century, and represented in 1939 two-thirds of the world newsprint trade. Leading imports were machinery, coal, crude petroleum, rolling-mill products, automobile parts, fruits, sugar, farm implements, cotton goods, raw cotton and rubber products. As Canada steadily advanced in industrialization, it exported more native products in a manufactured or semimanufactured form, and imported relatively more raw materials to sustain its growing secondary industry.

In trade Canada has been intimately linked with Great Britain and the United States. Thus in 1939 some 66% of its imports were drawn from the United States and thither went 41% of its exports; while in Great Britain it acquired 15% of its imports and sold 35% of its exports. This dominant position of two countries in its external trade characterized the dominion from 1867 on. Notable is the fact that since 1896 imports from the United States have annually exceeded half the total. From 1924 on the proportion of Canadian trade with other countries, especially other countries of the British empire, significantly increased. Thus in 1926 the percentage of imports from the empire outside Great Britain was five; by 1939 this percentage had increased to ten, and the percentage pertaining to exports in the same period increased from seven to eleven. The Ottawa Trade agreements of 1932 had obviously influenced this trend.

In the years from confederation to 1939, imports exceeded exports on 38 occasions, while exports exceeded imports on 34 occasions. The "unfavourable" balances occurred in years usually of heavy capital imports for extensive construction, especially of public works. The "favourable" balances may be regarded as Canada's successful meeting of foreign obligations.

The federal government has done much directly to encourage foreign trade, especially to assist the exporter in procuring markets abroad. The department of trade and commerce established the Commercial Intelligence service, which appointed commissioners and agents to make reports upon the demand in foreign countries for Canadian commodities. A *Commercial Intelligence Journal*, containing such reports, has been published weekly, and distributed among firms in the export trade. The government has also been active in negotiating commercial treaties with foreign states. The most important of these treaties in recent times was the Canada-United States agreement of Nov. 1938, whereby mutual concessions were made in the tariffs of the two countries, and the export of Canadian timber, livestock, grains, metals and some manufactures were stimulated. The leading Canadian banks by establishing branches abroad have also contributed much to the promotion of external trade. (A. Br.)

Education.—For details of Education in Canada see the section on this subject in the article *British Empire*.

ANTHROPOLOGY

Anthropologically as geographically, Canada must be considered as an integral part of the North American continent. The boundaries between the Dominion and the United States, Alaska and Newfoundland do not conform to ethnic divisions among the aborigines. The culture of the Canadian natives does not differ markedly from that of their neighbours.

The first explorers found the country inhabited by people of brown complexions, lank hair and primitive mode of life to whom the term "Indian" was applied. In later years the same designation was given to the various tribes encountered by adventurers, French and English, as they penetrated westward across the continent. In the north, however, the hunters dwelling on the shores of the Arctic were so different both in appearance and culture that the term "Indian" was inapplicable, and "Eskimo" was used instead.

Certain important physical characteristics are common to all Canadian Indians. The colour of the skin is dark brown—"red" is a misnomer and "yellow" an exaggeration; the black hair is leiotrichous (smooth); the zygomae (cheekbones) are prominent; the face is broad in comparison with the breadth of the head; the nose is usually well developed, though not flattened; the incisors are often concave, and the frontal portion of the skull is somewhat ill-filled. But it must be emphasized that there is no absolute uniformity of type. On the coast of British Columbia the natives are characterized by relatively short stature, heavy build, with round heads, broad faces and a certain amount of facial hair. On the Plains the stature is greater, the body more lithe and graceful, facial hair limited to an occasional sparse moustache, and the head form ranges from medium to low broad types. The Eastern type generally resembles that of the Plains, although several tribes have longer heads, and a few prehistoric dolichocephalic skulls have been found.

The Indians of Canada belong to one racial stock, related to the Mongoloid branch of mankind. An unmixed race does not exist in North America, and the physical differences in America suggest that the migrations from Asia came in successive waves, comprising non-homogeneous Mongoloid groups. Furthermore, environmental factors have probably produced considerable variation within America itself.

It is difficult to estimate the antiquity of man's settlement in America. Goddard (*American Anthropologist*, vol. xxix., 1927, p. 262) has recently summarized the evidence for human existence during interglacial periods, but Hrdlička and other students hold that the continent was uninhabited until post-glacial times. It is probable that the ancestors of the Indians came by the north-western route across Bering strait. Even at the present time the passage occasionally freezes so solidly that it is possible to walk from Asia to America, while the Diomede islands offer convenient stepping-stones for sea voyagers. The earliest immigrants were probably long-headed or dolichocephalic (possibly akin to the Palaeo-Amerinds of Haddon); the length of the skull among some of the Iroquoian and Algonquian peoples of Ontario may be either a survival of this characteristic or a mere deviation from the later and now predominant round-headed type. Norsemen undoubtedly reached the eastern coast, but have left no impress on the physique of the people. Other maritime adventurers had little effect upon Canada.

The Eskimo (*q.v.*), who inhabit the shore of the Arctic from north-west Siberia to Greenland, present an appearance very different from that of the Indians. Their hair is equally straight, but the skin colour lacks the warm brown of their southern neighbours. The large, long head is high, somewhat keel-shaped in general form; the nose is narrow and inconspicuous, which, combined with prominent cheek-bones and unusually broad face, gives a frontal appearance of flatness; the eyes are black with the epicanthic fold frequent; the hands and feet are even smaller than those of the Indians, and the stature usually less. These characteristics are most obvious in the Hudson Bay region; towards Alaska mixture appears to have taken place and the head is broader. The smooth hair and broad cheek-bones, however, indicate membership in the same general Mongoloid race, of which they may be regarded as a highly specialized offshoot. Sollas (*Journal of the Royal Anthropological Institute*, vol. lvii., 1927, p. 89) contends that they resemble the Chancelade type of Magdalenian Europe. At that period conditions in France resembled those under which the Eskimo now live, and it has been suggested that their ancestors slowly followed the retreat of the ice, later spreading along the shores of the Arctic, either by way of Asia or Greenland.

The presence of a large number of closely related and intermediate types prevents a rigid and satisfactory classification of the Indians by physical means alone, so other criteria must be employed. Linguistically, the tribes of Canada and Newfoundland can be divided into the following stocks:—

(1) **Beothukan.**—Little is known concerning the speech of the extinct Beothuk of Newfoundland, but limited vocabularies indicate that it was unrelated to any other known language.

(2) **Algonquian** (Algonkin, *q.v.*).—Tribes speaking Algonquian languages formerly roved over vast areas in eastern and central Canada. Early explorers encountered the Micmac in Nova Scotia and Prince Edward island, and the Malecite and Abnaki[1] in New Brunswick, whose descendants are still to be found in those provinces. North of the St. Lawrence, in the wilderness of northern Quebec and Labrador live the Montagnais and the Nascapee, hunters who still roam in small bands. Across the northern woodlands between James bay and the prairies are various Cree tribes, some of which have spread even to the slopes of the Rocky mountains. The Blackfoot of southern Alberta, Algonquian in speech, are a typical Plains tribe. Western Ontario, especially the region north of Lake Superior, is the home of the Chippewa or Ojibway, one of the most populous Canadian tribes, split into many sub-divisions dependent upon dialectical differences and geographical considerations. Eastward in central Ontario and Quebec, live, or lived, the Nipissing, the Temiskaming, the Ottawa, the Algonquin proper, the Mississauga, the Têtes de Boule and a host of minor groups. The fluidity of tribal organization, with consequent splitting-off of smaller bands, makes an enumeration of any but the more important groups impossible.

(3) **Iroquoian.**—When first encountered, the Five Nations of the Iroquois were resident south of the international boundary, but several tribes speaking languages belonging to the same stock were resident in southern Ontario. The Neutrals occupied much of the Niagara peninsula and the north shore of Lake Erie; the Hurons dwelt near Lake Simcoe; the Tobacco Nation were their western neighbours nearer Lake Huron. A vocabulary collected by Cartier in 1535 shows that Iroquoian peoples were then living in the St. Lawrence valley; these may later have amalgamated with the Hurons.

(4) **Siouan.**—This important linguistic stock is represented in Canada by the Assiniboin of Saskatchewan and Alberta, an offshoot of the Yankton Sioux who have moved north of the international boundary within recent years.

(5) **Kutenaian.**—The Upper and Lower Kutenai inhabit the mountain valleys of south-eastern British Columbia and northern Idaho. Their two dialects comprise a distinct stock.

(6) **Salishan.**—The Salish-speaking peoples comprise two main divisions, distinctive on both dialectical and geographical grounds. The interior group consists of the Shuswap, Okinagan, Thompson and Lillooet, resident in the valleys of the Fraser and the Thompson rivers in southern British Columbia. On the coast, the Salish extend from the international boundary to Cape Mudge, with an isolated enclave, the Bella Coola, on South Bentinck Arm; several tribes of the same stock inhabit south-eastern Vancouver island.

(7) **Wakashan.**—The Nootka, whose villages formerly extended along the western shore of Vancouver island, and the Kwakiutl of the north end of the island belong to this stock. Similar languages are spoken on the mainland north to Douglas channel.

(8) **Tsimshian.**—The Tsimshian tribes, formerly of considerable importance, live on the Nass and Skeena rivers in northern British Columbia. Their dialects differ fundamentally from those of the stocks already cited.

(9) **Haida.**—This language is limited to the people of the Queen Charlotte islands and part of the Alaskan mainland.

(10) **Athabascan** (*q.v.*).—Athabascan-speaking bands—their political organization is too intangible to warrant the name of tribe—rove over the vast regions of the Yukon and Mackenzie

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[1] In this article the spelling follows that adopted in *Handbook of American Indians* (Bulletin 30, Bureau of American Ethnology, Washington, 1906).

basin, eastward towards Hudson bay, generally north of the Algonquians. Southward they extend into the interior of British Columbia, coming in contact with the coastal tribes on the west and the interior Salish on the south. Other Athabascan groups, widely separated from their northern kinsmen, are found in Arizona, New Mexico and Mexico, while on the Canadian Plains the Sarsi are confined to a reserve near Calgary.

(11) **Eskimo.**—The Eskimo language, comprising several dialects, is spoken along the Arctic coast from Siberia to Greenland. Scattered settlements dot the whole shore of the Canadian Arctic, with the exception of the southern part of Hudson bay, and extend down the Labrador coast almost to Belle Isle.

Religion.—The Indians of Canada differ markedly in culture, in physical characteristics and in language, but certain elements prevail throughout, such as the importance of religious beliefs and practices. The forms in which non-human powers are conceived differ enormously, but the thoughts and actions of the natives are universally influenced by the conviction that supernatural beings are close at hand, ready to assist or to harm the individual, and that their help must be obtained for success in any venture. Throughout wide areas in the east and on the Plains, religious beliefs centre around the concept of a personal guardian spirit, usually obtained at adolescence by prayer and fasting. Among almost all tribes, respect is shown to shamans, "medicine-men" or "witch-doctors," individuals who have achieved miraculous powers which can be used either benevolently or malevolently. The rich mythology of the Indians abounds in references to superhuman incidents of all kinds. Although some tales are regarded as fiction, many are believed to be chronicles of events that took place in the distant past, and serve as constant reminders of the reputed existence of strange creatures endowed with tremendous power.

The Indians are undoubtedly proud, and their reaction to the attitude of superiority assumed by the white man is to withdraw into a shell of grave and dignified reserve which has been misinterpreted as taciturnity. Among themselves, the natives are as fond of laughter and joking as any other people. Their behaviour in times of joy, sorrow, fear, excitement or periods of stress is far from one of indifference, although pride leads them to conceal their emotions. The Iroquoian peoples and the Plains tribes respect martial achievement and fortitude in pain, but oratorical ability, skill in hunting, athletic prowess, wealth (on the Pacific coast), wisdom, religious power and other characteristics are also esteemed. Individuals vary, but their fundamental psychology is not radically different from that of white people, although the medium in which it is expressed—their culture—appears so strange to the European that the underlying qualities are usually misunderstood.

In material culture the wheel was unknown; the use of metals was limited to the beating out of unrefined copper; the dog was the only domesticated animal; and, north of Mexico, there was no system of writing. Stone was universally used for tools, frequently ground or polished to a smooth surface. Work in wood, bone, shell and ivory varied from area to area, dependent largely on local conditions.

ZONAL INFLUENCES

Climate, flora, fauna and geographical considerations have profoundly affected the life of the aboriginal Canadians. The culture of tribes living within given zones tends to conform to a type, irrespective of linguistic or physical classifications. On this basis the following areas can be distinguished:—

(1) **The Arctic Belt.**—The Eskimo (*q.v.*) of the Arctic islands and littoral differ from the Indians as markedly in culture as in physical characteristics or language. The keynote of their existence is dependence upon sea animals. Wild-fowl, rabbits, bear and caribou are hunted during the brief summers, but seals and whales are more important than any of these. The flesh is eaten, and the grease serves as fuel for the indispensable stone lamp used for heating and cooking during the winter. Wood is extremely scarce, but the Eskimo are skilful workers in bone, ivory and, to a lesser extent, stone. Their chief weapons are lances and harpoons, the latter fitted with detachable head and fore-shaft. The bow is composite, made of bone and drift-wood, elasticity being obtained by thong lashings. Similar ingenuity is shown in other Eskimo manufactures. Stone and, in the Coronation Gulf area, copper tools are set in bone handles; the bow-drill is used for perforating hard objects; well-tailored fur clothing is made; toys and toggles are carved of walrus ivory, and the vaulted snow house is a unique architectural achievement. The hunter's canoe is also distinctive, consisting, as it does, of a bone or a wooden framework over which a waterproof skin cover is stretched.

Eskimo political organization is limited to the simple band, comprising a number of related families. Such a group wanders over a vaguely defined area, returning year after year to the same camping-grounds following the movements of game. The leader is the most skilful hunter, but he is entirely without authority, and hereditary chiefs with executive or judicial power are unknown. Shamans have much influence, especially with regard to the enforcement of multitudinous hunting taboos, but there are few communal religious rites.

(2) **The Eastern Forest Area.**—Under this general heading may be considered Newfoundland (politically not included in the Dominion), the maritime provinces, most of Quebec and the interior of the Labrador peninsula. The present inhabitants are Algonquians, although Newfoundland was formerly the home of the extinct Beothuk (*q.v.*).

The north-eastern Algonquians in Quebec and Labrador, are the Montagnais (*q.v.*) and the Nascapee.

(3) **The Central Forest Area.**—This vast region, comprising all of Ontario with western Quebec and eastern Manitoba, can be divided into a northern and a southern sub-area, the latter being limited to the southern part of Ontario. The northern forests were inhabited, during the period of European exploration, by loosely organized Algonquians, subsisting upon deer and smaller animals, eked out with berries and nuts. Bark is still extensively used for utensils and shelters, and it was in the bark canoes of these woodland hunters that French-Canadian *voyageurs* penetrated to the Plains. The most important Algonquian "tribe," the Chippewa (*q.v.*), live north and west of Lake Superior. Lacking central authority, they are divided into a number of local groups, each with a vague council, electing a "chief" with nebulous authority. Socially, they are divided into exogamic, patrilineal clans. Socio-religious rites are unimportant, except ceremonies connected with the Midéwiwin, a secret society, the members of which claim tremendous religious powers.

The culture of the Iroquoian-speaking (*see* IROQUOIS) tribes of southern Ontario, the Hurons (*q.v.*), the Neutrals and the Tobacco Nation differed fundamentally from that of the Algonquians. Large crops of corn, beans, squashes and sun-flowers provided reliable food stocks and made possible the erection of villages which were moved only when the fields became exhausted. Communal houses were built; wood and bark were used for utensils, as was also rough pottery to some extent.

(4) **The Plains Area.**—Although the prairies of Manitoba, Saskatchewan and Alberta are inhabited by tribes of three distinct linguistic stocks, there is a general cultural uniformity. In the east the Plains Cree and the Plains Chippewa have many characteristics which are more highly developed among the Athapascan Sarsi, the Siouan Assiniboin and the Algonquian Blackfoot and Atsina. The centre of life was the bison. The flesh was eaten in tremendous quantities, either fresh or dried and pounded as pemmican; the skins provided clothing and covering for the movable tent; the bones were used for arrow-points and scrapers, and the dung served as fuel. The dressing of bison, elk and deer skins reached a high development, and raw-hide receptacles were used for storage vessels, basketry and pottery being unknown on the central Plains. The bow and arrow, lance, club and shield were more important than household utensils.

Chiefs, elective or hereditary, formerly exercised great authority, but martial achievement often enabled a man to attain a superior position. Male societies still flourish, their members exercising functions of a war-like, political, economic and social nature.

Success in life was usually attributed to the aid of a guardian-spirit, acquired at adolescence. The collection of certain symbolic objects was sometimes recommended in a dream or vision, and these, carefully preserved, often for generations, served as tangible articles of religious veneration. Intangible prerogatives are frequently closely associated with them. Socio-religious rites are extremely important on the Plains, the scattered divisions of a tribe assembling annually for the performance of elaborate symbolic celebrations, of which the Sun Dance is the best known.

(5) **The Mackenzie Area.**—Those parts of Canada inhabited by Athabascan-speaking peoples, the Déné so-called, form a single culture area, with two sections, (1) the Mackenzie valley and the barren country inland from the shores of the Arctic and Hudson bay, stretching south to the Plains and west almost to the Pacific; the home of the Hares, the Dog-Ribs, the Caribou-Eaters, the Yellow-Knives—so-called owing to their copper tools—the Slaves, the Chipewyan and the Beaver; and (2) the upland plateau of British Columbia, west of the Rocky mountains, inhabited by the Nahane, the Sekani, the Carrier and the Tsilkotin (Chilcotin). The Athabascan (*q.v.*) peoples extend even beyond this range.

The staple food supply of this area is the caribou; deer, rabbits, wild-fowl, fish and berries are eaten when obtainable, but, especially in the north, the roving hunting bands depend on the caribou. The toboggan simplifies transportation in winter, the canoe and the dog-drawn travois in summer; but life is hard at the best of times. Material culture is scanty; pottery is unknown; bark vessels are used for cooking; baskets are plaited of spruce-roots; clothing was formerly of skins; and one of the few distinctive traits of culture is the double lean-to. The Athabascans are unusually receptive to foreign influence, and have assimilated many elements from south and west.

The political organization of the eastern Athabascans comprises only the simple band, a loose-knit, patrilineal unit without definite leadership. The men have the reputation of cowardice, the women of immorality; exchange of wives takes place, and wrestling duels for women are reported. The settlements of the western Athabascans are semi-permanent, matrilineal clans are found among several of the tribes and chiefs have greater authority. The western shamans are said to have added the function of confessing to the powers claimed by their eastern prototypes.

(6) **The Interior Area of Southern British Columbia.**—The wooded valleys of southern British Columbia are inhabited by the Kutenai and the Salish-speaking Thompson, Shuswap and Lillooet. The rivers flowing westward are filled every year with salmon, which the natives formerly caught in large numbers and smoked or pulverized for winter use. Deer and mountain goats were hunted and berries collected in large quantities. Clothing was of deer-skin, while rabbit-skin blankets were woven prior to the introduction of European goods. Wood was used more extensively than on the Plains, including a kind of slat armour. Pottery was lacking, but excellent basketry is still produced, including water-tight vessels; twine weaving was employed for bags. Rush-covered lean-tos served for shelter, replaced in winter by permanent, semi-subterranean houses with combined door and flue.

Semi-hereditary chiefs, exercising considerable influence over local groups, formerly prevailed, but they lacked the martial prowess of their compeers on the Plains, or the respect based upon wealth as among the coastal groups. Ceremonial rites were also weakly developed, although puberty ceremonies were performed, and the Kutenai held an elaborate ritual before departing to the Plains on their annual bison hunt. In addition to guardian-spirits, there was a belief, among the Kutenai at least, in the sun as a vague supreme being. The culture of this area is, in many respects, intermediate between that of the Plains and the Pacific littoral.

(7) **The Coastal Area of British Columbia.**—This region, the most distinctive culture area in Canada, can be divided into three parts. The northern is occupied by the Haida, the Tsimshian of the Skeena river, the Niska of the Nass valley and the Tlingit of Alaska; the central, by the Kwakiutl and the Bella Coola; and the southern, by the Nootka and the Coast Salish, with many tribes resident in the United States.

In contrast to linguistic diversity on the coast, there is relative cultural uniformity. The chief food is salmon, which are smoked for storage. In addition, deep-sea fishing is practised by several tribes, olachen are boiled for their highly prized grease, berries and shell-fish are collected, deer and mountain goats are hunted, and the Nootka formerly captured whales at sea. These abundant sources of food supported a relatively dense population, living in permanent villages. The even-grained cedar was split into planks with which large, communal, rectangular houses were built; smaller boards were bent into serviceable water-tight boxes; enormous canoes were hollowed from the trunks; and totem-poles were carved and erected as heraldic posts. Pottery is unknown, but baskets and mats of bark and roots are still manufactured. Clothing was either made of skins or bark, or woven from mountain goat- or dog-hair. Nephrite was extensively used, and copper was beaten out into plaques having a ceremonial value.

Political organization is marked by the importance of hereditary rank. The Haida and the Vancouver Island Salish have four classes, chiefs, nobles, commoners and (formerly) slaves, each stratum being, in theory at least, endogamous. These distinctions are less rigid in the central sub-area, where, however, great deference is shown to the man who is able to display his wealth by a lavish bestowal of goods to validate the assumption of prerogatives. The strongly organized northern tribes are matrilineal, the southern are patrilineal; in the central region the influence of the former has led to the introduction of certain matrilineal institutions. Secret societies, employing masks and ingenious mechanical devices, further complicate social life. There is a firm belief in supernatural beings, whom the Bella Coola have organized into a pantheon, dominated by a supreme deity.

Bibliography.—*Handbook of the American Indian* (Bulletin 30, Bureau of American Ethnology, Washington, 1906), gives brief, authoritative notes on the principal tribes and chief elements of culture, with excellent bibliography. Clark Wissler's *The American Indian* is the most comprehensive recent work on North American anthropology. *See* also the publications of the Anthropological Division, National Museum of Canada, and articles in *The American Anthropologist, The Journal of American Folk Lore, Le Journal de la Société des Américanistes de Paris*, and *Annual Archaeological Reports for Ontario.*

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HISTORY

Early Discovery.—About A.D. 1000 Leif Ericsson, a Norseman led an expedition from Greenland to the shores probably of what is now Canada, but the first effective contact with Europeans was not until the end of the 15th century. John Cabot (*q.v.*), sailing from Bristol, reached the shores of Canada in 1497. Soon after, fishermen from Europe began to go in considerable numbers to the Newfoundland banks and to the coasts of the mainland of America. In 1534 a French expedition under Jacques Cartier, a seaman of St. Malo, sent out by Francis I., entered the Gulf of St. Lawrence. In the following year Cartier sailed up the river as far as the Lachine rapids, to the spot where Montreal now stands. During the next 60 years the fisheries and the fur trade received some attention, but no colonization was effected.

CANADA AS A FRENCH COLONY

At the beginning of the 17th century we find the first great name in Canadian history. Samuel de Champlain (*q.v.*), who had seen service under Henry IV. of France, was employed in the interests of successive fur-trading monopolies and sailed up the St. Lawrence in 1603. In the next year he was on the Bay of Fundy and had a share in founding the first permanent French colony in North America—that of Port Royal, now Annapolis, Nova Scotia. In 1608 he began the settlement which was named Quebec. From 1608 to his death in 1635 Champlain worked unceasingly to develop Canada as a Colony, to promote the fur trade, and to explore the interior. He pressed southward from the St. Lawrence to the beautiful lake which still bears his name and also westward, up the St. Lawrence and the Ottawa, in the dim hope of reaching the shores of China. He reached Lake Huron and Lake Ontario, but not the great lakes stretching still farther west.

The Chartered Companies.—The era was that of the Thirty Years' War (1618–48), and during that great upheaval England was sometimes fighting France. Already, in 1613, in time of peace, the English from Virginia had almost completely wiped out the French settlement at Port Royal, and when, in 1629, a small English fleet appeared at Quebec, Champlain was forced to surrender. But in 1632 Canada was restored to France by the treaty of St. Germain-en-Laye. Just at this time was formed under the aegis of Cardinal Richelieu the "Company of New France" known popularly as "The Company of One Hundred Associates." With 120 members it was granted the whole St. Lawrence valley and for 15 years from 1629 it was to have a complete monopoly of trade, while products from its territory were to enter France free of duty. In return, the company was to take to New France 300 colonists a year; only French Catholics might go; and for each settlement the company was to provide three priests. Until 1663 this company controlled New France.

It was an era of missionary zeal in the Roman Catholic Church, and Canada became the favourite mission. The Society of Jesus was only one of several orders—Franciscans (Récollets), Sulpicians, Ursulines, etc.—who worked in New France. The Jesuits have attracted chief attention, not merely on account of their zeal and numbers, but also because of the tragic fate of some of their missionaries in Canada. Among the Huron Indians, whose settlements bordered on the lake of that name, they secured a great influence. But there was relentless war between the Hurons and the Iroquois, occupying the southern shore of Lake Ontario, and when in 1649 the Iroquois almost completely destroyed the Hurons, the Jesuit missionaries fell victims to the conquerors' rage. Some missionaries to the Iroquois themselves met with a similar fate. Commercial life also languished. The company planned by Richelieu was not a success. It did little to colonize New France, and in 1660, after more than 30 years of its monopoly, there were not more than 2,000 French in the whole country. In 1663 the charter of the company was revoked. No longer was a trading company to discharge the duties of a sovereign. New France now became a royal province, with governor, intendant, etc., on the model of the provinces of France.

In 1664 a new "company of the West Indies" (*Compagnie des Indes Occidentales*) was organized to control French trade and colonization not only in Canada but also in West Africa, South America, and the West Indies. At first it promised well. In 1665 some 2,000 emigrants were sent to Canada; the European population was soon doubled, and Louis XIV. began to take a personal interest in the colony. But once more, in contrast with English experience, the great trading company proved a failure in French hands as a colonizing agent, and in 1674 its charter was summarily revoked by Louis XIV.

Exploration.—By 1659 two Frenchmen, Radisson and Groseillers, had penetrated beyond the great lakes to the prairies of the far West, and were probably the first Europeans to see the upper Mississippi. By 1666 a French mission was established on the shores of Lake Superior, and in 1673 Joliet and Marquette, explorers from Canada, reached and for some distance descended the Mississippi. Five years later Cavelier de la Salle was making his way westward from Quebec to discover the true character of the great river and to perform the feat, perilous in view of the probable hostility of the natives, of descending it to the sea. In 1682 he accomplished his task, took possession of the valley of the Mississippi to the Gulf of Mexico in the name of Louis XIV., and called it Louisiana.

There was keen rivalry between Church and State for dominance in this new empire. In 1659 there arrived at Quebec a young prelate of noble birth, François Xavier de Laval-Montmorency, who had come to rule the Church in Canada. An ascetic, who practised the whole cycle of mediaeval austerities, he was determined that Canada should be ruled by the Church, and he desired for New France a Puritanism as strict as that of New England. His special zeal was directed towards the welfare of the Indians. He insisted that the traders should not supply them with brandy, declared he would excommunicate any one who did so and, for a time, triumphed. In 1663 he was actually invited to choose a governor after his own mind and did so, but with no cessation of the old disputes. In 1672 Louis de Buade, Comte de Frontenac (*q.v.*), was named governor of New France, and in him the Church found her match. After a bitter struggle, he was recalled in 1682; but Canada needed him. He knew how to control the ferocious Iroquois, who had cut off France from access to Lake Ontario; to check them he had built a fort where now stands the city of Kingston. With Frontenac gone, these savages almost strangled the colony. On a stormy August night of 1689 Iroquois burst in on the village of Lachine near Montreal, killed four or five score of its people, and carried off more than 100 to be tortured to death at their leisure. Then the strong man Frontenac was sent back to face the crisis.

War with England.—It was a critical era. James II. had fallen in England, and William III. was organizing Europe against French aggression. France's plan for a great empire in America was now taking shape, and there, as in Europe, a deadly struggle with England was inevitable. Frontenac planned attacks upon New England and encouraged a ruthless border warfare. The English retaliated. Sir William Phips sailed from Boston in 1690, conquered Acadia, now Nova Scotia, and then hazarded the greater task of leading a fleet up the St. Lawrence against Quebec. On Oct. 16, 1690, 34 English ships, some of them only fishing craft, demanded the surrender of the town. When Frontenac answered defiantly, Phips attacked the place; but he was repulsed and in the end sailed away unsuccessful.

Each side had now begun to see that the vital point was control of the interior, which time was to prove the most extensive fertile area in the world. La Salle's expedition had aroused the French to the importance of the Mississippi, and they boldly determined to occupy it, to close in from the rear on the English on the Atlantic coast, seize their colonies, and even deport the colonists. The plan was audacious, for the English in America outnumbered the French by 20 to one. But their colonies were democracies, disunited because each was pursuing its own special interests, while the French were united under despotic leadership. Frontenac attacked the Iroquois mercilessly in 1696. In the next year the treaty of Ryswick was signed, and conquests were restored. In 1698 Frontenac died.

The peace of Ryswick proved but a truce. In Europe, renewed war in 1702 saw the brilliant victories of Marlborough, and in America France lost heavily. Though the English, led by Sir Hovenden Walker, failed in 1711 to take Quebec, they again seized Nova Scotia; and when the treaty of Utrecht was made in 1713, France admitted defeat in America by yielding to Britain her claims to Hudson Bay, Newfoundland, and Nova Scotia.

The British Conquest of Canada.—France still held the shores of the St. Lawrence, and she retained, too, the island of Cape Breton to command its mouth. There she built speedily the fortress of Louisburg and prepared once more to challenge British supremacy in America. With a sound instinct that looked to future greatness, France still aimed, more and more, at the control of the interior of the continent. The danger from the Iroquois on Lake Ontario had long cut her off from the most direct access to the West, and from the occupation of the Ohio valley leading to the Mississippi, but now, free from this savage scourge, she could go where she would. In 1701 she founded Detroit, commanding the route from Lake Erie to Lake Huron. Her missionaries and leaders were already at Sault Ste. Marie commanding the approach to Lake Superior, and at Michilimackinac commanding that to Lake Michigan. They penetrated to what is now the Canadian West, and it was a French Canadian, La Vérendrye, who pressed on into the far West until, in 1743, first recorded of white men, he came in sight of mountains which barred the way to the Pacific coast. France also crowned La Salle's work by founding, early in the 18th century, New Orleans at the mouth of the Mississippi. It was a far cry from New Orleans to Quebec. If France could link them by a chain of settlements and shut in the English to their narrow strip of Atlantic seaboard there was good promise that North America would be hers.

The project was far-reaching, but France could do little to make it effective. Louis XV. allowed her navy to decline and her people showed little inclination for emigration to the colonies. In 1744, when the war of the Austrian Succession broke out, the New England colonies planned and in 1745 effected the capture of Louisburg (*q.v.*), the stronghold of France in Cape Breton Island, which menaced their commerce. But, to their disgust, when the peace of Aix-la-Chapelle was made in 1748, this conquest was handed back to France. She continued her work of building a line of forts on the great lakes—on the river Niagara, on the Ohio, on the Mississippi; and the English colonies, with the enemy thus in their rear, grew ever more restive. In 1753 Virginia warned the French on the Ohio that they were encroaching on British territory. The next year, George Washington, a young Virginian officer, was sent to drive the French from their Fort Duquesne on the Ohio river, where now stands Pittsburgh, but was defeated, as was also the British general Braddock in 1755. In that year the British took the stern step of deporting the Acadian French from Nova Scotia (*see* NOVA SCOTIA: *History*). In 1756 the Seven Years War began. France had no resources to cope with those of Britain in America, and the British command of the sea proved decisive. On Sept. 13, 1759, Wolfe won his great victory before Quebec, and a year later at Montreal the French army in Canada surrendered. By the peace of Paris, 1763, Canada was finally ceded to Great Britain.

CANADA AS A BRITISH COLONY

The American Revolution.—After the peace, Canada was governed under the authority of a royal proclamation until, in 1774, the Quebec Act was passed by the Imperial Parliament. The western territory which France had claimed, extending as far as the Mississippi and south to the Ohio, was included with Canada in what was called the province of Quebec. This vast territory was to be governed despotically from Quebec; the Roman Catholic Church was given its old privileges in Canada; and the French civil law was established side by side with the English criminal law. The act linked the land-owning class in Canada and the Church by ties of self-interest to the British cause. The *habitant*, placed again under their authority, had less reason to be content.

In 1775 began the American revolution. Its leaders tried to make the revolt continental, and invaded Canada, hoping that the French would join them. They took Montreal and besieged Quebec during the winter of 1775–76; but the prudent leadership of Sir Guy Carleton, afterwards Lord Dorchester, saved Quebec and in 1776 the revolutionary army withdrew unsuccessful from Canada. Since that time any prospect of Canada's union to the United States has been very remote.

The American revolution profoundly influenced the life of Canada. The country became the refuge of thousands of American loyalists who would not desert Great Britain. To Nova Scotia, to what are now New Brunswick and Ontario (*qq.v.*) they fled in numbers not easily estimated, but probably reaching about 40,000. This meant bitter hostility on the part of these colonists to the United States, which refused in any way to compensate the loyalists for their confiscated property. Great Britain did something; the loyalists received liberal grants of land and cash compensation amounting to nearly £4,000,000.

Rebellion in Canada.—A prevailingly French type of government was now no longer adequate in Canada, and in 1791 the Constitutional Act was passed by the British parliament, separating Canada at the Ottawa river into two parts, each with its own government; Lower Canada, chiefly French, retaining the old system of laws, with representative institutions now added, and Upper Canada, on the purely British model. (For Lower and Upper Canada, *see* also QUEBEC and ONTARIO.) Each province had special problems; the French in Lower Canada aimed at securing political power for their own race, while in Upper Canada there was no race problem, and the great struggle was for independence of official control and in all essential matters for government by the people. Before this issue matured war broke out between Great Britain and the United States in 1812 from causes due chiefly to Napoleon's continental policy. The war seemed to furnish a renewed opportunity to annex Canada to the American union, and Canada became the chief theatre of conflict. The struggle was most vigorous on the Niagara frontier. But, in the end, the American invasion failed and the treaty made at Ghent in 1814 left the previous position unaltered.

In 1837 a few French Canadians in Lower Canada, led by Louis Joseph Papineau (*q.v.*) took up arms with the wild idea of establishing a French republic on the St. Lawrence. In the same year William Lyon Mackenzie (*q.v.*) led a similar armed revolt in Upper Canada against the domination of the ruling officialdom, which was known locally as the "Family Compact." In 1838 the Earl of Durham (*q.v.*) was sent to govern Canada and report on the affairs of British North America. Clothed as he was with large powers, he undertook in the interests of leniency and reconciliation to banish, without trial, and so save from possible execution, some leaders of the rebellion in Lower Canada. For this reason he was censured at home and he promptly resigned, after spending only five months in the country. But his *Report*, published in the following year, is a masterly survey of the situation and included proposals that profoundly influenced the later history of Canada. He recommended the union of the two Canadian provinces at once, the ultimate union of all British North America, and the granting to this large state of full self-government. The French element he thought a menace to Canada's future, and he desired all the provinces to unite so that the British element should be dominant.

The Union of Upper and Lower Canada.—To carry out Lord Durham's policy the British Government passed in 1840 an Act of Union joining Upper and Lower Canada, and sent as governor Charles Poulett-Thompson, who was made Baron Sydenham of Kent and Toronto. In the single Parliament each province was equally represented. By this time there were over a million people in Canada, and the country was becoming important. Lord Sydenham died in 1841, before his work was completed, and he left Canada still in a troubled condition. The French were suspicious of the union, aimed avowedly at checking their influence, and the complete self-government for which the "reformers" in English-speaking Canada had clamoured was not yet conceded by the colonial office. But rapidly it became obvious that the provinces united had become too important to be held in leading strings. The issue was finally settled in 1849 and Canada's right to control her own affairs was fully recognized when the earl of Elgin was governor. The Canadian legislature, sitting at Montreal, passed by a large majority the Rebellion Losses Bill, compensating citizens, some of them French, in Lower Canada, for losses incurred at the hands of the loyal party during the rebellion a decade earlier, and the cry was easily raised by the Conservative minority that this was to vote reward for rebellion. They appealed to London for intervention. The mob in Montreal burned the parliament buildings and stoned Lord Elgin himself because he gave the royal assent to the bill. He did so in the face of this fierce opposition, on the ground that, in Canadian domestic affairs, the Canadian parliament must be supreme.

The union of the two provinces did not work well. Each was jealous of the other and deadlocks frequently occurred. Commercially, after 1849, Canada was prosperous. In 1854 Lord Elgin negotiated a reciprocity treaty with the United States which gave Canadian natural products free entrance to the American market. The outbreak of the Civil War in the United States in 1861 increased the demand for such products, and Canada enjoyed an extensive trade with her neighbour. But, owing largely to the unfriendly attitude of Great Britain to the northern side during the war, the United States cancelled the treaty, when its first term of ten years ended in 1865, and it has never been renewed.

The union of the two provinces, however, did not give political stability. The French and English were sufficiently equal in strength to make the task of government well nigh impossible. In 1864 came the opportunity for change, when New Brunswick, Nova Scotia, and Prince Edward Island were considering a federal union. Canada suggested a wider plan to include herself, and in Oct. 1864 a conference was held at Quebec. The conference outlined a plan of federation which subsequently, with slight modifications, passed the imperial parliament as "The British North America Act."

CANADA AS A FEDERAL STATE

Canada was the first federal union in the British Empire and it came into being on July 1, 1867, a date ever since observed as a public holiday. The union sprang from necessity: Upper and Lower Canada, united in one legislature but divided on racial lines, English and French, had reached deadlock in government. Nova Scotia and New Brunswick, far away by the sea, had no connection by rail with the rest of British North America. Prince Edward Island and Newfoundland were stagnant in isolation. Stretching across the prairie and across the mountains to the Pacific were other vast areas under the British crown. Side by side with them and reaching from ocean to ocean was the United States, the North flushed with recent victory in the civil war, and irritated with Great Britain because of incidents in the war. A new era was opening with the building of railways and the flow of population into the American West. With such a nation at their doors, union among the British provinces offered the sole hope of successful growth. Yet only four provinces entered the union at first; Upper Canada, as Ontario, Lower Canada, as Quebec, and Nova Scotia and New Brunswick. Newfoundland still remains outside; and Prince Edward Island did not join until 1873.

The West had no part in the original negotiations, but such was the pressure of conditions that, by 1869, terms had been made with the Hudson's Bay Company (*q.v.*) to bring in its great territory of Rupert's Land, stretching westward to the Rocky mountains, and in 1871 British Columbia, the vast province on the Pacific, joined Canada. To complete Canada's ownership of the whole north of the continent, the British Government in 1878 conveyed to Canada all of British North America, except Newfoundland. The Yukon and other regions of the far north still, as territories, lie outside of the organized provinces.

The leader in these great movements was Mr. (Sir) John Alexander Macdonald (*q.v.*), who had remarkable political genius and was an astute manager of men. Born in Scotland, he had gone when still a boy to Canada with his family and, almost entirely self-educated, had practised law in the city of Kingston, Ontario. He had taken an active part in the politics of United Canada on the Conservative side and become leader. Canada East and Canada West were, however, still so divided that there was a separate leader for each division, and Macdonald had had as his French colleague a man of great energy, Mr. (Sir) Georges Etienne Cartier (*q.v.*). With the formation of the Dominion, this dualism ended and Macdonald was the single leader of his party. The union had been supported by the Liberals under George Brown and the first federal cabinet was a coalition, with Macdonald as Prime Minister. But party divisions were acute in Canada, Brown and other Liberals soon withdrew, and an election in 1868 confirmed the Conservatives in office. The election showed that while the two provinces of the older Canada had not been asked to pronounce upon the union, they approved of it. Strong dissent came, however, from Nova Scotia. Assent to the union had been carried in its legislature by the strong leadership of the Prime Minister, Dr. (Sir) Charles Tupper (*q.v.*). He had been opposed by his rival Joseph Howe (*q.v.*), and when, in 1868, the electors of Nova Scotia had their first opportunity to pronounce upon the project, Tupper alone was elected as a supporter and the other 18 members were pledged to its repeal. The legislature passed an almost unanimous appeal to the Queen to aid withdrawal, and sent Howe to England to press it. There he could not secure official support and, in the end, after securing for the Province some financial concessions, he accepted the inevitable and took office under Macdonald. The sequel was that, in the election of 1872, only one member from Nova Scotia was elected to support repeal.

Relations with Great Britain.—A cardinal feature of Sir John Macdonald's opinions was devotion to the political tie with Great Britain. At the conference at Quebec, in 1864, when the terms of union had been formulated, the leaders agreed that the federation should be called "The Kingdom of Canada." This was an anticipation of the day when Canada should claim political equality with Great Britain. At the time there was friction with the United States and the foreign office had the rather fanciful fear that to set up a kingdom on the borders of the republic would cause offence. Under this pressure, Macdonald and his colleagues had to agree that Canada should be called not a kingdom, but a dominion. A little later Macdonald's ardent imperialism had to endure another rebuff. The American government claimed from Great Britain compensation for the losses caused to American shipping by the southern privateer *Alabama*, which had been fitted out in a British port. On the other hand, Canada claimed compensation from the United States for raids across the Canadian frontier by Fenians who, after the close of the war, had caused great expense and some loss of life in Canada. There was also a dispute about the boundary of British Columbia and the ownership of the island of San Juan. Canada also claimed compensation from the United States for fishing rights conceded to Americans. Macdonald was appointed a member of the British commission which met an American commission at Washington in Feb. 1871, and resulted in the treaty of Washington. He found that the *Alabama* question dwarfed all others in the minds of his fellow commissioners from England and that the claims of Canada secured slight consideration. The San Juan question was referred for arbitration to the German emperor, who decided in favour of the United States, and Canada secured no compensation for the Fenian raids. A fishery commission created by the treaty sat, however, at Halifax and awarded to Canada $5,500,000 for the excess value of its fisheries, over the value to Canada, of American fisheries for a period of 12 years. The Commission marked a new stage in imperial relations, since for the first time it included a Canadian leader in negotiations with a foreign government. Macdonald's prestige secured the support of the Canadian parliament, which ratified the treaty as it affected Canada, but an election was near and he feared the cry that he had sacrificed the interests of Canada.

The First Riel Rebellion.—The remarkable achievement of the rapid extension of Canada across the continent to the Pacific led to problems which dominated politics for the next 20 years. Rupert's Land had been owned and ruled by the Hudson's Bay company ever since the grant made by Charles II.; but in 1869 the company was willing that Canada should take over the country on condition of paying a nominal price of £300,000, of securing to the company $\frac{1}{20}$ of the fertile lands as they were surveyed, and of the full ownership of about 45,000ac. about its posts. The problem of government remained. The great western section, which now forms the provinces of Saskatchewan and Alberta, had very few inhabitants except the native tribes and was destined to remain under federal tutelage for some 35 years still; but in the eastern section, the present Manitoba (*q.v.*), were some 10,000 settlers who desired local self-government on the lines of the older provinces. There were two elements in the population. Fort Garry, the present Winnipeg, on the left bank of the Red river, was the centre of the English-speaking population, chiefly Protestant and of Scottish descent, while St. Boniface on the right bank was the centre for the French-speaking and Roman Catholic element. During more than a century French fur traders had been in the country, they had intermarried with native women, and a race, known as Métis or half-breeds, had grown up which far outnumbered the English in the country.

The Government at Ottawa had not yet learned how to rule a new empire and took few precautions to soothe inevitable suspicion. The Métis wanted guarantees as to their French language and their religion; and above all secure titles to their farms. Few of the Métis had deeds, and when in the summer of 1869 agents from the East were entering the country and making surveys, suspicion entered the minds of these remote and ignorant people that their rights would not be respected. A wise leader might have secured needed guarantees, but unfortunately there now came to the front one Louis Riel (*q.v.*), a little better educated than his fellows, but a man of violent passions and unbalanced judgment. While the English-speaking settlers held aloof, Riel seized Fort Garry and set up a provisional government with himself as president. Canada was to take over the region on Dec. 1, 1869, but when the new governor, Mr. William MacDougall, arrived at the frontier by way of the United States, he was not allowed to enter the country. The government at Ottawa then sent to Fort Garry Donald Alexander Smith (Lord Strathcona *q.v.*). He was not familiar with the West, but he was prominent in the affairs of the Hudson's Bay company, and much was hoped from his Scottish prudence and tact. Riel, however, imprisoned him and other English-speaking leaders and seized the property of the company. His worst act was the summary trial and brutal execution of Thomas Scott, a young man from Ontario, who had used defiant words. Riel was undoubtedly partly insane, but he was in possession, and the only way to dislodge him was to send from the East a military expedition. It was placed under Col Garnet (afterwards Lord) Wolseley. There was no railway from Canada to the West, a military force could not pass through the United States, and Wolseley had to take his men across hundreds of miles of wilderness from Lake Superior to Fort Garry. He reached the fort in Aug. 1870, to find that Riel had fled. In such stormy conditions it was that Manitoba came into being as a self-governing province.

The Transcontinental Railway.—In Canada, as in the United States, a vast territory makes railways and tariffs the leading interest in politics. In 1872 Macdonald had to confront the realities of building a railway to the Pacific Ocean. Between Ottawa and Winnipeg were 600 miles of wilderness, with rivers and swamps to cross. Then came 1,000 miles of prairie and after that 500 miles of rugged mountains, across which as yet no suitable pass was known. How best to build it—by government or by a private company? Canada decided for a private company. When the second federal election came in 1872, two groups of financial interests, one in Montreal and one in Toronto, were bidding for the contract which would carry with it heavy subsidies from the government. Sir George Etienne Cartier had lost support in Quebec because of the racial issue in Manitoba. French Canada is always peculiarly sensitive to any unfairness to the French. In Ontario there had been great outcry at Riel's execution of Scott, an Orangeman, and the legislature had offered a large reward for Riel's apprehension, while in Quebec it was held that the French settlers in Manitoba had had genuine grievances, voiced by Riel, and that a general amnesty should be granted to those who took up arms. Macdonald feared this agitation and Cartier was in fact defeated in Quebec because he was a member of the government which refused amnesty. Moreover, elections in the new vast Canada were costly and Macdonald needed money for election expenses. He won the election but he had to face an acute crisis when he met the new Parliament.

The charge was then made and proved that during the election Macdonald had received from Sir Hugh Allan (*q.v.*), the head of the Montreal company which wished to build the Pacific railway, some $300,000 for election expenses, and the inference was that a corrupt bargain had been made with Allan to build the railway. The charge created a sensation. Parliament appointed a commission to investigate and the Governor-General, Lord Dufferin (*q.v.*), took up so stern a position that he was prepared to adopt the dangerous course of dismissing the ministry. In Oct. 1873, when the commission's report acquitted Macdonald of personal corruption but established the receipt of the large sum for election expenses, he resigned, and a Liberal ministry came into office with Mr. Alexander Mackenzie at its head. In the election which followed the new government was sustained by a large majority.

The Protectionist "National Policy."—The defeat of Macdonald left in the air the building of the line to the Pacific; yet it was chiefly on this condition that British Columbia had entered the union. Mr. Mackenzie's government held that to complete the line within the agreed ten years was impossible. This caused in British Columbia angry charges of breach of faith and an agitation for withdrawal from the federation. Mr. Mackenzie pleaded for patience, Lord Dufferin himself went to British Columbia, but even his buoyant tact, which had a tint of blarney, did not soothe the discontent. Meanwhile, the Liberal government was proceeding with the railway as a government line.

It was the problem of tariffs which in the end solved the railway issue and brought Macdonald back to power. Canada's position is made difficult by her having only one neighbour, the United States, with a population about 12 times as great and with highly developed industries. The Liberal government had to face a period of acute depression and annual deficits. There was an alarming exodus of population to the United States and, to give opportunity at home, Macdonald now became the spokesman of a policy of protection for Canadian industries—a National Policy as he named it. Mr. Mackenzie's government adhered to a tariff for revenue only. He tried, but failed, to make a bargain with the United States to open the American market to Canada's natural products, a revival of the reciprocity treaty which the United States had ended at the close of the Civil War. The result was that, when an election came in 1878, Canada accepted by a large majority the national policy, Macdonald again became prime minister, and remained in office until his death in 1891.

The Canadian Pacific Railway.—In 1879, the new minister of finance, Sir Leonard Tilley, introduced and carried a bill to protect Canadian industries which has been only slightly modified since that time. The immediate result was disappointing. New industries sprang up but Canada had a small home market and almost no export market. Yet with unbounded courage the government faced the great task of linking the Pacific and the Atlantic by a railway. The Canadian Pacific railway company was formed with headquarters at Montreal. At its head was Mr. George Stephen (Lord Mountstephen), and its active manager was a man of boundless energy and resource, Sir William van Horne. The building of the line was pressed on, and on Nov. 7, 1885, at a little mountain station in British Columbia, Mr. D. A. Smith (Lord Strathcona) drove the last spike needed to link the East and the West by a railway. Twenty-five million ac. of land in the west and $25,000,000 formed the subsidy of Canada to the project, but, even with this support, there were times when it barely escaped bankruptcy. Its affairs were managed with fine insight and integrity and it has become one of the world's greatest organizations and much more than a railway. With its millions of acres of land, it has played a great part in colonizing the West and it has become, besides, a great shipping organization with a fleet of steamships on the great lakes, the Pacific, and the Atlantic, girdling the world.

The Second Riel Rebellion.—Experience quickly showed that the pushing of a railway into a region inhabited by native tribes and a few scattered settlers aroused suspicion. For the natives, the railway meant the ultimate disappearance of the herds of buffaloes on which they relied for food. In the valley of the Saskatchewan were many half-breed settlers, some of them refugees from Manitoba after the rebellion of 1869, and they now had fears for the security of the titles to their lands. Louis Riel was still alive, and these ignorant people begged him to come rom his refuge in the United States to lead them in their difficulties. As in 1869, the government at Ottawa failed to realize the gravity of the situation. There was danger of a rising of the Indian tribes. Blackfeet and Crees still waged war on each other and measured victory by the number of scalps taken, and they were demoralized and made reckless by the illicit sale of whisky, which caused brutal outrages. Speculators in land were flocking into the country and caused dismay to its people. The West was, in truth, a wild region, like that across the border in the United States. To preserve order, the federal government had created in 873 a mobile force known as the North-west Mounted Police, which saved Canada from the lawlessness of the mining camps in the United States. But, none the less, a crisis came in 1885.

By this time, Riel's mind had become so unbalanced that he proclaimed himself the prophet of a new religion and, in the spring of 1885, he set up a provisional government on the Saskatchewan which denied the authority of Canada, and announced separation from the Roman Catholic Church. On March 24 half-breeds attacked, near Prince Albert, a party of mounted police under Major Crozier and killed 14 of his men and wounded 25. Riel appealed to the Indian tribes to join him and drive out the whites, and there was danger of extensive massacres of scattered loyal settlers in the region.

Thus it happened that Canada had the task of suppressing a second rebellion. It was difficult, for the railway from Lake Superior to Winnipeg was not yet completed, and the troops had to march in bitter winter weather over the uncompleted sections of the line. The rebel force was led with skill by Gabriel Dumont, but when the Canadians, under an Imperial officer, General Middleton, reached the Saskatchewan, they carried the rebel entrenchments at Batoche. By May, Riel was a prisoner and, soon after, Dumont was a refugee in the United States. The rising had cost Canada about 200 lives. Riel was put on trial at Regina, the capital of the north-west territories, and there, late in 1885, he was hanged. Eight Indians were also hanged in the presence of many natives, and this ended their fantastic ambition to drive the whites from the West. The execution of Riel had far-reaching consequences. In Quebec, the plea urged in 1870 was repeated that the rebels had real grievances and that, moreover, since Riel was really insane his execution was unwarranted and due to the animosity of the English towards the French. The Quebec Conservatives were divided by rivalries, and in a few years the Liberal Party became and remained dominant in Quebec.

Sir Wilfrid Laurier.—After the retirement of Mr. Mackenzie from the leadership, Mr. Edward Blake (*q.v.*) had been chief of the Liberal party. His defeat in the two elections of 1882 and 1887 led to his retirement and he was succeeded by Mr. (Sir) Wilfrid Laurier, who remained the Liberal chief for 32 years until his death in 1919. Like Macdonald, Laurier was a man of striking personality. His ancestors had lived for many generations in French Canada; his family was poor; and he had been reared in a French Canadian village with only the advantages of a small college conducted by priests and a course in law at McGill university. Yet he had the courtly bearing of a *grand seigneur*, and his stately dignity never failed. He was called to a difficult position, for it seemed doubtful whether a French leader could unite both the English and the French elements in the Liberal party. It was not long, however, before it was clear that he had political tact and skill to rival that of Macdonald.

Laurier's first election came in 1891. The times were bad and the Liberals hoped for improvement in closer trade relations with the United States. Their policy called for unrestricted reciprocity in trade and this gave Macdonald the chance to urge that such a step would lead to political union. He was old, he realized that this was likely to be his last election, and he won it largely by the rallying cry for the link with Britain: "a British subject I was born; a British subject I will die." The effort wore him out and he died early in the summer of 1891. Sir John Abbott, a Montreal lawyer, succeeded him, and in 1892, Sir John Thompson, a Nova Scotian, showed skill and capacity as prime minister. He died suddenly in 1894 and was followed, wholly on grounds of seniority, by an Ontario Orangeman, Sir Mackenzie Bowell. The party, floundering with divided counsels and no strong head, at last turned, in 1896, to Sir Charles Tupper. He had been absent from Canada as High Commissioner in London and he returned to lead a disorganized party corrupted, as all parties tend to be corrupted, by a long tenure of office.

Again the West brought a storm in Canadian politics. Manitoba had had sectarian schools but the Liberal government of 1890 held that this division weakened education, and it unified the schools in a non-sectarian system. From the first, the Roman Catholic element had feared a policy which should remove the teaching of their beliefs in schools supported by the state, and to protect them a provision had been included in the constitution of Manitoba that the federal government might override provincial action which should abolish such a right. Education in Canada was administered by the provinces. Laurier thought that an injustice had been done. No word of his, he said, should embitter the struggle, but he pointed out that, while the federal government might by legislation direct the correction of the grievance, it had no power to intervene in the administration of education in Manitoba. To give orders which it had no means of enforcing would prove futile. Conciliation would do more than a merely legal demand. This he promised if placed in office, and meanwhile "Hands off Manitoba."

Tupper was in a difficult position. Many of his supporters were Orangemen and he was yielding to insistent demands of Roman Catholic bishops to coerce an unwilling province. He introduced what was called a Remedial Bill but the term of parliament expired before he could force it through, and in the election which followed he was defeated.

Thus it was that in 1896, after 18 years of Conservative rule, the Liberals came into power. Governments endure in Canada and Laurier remained prime minister for 15 years until 1911. It was one of the ironies of politics that Manitoba had voted for its own coercion, while Quebec, in which the people were supposed to be amenable to episcopal direction, supported Laurier by a large majority. Some episcopal extremists sent an appeal to Rome urging the excommunication of the Catholic leader who had defied the bishops, and this policy was reported to be under serious consideration by the entourage of Pope Leo XIII. A personal envoy went unofficially from Laurier to put the case before the Pope, with the result that Cardinal Merry Del Val was sent to Canada and made a report which amounted to a rebuke to the bishops for undue interference in politics. The Liberal government of Manitoba made some concessions to a Liberal government in Ottawa, but the separate schools were not restored.

Imperial Preference.—The new government faced its tasks with energy. The problem of the tariff was urgent, for the Liberals had preached the doctrines of Free Trade. They had, however, to face the condition that many industries had grown up under Protection and that to open the door to the more highly developed manufactures of the United States would involve disaster. The year 1897 was the 60th of the reign of Queen Victoria, and Laurier met his difficulties with a brilliant stroke. Though he made but slight changes in the tariff, he used the occasion of the jubilee to give to Great Britain a reduction of 25%, later increased to 33⅓% of the tariff. He visited England for the first time in that year and was a conspicuous figure in the celebrations. His policy of Preference proved enduring and remains in force.

The great need of Canada was to people the empty spaces of the West. In the cabinet was the very capable minister of the interior, Mr. Clifford Sifton, a former prime minister of Manitoba, who understood the problems of the West. Sifton set on foot a movement which carried settlers to Canada on a scale so great, in relation to the total population of the country, that it had not been equalled even by the United States. He drew them from Great Britain, from continental Europe, and, to general surprise, in large numbers from the United States where free grants of land were no longer available.

The result was that, within ten years after the Liberal government took office, the population of the prairie country had so increased that it was necessary to set up two new provinces, Saskatchewan and Alberta, with self-government on the lines of the other seven provinces. This was done in 1905, not without friction, for again the demand was made for the right to separate schools, supported by the state, in which should be taught the Roman Catholic faith. Minor compromise eased the friction and Regina and Edmonton, so recently little more than trading posts, soon had impressive parliament buildings as capitals respectively of Saskatchewan and Alberta. The political framework of Canada from the Atlantic to the Pacific was thus completed.

French Canadian Nationalism.—The politics of Canada are always haunted by racial issues. When Canada was still a French colony a cleavage grew between the old and the new France which bred in the Canadians a sense of separation from Europe and endured under British rule. One result was an unwillingness to share in any conflicts not directly affecting Canada. Though politically British, they did not share in the unity of sentiment which leads Britons in all parts of the world to stand by each other in time of danger. When the South African War broke out in 1899, outside of Quebec, public sentiment was so strong for aiding Great Britain that Canadian contingents were recruited and sent to South Africa, where they made a creditable record. They were paid, however, by Great Britain, not by Canada. Laurier's chief political strength was in Quebec and he realized the danger there to his prestige of this share in imperial wars. Following on this war came the rapid approach of conditions in Europe which were to result in the World War. Canada was not equipped for war. She had no fleet, and a considerable section of public opinion was demanding that she should take some share in the naval defence of the Empire. Laurier knew that in Quebec any move in this direction would arouse antagonism. Henri Bourassa (*q.v.*), grandson of Papineau, the rebel of 1837, became the able and eloquent exponent of opposition to taking any share in imperial wars. Yet the pressure of other opinion was such that, in 1910, Laurier was forced to acquire two men-of-war as training ships, and in the next year to found a small naval college at Halifax and thus make the beginnings of a Canadian navy.

In 1911 came an election which resulted in Laurier's defeat. In Quebec, his support had cooled, owing to Bourassa's attacks on his imperialism. What broke his power was, however, quite another question. Canada had long sought reciprocity in trade with the United States and, early in 1911, an agreement was reached at Washington for a wide measure of free trade between the two countries. The farmers of the West welcomed the proposal joyously; it would give them wide markets and cheaper agricultural implements. But the industries were naturally alarmed at any intrusion on a protected field; the railways feared diversion of traffic from the long lines running east and west to shorter routes by way of the United States; and banking interests were alarmed lest closer relations should lead to the financial dominance of New York. These considerations were reinforced by the strong British sentiment in Canada, which resented the giving to the United States of advantages in trade superior to those of Great Britain. Laurier dissolved parliament with confidence, but he was defeated and the Conservative leader Mr. (Sir) Robert Borden (*q.v.*) became in 1911 prime minister of Canada.

Relations with the United States.—During Laurier's term of office, relations with both Great Britain and the United States had become more clearly defined. In successive imperial conferences he refused to accept for Canada any direct responsibility for other than Canadian affairs, a policy in which his opinions ran counter to those of the British colonial secretary, Mr. Chamberlain. Canada, Laurier always said, would do her duty in any emergency but he would not give pledges in advance. Canada was moving towards control of her own foreign affairs and there was a certain uneasiness at Britain's conduct of Canada's relations with the United States. The Conservative government of Sir John Thompson had secured by arbitration the rejection of a claim by the United States to jurisdiction over Bering Sea in order to protect American interests in the seal fisheries of the Pribyloff Islands. A more difficult case arose, however, in 1903 in connection with the boundary between Canada and Alaska. A decision favourable to the United States was reached by the vote of Lord Alverstone with three American commissioners against his two Canadian colleagues, though he had previously reached an agreement with them and signed a common verdict. Later revelations showed that his change of view had been determined by a sharp menace from the American president, Mr Roosevelt, that he would dictate a settlement if the commission should fail to agree.

A happier phase of relations with the United States came in 1911 in the establishment of an international joint commission with three commissioners named by the United States and three by Canada to continue in permanence and to which should be referred questions relating to the use of boundary waters. These include such difficult questions as the building of dams and the generation of electrical power on boundary rivers; and it was further provided that, by agreement of the two governments, the commission might exercise comprehensive powers in determining rights, obligations and interests in the relations of one country to the other or of their respective inhabitants. In its task of settling difficulties peaceably the treaty ranks with the important Rush-Bagot convention of 1818 which brought about disarmament on the Great Lakes and, indeed, on the whole boundary line.

The Naval Question.—The new Conservative government was confronted at once by the danger of war in Europe. In 1912 Sir Robert Borden visited England for a conference with the British authorities, who convinced him that, in view of Germany's preparations, there was an emergency in naval affairs. In consequence, in Dec. 1912, the prime minister submitted to Parliament a proposal to build three warships at a cost not exceeding £7,000,000, to be placed at the disposal of the King for naval defence. The plan of a Canadian navy was not abandoned, but was postponed in view of urgency. The proposal was hotly debated. Even the mild naval policy of Sir Wilfrid Laurier had aroused the nationalist group in Quebec which scented imperialism. The session of 1913 saw determined obstruction which led to the adoption of the closure in debate, already found necessary in England. The House of Commons, by 101 votes to 68, supported the naval bill which, however, failed to pass in the Liberal Senate. Thus on the eve of the World War Canada was giving almost no aid in naval defense. (G. M. W.)

WORLD WAR I AND AFTER

The British declaration of war on Germany on Aug. 4, 1914, automatically involved Canada. The technical point of the degree of Canada's participation was not raised, for Canadians generally believed the war to be just, and supported its prosecution with complete unanimity. This was further indicated by the number of men who enlisted in the Canadian Expeditionary force. In all, over 600,000 men saw service, of whom more than 425,000 went overseas. This was exclusive of the men who joined the royal air force, or other branches of the British service. Canadian naval contributions were small, although patrols were maintained in vital east and west coast areas. The Canadian army saw service chiefly in northern France, taking part in the second battle of Ypres (1915), the Somme (1916), the storming of Vimy Ridge (1917) and the breaking of the Hindenburg Line (1918). From 1917 onwards, the four Canadian divisions in France were under the command of Sir Arthur Currie.

The other great contribution to the Allied cause was in munition and food production. At the outbreak of war, Canada had only one small-arms factory at Quebec. Before the end of the war, Canada was producing a considerable part of the munitions used on the western front. Shipbuilding was likewise undertaken in order to offset the depredations of the submarine. Demands for Canadian food products, especially wheat and beef increased as the war progressed; the export of beef rising from $6,000,000 in 1913 to $85,000,000 in 1918. Wheat export played an important part in Canadian war finance.

The prosecution of the war placed an increasing burden on the Canadian people. The cost of living greatly advanced, and with it taxation. In spite of such novelties as an income tax, and an excess profits tax, the government was compelled to borrow heavily. Most of its borrowings were domestic in origin, in the form of "Victory bonds," or, more popularly priced, thrift and war saving stamps. All the loans were much oversubscribed; the 1917 loan which called for $150,000,000, yielding $250,000,000. By 1916 difficulty was met in finding men for the armed services, in competition with wartime industry and agriculture. The following year, a Compulsory Military Service act was passed, and a coalition, or union government formed. The act met with considerable opposition from labour and farmers, and in operation was largely ineffective.

The re-establishment of the Canadian ex-serviceman had many ramifications. A special government department was organized under Sir James Lougheed which sought to find employment or vocational training for those who desired them, or which supplied medical and hospital care for the disabled. Pensions were provided for wounded men and for the widows and dependents of those who had been killed. An interesting effort was made to place returned men on farms, the government providing free land and loans at low interest to the soldier settlers. The Great War

Veterans association, and kindred organizations, also bore a large share in rehabilitating the returned men.

World War I had a profound effect on the Canadian economy. Heavy industry and mining were immensely stimulated, hydroelectric development increased, and the production of pulp and paper advanced to the proportions of a national industry. All branches of agriculture, especially grain growing, were likewise greatly advanced. Another notable feature of the period was extensive government regulation of, and participation in, private business. This was especially true of the railways. In 1917 the Canadian Railway association was formed, on government instigation, to supervise and co-ordinate services. Two years later the government, as explained below, was in possession of about one-half the railway mileage of the country. Even farming was regimented through the action of the Wheat board which regulated prices.

Postwar Attitudes.—The postwar period witnessed great changes in the national outlook. Education became more "practical." Technical and vocational schools took their place with the older collegiate and grammar schools. In the universities, along with instruction in the liberal arts and the professions, courses in business administration and finance appeared. Enrolment in the universities vastly increased, as the curricula were widened, and as industry and business began to demand a highly trained personnel. A number of new university reorganizations were effected, among them L'Université de Montréal, which served the needs of the numerous and wealthy French Canadian population of Montreal and the vicinity. Financial aid from governments, municipal or provincial, was another development. This, as so much else in higher education, was a conscious borrowing from the United States, where the "state university" was a recognized feature.

In church life, among Protestant bodies, there was a marked trend towards amalgamation, accompanied by a declining emphasis upon denominational and dogmatic peculiarities. This culminated in 1925 in the fusion of the Congregational and Methodist Churches, and a large section of the Presbyterian Church, to form the United Church of Canada. The United Church thus became the most numerous Protestant body, and demonstrated a consistent and lively interest in education and social questions. In 1918 the Anglican Church adopted a new *Book of Common Prayer*, especially adapted to Canadian use, and assumed, at the same time, as its official title, the Church of England in the Dominion of Canada.

The woman suffrage movement was also much advanced. In some of the provinces, and practically all the municipalities, women were enfranchised even before World War I. The War Times Election act gave a partial enfranchisement in the dominion at large, to be completed by the Franchise act of 1920. By an extraordinary anomaly, although women could both vote for, and sit in the Canadian house of commons, they were debarred from the senate till 1930.

General interest in social betterment was shown in attempts to regulate the use and sale of intoxicating liquor. Local option had a wide vogue throughout Canada in prewar years, particularly in rural areas. In part as a wartime measure, and stimulated, no doubt, by the example of the United States, some of the provinces attempted total prohibition, with very indifferent success. By 1927, however, the Quebec scheme, which permitted the sale of liquor under strict government regulation, was generally adopted. Liquor control had an international aspect, because of illicit export into the United States, and the attendant smuggling of American merchandise into Canada.

This was the subject of a great deal of inquiry in 1926, but little was accomplished till the adoption of the 21st amendment by the United States in 1933.

The most far-reaching development in outlook, however, was the growth of a strong national feeling. It was greatly forwarded by the leading statesmen of the day, Sir Robert Borden, the wartime prime minister, Sir Wilfrid Laurier, the leader of the Liberal party, and his successor, William Lyon Mackenzie King. It was a direct consequence of Canada's accomplishments and sacrifices in World War I, and the pride which these engendered. Inevitably, nationalism insisted on an increasing degree of autonomy within the commonwealth, and the recognition of that autonomy by the outside world. In pursuance of this policy, Canada was represented at the Peace conference in 1918 and 1919, signed the treaty of Versailles and became a member of the League of Nations. The Canadian parliament formally ratified the treaty of Versailles, after a prolonged debate, in which Canada's status as an autonomous nation was vigorously asserted. Contemporaneous was a growing North American point of view, which was demonstrated in an emphatic fashion in 1921, when Canada was largely responsible for inducing Britain to abandon her alliance with Japan, chiefly in deference to United States opinion. Indicative of her increasing independence was Canada's refusal to be bound by Imperial agreements unless formally engaged in by her. This was shown dramatically in 1922, when the prime minister, Mr. King, refused to accede to Britain's request for troops in the impending crisis with Turkey till parliament had been consulted. In the various postwar European settlements, Canada had little part. She refused to ratify the treaty of Lausanne, or the Locarno security pact, asserting that not having been consulted, and not having signed, she had no obligation. The right to separate diplomatic representation was successfully asserted as early as 1920, although it was not till 1927 that the first legation was opened at Washington. After that date Canada established legations at Paris and Tokyo. In 1923 treaty-making power was asserted in negotiating and signing the Halibut treaty with the United States. Assertions of autonomy as sweeping as these, demanded a restatement of Canada's relations to the British empire. The formula was found at the Imperial conference of 1926, which declared the dominions to be partner nations with Britain, equal in status, and bound together only by an allegiance to a common crown. The Statute of Westminster (*q.v.*) gave formal definition to the declaration of the conference.

Economic Issues, 1919–24.—Postwar economic conditions were exceedingly chaotic. By 1920 the inescapable slump from the prosperous war years had set in. Food products, which had brought famine prices, were almost unsalable, wheat falling from its 1919 level of $2.15 a bushel to 60 cents in 1920. The plight of the farmer was the more severe, since his fixed costs, in the form of taxes, wages, repairs and freight rates stood at their war level. The eastern farmer, with his diversified crop, and with a constant demand for beef and dairy products in the cities, managed to sustain himself. The prairie farmer, as the producer of only one crop, wheat, was in a very different position. To be engaged in profitably, wheat farming had to be conducted on a large-scale basis, and with machinery. This necessitated a large capital outlay, which was usually found in the form of bank loans. To his other difficulties, the western farmer added indebtedness with ruinous interest rates, in terms of prevailing prices. Under these circumstances, forms of co-operation became popular. The most successful was the Grain Growers' association which had been founded in 1901. By 1919 it had over 33,000 members, owning its own elevators, paying substantial dividends and carrying on a vigorous press and educational campaign in the interest of agrarian solidarity. There was a host of other co-operatives, the Saskatchewan Co-operative Elevator company, the Alberta Farmers' co-operative, and so on. In Ontario the United Farmers sponsored certain co-operative features, but without the success of their western counterparts. The co-operatives and the farm organizations probably helped to check the downward trend in agricultural prices, but they did no more. Returns to the farmer continued low, failing to rise with the prosperity of the later 1920s, and constituting one of the most dangerous phases of the national economy between World Wars I and II.

Impinging on the whole postwar settlement was the problem of the railways. Specifically, it involved the great through lines, the Canadian Northern, the National Transcontinental, the Grand Trunk Pacific, and its parent, the Grand Trunk of Canada. These lines had been built, or vastly extended, in the period of intense optimism and expansion before 1914. During World War I all had been forced to appeal for some form of government aid. In

1917, following the report of the Drayton-Acworth commission, the Canadian Northern was nationalized, the financial settlement being reached by arbitration. The road was taken under government control, and operated along with the National Transcontinental, and the still older publicly owned railways, the Intercolonial and the Prince Edward Island railway. In the spring of 1917 the Grand Trunk Pacific, and in the autumn the Grand Trunk of Canada, passed into government hands. In 1921 a board of arbitration, composed of Sir Thomas White, Sir Walter Cassells and William Howard Taft, the ex-president of the United States, attempted to evaluate the road. The board came to no final decision; White and Cassells presenting a majority report, Taft a minority report. The former declared the common and preferred stock of the railway to be worthless, the latter asserting that it had a value of $48,000,000. In 1923 the Grand Trunk was included in the government-owned, or Canadian National, system, the headquarters fixed at Montreal, and a new president, Sir Henry Thornton, who had wide experience in United States and English railways, appointed. To Thornton fell the formidable task of fusing the policies, staffs and properties of the original railways. In addition, there was inherited a staggering load of debt which was increased by government loans for improvements or maintenance. Since the administration could not modify the capital structure, it was forced to devote its attention to reducing costs and securing more traffic. In the larger sense, little was done towards solving the transportation problem. Beside the national system existed the Canadian Pacific, privately owned, ably managed, unified, possessed of fleets on the Atlantic and Pacific, and the heir to a long tradition of successful service. Between the two railways, inevitable rivalry developed, marked by competitive building and costly duplication of services.

The period of postwar deflation presented a curious paradox. While the prices of primary products and wages fell, the prices of other commodities and services remained high. Amply protected by the tariff, or sustained by government subsidy, industry generally weathered the difficult years between 1919 and 1924. It suffered, of course, from heavy taxation, yet those taxes which bore directly on industry were earliest removed, the excess profits tax disappearing first. There was no reduction of the tariff till 1923, when the reductions were offset by bonuses to favoured industries. Taxes, such as the sales tax, income tax and a variety of "nuisance" taxes which fell on individuals, rather than on corporations, remained. The much inflated cost of living produced widespread discontent, and, in one or two instances, serious disorder. In 1919 occurred the Winnipeg strike, which began over the question of collective bargaining and rapidly developed into a general sympathetic strike, involving city employees as well as other workers. The strike was ultimately broken by the intervention of the dominion government and the arrest of the labour leaders. Four years later (1923) a serious strike developed among the employees of the Dominion Iron and Steel company at Sydney, Nova Scotia. The issue was union recognition, and the strike was lost to the men by the employment of troops. The number and severity of the disputes were symptomatic of deep-seated economic discontent, rather than radical political tendencies, as reactionary elements in Canada affected to believe.

Political Stalemate, 1921–26.—For nearly a decade the political situation remained confused. The union government lost favour in spite of the ability of the new prime minister, Arthur Meighen. On the other hand, Liberalism made a remarkable resurgence, under the leadership of W. L. Mackenzie King. Significant of the general unrest was the organization of a western farm bloc, the National Progressive party, and the alliance of labour and farmer in the east. The Progressive program inclined towards national ownership, state aid to agriculture and vigorous assertion of the "new nationalism," freer trade and reciprocity with the United States. In the general elections of 1921 no party received a working majority, although the Liberals formed the largest group. Mr. King, however, formed a government counting shrewdly on a good deal of Progressive support. Liberal policy was sensibly modified by this consideration, and engaged itself in tariff revision, definition of Canada's autonomy and efforts to promote economy in public administration. The elections of 1925 produced no change in the cumbersome three-party arrangement, except for the advance of the Conservatives to the position of the largest group. Relying on Progressive support, Mr. King remained in office, till he was defeated in the summer of 1926. On being refused dissolution, he resigned, his place being taken by Mr. Meighen in a brief three-day administration. The succeeding elections broke the deadlock, the Liberals returning to office with a sufficient majority over all other parties. The Progressive party practically disappeared, its members merging with the victorious Liberals. The year 1926 marked the return to the two-party system, and, more significantly, the determination of the country to secure a powerful government which would assist it in reaping the full benefits of the wave of good times.

Prosperity Years, 1925–29.—Improved conditions, which had been apparent as early as 1925, produced an unparalleled period of prosperity. Much of it was a reflection of bettering conditions throughout the world, thereby benefiting Canada as a great exporting nation. Nevertheless, within Canada was advantageous change. A rise in the price of agricultural products helped the farmer who was further assisted by the extension of branch lines of railway through the wheat-growing region of the west. Industry was stimulated by the influx of foreign capital; in 1927 alone, about $250,000,000 being invested in Canadian enterprises. Another feature was the establishment of branch factories of United States or British origin. Industrial expansion was immensely accelerated by the new methods of mass production, and the rationalization of manufacturing processes. Business mergers were constantly effected, with the result that small or weak firms were eliminated. Accompanying these developments, was a boom on the stock market, in which the no-par common stock became exceedingly popular, thanks to its speculative possibilities. The market was extremely active, and became a species of barometer of optimism and prosperity. The vogue of the stock market as a means of money-making was one of the phenomena of the period. It was indulged in by all classes of people, the majority of whom had little financial experience, and eagerly purchased stock whose quoted price bore no relation to its actual value.

The effect of the good times was seen at once in rising employment, and in increasing purchasing power. In the cities it was marked by a great advance in homeownership, and everywhere by a rising sale of life insurance, automobiles and household helps of one kind and another. While many of the articles purchased were in the nature of luxuries, they raised the standard of living, and added immensely to the comforts of life.

Increased incomes enabled corporations and governments to multiply their services. The railways spent heavily on equipment; the Canadian Pacific opening the palatial Royal York hotel in Toronto at the cost of $16,000,000. The same year witnessed the formation of the Beauharnois Light, Heat and Power corporation to develop electric energy from the St. Lawrence river. As a consequence of its mounting revenues, the dominion government was able to embark on new projects. The building of the railway to Hudson bay was resumed, and completed, along with harbour and grain storage facilities at Churchill, in 1931. At the same time, the province of Ontario brought its publicly owned railway, the Temiskaming and Northern Ontario to tide water at Moosonee on James bay. The economic value of these outlets remained to be proved, but they symbolized the buoyancy and ambition of those prosperous years. The dominion likewise increased its subsidies to the prairie, and maritime provinces, enabling them to provide greater services for their citizens. Attempts were made to stimulate immigration, under the provisions of the Empire Settlement plan, especially from Britain and northwestern Europe, by offering reduced ocean passage to farm labour and domestic servants. In these projects, church organizations and the railways, as well as government, were interested. The success of the immigration venture was not great; in numbers it scarcely balanced the drift of Canadians to the United States, and in quality it failed completely to replace the loss of young professional men and women who were attracted to the American cities. Finally, in 1930, the policy of assisted immigration was definitely brought to an end. Much more popular was the government's steady reduction of taxation. The tariff was progressively scaled down, especially as it affected textiles. The budget of 1928 made substantial cuts in the income tax and sales tax and reduced postage to its prewar rate. In 1927 Canada achieved what is probably its final dimensions, by losing 120,000 sq.mi. of its eastern territory to Newfoundland under the terms of the Labrador Coast award. The same year saw the celebration of the diamond jubilee of confederation, the brilliant ceremonies at Ottawa, and elsewhere, serving to emphasize the period of unprecedented good times.

Depression, the Economic Phase 1929–35.—In the autumn of 1929 Canada was overtaken by an unparalleled business depression which affected every phase of national life. While the depression was world-wide, certain features were peculiar to Canada. As a great exporting nation, Canada suffered in the general decline of trade; her foreign trade dropping from the 1929 level of $2,505,000,000 to $1,245,000,000 in 1931 High tariffs, notably the Hawley-Smoot tariff of the United States (1930), as well as the tariffs of France, Germany and Italy, damaged Canadian agriculture or industry. Public and corporation indebtedness, in an era of reduced revenues, and business stagnation constituted a severe check upon recovery, even when conditions began to improve. The depression was ushered in by the spectacular crash of the Montreal and Toronto stock markets on Oct. 29 and Nov. 13, 1929, with resulting losses of over $5,000,000,000. In the course of the next two years the speculative character of many market transactions became apparent with the decline in value of $5,500,000,000 on some 50 stocks. Equally alarming was the decline in railway traffic, which reached its lowest level in 1930. Both the Canadian National and the Canadian Pacific were seriously affected, the latter road being compelled to forego its annual dividends. The coal industry of Nova Scotia, and the pulp and paper industry of Ontario and Quebec, which were dependent on the outside market, suffered severely. Western agriculture experienced a disastrous setback in sagging farm prices, and in the drought which swept southern Saskatchewan in 1934. The revenues of governments, as well as the revenues of corporations and private individuals diminished as sales fell off, and the era of confidence and expansion came to an end. Unemployment became general. In 1933 the minister of labour reported 1,357,562 persons receiving relief, and a year later the figure stood at 1,207,345. Trade union membership (a useful index) declined from the 1929 level of 319,476 to 280,704 in 1935.

The severity of the depression thrust the Canadian government into active effort to protect existing business, and to stimulate trade by seeking new markets. Tariff revision upwards was commenced in 1930, when the budget provided for countervailing duties, in reply to the provisions of the Hawley-Smoot tariff. Later in 1930, at a special session of parliament, the tariff was stiffened on agricultural products and manufactured goods, with increases from 15% to 50% on the anti-dumping rate. In the budget of 1931 the upward trend continued. More positive in character were efforts to secure new trade outlets. At the Imperial conference of 1930, the prime minister, R. B. Bennett, proposed that the commonwealth nations, while retaining their individual tariffs, should levy a tariff of 10% on foreign imports. Two years later the Ottawa Economic conference provided a limited response to this proposal, when a series of bi-lateral trade agreements were made between the various commonwealth states. Canada's chief gains were preferential treatment of certain farm products on the British market, in return for reduced import duties on some 200 manufactured goods. In 1932 the St. Lawrence Deep Waterways treaty was signed with the United States providing for so widening and deepening the river and Great Lakes channels that ocean-going vessels could reach Port Arthur or Chicago. The increased production of electric energy was another benefit that would flow from the agreement. Indicative also of fresh Canadian interest in the United States was Mr. Bennett's desire to discuss reciprocity. Domestic issues in the United States intervened, but in the autumn of 1935 W. L. Mackenzie King, the new Liberal prime minister, signed a treaty which reduced the Canadian tariff on manufactured and semi-manufactured goods to the 1930 level, in return for preferential treatment of Canadian farm products, fish, lumber, wood pulp and such minerals and metals as nickel and asbestos. At the same time, a trade agreement was reached with Japan. In Jan. 1939 the United States treaty was renewed, with certain modifications, for another three years.

In the domestic field, the most important economic legislation was the creation of the Bank of Canada in 1934. It was founded in response to the recommendations of the Royal Commission on Banking (1933), and was intended to act as the government bank, handle debt and credit policy, control currency and foreign exchange, and possess the sole right of note issue. As originally designed, the Bank of Canada was a private institution under government supervision, but in 1938 the government assumed complete control. Another instance of government regulation was the formation of the Canadian Broadcasting commission in 1932, which gradually acquired privately owned stations, and laid down broad policies for radio programs within Canada.

Throughout the depression the problem of unemployment and relief bulked large. Until 1934 the chief palliatives were public works financed by the dominion government on the basis of loans contracted in 1932 and 1934. Relief was a rural problem as well, chiefly in the west, where in Saskatchewan alone there were over 100,000 farmers receiving some form of government aid. Believing that only long-scale methods would be of any avail, in 1935 Mr. Bennett sponsored an extensive social program very similar to the "New Deal" legislation in the United States, limiting hours of work, establishing minimum wages and setting up a national employment service and employment insurance. The Farmers' Creditors act was amended to further alleviate debt burden In order to regulate unfair business practices a Trade and Industry commission was provided, and the criminal code so amended as to cover false advertising and to deal with employers who flouted the labour codes. Finally, a National Economic council was created to deal with social and economic problems, and to provide the government with expert advice While much of this program was inspired by United States example, the greater part proceeded from the findings of the house of commons into mass buying practices. The Canadian supreme court, and the Imperial privy council, however, declared most of this legislation unconstitutional, as lying outside the exclusive competence of the dominion parliament. The new Liberal administration, which came into office in the autumn of 1935, observing the fate of its predecessor's efforts, fell back on a program of "productive public works" pending the investigations of a commission into the relations of the dominion and the provincial governments. The problem of relief was, therefore, hedged by unusual complications, novelty and the conflicting jurisdictions of three governments, municipal provincial and central.

Profoundly affected by (and profoundly affecting) general conditions was the related plight of agriculture and railways. In common with other exporters, the wheat farmer suffered from decreasing prices. As early as 1931 the Canadian government had begun the practice of paying bonuses to the western farmers. In 1935, through the medium of the Wheat board, it tried to intervene between the grain grower and the world market, by purchasing at a minimum price and holding for a rise. As, however, wheat steadily accumulated (with no corresponding improvement in world demand), the government found itself the possessor of an ever-growing quantity which grew from 225,000,000 bu. in 1934, to 300,000,000 bu. in 1940, and to 575,000,000 bu. in 1941. Finally, the government was compelled to limit its purchases, and ultimately to subsidize the farmer to allow his land to lie fallow. Powerfully influenced by the stagnation in the prairie farm world were the railways. The royal commission of 1932 (the Duff commission) proposed to reduce competition between the Canadian Pacific and the Canadian National by the common use of tracks, terminals and by the pooling of various services Changes were also suggested in the management of the nationally owned system. In 1933 the pooling plan was put into effect in central Canada While the scheme was effective, it was too limited to have any general influence on the railway situation. To unification, joint ownership, or even compulsory co-operation, the railways themselves and large sections of the Canadian public seemed resolutely opposed. In its fundamentals, the railway problem remained unsolved at the beginning of 1943.

Social and Political Discontent.—The depression period produced important political changes. In 1930 dissatisfaction with the Liberal government's policies swept the Conservatives into office. The new Conservative prime minister, R. B. Bennett, was a highly successful western lawyer, and imparted to his party a good deal of his aggressiveness and independence. The Conservative program for recovery embraced, at various times, high tariffs, empire trade, reciprocity with the United States and, in the last months of its power, extensive state control of business. The Bennett government also sponsored a far-reaching inquiry into price spreads and mass buying which revealed shocking business practices, sweat shop conditions and appallingly low rates of wages. In 1935, however, the Conservatives were driven from office by the Liberals. A similar turn-over took place in the provinces, the Maritimes going Liberal between 1933 and 1935, Ontario and Saskatchewan in 1934, while in 1936 the Liberal regime in Quebec was overthrown after 40 years of office. Of greater significance than the alternation of the old parties, was the appearance of new groups whose political and social programs proceeded directly from depression conditions. In 1935 the Social Credit party swept Alberta, and, under the guidance of William Aberhart, commenced a crusade on lines made familiar in Major Douglas' *Credit, Power and Democracy*. In the same year Social Credit entered the dominion field by returning 17 members to Ottawa. The importance of the party was less in the novelty of its program than in its ability to vocalize agrarian discontent. Broader based was the Co-operative Commonwealth federation, or the C.C.F., with its program of a socialized economic order, led by the veteran social worker, J. S. Woodsworth. Although primarily western in origin, the C.C.F. made considerable progress in central and eastern Canada, sufficient to alarm the old-line parties and to cause them to attack it vigorously. In the 1930s party lines blurred, the traditional distinctions between Conservatives and Liberals vanishing before the fundamental divisions of rights and lefts, haves and have nots.

The European Crisis and Economic Recovery.—In the summer and autumn of 1933 the first indications of returning business prosperity appeared. The price of wheat advanced, car loadings increased and stock market buying resumed. Optimism was sustained by similar, if more spectacular, advances in the United States. Gold mining received an immense fillip from the United States revaluation law, which raised the price of gold from $20 to $35 an ounce. Gold export helped to redress the balance of interest payments to the United States, and to that degree furthered recovery. Within Canada, a boom developed in the mining regions of Quebec, Ontario and Manitoba. The mining of base metals, particularly nickel, was forwarded by purchases by Japan, which required the metal for its projected military operations against China. Activity in mining extended into the relatively new area of the Northwest Territories, where amazing finds of silver, gold and radium were made between 1931 and 1935. The new regions were made accessible by the aeroplane, and by the tractor train which transports men, mail, heavy mining machinery and general supplies. In 1937 the Hudson's Bay company supply vessels coming from the eastern and western arctic effected a junction, thus proving the commercial feasibility of a northwest passage. Declining drought and the action of the Wheat board in stabilizing grain prices aided agriculture. Industry improved with increasing Canadian defense demands, and, much more, by the outbreak of World War II in the autumn of 1939. The extensive plans to convert Canada into a British commonwealth arsenal, although mooted in 1938, had not materialized before 1940. The railways reflected the more active business conditions, supplemented by the movement of troops and war supplies. Similarly, the index of employment rose, and by the end of 1939 conditions had substantially improved, although they had not reached the level of a decade before.

The development of an international consciousness was retarded by divergence of opinion within Canada. Nationalism, which had been so marked in the 1920s, vanished, its place being taken by a search for some form of collective security, or in closer methods of collaboration with the commonwealth and the United States. The ideals of the League of Nations had a wide acceptance, and able advocacy from Mr. King and his principal lieutenants, Raoul Dandurand and Ernest Lapointe. Nevertheless, as a group, Canadians were unwilling to see League action made effective, as witness their equivocal stand in 1932 at the beginning of the Sino-Japanese War, or the repudiation of the Canadian delegate to the League on the application of economic sanctions to Italy in 1935. In British commonwealth affairs Canada made full use of the existing machinery, the Imperial conference and the high commissionership, and seemed to have expected to be "informed," but not necessarily "consulted" on the various moves of British European policy. In its relations with the United States, Canada was much more forthright, thus indicating increasing commercial interdependence and an increasing American consciousness. In 1936, and again in 1937, President Roosevelt visited Canada, his visits being followed by important diplomatic pronouncements which were tantamount to extending the Monroe doctrine to Canada. Yet Canada's growing concern in the Americas was not sufficient to carry it into the Pan American union, in spite of substantial investments in Peru and Brazil. To the various world crises, Canada's response was by no means clear cut. Her sympathy went to China; her scrap metal and nickel to Japan. The Italian invasion of Abyssinia and the Spanish civil war served to accentuate rightist and leftist groupings within the country. In official circles the Munich appeasement policy was tacitly accepted, and as late as the spring of 1939 the government refused to countenance any program which would involve Canada in war in defense of the smaller nations.

In view, however, of world tension Canadian defense estimates were increased in 1936, 1937 and 1938, greater attention being given to the air and naval services. Following Munich, these preparations were much advanced, militia reorganization undertaken and modern coastal defenses prepared for the Atlantic and Pacific ports. In 1939 the Commonwealth Air Training plan was begun for the annual training of 35,000 pilots, observers and air gunners, the personnel being largely Canadian, but the cost being divided among the other British commonwealth nations.

The spring of 1939 witnessed the visit of King George and Queen Elizabeth. Touching as a demonstration of personal attachment, the royal visit was emphatic of Canada's constitutional position, the king being hailed as the national sovereign, and performing certain functions, such as opening parliament, and relying on the direction of the prime minister during his stay in the country, which were indicative of his constitutional relation to Canada. The Canadian declaration of war occurred Sept. 10, 1939. (*See* WORLD WAR II.)

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(J. I. C.)

CANADA BALSAM, an exudation of the North American balsam fir, called also Canada turpentine and balsam of fir. It is strictly speaking a turpentine (*q.v.*) and not a balsam (*q.v.*), and at ordinary temperature is a yellow solid. It belongs to the class of oleo-resins which are natural products consisting of resin (*q.v.*) dissolved in a volatile oil. It is of importance in optics on account of its refractive index, which is 1.53 for the sodium D lines, being close to that of glass. (*See* also COLOUR; FIR; LENS; OPTICS.)

CANADA-KANSAS CITY-GULF ROAD, a highway extending from Duluth, Minn., through Iowa and along the boundary lines between Kansas and Missouri, Arkansas and Oklahoma, Louisiana and Texas to Cameron, Louisiana on the Gulf of Mexico. It traverses the generally level but somewhat rolling agricultural region west of the Mississippi river for a distance of about 1,600 mi. and includes Minneapolis, St. Paul, Fort Dodge, Kansas City, Joplin, Shreveport and Lake Charles in its course.

BY COURTESY OF THE IOWA GEOL. SURVEY

CANADA THISTLE, A PESTIFEROUS WEED, 1 TO 6 FT. HIGH, OFTEN INJURIOUS TO GROWING CROPS

CANADA THISTLE, the creeping thistle (*Cirsium arvense*) of Europe, now extensively naturalized in North America, where it is found in fields and waste grounds from Newfoundland to British Columbia and southward to Virginia and California. In many places it is an exceedingly pernicious weed. It is a perennial, 1 ft. to 6 ft. high, creeping extensively by horizontal rootstocks and forming patches. The staminate (male) and pistillate (female) flowers are borne on separate plants. The grooved stems, somewhat branched above, bear deeply cut, exceedingly prickly leaves and numerous clustered, purple or white flowerheads about 1 in. broad. As the plant spreads by long, underground rootstocks as well as by wind-borne seeds, it is very difficult to eradicate. Short rotation of crops, intensive cultivation of field crops and rigorous cutting of the plant along roadsides and in waste grounds before the seeds mature, or spraying with chemicals, are the most effective means of control. (*See* THISTLE.)

CANADIAN ARCTIC ISLANDS comprise the archipelago which lies north of Canada with Davis strait, Baffin bay, Smith sound and its northward continuation on the east and the Beaufort sea on the west. The Norwegian government recognized in 1930 British sovereignty over the Sverdrup group of Arctic islands.

The largest islands of the archipelago are Baffin, Ellesmere and Victoria, which are about 201,600, 75,024 and 79,269 sq.mi. respectively. Total land area of the archipelago is about 500,000 sq.mi.; pop. (1941) 2,799. Baffin Island contains several large, little known lakes. The loftiest land is in the east where Baffin and Ellesmere Islands rise to 5,000–6,000 ft. In the middle the islands are low but in the west of the archipelago there are elevations of 3,000 ft. The islands are built mainly of Palaeozoic strata laid down on the submerged border of the Archaean shield of Canada. In central Victoria Island, Melville and Boothia peninsulas, parts of Baffin, Devon and Ellesmere Islands, there are large areas of Archaean rock. To the north of this old shield, heavy folding occurs in the Palaeozoic rocks of Ellesmere Island and has been traced eastward into northern Greenland. In parts there are gently folded Triassic and Tertiary beds overlying the Palaeozoic strata. Permanent ice occurs only in parts of Baffin, Devon, Ellesmere and Heiberg Islands and nowhere does it mask completely the underlying relief. Islands farther west are too low and have too little precipitation for glaciers to form. The channels between the islands due to erosion and faulting in the depressed plateau are mostly shallow and, being landlocked, are liable to be blocked with pack ice. It was this ice which made the chief difficulties in the long search for a northwest passage and makes that passage useless for commerce. Winter snowfall being slight, there are two to three months in summer during which the low ground is free from snow. This allows mean temperatures to rise to over 40° F. and absolute maxima to reach 60° F. or more at that season. Vegetation is a form of open tundra which is luxuriant and bright in summer. Animals include the caribou, musk-ox, polar bear, wolf, fox, hare, lemming, ermine and glutton as well as seals, walrus and narwhal. Eskimos inhabit the southern and eastern islands and apparently had once a wider range toward the northwest. In 1926 a land area of 571,605 sq.mi. in the Arctic islands and adjacent mainland was set aside as a native game preserve within which trapping was confined to the Eskimos. Occurrences of graphite and mica near the southeast coast of Baffin Island have been known for more than 360 years; some mining has been done for both these minerals. Coal has long been mined for local use from a small basin of Tertiary rocks near Pond Inlet, on Baffin Island. The territories of the Hudson's Bay company, including many of the islands, were brought within the new Dominion of Canada in 1869, and in 1880 Canada was granted all British territory in the northern waters of America between 60° and 141° W. The islands form the greater part of the Franklin district of the Northwest Territories. At Pangnirtung, on the east coast of Baffin Island, are stationed a government medical officer and a detachment of the Royal Canadian Mounted Police, and there, too, are a Church of England mission and hospital, post office, radio station and trading post. There are also police detachments at Frobisher Bay, Lake Harbour and Pond Inlet, and post offices at the two latter, and at these points, as well as at Arctic Bay, Cape Dorset and River Clyde, are radio stations and trading posts. Church of England missions operate also at Lake Harbour and Pond Inlet, and those of the Roman Catholics at Cape Dorset and Pond Inlet; and the former has a mission, in addition, at Cambridge Bay, Victoria Island, where there is a trading station and police post.

Each summer the Arctic archipelago is visited by the government vessel "Nascopie."

Bibliography.—In addition to books on Arctic Regions (*q.v.*), *see* E. Shackleton, *Arctic Journeys: The Story of the Oxford University Ellesmere Land Expedition* (1937); R. Finnie, *Canada Moves North* (1942); V. Stefansson, *The Friendly Arctic*, 2nd ed. (1943); Canadian Department of Mines and Resources, *The Northwest Territories* (1943); "British Expedition to North Baffin Island, 1938–39," *Polar Record* (Jan. 1940); R. Bentham and D. Jeness, "Eskimo Remains in S. E. Ellesmere Island," *Trans. Roy. Soc. of Canada*, sec. 2 (1941); T. H. Manning, "The Foxe Basin Coasts of Baffin Island," *Geog. Jour.* (May–June 1943).

CANADIAN LITERATURE (IN ENGLISH). Perhaps the most notable examples of Canadian literature in English are to be found in the field of history, where the outstanding achievement is *Canada and its Provinces* (1913 *seq.*), a history of the country in 23 volumes, edited by Sir Arthur G. Doughty and Dr. Adam Shortt, and counting among its contributors most of the recognized authorities on Canadian history, biography and economics. Another notable essay in Canadian history is the series known as the *Chronicles of Canada* (1920 *seq.*) in 32 volumes, edited by G. M. Wrong and H. H. Langton, each volume by a competent Canadian writer.

Of individual works, William Kingsford's (1819–98) *History of Canada* (1887–98), in 10 volumes, is still the most ambitious, carrying the story of the country from its earliest beginnings down to the Union of 1841. In the main it is accurate, but the style is heavy and unattractive. J. C. Dent's (1841–88) *Last Forty Years* (1880) is practically a continuation of Kingsford. Dent also wrote an interesting but one-sided account of the Rebellion of 1837–38. A useful but somewhat perfunctory general history is F. B. Tracy's *Tercentenary History of Canada* (1908). Robert Christie's (1788–1856) *History of Lower Canada* (1845–55), was the first serious attempt to deal with the period of British rule, and is still useful. Histories of the Maritime Provinces have been written by Thomas Chandler Haliburton (1796–1865), Beamish Murdoch (1800?–1876), and James Hannay (1842–1910). Haliburton's is much the best of the three, but none covers the later history of these provinces. The brief but stirring history of western Canada has been told by Alexander Begg (1840–98) and his namesake (1825–1904), by George Bryce (1844–1931), and in such studies as Agnes Laut's (1871–1936) *Conquest of the Great Northwest* (1908) and L. J. Burpee's (b. 1873) *Search for the Western Sea* (1935) and J. B. Brebner's *Explorers of North America* (1933). F. O. S. Scholefield's (1875–1919) and F. W. Howay's *British Columbia* deals comprehensively with the history of that province. Brief and popular histories of Canada have been written by J. M. McMullen (1820–1907), Sir Charles G. D. Roberts (1860–1943), Sir John Bourinot (1837–1902), W. L. Grant (1872–1935), and George Bryce. But Canadian scholarship and research are shown at their best in such special works as Sir Arthur G. Doughty's (1860–1936) *Siege of Quebec* (1901–2), William Wood's (b. 1864) *Fight for Canada* (1905), Sir C. P. Lucas' (1853–1931), *Canadian War of 1812* (1906) and *History of Canada 1763–1812* (1909), G. M. Wrong's *Rise and Fall of New France* (1929), and *Canada and the American Revolution* (1934), A. L. Burt's *Old Province of Quebec* (1933), and D. C. Harvey's *French Régime in Prince Edward Island.* Sir Robert Borden's (1854–1937) *Canada and the Commonwealth* (1928) and *Memoirs* (1938), and Mackenzie King's (1874–) *Message of the Carillon* (1927) prove that Canadian statesmen sometimes put their thoughts into print. Standard works in their several fields are Sir John Bourinot's *Parliamentary Procedure and Practice* (1884), W. P. M. Kennedy's *Constitution of Canada* (1922), and the series of *Canadian Constitutional Documents* (1914–35) edited by Doughty, Shortt, McArthur and Story.

Canadian biography has been devoted mainly to political subjects. The most important work in this field is *The Makers of Canada*, published in a new and revised edition in 1926, in 12 volumes, including an *Encyclopaedia of Canadian History.* Each of the biographies is by a competent Canadian writer, and the series is edited by W. L. Grant. An indispensable work is W. S. Wallace's *Dictionary of Canadian Biography* (1926). Other important biographies: Sir Joseph Pope's (1854–1926) *Sir John Macdonald* (1894), O. D. Skelton's (1878–1941) *Sir Alexander Galt* (1920) and *Sir Wilfrid Laurier* (1921), E. M. Saunders' (1829–1916) *Sir Charles Tupper* (1916), Isabel Skelton's (b. 1879) *Thomas D'Arcy McGee* (1925), C. R. W. Biggar's *Sir Oliver Mowat* (1905), Beckles Willson's *Lord Strathcona* (1915), L. J. Burpee's *Sir Sandford Fleming* (1915), Sir John Willison's (1856–1927) *Reminiscences* (1919), Chester New's *Lord Durham* (1920), Harvey Cushing's *Sir William Osler* (1925), Sir Richard Cartwright's (1835–1912) *Reminiscences* (1912), Arnold Haultain's *Goldwin Smith* (1913), and James Mavor's (1854–1925) *My Windows on the Street of the World* (1924).

In the literature of such a country as Canada books of exploration and travel fill relatively a much larger place than in the literature of older countries. The original narratives of such discoverers as Jacques Cartier, Champlain, La Salle, Radisson, La Vérendrye, in the French period; of Mackenzie, Thompson, Fraser, Cook and Vancouver in the west; and of Hudson, Foxe, James, Franklin, Hearne, Back, and many others, in the far north, are to-day very rare in their early printed form, or have remained until recently in manuscript. Thanks largely to such agencies as the Champlain Society, many of these journals have been in recent years either printed for the first time or reprinted, with scholarly notes and introductions. It is appropriate to note here the important contributions made to Canadian history, literature and science, through such agencies as the Public Archives, the National Museum, the Royal Society of Canada and the Canadian reviews.

In literary essays very little has as yet been accomplished, unless we may count Goldwin Smith (*q.v.*) as in some sense a Canadian. As a scholar, a thinker, and a master of pure English he exerted a marked influence upon Canadian literature and life, though some of his political views made very little appeal to Canadian sentiment. Some of the books of Stephen Leacock (1869–1944), Archibald MacMechan (1862–1933), Peter McArthur (1866–1924), W. H. Blake (1861–1924) and Pelham Edgar (1871–   ) deserve to be mentioned here.

Poetry.—Conditions of Canadian life, as suggested, have not been altogether favourable to the birth of great poets, but within the limits of their song such men as Archibald Lampman (1861–91), William Wilfred Campbell (1860–1919), Sir Charles G. D. Roberts (1860–1943), Bliss Carman (1861–1929), Duncan Campbell Scott (1862–1944), George Frederick Cameron (1854–85) and Frederick George Scott (1861–1944) have written verses worth remembering. Lampman's poetry is perhaps the most finished and musical. Campbell's poetry, in spite of a certain lack of compression, is full of dramatic vigour; Roberts has put some of his best work into sonnets and short lyrics, while Carman has been successful with the ballad; the simplicity and severity of Cameron's style won the commendation of even so exacting a critic as Matthew Arnold. Charles Mair (1840–1927) was a survival from the pioneer period. His long narrative poem *Tecumseh* (1886) is on the whole a fine piece of work. One remarkable drama, *Saul* (1857), by Charles Heavysege (1816–1876), belongs to Canadian literature. Though unequal in execution, it contains passages of exceptional beauty and power. The sweetness and maturity of the verses of Isabella Valency Crawford (1851–87) are also worthy of remembrance. The *habitant* poems of W. H. Drummond (1854–1907) stand in a class by themselves, between English and French Canadian literature, presenting the simple life of the farmer of Quebec with sympathy, humour and picturesqueness. Robert W. Service is the poet of the Yukon. Marjorie Pickthall (1883–1922) produced three little volumes containing verse of unusual charm. John McCrae (1872–1918) will be remembered because of his one heart-stirring poem "In Flanders Fields." Of the more recent writers Wilson Macdonald's *Out of the Wilderness* (1926), marks him as a poet of some promise. Other new Canadian poets are Norah Holland, Beatrice Taylor, E J. Pratt, Louise Morey Bowman, Audrey Brown and George Herbert Clarke. Collected editions are available of the works of Lampman, Crawford, Roberts, Carman, Campbell, Mair, D. C. Scott, F. G. Scott, Drummond and Pickthall. Selections from the poems of these and other Canadian writers are found in the following anthologies:—W. D. Lighthall's *Songs of the Great Dominion* (1889), Wilfred Campbell's *Oxford Book of Canadian Verse*, John W. Garvin's *Canadian Poets* (1925), Theodore Rand's *Treasury of Canadian Verse* (1900), N. A. Benson's *Modern Canadian Poetry* (1930) and L. J. Burpee's *Century of Canadian Sonnets* (1910). Two books that may be noted here are C. M. Barbeau's *Folk Songs of French Canada* (1925) and J. M. Gibbon's *Canadian Folk Songs* (1927).

Fiction.—The first distinctively Canadian novel was John Richardson's (1796–1852) *Wacousta* (1832), a stirring and readable tale of the war of 1812. Richardson afterwards wrote half a dozen other romances, dealing chiefly with incidents in Canadian history. Susanna Moodie (1803–85) and Katharine Parr Traill (1802–99), sisters of Agnes Strickland, contributed novels and tales to one of the earliest and best of Canadian magazines, the *Literary Garland* (1838–47). *The Golden Dog*, William Kirby's (1817–1906) fascinating romance of old Quebec, first appeared in 1877 in a pirated edition. Twenty years later the first authorized edition was published, and it has often been reprinted. James de Mille (1833–80) was the author of some 30 novels, the best of which are *Helena's Household* (1868), a story of Rome in the 1st century; *The Dodge Club* (1869), a humorous book of imaginary travel, which appeared, curiously enough, a few months before *Innocents Abroad*. De Mille's posthumous novel, *A Strange Manuscript found in a Copper Cylinder* (1888), is a satire upon the modern worship of wealth. In form it anticipated the romances of Rider Haggard. Sir Gilbert Parker (1862–1932) made good use in many of his novels of the inexhaustible stores of romantic and dramatic material that lie buried in forgotten pages of Canadian history. Charles W. Gordon, "Ralph Connor" (1860–1937) was probably the most popular of Canadian novelists. His stories deal largely with pioneer life in the West; as those of Robert Stead and Nellie McClung are devoted to western farm life.

Sara Jeannette Duncan (Mrs Everard Cotes, 1862–1922) published a very entertaining book of travel fiction, *A Social Departure*, in 1890. Between that year and 1914 she wrote nearly a score of light and readable novels. Lucy M. Montgomery (Mrs. Macdonald, [1874–1942]) and Frederick William Wallace (1886–   ) stand easily first among novelists of the Maritime Provinces. In *Anne of Green Gables* (1908) and its successors Mrs. Macdonald has written a series of very delightful books for girls. Mark Twain wrote to a friend, according to Dr. MacMechan, "In Anne Shirley you will find the dearest and most moving and delightful child of fiction since the immortal Alice." F. W. Wallace is the author of a number of stories of the deep sea fishermen of Nova Scotia and the glorious days of the "Bluenose" clipper ships. He has also produced two more serious books, *Wooden Ships and Iron Men* (n.d.) and a sequel *In the Wake of the Wind Ships* (1927). While these two are not fiction, C. H. J. Snider has combined history with fiction in his tales of the Great Lakes and the war of 1812, *In the Wake of the Eighteen Twelvers* (1913). Mrs. L. Adams Beck, of Victoria, B.C. (d. 1931), wrote tales of the Orient, under her own name, and equally readable historical novels under the pen-name of "E. Barrington." In the Prairie Provinces a rather remarkable group of Scandinavian-Canadian novelists did much good work in the interpretation of the life of their people in the new environment of the Canadian west. The outstanding names in this group are Martha Ostenso (1900–   ), Frederick Philip Grove (1872–   ) and Laura Goodman Salverson (1890–   ). Mazo de la Roche (1885–   ) has written a remarkable series of novels of life in Ontario. An exceptionally effective group of short stories is Marjorie Pickthall's *Angels' Shoes* (1923), and a remarkable autobiography in the form of fiction is Philip Grove's *A Search for America* (1927); Morley Callaghan's *More Joy in Heaven* (1937) and Patrick Slater's *Yellow Brier* (1934) are outstanding.

Children's books of distinct merit are Cyrus MacMillan's *Canadian Wonder Tales* (1918), and *Canadian Fairy Tales* (1922), H. A. Kennedy's *New World Fairy Book* (1904), Isabel Eccleston Mackay's *The Shining Ship* (1918), Marjory MacMurchy's *The Child's House* (1923), T. G. Marquis' *The King's Wish* (1924), Marshall Saunders' *Beautiful Joe* (1894), and *Jimmy Goldcoast* (1924), Helen B. Sandwell's *Valley of Colour Days* (1924) and the animal stories of Sir Charles G. D. Roberts and Ernest Thompson Seton.

Thomas Chandler Haliburton (*q.v.*) stands in a class by himself. In many respects he is the most striking figure in Canadian literature. He is best known as a humorist. But there is more than humour in Haliburton's books. He lacked, in fact, but one quality to make him a great novelist: he had no conception of how to construct a plot. But he knew human nature, and knew it intimately in many of its phases; he could construct a character and endow it with life; his people talk naturally and to the point; and many of his descriptive passages are admirable. Those who read Haliburton's books only for the sake of their humour will miss much of their value. His inimitable *Clockmaker* (1837) as well as such of his later books as *The Old Judge* (1849), *The Attaché* (1843), *Wise Saws and Modern Instances*

(1853) and *Nature and Human Nature* (1855), are mirrors of colonial life and character.

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CANADIAN LITERATURE (IN FRENCH). Early in the 20th century, French Canadian literature entered upon a period of revival and rapid progress. This should not, however, be allowed to obscure the fact that important works were produced earlier, and laid the foundation for the intellectual movement of the 20th century.

The French language was introduced by the colonists of the 17th and 18th centuries, and has been preserved down to the present day in great purity by all groups of French Canadians, particularly those of the French province of Quebec. Some of the older forms of the language have been preserved more accurately than in France itself; for linguistic development has been less rapid in Canada owing to the smaller number of persons who speak French and their distance from the mother country. Canadian French has, moreover, been enriched by new words of Canadian origin. About 1860 several writers, living in the province of Quebec, combined to form an intellectual movement which led to an improvement in the quantity and quality of French Canadian literature. The leaders were the Abbé Raymond Casgrain, Antoine Gérin-Lajoie, Hubert Larue and Joseph-Charles Taché.

Even before this time, however, there were writers whose works deserve to be remembered, and whose influence made itself felt on those who followed them. One of the most important names in the early history of French Canadian literature is that of Etienne Parent (1802–74), who was for many years editor of the first French Canadian journal *Le Canadien*, and who was also the author of a number of articles on political and social questions.

History.—The eloquent *Histoire du Canada* of François-Xavier Garneau (1809–66) (*q.v.*), which began to appear in 1845, is, in spite of its defects, a standard work which still retains its value. Garneau did not have access to all the sources of information which modern research has made available, and his style is sometimes over-enthusiastic, but his history formed the basis of all the historical studies written after it. Somewhat later than Garneau, the Abbé J.-B. A. Ferland (1805–65) published a *Cours d'Histoire du Canada* which gives an excellent account of French rule in the country.

One of the principal historians of the early period of French Canadian literature is Antoine Gérin-Lajoie (1824–82) who published a well-documented political study entitled *Dix ans d'Histoire du Canada, 1840–1850*, describing the struggles which preceded the setting up of responsible government after the Act of Union between Upper and Lower Canada in 1840.

The Abbé Raymond Casgrain (1831–1904) was a historian who combined learning with imagination. His works include skilfully composed descriptions of episodes in national history, such as *Pèlerinage au Pays d'Evangeline* (1885), *Montcalm et Lévis* (1891) and *Une Seconde Arcadie* (1894).

Benjamin Sulte (1841–1923) belonged to the generation of Canadian historians who explored both the wider and the more detailed aspects of history. After publishing *L'Histoire des Canadiens-Français* (1882–84) he wrote a number of studies and monographs on special problems of Canadian history. Joseph-Edmond Roy (1858–1913) was undoubtedly one of the most painstaking historians of the end of the last century. His *Histoire de la Seigneurie de Lauzon*, in five volumes, contains most valuable information on the history of popular manners and customs.

In the 20th century history continued to be the most important branch of French Canadian literature. More rigorous scientific methods were, however, adopted. The Abbé Auguste Gosselin wrote the history of the Catholic Church in Canada in the form of episcopal monographs. Mgr. Amédée Gosselin, archivist of the Laval University of Quebec, published an abundantly documented study, *L'Instruction au Canada sous le régime français* (1911).

Sir Joseph Chapais, professor at the Laval University of Quebec, has won a place among French Canadian historians by his numerous works, which are notable for their objective character. He published monographs on *Jean Talon*, commissioner of the king of France in Canada (1904) and on the *Marquis de Montcalm* (1911). He then published his *Cours d'Histoire du Canada* in four volumes, dealing with the English rule from 1760–1850, which is dedicated to the Laval University. His great authority as a historian is largely due to his careful research work combined with the vitalizing influence of strong feeling and a lofty style.

The Abbé Lionel Groulx, professor at the University of Montreal, has published historical works which a strong nationalist tendency sometimes prevents from being altogether reliable. Among them are *La Confédération Canadienne* (1918); *La Naissance d'une Race* (1919), *Lendemains de Conquête* (1920) and *Vers l'Emancipation* (1921).

Poetry.—Canadian poetry found its first inspiration in national history. The earliest poetic school which arose at Quebec was a school of patriotic poetry. This was one of the manifestations of the literary movement of 1860.

Octave Crémazie (1827–79) (*q.v.*), the first French Canadian poet, wrote patriotic verse inspired by memories of the French régime. *Le Chant du vieux Soldat Canadien* was one of his most popular poems with his fellow-countrymen, who shared his attachment to France and to their own French origin. His *Drapeau de Carillon* celebrates a victory of Montcalm. He also wrote poems dealing with European events, such as *La Guerre de Crimée* and *Castelfidardo*. He wrote a certain number of philosophical poems, including *Les Morts* and *La Promenade des Trois Morts*. Louis Fréchette (1839–1908) (*q.v.*) surpassed the older poet in the variety and in the quality of his work. The French Academy crowned his *Fleurs boréales* (1879) and *La Légende d'un Peuple* (1887). Fréchette also published other volumes of lyric poetry, including *Les Oiseaux de Neige* (1879) and *Feuilles volantes* (1891). Influenced by Victor Hugo, he attempted the epic style in *La Légende d'un Peuple*. He took those events and those personalities which best represented the glories of French Canadian history, and wove them into an epic of his country. *La Légende d'un Peuple*, although it is sometimes too rhetorical in style, won an immense success.

Pamphile Lemay (1837–1918) was another of the followers of Crémazie. Although he had genuine lyrical feeling, he wrote with too much facility and without sufficient care. His early volumes, *Essais poétiques* (1865), *Les Vengeances* (1875), *Une Gerbe* (1879) and *Petits Poèmes* (1883) bear traces of artistic negligence. His talent is best illustrated by his volume of sonnets *Les Gouttelettes* (1904). Lemay's principal theme is Canadian life with its traditions, its picturesque customs and its religious faith. He was undoubtedly a precursor of the *Terroir* school of recent years, which records with loving care the humble but picturesque aspects of French Canadian popular life.

William Chapman (1850–1917), a contemporary of the two last-mentioned poets and a member of the Quebec school, celebrated the glorious past of the French Canadians in his volume *Les Aspirations* (1904). His style is sometimes rather strained; there is more sincerity and feeling in his *Rayons du Nord* (1910) and *Fleurs de Givre* (1912).

Other members of the patriotic school inaugurated by Crémazie are Alfred Garneau (1836–1904), who published his *Poésies*, Adolphe Poisson (1849–1922), author of *Heures Perdues* (1894), *Sous les Pins* (1902), and *Chants du Soir* (1917), and M. Nérée

Beauchemin, author of *Floraisons matutinales* (1897) and *Patrie intime* (1928). Alfred Garneau tends toward a more intimate style of lyric poetry, characterized by greater delicacy of form, thus preparing the way for a new school, consisting mainly of Montreal poets, which now came into existence.

Emile Nelligan, whose poetic career was unfortunately cut short by illness, published a number of psychological poems in 1903 which showed a certain morbidity of temperament, but a high degree of poetic talent. Albert Lozeau (1878–1924) is the most important and at the same time the most prolific of the Montreal psychological school. His volumes of verse, *L'Ame Solitaire* (1907), *Le Miroir des Jours* (1912) and *Les Images du Pays* (1926), contain meditations on love, suffering, nature and Canadian life. Paul Morin, in *Le Paon d'Email* and *Poèmes de Cendre et d'Or*, writes in a descriptive style; his main interest is in line and colour. His verse is impersonal, objective and largely exotic. His versification is of high quality; in this respect some of his poems surpass anything which French Canadian literature has produced. Jean Charbonneau, author of *Les Blessures*, *L'Age de Sang* and *Les Prédestinés*, and Albert Dreux, author of *Les Soirs* and *Le Mauvais Passant*, derive their inspiration from psychological study and from the love of nature.

Soon, however, there arose another poetical school which has greater affinity with the Quebec school. Its inspiration is patriotic, and it finds its subjects in the picturesque features of popular life, customs and traditions. Madame Blanche Lamontagne is the best poet of this group, which has been called the *Terroir* school. Her best-known volumes are *Par nos Champs et nos Rives* (1917), and *La Vieille Maison* (1920). Her poetry is full of sincere feeling, and shows great variety. Other poets of this school are Albert Ferland, author of *Canada chanté*, Englebert Gallèze, who wrote *Chemins de l'Ame* (1910), and Alphonse Desilets, author of *Mon Pays, mes Amours* (1913) and *Dans la Brise du Terroir* (1922). The Abbé Arthur Lacasse, who published *Heures Solitaires* (1916), *L'Envol des Heures* (1919) and *Heures Sereines* (1927) belongs both to the religious and to the *Terroir* schools.

Novels and Essays.—The Canadian novel made its appearance at the same period as history and poetry. Philippe Aubert de Gaspé (1786–1871) published *Les Anciens Canadiens* in 1863; this is a novel of manners, in which the author gives an account of the old customs and traditions of the country. Another novel of manners, *Jean Rivard* (1864) by Antoine Gérin-Lajoie (1824–82) (*q.v.*), not only depicts the life of a settler, but is also intended to show that it is the duty of young Canadians to remain on the land, and not to emigrate to the industrial towns of the United States.

There are not many French Canadian novels of great importance. Among the most successful novelists may be mentioned Joseph Marmette (1844–95), who wrote a number of historical novels, and Laure Conan (1845–1924), whose psychological novels include *Angeline de Montbrun* (1884), *L'Oublié* (1902) and *La Sève Immortelle* (1924). Among later writers, M. Ernest Choquette (1862–1941), with his *Les Ribaud* (1898) and *Claude Paysan* (1899), R. de Roquebrune with *Les Habits Rouges* (1923), *Les Dames Le Marchand* (1927) and Harry Bernard with *La Terre Vivante* (1925) and *La Maison vide* (1926) have all produced works in which history and descriptions of manners are combined with psychological analysis.

French Canadian literature includes a large number of essays and travel sketches which have achieved considerable success. Faucher de Saint-Maurice (1844–97), a writer of great imagination and sensitiveness, wrote mainly travel impressions: *De Québec à Mexico* (1866), *A la Brunante, Contes et Récits* (1874), *De tribord à babord* (1877) and *Loin du Pays* (1889).

Arthur Buies (1840–1901) is undoubtedly the greatest master of the essay; he is notable for his witty and lively style. His principal works include *Chroniques, Humeurs et Caprices* (1873), *Chroniques, Voyages* (1875) and picturesque studies in descriptive geography such as *L'Outaouais supérieur* (1889), *Au Portique des Laurentides* (1891) and *La Vallée de la Matapédia* (1895).

Napoléon Legendre (1841–1907) and Ernest Gagnon (1834–1915) wrote interesting studies of manners and history. Adolphe Routhier (1839–1920) left a considerable body of critical and other writings. *A travers l'Europe* (1881 and 1883), *A travers l'Espagne* (1889), *De Québec à Victoria* (1893) and *Québec et Lévis* (1900) may be specially mentioned. He also wrote a novel on a Biblical subject, *Le Centurion* (1909). Adolphe Routhier is notable for the taste and artistry of his prose style. One of the most polished prose writers is Adjutor Rivard, the author of popular artistic sketches, *Chez nos Gens* (1918).

Philosophy and Criticism.—One of the characteristics of the revival of French Canadian literature in the 20th century is the development of philosophical and critical literature. There were few important philosophical works until recently, when Mgr. Louis-Adolphe Paquet, professor at the Laval University of Quebec, published a series of social and religious studies written in a classical style: *Principes généraux du droit public de l'Eglise* (1908), *L'Eglise et l'Education* (1909), *L'Organisation religieuse et le pouvoir civil* (1912), *L'Action religieuse et la loi civile* (1915) and five series of *Etudes et appréciations*. M. Henri Bourassa, leader of the nationalist school, has published a number of political studies written in a style of great vigour, including *Que devons-nous à l'Angleterre?* (1915) and *Hier, Aujourd'hui, Demain* (1916). Somewhat earlier, Edmond de Nevers (1862–1906) made valuable contributions to sociology and history: *L'Avenir du peuple canadien-français* (1896) and *L'Ame Américaine* (1900).

Not much of importance has been produced in the sphere of political oratory except the speeches of Sir Wilfrid Laurier, who excelled as a parliamentary speaker. The chief representatives of academic eloquence are Adolphe Routhier and Sir Joseph Chapais. A religious speaker of great power was Mgr. Paul-Eugène Roy (1859–1926), archbishop of Quebec. His published speeches, *Discours patriotiques et religieuses* (1926), *Action Sociale catholique et Tempérance* (1927) and *Apôtres et Apostolat* (1927) show great dialectical power combined with imagination and a graceful style.

Practically the first exponent of literary criticism in Canada was Mgr. Camille Roy. He was the first to make a systematic study of French Canadian literature and its history. Henri d'Arles has also made valuable contributions to criticism with his *Essais et Conférences* (1910), *Nos Historiens* (1921) and *Louis Fréchette* (1925).

The branch of French Canadian literature which has made least progress is the drama. No important theatrical works have as yet been produced. French Canadian literature is nevertheless in a flourishing condition at the present time. During the last 20 years there has been great progress in almost all branches of literary activity.

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CANADIAN NATIONAL RAILWAYS, 23,790-mi. long railway system operated by the Dominion Government of Canada. The system, the largest in America in point of miles of road operated, was formed of five separate railways. Two of these, the Intercolonial and the National Transcontinental, were built by the Dominion Government as instruments of national policy. The other three, the Canadian Northern, the Grand Trunk, and the Grand Trunk Pacific, were privately owned systems whose impending bankruptcy at the time of the 1914–1918 World War impelled the Government to come to their aid with financial assistance which reached such proportions that their taking over by the

Government followed as a matter of course. The system is operated as a unit under a board of seven directors appointed by the Dominion Government; the president, chief operating officer of the company, is chairman of the board. General offices are at Montreal, Quebec.

Unlike nationally owned or controlled railways of most other countries, the Canadian National system has not a railway transportation monopoly; over a large part of its territory the system meets keen competition from private railways, as well as from waterway and highway carriers. Every province, and every important city and town, inland and ocean port of Canada, is served by the Canadian National's railway lines; adjacent sections of the United States are also served by the system's lines. Railway equipment at Dec. 31, 1939, included 2,562 locomotives, 88,903 freight cars, 3,158 passenger-train cars, and 6,205 service cars. During the year 1939, 10,144,749 revenue passengers and 45,691,284 tons of revenue freight were carried. Operating revenues of the above system for the year 1939 amounted to $203,820,186. Separately operated, but closely allied, is the Canadian National (West Indies) Steamships service between eastern Canada and Bermuda, West Indies and Caribbean ports. Separately operated is the Canadian National-owned Trans-Canada Air Lines giving service between east Canada and the Pacific Coast. (S. J. H.)

CANADIAN PACIFIC RAILWAY COMPANY operates a railway extending across Canada from Halifax on the Atlantic coast to Vancouver and Victoria on the Pacific, and by a network of branch lines reaches practically every town and city in the Dominion. By its own Atlantic and Pacific fleets it provides under one management a direct artery of communication between Europe and Asia. It was built to unite the scattered provinces of Canada into an economic, as well as a political confederation. The construction of the line was begun by the Dominion Government in fulfilment of an agreement made with the Province of British Columbia in 1871 to secure construction of a transcontinental line. Progress as a Government undertaking was unsatisfactory, and it was decided to turn the project over to private capital. A syndicate headed by Lord Mount Stephen, first president, Sir William Van Horne, Lord Strathcona and others was given ten years in which to build it. In the face of tremendous physical and financial difficulty, and great opposition, the main line from Montreal to the Pacific was finished in five years, the last spike being driven on Nov. 7, 1885. Settlement of Canada's west by the company followed. Mileage of lines owned, leased and operated in Canada is 17,169·4; lines controlled and separately operated in Canada 69·6, and United States 3,832·7, a total of 21,071·7; passenger and freight liners on the Atlantic 14; on the Pacific 4; coastal, lake and river steamships 37; hotels owned and operated 14; lodges 6. The company, in conjunction with the Canadian National Railways, participates in the new Vancouver Hotel. It operates and owns its sleeping, parlour and dining cars, also owns and operates a telegraph and cable company and an express company, covering every important point in the world. The company builds most of its own rolling stock and engines. Total investment in property at Dec. 31, 1939 was $1,192,288,990. Capitalization: ordinary capital stock authorized $500,000,000; issued $335,000,000; 4% preference $137,256,921; 4% debenture stock $295,438,228, funded debt $209,153,126. The head office is in Montreal, Quebec. (E. W. B.)

CANADIAN PRESS, THE. About 100 daily newspapers in the Dominion of Canada form The Canadian Press, which cooperatively collects and distributes news over a net-work of 12,000mi. of leased wires. Members appropriate about $780,000 annually to cover the cost of this news service. The Canadian Press operates in close relation to the Associated Press. Both are mutual and non-profit making. Between them there is an exchange of news. For foreign news, The Canadian Press has a bureau at London receiving Reuters and Press Association services and its New York bureau receives the Associated Press and Havas reports.

CANADIAN ROCKIES CIRCLE TOUR, as its name implies, extends loop-fashion from Calgary, Alberta, Canada, through eastern British Columbia as far east as Macleod and back to Calgary. It covers 567m. in its course and twice crosses the continental divide of the Rocky mountain system, following the Trans-Canada highway throughout most of its length.

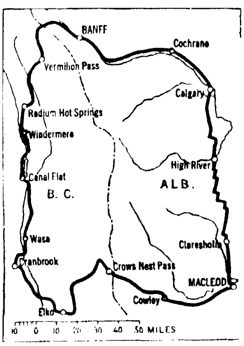
CANAL CRAFT: *see* Barges and Canal Craft.

CANALE or CANALETTO, ANTONIO (1697–1768), Venetian painter, born on Oct. 18, 1697, was educated under his father, Bernard, a scene-painter of Venice, and for some time followed his father's profession. In 1719 he went to Rome, to study architecture. On his return home he devoted his powers to painting, finding subjects in the architecture of his native city, which he painted with a clear and firm touch, with magnificent perspective and mastery of colour. He resided some time in England, in 1746 and in 1753. The National Gallery, London, has five pictures by him, notably the "View on the Grand Canal, Venice," and the "Regatta on the Grand Canal." He died on April 20, 1768. Among his pupils, whose work passed at an early date under the misleading title of "Canaletto," were Francesco Guardi, Michele Marieschi, Antonio Visentini, Zattaglioni and Columbini. Bellotto (commonly named Bernardo), who is also sometimes called Canaletto (1724–1780), was his nephew and pupil, and painted with deceptive resemblance to the style of the more celebrated master.

CANALEJAS Y MENDEZ, JOSÉ (1854–1912), Spanish politician, was born in Ferrol on July 31, 1854. He graduated (1871) at the university of Madrid, took his doctor's degree (1872), and became a lecturer on literature (1873). He entered his father's engineering works and studied railway problems, but continued his literary work, publishing a history of Latin literature in two volumes. He was elected deputy for Soria in 1881, became under-secretary for the prime minister's department under Posada Herrera (1883), minister of justice (1888), and of finance (1894–95). He was president of the chamber in the Moret administration, and became prime minister and chief of the Liberal party in 1910. He was murdered in Madrid on November 12, 1912, while in office. Canalejas believed in the possibility of a monarchy open to a thoroughgoing democratic policy both in economic and in civil and political matters. A sincere Catholic, he was nevertheless a strong anti-clerical, and a champion of the rights of the State against the encroachments of the Church. By his death the Spanish Liberal party lost the only statesman capable of uniting it under one definite programme.

CANALIS (sometimes Canal), in architecture, the depressed portion of the band whose spiral curvature forms the volute of the Ionic capital (*see* Order).

CANALS AND CANALIZED RIVERS. A canal is an artificial watercourse used for the drainage of low lands (*see* Drainage of Land), for irrigation (*q.v.*), or more especially for the purpose of navigation by boats, barges or ships. For canalized rivers *see* below. Traffic on inland waterways and international agreements affecting them are dealt with in the article Inland Water Transport. *See* also the articles on particular rivers, canals and places; *e.g.*, Thames; Meuse; Kiel, etc.



CANADIAN ROCKIES CIRCLE TOUR

Early History of Canals.—Probably the first canals were made for irrigation, but in very early times they came also to be used for navigation, as in Assyria and Egypt. The Romans constructed various works of the kind; Charlemagne projected a system of waterways connecting the Main and the Rhine with the Danube; while in China the Grand Canal, joining the Pei-ho and Yang-tse-Kiang and constructed in the 13th century, formed an important artery of commerce, serving also for irrigation. But although it appears from Marco Polo that inclines were used on the Grand Canal, these early waterways were for the most part only practicable between points that lay on nearly the same level, no method being known of conveniently transferring boats from one level to another; and inland navigation could not become generally useful until this defect had been remedied by the employment of locks.

Doubts exist as to the person, and even the nation, that first introduced locks. Some writers attribute their invention to the Dutch, holding that nearly a century earlier than in Italy locks were used in Holland, where canals are very numerous owing to the favourable physical conditions. On the other hand, the contrivance has been claimed for engineers of the Italian school, and it is said that two brothers Domenico of Viterbo constructed a lock chamber enclosed by a pair of gates in 1481, and that in 1487 Leonardo da Vinci completed six locks uniting the canals of Milan. In any case the introduction of locks in the 14th or 15th century gave a new character to inland navigation.

The Languedoc canal (canal du Midi), which connects the Bay of Biscay with the Mediterranean, may be regarded as the pioneer of the canals of modern Europe. It has 119 locks in a length of 148 miles and rises to an elevation of 620ft. above sea-level, its depth being about 6½ feet. It was designed by Baron Paul Riquet de Bonrepos (1604–80) and was finished in 1681. With it, and the still earlier Briare canal (1604–42), France began that policy of canal construction which has provided her with over 3,000 miles of canals, in addition to over 4,600 miles of navigable rivers. In Russia Peter the Great undertook the construction of a system of canals about the beginning of the 18th century, and in Sweden a canal with locks, connecting Eskilstuna with Lake Mälaren, was finished in 1606. In England the oldest artificial canal is the Foss Dyke, a relic of the Roman occupation. It extends from Lincoln to the river Trent near Torksey (11m.), and formed a continuation of the Caer Dyke, also of Roman origin but now filled up, which ran from Lincoln to Peterborough (40m.). Camden in his *Britannia* says that the Foss Dyke was deepened and to some extent rendered navigable in 1121. Little, however, was done in making canals in Great Britain until the middle of the 18th century, though before that date some progress had been made in rendering some of the larger rivers navigable. In 1759 the duke of Bridgewater obtained powers to construct a canal between Manchester and his collieries at Worsley. This work, of which James Brindley was the engineer, was opened for traffic in 1761, and there followed a period of great activity in canal construction, which, however, came to an end with the introduction of railways. In the United States the first canal was made in 1792–96 at South Hadley, Mass., and canal building was carried on with great activity from the beginning of the 19th century until about 1837, when the advent of railways checked their development. Out of a total of over 4,500 miles of canals built, mostly in New York, Pennsylvania and Ohio, 2,444 miles were out of use or abandoned in 1911.

The canals made in the early days of canal-construction were mostly of the class known as *barge* or *boat canals* and, owing to their limited depth and breadth, were only available for vessels of small size. But with the growth of commerce the advantage was seen of cutting canals of such dimensions as would enable them to accommodate sea-going ships. Such *ship canals* are referred to in the last section of this article.

BARGE CANALS

Choice of Line.—In laying out a line of canal the engineer is more restricted than in forming the route of a road or a railway. Gradients being inadmissible, the canal must either be made on one uniform level or must be adapted to the general rise or fall of the country through which it passes by being constructed in a series of level reaches at varying heights above a datum line, each closed by a lock, or some equivalent device, to enable vessels to be transferred from one to another To avoid unduly heavy earthwork, the reaches must follow the bases of hills and the windings of valleys, but from time to time it will become necessary to cross a depression by the aid of an embankment or aqueduct, while a piece of rising ground or a hill may involve a cutting or a tunnel. Sharp bends must be avoided, the permissible radius of curves depending on the dimensions of the vessels for which the canal is designed and the width of the waterway.

Aqueducts.—Brindley took the Bridgewater canal over the Irwell at Barton by means of an aqueduct of three stone arches, the centre one having a span of 63ft., and Thomas Telford arranged that the Ellesmere canal should cross the Dee valley at Pont-y-Cysyllte partly by embankment and partly by an aqueduct 1,000ft. long and 127ft. above the river, consisting of a cast-iron trough supported on iron arches with stone piers. In the building of the Manchester Ship Canal it became necessary to replace Brindley's aqueduct at Barton, which was only high enough to give room for barges, by a swing aqueduct, the first of its kind, to allow shipping to pass in the canal under it. (*See* MANCHESTER SHIP CANAL.)

Tunnels.—One of the earliest canal tunnels was made in 1766–77 by Brindley at Harecastle on the Trent and Mersey canal. It is 2,880yd. long, 12ft. high and 9ft. wide, and has no tow-path, the boats being propelled by men ("leggers") lying on their backs and pushing with their feet against the tunnel walls. This tunnel was in 1928 out of use owing to subsidence due to coal workings. Traffic is now worked through a second tunnel, parallel to this but 16ft. high and 14ft. wide, including a tow-path, which was finished by Telford in 1827. Standedge tunnel, on the Huddersfield canal, is over three miles long, and is still (1928) worked by "leggers." Tunnels on Continental canals, especially in France, are numerous and of much larger dimensions than those on English canals. One, on the St. Quentin canal, 6,200yd. long, is 26¼ft. wide and 22¾ft. high. The Royaulcourt tunnel on the Nord canal (completed 1923) is 4,757yd. long, 33ft. wide and 28¼ft. high, with an enlarged passing place in the middle. The largest canal tunnel in the world is that at Rove (fig. 8) near Marseille. (See *Ship Canals* below.)

Dimensions.—The dimensions of a canal, apart from considerations of water-supply, are regulated by the size of the vessels which are to be used on it and, to some extent, by their speed. According to J. M. Rankine (*Manual of Civil Engineering*), the depth of water and sectional area of waterway should be such as not to cause any material increase of the resistance to the motion of the boats beyond what would be encountered in open water, and he laid down the following rules as fulfilling these conditions:—

Least breadth of bottom	=2 × greatest breadth of boat.
Least depth of water	=1½ ft. + greatest draught of boat.
Least sectional area of waterway	=6 × greatest immersed midship section of boat.

Rankine was considering the small barges in use in his day, but his proportions are still very generally accepted. In large modern canals it is, however, usual to allow a greater clearance than 18in. under the boat, the amount increasing with the size and the speed of the vessels (*see* HYDRAULICS). The ratio of wetted cross-section of the canal to the immersed cross-section of boat varies in modern canals from 4:1 to 6.5:1. The larger the ratio, the less will be the erosion of the banks, which increases with the speed of vessels. The ordinary inland canal in England is commonly from 18 to 30ft. wide at the bottom, 30 to 45ft. at the water level, with a depth of 3½ to 5 feet. The early continental canals were a little larger, being usually designed for boats of 100 tons or more. In some recent French canals a depth of 8½ft. and a width of 39½ft. at a depth of 6½ft. have been adopted for the waterway; and the locks, designed for two barges in line, are 280ft long and 19·7ft. wide. The tendency on all continental waterway systems has been, since the last decade of the 19th century, to increase the ruling dimensions of both canals and canalized rivers in order to allow a larger proportion of the craft using the great free rivers, such as the Rhine, to navigate the locked waterways. In Germany, for instance, canals have been constructed with a width of 69ft. and upwards.

Canal Banks, etc.—To retain the water in porous ground, and especially on embankments, a watertight lining of puddle clay must be provided on the bed and sides of the channel, or some other means, such as a lining of concrete, adopted to prevent leakage (fig. 1). The difficulty of maintaining canals on embankments is always a serious one even on banks of quite moderate height.

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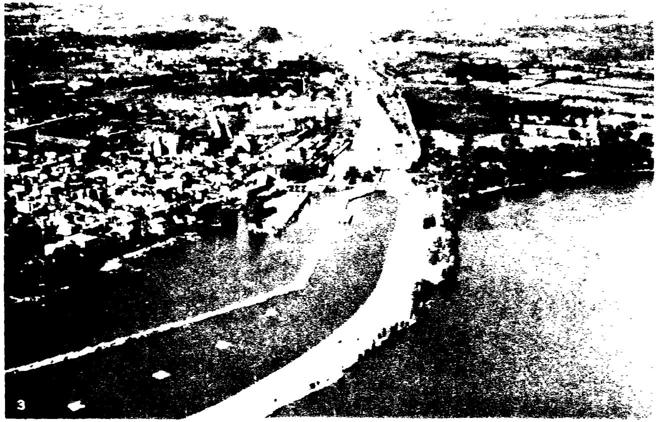

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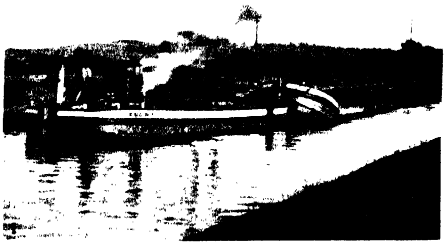
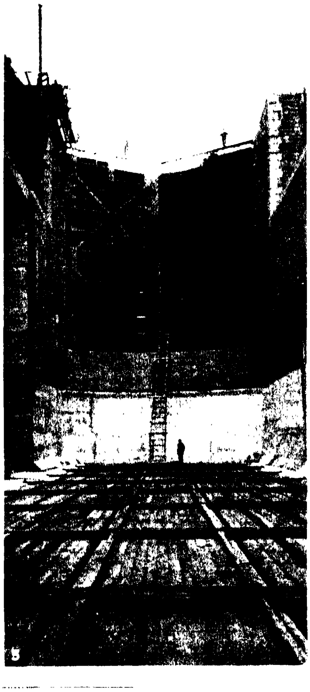
BY COURTESY OF (1) DIRECTEUR GENERAL DES PONTS ET CHAUSSEES (2) THE REICHSZENTRALE FUR DEUTSCHE VERKEHRSWERBUNG (3) THE CANADIAN NATIONAL RAILWAYS, OFFICIAL PHOTOGRAPH ROYAL CANADIAN AIR FORCE PHOTOGRAPH, (4) INTERNATIONAL

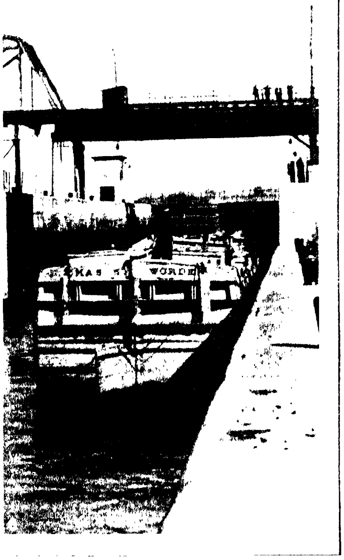
CANALS OF EUROPE AND NORTH AMERICA

1. Liége canal at Maestricht, Holland, showing the basin and canal craft
2. Entrance to the Elbe-Trave canal at Lubeck, Germany
3. The Lachine canal near Montreal, showing entrance locks at upper end
4. The All-American canal, largest irrigation ditch in the U.S.A., built to reclaim approximately 1,000,000ac. in Southern California

CANALS AND CANALIZED RIVERS







BY COURTESY OF (1) GENERAL MANAGER, AIRE AND CALDER NAVIGATION; (3) DIRECTEUR GENERAL DES PONTS ET CHAUSSÉES; (4) THE CHIEF ENGINEER, RIVER TRENT NAVIGATION; (5) THE SWEDISH GOVERNMENT ENGINEER; PHOTOGRAPH (2, 6) EWING GALLOWAY

CANAL SHIPPING IN INDUSTRIAL CENTRES

1. A train of compartment boats on the way to Goole in Yorkshire, England, by way of the Aire and Calder Navigation. The compartment boats, which are loaded with coal, are shown towed by a tugboat. Each compartment holds 40 tons; the tow represents 700 800 tons of coal

2. The junction of the Neckar and Rhine rivers outside of Mannheim. The factories of Mannheim, an important industrial city of Germany, are benefited by the cheap canal and river transport on these waterways

3. Belgium lock at Cappelle au Bois, situated along the canal which originates at Brussels and flows into Le Rupel river

4. Lock at Hazleford on the Canalized River Trent with three barges and internal combustion tug

5. The Trollhätte Ship canal, Sweden. One of the three locks of the Trollhätte canal is shown under construction before the admission of water. The internal dimensions of all three locks are 321x45 feet. Each is over 50 ft. deep from coping to floor. In filling and emptying the lock, the water passes through the floor openings which connect with the culverts

6. Barges in lock 9 of the New York State barge canal. This canal, which is a reconstruction of the old Erie canal, connects the Hudson river at Troy with Lake Erie at Buffalo

The sides of canals are usually sloped, the angle varying with the nature of the soil from 1 in 1½ to 1 in 3 or even flatter. In rock cuttings the sides are often nearly vertical. To prevent the erosion of the sides by the wash from boats it is usual to protect the banks at and near the water line by stone rubble or pitching, concrete or brick paving or fascine work, in some cases combined with continuous piling (figs. 1 and 2). A berm—a narrow level strip along the bank at or just under the water level—is sometimes formed in the bank to minimize the effect of wash (fig. 2).

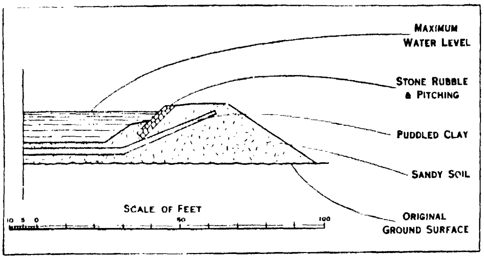


FIG. 1 HALF CROSS-SECTION OF A PORTION OF THE DORTMUND-EMS CANAL, BUILT ON EMBANKMENT OF PERVIOUS MATERIAL

Water Supply.—If there be no natural lake in the district for storage and supply, or if the engineer cannot draw upon some stream of sufficient size, he must form artificial reservoirs in suitable situations. They must be situated at such an elevation that the water from them may flow, through feeders, to the summit-level of the canal; and, if the expense of pumping is to be avoided, they must command a sufficient catchment area to supply the loss of water from the canal by evaporation from the surface, percolation through the bed, leakage at gates and lockage. Since the consumption of water in lockage increases both with the size of the locks and the frequency with which they are used, the difficulty of finding a sufficient water supply may put a limit to the density of traffic possible on a canal or may prohibit its locks from being enlarged so as to accommodate boats of the size necessary for the economical handling of the traffic under modern conditions. It may be pointed out that the up consumes more water than the down traffic. An ascending boat on entering a lock displaces a volume of water equal to its submerged capacity The water so displaced flows into the lower reach of the canal and, as the boat passes through the lock, is replaced by water flowing from the upper reach. A descending boat in the same way displaces a volume of water equal to its submerged capacity, but in this case the displaced water flows back into the higher reach where it is retained when the gates are closed.

Some economy of water in locking may be effected by using side ponds (*see* below); but, nevertheless, it is necessary in the case of some canals to resort to pumping in order to supply deficiencies, particularly in dry seasons and on summit levels. There are many canal pumping installations in France, Germany and England. Electric power has been utilized for pumping in some plants.

Waste-weirs and Stop-gates.—An essential adjunct to a canal is a sufficient number of waste-weirs to discharge surplus water accumulating during floods. The waste-weirs are placed at the top water-level of the canal, so that when a flood occurs the water flows over them and thus relieves the banks. Culverts, when constructed under a canal embankment to pass streams and flood water, must be of ample dimensions (*see* WEIR).

Safety or stop-gates are necessary at intervals for the purpose of dividing the canal into isolated reaches so that, in the event of a breach, the gates may be shut, and the discharge of water confined to the reach intercepted between two of them. In broad canals these stop-gates may be formed like lock gates; or in small works they sometimes consist of thick planks slipped into grooves. Self-acting gates have been tried but have not proved trustworthy. Stop-gates consisting of a horizontally framed steel shutter of the width of the canal, suspended from an overhead bridge and counterbalanced, are used on some modern canals: these can be lowered by means of gearing into grooves built in the canal sides.

Locks.—In large locks, as well as in most of the small locks of modern construction, the sluices by which the lock is filled or emptied are carried through the walls, but in many old locks the sluices consist of small openings in the gates.

The gates, generally of oak in old canals, but more usually of steel in large canals and those of later date, fit into recesses of the walls when open, and close against sills in the lock bottom when shut. In small narrow locks single gates only are necessary; in large locks pairs of gates are required, fitting together at the head or "mitre-post" when closed. The vertical timber at the end of the gate is known as the "heel-post," and at its foot is a casting that admits an iron or steel pivot which is fixed in the lock bottom, and on which the gate turns. Iron straps round the head of the heel-post are let into the lock-coping to support the gate. The gates are opened and closed by balance beams projecting over the lock side in the case of many small locks and by hand gearing in others. Electrically operated machines are largely employed on canals of modern construction in America and on the continent of Europe for opening and closing lock gates and sluices (*See* also DOCKS.)

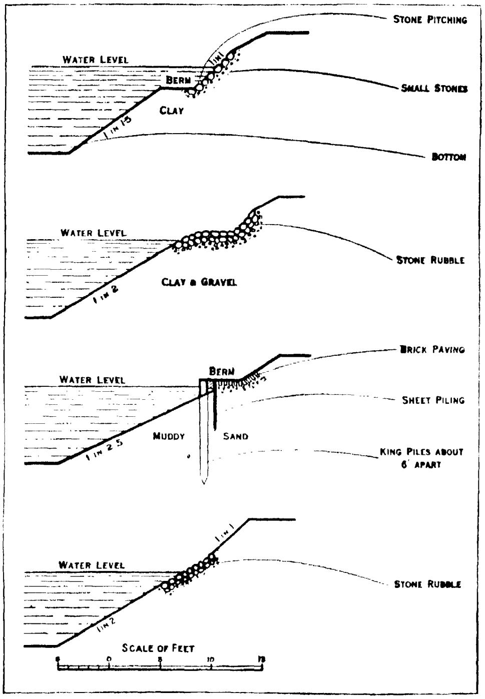


FIG. 2.—CROSS-SECTION OF BARGE CANAL BANKS, SHOWING THE SLOPING SIDES, THE STONE RUBBLE TO PROTECT AGAINST WASH, AND THE BERM, A NARROW LEVEL STRIP THAT INCREASES THE CROSS-SECTIONAL AREA OF THE AVAILABLE CHANNEL IN CANALS LIABLE TO FLOOD WATER

In order to economize water, canal locks are made only a little larger than the largest vessel they have to accommodate (*see* below: *Canal Barges* and *Modern Canal Development*). In many canals constructed since 1900, however, provision is made for admitting a train of barges; such long locks have sometimes intermediate gates by which the effective length is reduced when a single vessel is passing (fig. 6).

The lift of canal locks, *i.e.*, the difference between the levels of adjoining reaches, rarely exceeded 12ft. up to the end of the 19th century and in some locks the lift is as little as 1½ft. The modern practice is to build one lock with high lift in preference to a flight of shallower locks in all cases where the configuration of the ground and considerations of water supply allow of this being done. In Germany, for instance, there is at least one lock with a lift of over 65ft., and lifts of 20 to 40ft. are not uncommon in America and on the continent of Europe.

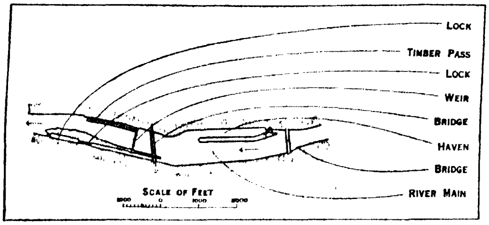


FIG. 3.—PLAN OF LOCKS, WEIR AND HAVEN, ON THE RIVER MAIN, NEAR FRANKFORT

To save water, especially where the lift is considerable, side ponds are sometimes employed. They are reservoirs into which a portion of the water from a lock-chamber is run and stored instead of being discharged into the lower reach, and it is used once more for partially filling the chamber. The consumption of water is in some cases reduced by this means by 50%. Double locks, may also be used to save water, since each serves as a side pond to the other, and to save time, since vessels can pass up and down simultaneously.

Lateral Canals.—The name "lateral canal" is given to an artificial navigable locked waterway, constructed at the side of or near to the course of a river, which for varying reasons, such as the presence of rapids or falls, is not navigable and may be unsuitable for canalization or improvement. A lateral canal draws its supply of water from the river with which it is connected, and is, in fact, a "by-pass," vessels entering it from the river at the higher end and re-entering the river at its lower end or vice versa. There are many examples of lateral canals in Canada, notably those connected with the river St. Lawrence, also in the United States and on the continent of Europe, particularly in France.

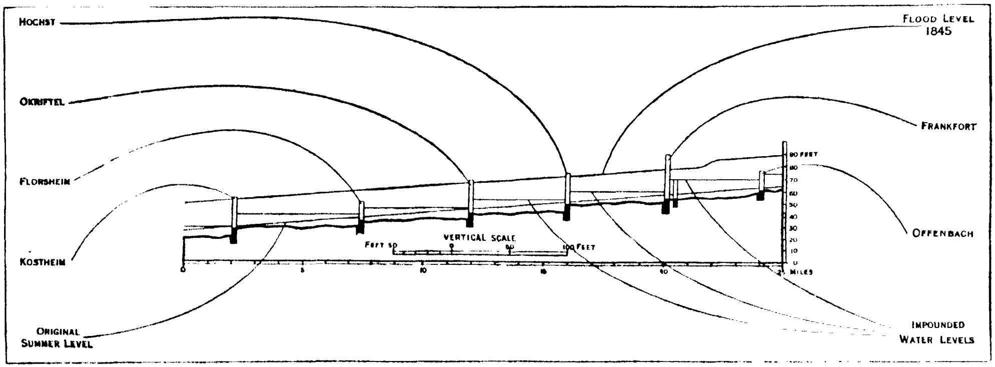


FIG. 4.—LONGITUDINAL SECTION OF CANALIZED RIVER MAIN, BETWEEN OFFENBACH AND KOSTHEIM, GERMANY, SHOWING THE WEIRS AND LOCKS WHICH DIVIDE THE RIVER INTO A SERIES OF LEVEL REACHES

Inclines.—Economy of water can be effected by the use of inclined planes or vertical lifts in place of locks. In China rude inclines appear to have been used at an early date, vessels being carried down a sloping plane of stonework by the aid of a flush of water or hauled up it by capstans. On the Bude canal (England), now abandoned, this plan was adopted in an improved form for small boats. Another expedient, often adopted as an adjunct to locks where many small pleasure boats have to be dealt with, is to fit the incline itself with rollers, upon which the boats travel; and at Boulter's lock on the Thames an electric conveyor is provided on the inclines. In some early cases boats were conveyed on a wheeled trolley or cradle running on rails. This plan was formerly in use on the Morris canal (New Jersey), built in 1825–31, in the case of 23 inclines, the rise of each varying from 44 to 100 feet. Between the Ourcq canal and the Marne, near Meaux, the difference of level is about 40ft., and small barges weighing about 70 tons are taken from the one to the other on a wheeled cradle over an incline nearly 500yd. long. Heavy loaded barges are, however, apt to be strained by being supported on cradles in this way, and to avoid this objection an incline carrying a tank on wheels filled with water in which the barge floated, was constructed about 1840 on the old Chard canal (England), now abandoned. Ten years later a similar incline was adopted on the Monkland canal in Scotland, where two tanks were used, one going up while the other was going down, counter-balancing each other. The power required was provided by steam engines.

Lifts.—Vertical lifts can only be used instead of locks at places where the difference in level occurs in a short length of canal, since otherwise long embankments or aqueducts would be necessary to obtain sites for their construction. An early example was built in 1809 at Tardebigge on the Worcester and Birmingham canal.

At Anderton a lift was erected in 1875 to connect the Weaver navigation with the Trent and Mersey canal, which at that point is 50ft. higher than the river. The lift is a double one, and can deal with barges up to 100 tons; the vessels are water-borne in a wrought-iron tank 75ft. long and 15½ft. wide. Until 1908 the tanks were raised and lowered by means of hydraulic rams but in that year electric power was substituted, each of the two tanks being counter-balanced by weights and operated by electric winches. (*See* J. A. Saner, *Proc. Inst. C.E.*, vol. clxx., 1910.) A similar hydraulic lift, completed in 1888 at Fontinettes on the Neuffossé canal in France, can accommodate vessels of 300 tons, a total weight of 785 tons being lifted 43ft.; and a still larger example on the Canal du Centre at La Louvière in Belgium, built in 1888, has a rise of 50ft., with tanks that will admit vessels up to 400 tons, the total weight lifted amounting to over 1,000 tons This lift, and three others of the same character, which, however, were not completed until 1921 although commenced many years before, overcome the rise of 217ft. which occurs in this canal in the course of 4¾ miles.

The La Louvière lifts are the only examples constructed in Europe since 1899, when the Henrichenburg lift on the Dortmund-Ems canal was opened. The latter raises barges of 600 tons carrying capacity through a height of 46 feet. The single tank is 223 x 28ft. internally, the depth of water being 8¼ feet. The operation of the lift is effected by an ingenious arrangement of balancing floats immersed in deep tank-shafts. At Peterboro, Ontario, there are two hydraulic barge-lifts constructed about 1908. Neither lifts nor inclines are in use in the United States.

Generally speaking, canal constructors, both in America and on the continent of Europe, have, for many years, shown a decided preference for high-lift locks to either mechanical lifts or inclines.

Canal Barges.—The following table gives particulars of some of the typical barges in use on European canals and canalized rivers. (*See* also below: *Modern Canal Development.*)

	Length. Ft.	Beam. Ft.	Draft, laden. Ft.	Carrying capacity. Tons.
England.				
Canal boat	70–72	7	3·25	30
Barge	60–72	14	3·25	60
France.				
Péniche-Flamande (on standard canals) . .	Up to 126	16·4	5·0	300
Chalands (on the Seine and other important canalized rivers)	110–167	16·4 to 26	6·6 to 10	300–600
Grand Chalands (on the Seine and other important canalized rivers) .	173 to 200	26·5	10·6 (max.)	Up to 1,000
Belgium.				
Barge on standard canals	123 to 128	16·6	7·6 (max.)	300–375
Rhine boats (on some canals and canalized rivers) .	135 to 157	21–25	..	300–500
Germany.				
On most of the canals east of Berlin .	180	26·25	5·5	400
On most of the canals west of Berlin . . .	213	26·25	6·0 to 6·5	600

Speed of Haulage on Canals.—The horse or mule walking along a towpath and drawing or tracking a barge by means of a towing rope, still remains the typical method of conducting traffic on the smaller canals, not only in England, but on the continent of Europe. Horse traction is very slow; the maximum speed is about 3m. per hour, and the average, which, of course, depends largely on the number of locks to be passed through, much less.

At speeds over *c.* 3m. per hour the "wash" of the barge begins to cause erosion of the banks and thus necessitates the employment of protective measures which are commonly provided in all canals of modern construction (*see* above). Moreover the tractive effort required to haul a barge increases with the speed at a rate which much exceeds a direct proportion; and careful trials carried out in France and Germany since 1909 show that, on barge canals, a speed greater than 3m. or 3½m. per hour is uneconomical as regards both haulage and maintenance costs. The speed on French canals is limited to five km. (3·11m.) per hour; and a tug or tractor with its tow of barges usually does from 13 to 18m. per day on the average (including going through locks). The speed limitations (1928) on German, Belgian and Swedish canals are on a par with the French. It may be noted in passing that, in towing or hauling barges on a canal, the tractive force per barge decreases with the number of barges in tow.

Tugs and Self-propelled Barges.—Steam towage was first employed on the Forth and Clyde canal in 1802, when a tug-boat fitted with engines by W. Symington drew two barges for a distance of 19½ miles in six hours in the teeth of a strong headwind. Tugs are only economical where there are either no locks, or locks either large enough to admit the tug and its train of barges simultaneously or spaced at long intervals: otherwise the advantages are more than counter-balanced by the delays in locking. On the Bridgewater canal, which has an average width of 50ft. with a depth of 5½ft., and has no locks for its entire length of 40 miles except at Runcorn, where it joins the Mersey, tugs tow four barges, each carrying 60 tons, at a rate of nearly 3m. per hour.

On the Aire and Calder navigation, where the locks have a minimum length of 215ft., a large coal traffic is carried in trains of boat-compartments. The boats are nearly square in shape, except the leading one which has an ordinary bow. They are coupled together so that they can move both laterally and vertically; and a wire rope in tension on each side enables the train to be steered. No boat crews are required, the crew of the tug regulating the train. Each compartment carries 35 tons, and the total weight in a train varies from 700 to 900 tons. On the arrival of a train at Goole the boats are detached and discharged into sea-going ships by means of cradles and hydraulic hoists.

Barges self-propelled by steam-power were first tried on the Forth and Clyde canal by Symington as early as 1789. Since 1910 the use of internal combustion motors as a means of propulsion on canals has considerably increased. Even on the smaller canals many barges in all parts of the world are now self propelled.

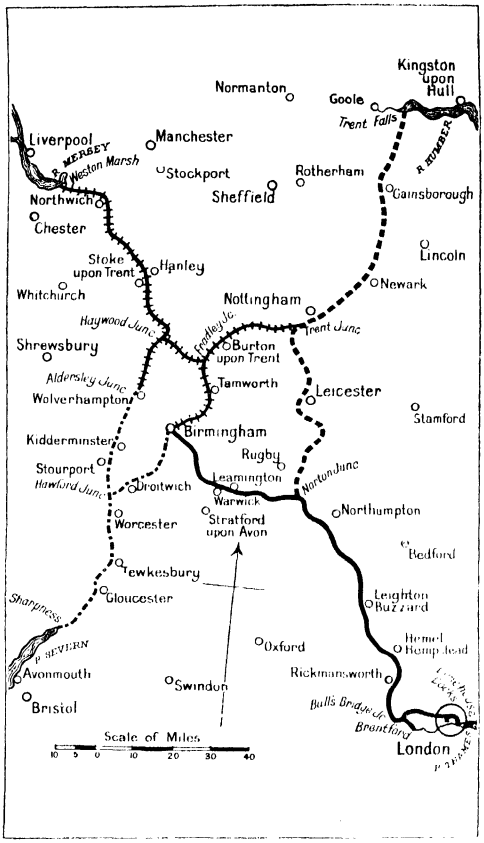


FIG. 5 INLAND WATERWAYS AND CANALS, RECOMMENDED BY THE BRITISH ROYAL COMMISSION, 1909, FOR ENLARGEMENT TO TAKE BARGES OF 100 TONS CARRYING CAPACITY

The four groups of waterways, shown by different lines, were known as "The Cross"

Mechanical Traction on Canals.—In several long tunnels and deep rock cuttings in France where no towpaths have been provided, recourse has been had to a submerged chain which is passed round a drum on a tug; this drum is rotated by steam power and thus the tug is hauled through the reach. The same system is in use on the Regents Canal (London) for towing barges through the Islington tunnel. In the Mont-de-Billy tunnel, at the summit level of the Aisne-Marne canal, a system of cable-traction was established in 1893, the boats being taken through by being attached to an endless travelling wire rope supported by pulleys on the towpath.

Small locomotives running on rails along the towpath were tried, towards the end of the 19th century, on the Shropshire Union canal, where they were abandoned on account of practical difficulties in working. About the same time similar experiments were made on canals in France and Germany, where, however, the financial results were not satisfactory. On portions of the Teltow canal, joining the Havel and the Spree, electric tractors run on rails along both banks, taking their current from an overhead conductor; they attain a speed of 2½m. an hour when hauling two 600-ton barges. Electricity is also utilized for working the lock gates and for various other purposes along the route of this canal. Electric tractors are also employed on the Charleroi canal (Belgium), and petrol tractors on the Bourgogne canal (France).

Since about 1923 on the Canal du Nord, between St. Omer and Janville, electric tractors running on rails on the bank haul 300-ton barges in groups of two or more. On the Calais-St. Omer section light caterpillar road tractors of the Citroën type were established in 1925 for hauling two or more loaded barges. Electric rail tractors are also employed on sections of the St. Quentin and other canals in the north of France, and were experimented with on the Liege-Antwerp canals in Belgium in 1919, but soon abandoned. Mechanical traction has not developed in so marked a manner as towage; and, on the whole, the results do not show any considerable decrease in cost compared with other haulage or towage, nor has the speed of the boats been materially increased. The cost of installing and working a system of electric rail traction is only justified in cases where, as on some of the canals in the north of France, the traffic is intense; on the St. Quentin canal the traffic intensity before the war amounted to between six and seven millions of tons per annum and in 1926 had nearly returned to six millions. On the Nord system light tractors are preferred for the less busy sections. Electric capstans are provided at many French and a few Belgian and Dutch canal and river locks for facilitating the passage of barges. In some cases little use appears to be made of these facilities.

Inland Ports.—In the early days of canals the equipment of terminal and intermediate wharves at which goods in transit were handled was of the simplest description The modern canal or other inland waterway, on the other hand, must provide adequate terminal and intermediate port facilities in the nature of lay-byes, wharves, warehouses, crane equipment, etc., if a large traffic has to be handled; or, alternatively, such facilities must be furnished by municipalities or local or private enterprise.

CANALIZED RIVERS

Rivers whose discharge is liable to become quite small at their low stage, or which have a somewhat large fall, as is usual in the upper part of rivers, cannot be given an adequate depth for navigation by regulation works alone; and their ordinary summer level has to be raised by impounding the flow with weirs at intervals across the channel (*see* Weir and River and River Engineering), while a lock (*q.v.*) has to be constructed alongside the weir, or in a side channel, to provide for ships (fig. 3). A river is thereby converted into a succession of fairly level reaches rising in steps up-stream, and providing a comparatively still-water navigation like a canal; but it differs from a canal in the introduction of weirs for keeping up the water-level and in the provision for the regular discharge of the river at the weirs Canalization secures a definite available depth for navigation; and the discharge of the river is generally ample for maintaining the impounded water-level, as well as providing the necessary water for locking. The navigation, however, is liable to be stopped during the descent of high floods, which in many cases rise above the locks (fig. 4); and it is necessarily arrested in cold climates on all rivers by long, severe frosts, and especially on the break-up of the ice. (This also applies to canals, even in England; and the suspension of traffic during prolonged frosts is one of the disadvantages, compared with railways, under which canals have to operate.)

Many small rivers, like the Thames above its tidal limit, have been rendered navigable by canalization; and several fairly large rivers have thereby provided a good depth for vessels for considerable distances inland. Thus the canalized Seine has secured a navigable depth of 10½ft. from its tidal limit up to Paris, a distance of 135 miles and a depth of 6½ft. up to Montereau, 62 miles higher up. Regulation works for improving the river Main, from its confluence with the Rhine opposite Mainz up to Frankfurt, failed to secure a minimum depth of 3ft. at the low stage of the river, and canalization works, carried out between 1883 and 1900 by means of six weirs in the 26½ miles between the Rhine and Offenbach, above Frankfurt, provided a minimum depth of 8¼ feet. (*See* below for other references.)

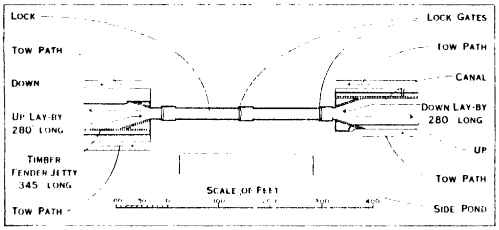


FIG. 6.—PLAN OF TYPICAL LOCK ON THE CANAL DU NORD, FRANCE
The lock is 279 ft. long, but an intermediate gate, shown in the centre of the drawing, is used when a short lock chamber suffices for the passage of barges

On ascending a river it becomes increasingly difficult to obtain a good depth by canalization owing to the progressive inclination of the river-bed. Thus, even on the Seine, with its moderate fall, a depth of 10½ft. has been obtained on the Lower Seine by weirs placed on the average 13½m. apart, but on the Upper Seine weirs are required at intervals of only about 4½m. to attain a depth of 6½ft.

MODERN CANAL DEVELOPMENT IN EUROPE AND AMERICA

Accounts of the canal systems will be found in the articles on the various countries: in this section some modern developments in connection with canals and canalized rivers are briefly referred to.

Great Britain.—When the era of railways commenced British waterways had attained to the highest point of their prosperity. As the development of the railway system advanced, many of the canal companies were alarmed for the future and sold their undertakings to the railway companies, who in 1906 owned 1,138m. out of a total of 3,902m. of inland waterways in the United Kingdom; the latter figure including about 1,500m. of canalized rivers. These figures were practically unchanged in 1928. Public interest in the canal problem led to the appointment in 1906 of a Royal Commission to report on the canals and inland navigations of the Kingdom. (In England there is a particular meaning attached to the word *navigation* which implies a canalized river; *e.g.*, the Weaver Navigation, as distinct from an artificial canal.) Its report, published in 1909, was not unanimous and the recommendations of the majority of its members have not since been acted upon by the Government. The most important proposals were, (*a*) the creation of a Waterways Board, which was to acquire and manage the principal canals of England, and (*b*) the improvement of the main canal and river routes, linking the Mersey, Humber and Severn estuaries and the Port of London respectively with Birmingham and the Midlands, to the standard necessary for 100-ton barge traffic or alternatively for 300-ton barges. The system of canals proposed to be thus improved came to be known as "the Cross" (fig. 5). (*See* the *Reports*, *Evidence*, etc., Royal Commission on Canals and Waterways, 1906–09, 11 vol., particularly *Final Report* Cd. 4979 [1909].)

Comparison of British waterways with those of the continent of Europe often leads to fallacious conclusions unless the important differences, natural and economic, are recognized. In those parts of Europe where inland navigation is most successful, the canals are to a large extent feeders of, or links joining up, large and important rivers either free or canalized; and further, the average length of haul is immensely greater than in England, the water supply is usually abundant, and the country generally flatter and in many respects less developed. Moreover, the continental waterways receive, either directly or indirectly, substantial subsidies from the State and are protected in most countries against railway competition. The improvement of the river Trent, between Newark and Nottingham, a small section of one of the routes proposed for enlargement by the Commission, was, however, carried out between 1921 and 1926, and the construction of four new locks on this portion of the river enables 120-ton barges to navigate from the Humber as far as Nottingham.

France.—The Canal du Nord, begun in 1907, and 58 miles long, connects the Sensée canal at Arleux and the Oise canal at Noyon. It is noteworthy on account of its considerable rise and fall, crossing two watersheds, its 19 locks, some of which have a rise of 21½ft., and two long tunnels. The water supply is obtained by pumping, by means of electricity, from reach to reach the waters of the Sensée, the Somme and the Oise. The minimum bottom width is 33ft., the depth 8⅙ feet. It is the best example of the improved standard type of 300-ton barge canal in France. The locks, 279ft. by 19·6ft. internally, taking two barges and a tug at once (fig. 6), are provided with cylindrical sluices and single-leaf gates all worked electrically. The works, which were wrecked in the course of the War, were completed in 1923.

Holland.—The principal inland navigations in Holland are the rivers and canals between the North Sea, the ports of Rotterdam and Amsterdam and the German frontier. Many improvements have been effected in the Dutch waterways since 1910; those affecting barge canals being in most cases such as will permit the navigation of the large Rhine barges carrying 2,000 tons. The largest of these vessels are about 400ft. in length with a *maximum* beam of about 46ft. and draught of 12 feet. The locks are constructed with internal dimensions, 855ft. by 52½ft., and a depth over sills of 12½ft.; they accommodate two long barges and a tug in line ahead. Intermediate gates are provided for use in single barge locking. One of these large locks can usually be emptied or filled in about five minutes.

One of the most important of these new or improved waterways is that from Nijmegen to Maastricht. It is made up of the Meuse-Waal canal, completed 1927, the canalized Meuse and the Juliana canal. The standard canal section adopted is 130ft. bottom width, 196ft. at water level with side slopes of 1 in 3 and depths of from 11 to 13 feet. Electric pumping plant has been installed to deal with excess of flood water in the canal portions. Five locks have been constructed in a length of about 67 miles of the canalized Meuse. These locks have weirs with navigation openings about 200ft. in width which can be used for the passage of barges when the water level is high.

Central Europe.—The navigation of the upper reaches of the Rhine above Strasbourg is complicated by clause 358 of the Treaty of Versailles by which France is authorized to build a lateral canal alongside the Rhine between Basle and Strasbourg and to draw water from the river for the production of electric power. Before the War the Swiss had built an inland port at Basle in anticipation of the improvement of the river channel below that town which is normally navigable only during the summer season by barges of small draught. Three distinct methods of providing an improved navigation are possible: (a) improvement of the river by regulation and deepening, (b) canalization of the river, and (c) the construction of a lateral canal. Swiss and German opinion favoured one or other of the two first alternatives: the French pressed strongly for the last. Prolonged discussion ended in 1925 in the approval by the Central Commission of the Rhine being given both to the carrying out of river improvements by Switzerland and Germany and to the construction by France of the lateral canal which must be navigable and as free as the river itself. The first section of the canal, that between Basle and Kembs, was begun by France, with the concurrence of Switzerland, in 1927. This section is probably the most important from the point of view of navigation, as it avoids the Istein rapids below Basle. The canal and its lock will accommodate Rhine barges of over 1,200 tons capacity.

The enlargement of the waterways system connecting the Rhine and the Danube, by way of the Main, was commenced by Germany in 1921, and was (1928) in course of alteration by the improvement of certain existing river and canal navigations and the construction of some new canals. The enlarged waterways are intended for barges carrying from 1,200 to 1,500 tons.

United States of America.—The total length of improved navigable rivers in the United States is now upwards of 23,500 miles. At least 40 distinct and separate rivers have been improved by canalization. (*See* Col. E. H. Schulz, U.S. Army, *International Congress of Navigation Proceedings*, 1923.) Since 1900 an immense amount of improvement of the inland waterways, both natural and artificial, has been accomplished. As a rule, canalization is well inland, the lower and middle reaches of the great rivers being open navigations. For instance, on the Hudson, the first lock is at Troy, 153 miles from the sea; on the Mississippi, at Keokuk 1,461 miles; on the Tennessee, 1,339 miles; and on the Missouri there is open navigation to Fort Benton, Montana, 3,555 miles from the Gulf of Mexico. The construction of locked waterways near seaports to connect ocean traffic with inland navigations is comparatively modern. The New Orleans Industrial canal and the Lake Washington canal at Seattle (*see* below) are examples.

When traffic on American rivers began to be intense, recourse was had to extensive canalization in cases where shallow water and limited flow gave rise to difficulties either seasonal or continuous. Among the rivers so improved are the Ohio, with its tributaries, the Allegheny and Monongahela; the Kanawha, West Virginia; the Kentucky in Kentucky; the Cumberland in Kentucky and Tennessee; the Tennessee in Kentucky, Tennessee and Alabama; the Black Warrior and Tombigbee in Alabama; the Columbia River in Oregon and Washington, and the Mississippi above Keokuk.

The locks on the Ohio are among the largest on the great rivers of the United States. The river improvements carried out since 1910 include the construction of 50 locks between Pittsburgh and Cairo, a distance of 968 miles. The cost of the improvements exceeded $100,000,000. Each lock is 600 x 110ft. internally, with depth over sills ranging from 9 to 12 feet. The lift of the majority of the locks varies from 6 to 12ft., but one, completed in 1921, has a lift of 29 feet. A navigable depth of 9ft. is secured throughout by the construction of weirs, with movable crests, one at each lock. The movable weirs secure the advantages of open river navigation when the natural depth in the channel is 9ft. or more

The Keokuk lock, the lowest on the Mississippi, was completed in 1913. In this case the dam was constructed primarily as a part of a hydro-electric power project. The lock, 380x110ft. internally, with 7ft. over the sills, has a considerable lift—41 feet. The upper gate is of floating-caisson type and is operated by compressed air.

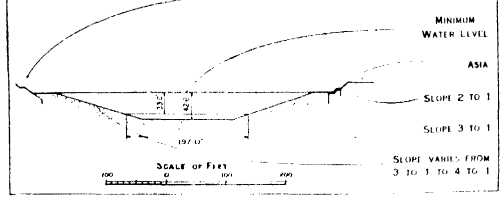


FIG. 7—CROSS-SECTION OF THE ENLARGED SUEZ CANAL, SHOWING A MINIMUM DEPTH OF 42½ FT., AND A MINIMUM WIDTH, AT DEPTH OF 33 FT., OF 197 FEET. THE ENLARGEMENT WAS IN PROGRESS IN 1928

Apart from the river improvements effected by the Federal Government, which controls all navigable rivers, several of the States have undertaken canal work; the most notable instance being the reconstruction, by New York, of the old Erie canal which now forms the New York State barge canal. This work, carried out between 1905 and 1918, at a cost, including branches and terminals completed subsequently, of over $170,000,000, connects the Hudson river at Troy with Lake Erie at Buffalo.

(*See* N. E. Whitford, *History of the Barge Canal of New York State*, and the *Book of Plans*, published by N.Y. State, Albany, 1921–22.) Altogether, including branch canals and the Lake Champlain section, there are 525 miles of canal proper, with 57 locks. Ships and barges up to 300ft. in length and 44½ft. beam can navigate the canal. Some of the barges using it have a cargo capacity of 2,500 tons. All the locks have a depth of 12ft. over sills, and the maximum lift in any one is 40½ feet. All lock and other machinery is operated electrically and the canal and its terminal ports are equipped in lavish manner with mechanical appliances. There is at Oswego, on this canal, a novel and interesting system of siphons for emptying and filling the lock chamber. The traffic on the canal, up to 1928, had not justified the expenditure on its construction.

Locks and Weirs in U.S.A.—Since 1910 practically all locks on inland waterways in the United States have been constructed of concrete. No mechanical lifts or inclined planes are in use, and no provision is made at any of the locks for mechanical haulage of vessels through them. Electric locomotives for rack traction are, however, employed for towing ships through the locks of the Panama canal. The large majority of the navigable waterways of the States being rivers of very variable flow, the provision of dams or weirs with sluices has usually been necessary in conjunction with lock construction, and many of these works are of considerable magnitude. Steel lock gates of the double-leaf mitred type are adopted generally for new works; but rolling caisson gates are also used for closing many of the river locks, particularly at the upper ends of wide locks on rivers. The silting up of the caisson chambers has, however, given trouble in some cases; and their use has been abandoned in works carried out since 1916. "Tumbling" or flap gates ("bear trap") hinged on a horizontal axis have also been used in a few instances. Sluice valves are constructed in the lock walls and are frequently of the "butterfly" type, but Stoney gate sluices and cylindrical valves predominate. The practice of placing sluice valves in the gates has been abandoned. Movable weirs of the Chanoine and needle types were formerly much used, but in the dams and weirs of later construction some form of sliding or hinged sector gates has often been adopted. The Stoney sluice is typical of the first class and the Taintor gate of the second (*see* WEIR).

Canada.—The splendid inland navigation system of Canada mainly consists of natural lakes and rivers. Most of the artificial waterways are lateral canals cut in order to enable vessels to avoid rapids in the rivers. The earliest locked canal in America, completed in 1783, was made to avoid rapids on the St. Lawrence river between Lake St. Francis and Montreal. The lateral canals of the St. Lawrence have an aggregate length of about 46m., and afford a means of navigation from Lake Ontario to Montreal for all vessels which can pass the locks, which have usable dimensions of 270x44ft. with a depth of water of 14ft. on the sills (*see* GREAT LAKES).

SHIP CANALS

Ship canals, from an engineering point of view, chiefly differ from barge canals in the magnitude of the works they involve, but there is no definite line of distinction. For instance, the so-called Marseille-Rhône ship canal has approximately the same limiting structural dimensions as the New York State barge canal. Speaking generally, ship canals accommodate ocean going ships, within the limits of their dimensions, while barge canals are restricted, normally, to inland navigation craft and special types of coasting vessels. The terminal works of a ship canal, *e.g.*, sea approaches, locks, etc., are usually such as commonly form part of dock and harbour (*q.v.*) works.

Ship canals have mostly been constructed either to shorten the voyage between two seas by cutting through an intervening isthmus, or to convert important inland places into sea-ports. An early example of the first class is afforded by the Caledonian canal (*q.v.*) opened in 1822, while among later ones may be mentioned the Suez, Kiel and Panama canals (*qq.v.*). One of the earliest examples of the second class is the small ship canal between Sharpness and Gloucester, completed in 1827, and among later ones are the Manchester ship canal (*q.v.*) and the canal from Zeebrugge on the North Sea to Bruges (*q.v.*).

Isthmian canals may be either open cuttings, like the Suez canal, or locked canals as at Panama. Many have been enlarged since their first construction; and this in the case of a simple cutting can be effected by degrees and in stages; as for instance in the Suez canal, whose dimensions have been increased by dredging and in other ways from a depth of 26ft. and bottom width of 72ft. to minima of 39½ft. and 148ft. respectively. Further enlargement, sanctioned in 1921, to a minimum depth of 42½ft. and a minimum width of 197ft. (at a depth of 33ft.) was still in progress in 1928 (fig. 7). Locked canals, if they have to be enlarged, present a different problem, of which the North Sea-Amsterdam ship canal furnishes an example. This canal, which is 15½m. in length from Ymuiden on the North Sea to Amsterdam, was constructed between 1865 and 1876 to supersede the Great North Holland canal made early in the 19th century from the Texel Roads to Amsterdam. Originally it had a depth of 23ft., bottom width of 88½ft., and an entrance lock 394x60ft. internally. In 1896 a second sea lock, 738x82ft. and 33ft. deep over the sill at mean tide level, was constructed to meet the increased dimensions of shipping, and the entrance channel and canal section were enlarged. In 1921 further enlargement was undertaken; and the building of a new lock, the largest in the world (1928), was begun in the following year. It is 1,315ft. long, 164ft. wide and 50ft. deep over the entrance sill at mean tide level. The harbour and canal have been deepened to 40ft. and the canal widened to 246ft. at the bottom.

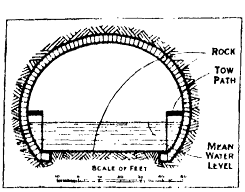


FIG. 8.—CROSS-SECTION OF THE ROVE TUNNEL, FRANCE, THE LARGEST TUNNEL SECTION IN THE WORLD

The new lock (completed 1928) is, in fact, considerably larger than is necessary for the near future; but its dimensions will allow the harbour to be deepened and the section of the canal to be still further increased.

The Cronstadt canal (1878–84), connecting the roadstead of Cronstadt with the port of Leningrad (Petrograd), is a channel 28ft. deep. It is dredged through the Neva bay and protected by lateral moles or embankments on either side for a great part of its length of about 18 miles.

The Corinth canal cut through the Isthmus of Corinth, which connects the Morea to the mainland of Greece, is four miles long and is without locks. The canal passes through high land, mostly rock, and the deepest cutting is 285 feet. A small difference in tidal ranges at the two ends causes a current through the canal which rarely exceeds two knots. The bottom width is 72ft. and the depth 26¼ft. below mean sea level. The cut was actually commenced in the time of Nero whose work was incorporated in the canal when it was completed between 1882 and 1893.

Belgium possesses several ship canals of moderate dimensions; the oldest is the Ghent-Terneuzen canal connecting the city of Ghent with the river Scheldt at Terneuzen, about 12m. above Flushing. Originally constructed during the years 1825–27, when Belgium was united with Holland, half of its length of 18 miles is now in Dutch and the other half in Belgian territory. It has been enlarged and now has a depth of 28½ft. with bottom width of 164ft., except in the Dutch section which is narrower but of the same depth. At Terneuzen there are three sea locks and near the Dutch frontier three regulating locks which are only used for flood water control. The canal is at one level throughout. Ships drawing 26–27ft. can navigate up to Ghent where an extensive and well equipped inland port has been constructed. The Roupel ship canal, between a tributary of the Scheldt and Brussels, where an inland harbour has been built, was opened in 1922. This waterway, 20m. long, has a minimum bottom width of 66ft. and a depth of 21 feet The three locks are 374x52½ft. internally. Ships drawing 18ft. can pass by the canal from the sea up to Brussels.

The Bruges ship canal (1896–1907) begins in the harbour of

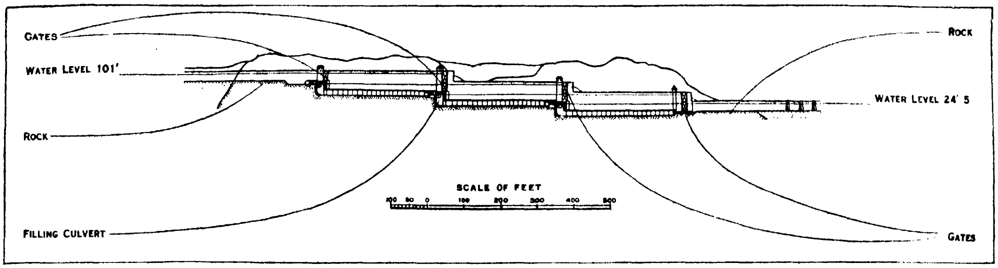


FIG. 9.—SECTION THROUGH LOCKS ON THE TROLLHATTE SHIP CANAL, SWEDEN
This canal completed in 1916, connects Gottenburg with Lake Vänern. The three locks shown overcome a total rise of 77ft., and are 321½ft. x 45ft. internally

Zeebrugge, on the Belgian coast, which was constructed at the same time. It connects this port with the city of Bruges, 6¼m. distant, where basins and quays for sea-going ships have been built. The entrance lock at Zeebrugge is 518x65½ft. internally and is closed by rolling caissons; the canal is 72ft. wide at the bottom, 229ft. at water level and 28ft. deep. The basins at Bruges are in communication with the canal system of Belgium.

Sweden possesses an abundance of lakes and rivers but, on account of the uneven nature of the country, the rivers generally are not naturally navigable and some of them have been canalized. The canal system dating, for the most part, from the middle of the 19th century, is extensive. In general the locks measure 117x24ft.x10ft. deep, but in some cases they are smaller. Three of these canals have been reconstructed as ship canals since the beginning of the 20th century.

The Trollhätte ship canal, completed in 1916, connects Göttenburg and the Kattegat with Lake Vänern in southern Sweden and is, for the most part, the canalized Göta river. It is remarkable for a flight of three contiguous locks overcoming a total rise of 77 feet. The canal is 52 miles long and the locks are 321½x45ft. internally with a depth of 18ft. The Göta canal, connecting Lakes Vänern and Vattern with the Baltic, having locks of less dimensions than those of the Trollhätte, enables small vessels to cross Sweden from Göttenburg to the Baltic.

The Södertälje canal between Lake Mälaren and the Baltic was reconstructed in 1924, the one lock being 450x67ft. and 27ft. deep. The canal itself was deepened in 1924 to take ships drawing about 20ft. and will be further enlarged, if required, up to the capacity of the lock.

The Hammarby canal, a short cut, completed in 1926, between Stockholm and Lake Mälaren, one of the larger Swedish lakes, has one lock with internal dimensions 358x57ft.x20¾ft. deep. The locks on the Södertälje and Hammarby canals are interesting as having balanced sector gates of a novel type, which uphold moderate heads of water on either side.

The Marseille-Rhône ship canal, commenced before the War but only partially completed in 1928, does not accommodate large sea-going vessels, but is designed to open up the port of Marseille to barge traffic on the Rhône and the inland navigation system of France generally. It also places Marseille in direct inland water communication with the Étang de Berre, an inland lake over 70 sq.m. in area, capable of considerable industrial development. The total length of the waterway is about 48m. and it extends from the harbour of Marseille to Arles on the Rhône, passing through the mountainous district of Nerthe by a tunnel at Rove, thence through the Étang de Berre to Port-de-Bouc where it connects with an old barge canal to Arles which was being enlarged in 1928. The canal is level throughout, but has two regulating locks and one, at Arles, between the river and the canal. These are 525ft. long and 52ft. wide. The waterway, normally 75ft. wide at bottom, is 10ft. deep in the completed sections. The Rove tunnel, nearly 4½m. in length, cut through rock, has a width of 72ft. and a height of 37ft. above the water level, the depth of water in the tunnel being 13 feet. The cross section is larger than that of any other tunnel in the world (fig. 8).

United States and Canada.—Important ship canals, in addition to the Panama canal (opened to traffic in Aug. 1914), have been made since the beginning of the 20th century. The New Orleans Industrial canal connects the Mississippi river with Lake Pontchartrain, 5½ mi. distant. It was completed in 1923 at a cost of over $25,000,000, and its construction was brought about mainly by the desire to provide increased waterside frontage at the port of New Orleans. Moreover, it forms part of a scheme (1928) for connecting New Orleans with the Gulf of Mexico by way of Lake Pontchartrain and a short artificial cut between the lake and the sea. The lock at the entrance to the canal is constructed on a foundation of 24,000 piles driven through a bed of very fine quicksand. The usable dimensions of the lock are 640x75ft., with 31ft. depth over sills at lowest water in the Mississippi river. The canal at its minimum section is 30ft. deep, 150ft. wide at bottom and 300ft. wide at water level.

The Lake Washington ship canal, eight miles long, extending from Puget sound to Lake Washington, was opened in 1916. The sea entrance at Seattle has two locks, the larger of which has a usable length of 825ft., with intermediate gates, and is 80ft. wide. The depth over the sill varies from 25 to 44ft. according to the state of the tide. Flood water is provided for by the construction of a dam with movable crest gates.

The Cape Cod canal, connecting Cape Cod bay on the east, with Buzzards bay on the west of the Cape Cod isthmus, is 7¾m. in length with dredged approaches which make the total length of the cut 13 miles. Its construction was begun in 1909 and the waterway was first opened to traffic in 1914, since when the works have been completed to give a depth of 25ft. at low water. There is at present no regulating lock on the canal; and on account of the difference in sea levels at the two ends there is at times a considerable current flowing through it. It provides a shorter route than the exposed open sea route between New York and Boston

For the St. Mary's Falls canal, or, more correctly, canals, connecting Lakes Superior and Huron at Sault Ste. Marie, and, the new Welland ship canal connecting Lakes Erie and Ontario in Canada, *see* GREAT LAKES. The canal itself is excavated to 25ft. depth with provision for a depth of 30ft. later. The cost of the new waterway was about $110,000,000.

The project for cutting a ship canal through the upper Florida peninsula, initiated by the state legislature in 1933 was approved early in September 1935 by President Roosevelt and $5,000,000 of PWA funds were allotted for the purpose.

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Improvement of Rivers (2nd ed., 1913) is the best modern work in English on canalized rivers (vol. ii.).

The most generally useful works in French are Paul Vidal, *Rivières Canalisées;* and O. Jacquinot and *F.* Galliot, *Canaux,* both volumes in section *Navigation Interieure* of the series "Encyclopédie de Génie Civil" *(1922).* For U.S.A waterways *see* the *Annual Reports* of Chief of Engineers U.S. Army and the *Reports* of the Commissioner on Inland Waterways, etc. (Washington, 1909–13).

See also the *Reports,* etc., of the Royal Commission on Canals, including vol iv which is a valuable report by Sir W H. Lindley on *Continental Waterways* and *Proceedings, Inst. C.E.* The *Reports* of the International Navigation congresses (1885 *et seq.*) contain valuable papers, particularly those of the Milan (1908), Philadelphia (1912) and London (1923) congresses. Exhaustive bibliographies were issued by the I.N.C. bureau, Brussels, 1908– . (N. G. G.)

CANANDAIGUA, a city of New York, U.S.A., at the northern end of Canandaigua lake, 30 mi. S.E. of Rochester; the county seat of Ontario county and a summer resort. It is on Federal highway 20, and is served by the New York Central and the Pennsylvania railways. Pop. (1940) 8,321. Institutions are the U.S. veterans' hospital; Clark Manor house, home for aged persons; Ontario County Historical museum, a public library and Brigham hall (mental sanatorium). Important industries are: enamelware, corsets, knitting, canning and grape culture. The city occupies the site of an Indian village (Kanandarque) which was destroyed by Gen. John Sullivan in 1779. It was settled in 1789, incorporated as a village in 1815 and as a city in 1913.

CANARD, a sensational story, hoax, or false report, especially one circulated by newspapers. This use of the word in France dates from the 17th century, and is said to have originated in the old expression, *vendre un canard à moitié,* to half-sell a duck, *i.e.,* to pretend to sell, to cheat.

CAÑARIAN, a group of tribes of South American Indians, supposed on very meagre evidence to constitute an independent linguistic stock. The Cañaris lived at the period of the Spanish conquest in the highlands of Southern Ecuador, from Alausi southward to the Jubones river, and extended west as far as the Gulf of Guayaquil. They were conquered and largely destroyed by the Incas in the course of expansion of their empire in the 15th century. The Cañaris were sedentary, agricultural folk, wearing poncho-like garments of cotton or woollen textiles, and living in thatched roof houses of poles plastered with mud. They were skilful workers in copper and gold. Their chief weapons were a wooden sword, a javelin and club. Chiefs were buried with much treasure in deep well-graves. In their religious ceremonies they practised human sacrifice (chiefly of children) on a scale rare in South America.

See F. G. Suarez, *Estudio historico sobre los Cañaris* (Quito, 1878).

CANARY, a passerine bird (*Serinus canarius*), belonging to the family Fringillidae or finches (*see* FINCH). It is a native of the Canary Islands and Madeira, where it occurs abundantly in the wild state, and is of a grayish-brown colour, slightly varied with brighter hues. It was first domesticated in Italy during the 16th century. Afterwards, the canary was the subject of careful artificial selection, the result being the production of a bird differing widely in the colour of its plumage, and even in size and form, from the wild species. The prevailing colour of most varieties of the canary is yellow. Size and form were also modified by domestication, the wild canary being not more than 5½ in. in length, while one well-known Belgian variety usually measures 8 in. There are also hooped or bowed canaries, feather-footed forms; and topknots, having a distinct crest on the head. Most of the varieties, however, differ merely in the colour and the markings of the plumage. Hybrids are common, the canary breeding freely with the siskin, goldfinch, citril, greenfinch and linnet. The hybrids thus produced are almost invariably sterile. In a state of nature canaries pair, but under domestication the male bird is polygamous. The canary is very prolific, producing three or four broods (of up to six eggs each) every year and in a state of nature it is said to breed still oftener. The work of nest-building and incubation falls chiefly on the female, while the duty of feeding the young rests mainly with the cock. The natural song of the canary is loud and clear. They readily imitate other birds. In Germany gramophone records of the nightingale's song have been used to train cocks to sing almost like nightingales. Their young learn the new type of song from their fathers. Canaries reared in the Harz mountains are most famous for their songs. A wild race, the serin (*S. c. serinus*) is common from northwest Africa and northern France to Asia Minor, coloured like a mule canary. (G. F. Ss.)

CANARY ISLANDS (*Canarias*), a Spanish archipelago in the Atlantic ocean; about 60 mi. W. of the African coast, between 27° 40′ and 29° 30′ N., and between 13° 20′ and 18° 10′ W. Pop. (in 1940), 680,294; area 2,894 sq.mi. The Canary Islands may be considered as two groups, one of which, including Tenerife, Grand Canary, Palma, Hierro and Gomera, consists of mountain peaks, isolated and rising directly from an ocean of great depth; while the other, comprising Lanzarote, Fuerteventura and six uninhabited islets, is based on a single submarine plateau, of far less depth. After the researches of Leopold von Buch the Canary Islands became classical ground to the student of volcanic action. Buch considered them to be representative of his "craters of elevation." In common with the other West African islands they are of volcanic origin. The lavas consist chiefly of trachytes and basalts.

Climate.—From April to October a north or northeast wind blows upon the islands, beginning about 10 A.M. and continuing until 5 or 6 P.M. In summer this wind produces a dense stratum of sea-cloud. In winter the islands are occasionally visited by a hot southeast wind from Africa, which is called the *Levante,* and sometimes brings locusts. In 1812 it is said that locusts covered some fields in Fuerteventura to the depth of 4 ft. The climate generally is mild, dry and healthy. On the lower grounds the temperature is equable, the daily range seldom exceeding 6°. At Santa Cruz the mean for the year is about 71°.

Fauna and Flora.—The indigenous mammals of the Canary Islands are very few in number. The dog, swine, goat and sheep were alone found upon the island by the Spanish conquerors. The ferret, rabbit, cat, rat, mouse and two kinds of bat have become naturalized. The ornithology is more interesting, on account not only of the birds native to the islands, but also of the stragglers from the African coast. Among the indigenous birds are some birds of prey, such as the African vulture, the falcon, the buzzard, the sparrow hawk and kite. There are also two species of owl, three species of sea mew, the stockdove, quail, raven, magpie, chaffinch, goldfinch, blackcap, canary, titmouse, blackbird, house swallow, etc.

The position of mountainous islands like the Canaries, in the subtropical division of the temperate zone, is highly favourable to the development, within a small space, of plants characteristic of both warm and cold climates. Buch refers to five regions of vegetation in Tenerife:—(1) From the sea level to the height of 1,300 ft. This he styles the African region. The climate in the hottest parts is similar to that of Egypt. Here are grown, among the other introduced plants, the coffee tree, date palm, sugar cane, banana, orange tree, American agave and two species of cactus; and among indigenous plants, the dragon tree on the northwest of Tenerife. A leafless and fantastic euphorbia, *E. canariensis,* and a shrubby composite plant, *Cacalia kleinia,* give a character to the landscape about Santa Cruz. (2) Between 1,300 ft. and 2,800 ft. This is the region of south European vegetation, the climate answering to that of southern France and central Italy, with vines and cereals. (3) The region of indigenous trees, including various species of laurel, *Ardisia, Ilex, Rhamnus, Olea, Myrica* and other trees found wild also at Madeira. It extends to the height of 4,000 ft (4) The region of the beautiful *Pinus canariensis,* extending to the height of 6,400 ft ; here the broad-leaved trees have ceased to grow, but aborescent heaths are found throughout its whole extent, and specimens of *Juniperus oxycedrus* may be met with (5) The region of Retama (*Cytisus nubigenus*), a species of white-flowering and sweet-scented broom, which is found as high as 11,000 ft. The number of wild flowering plants may be estimated at 900, upwards of 270 of which are peculiar to the Canaries

Inhabitants.—The Guanches (*q.v.*), who occupied the Canaries at the time of the Spanish invasion, no longer exist as a separate race. The present inhabitants are slightly darker than the people of Spain, but in other respects are scarcely distinguishable from them. The men are of middle height, well-made and strong.

Spanish is the only language in use. Fully 80% of the inhabitants could neither read nor write in 1900; but education later progressed more rapidly than in many other Spanish provinces. Good schools are numerous, and the return of emigrants and their children who have been educated in the United States tends to raise the standard of civilization. The sustenance of the poorer classes is chiefly composed of fish, potatoes and *gofio,* which is, as in Cuba, merely Indian corn or wheat roasted, ground and kneaded with water or milk.

Government.—The archipelago formed one Spanish province until 1927, when rivalry between the two chief ports of the island group, Las Palmas and Santa Cruz de Tenerife, caused it to be divided into two administrative districts. Appropriate civil and military officials reside in both capital cities. The province furnishes no men for the Spanish peninsular army, but its annual conscription provides men for the local territorial militia, composed of regiments of infantry, squadrons of mounted rifles and companies of garrison artillery—about 5,000 men all told. The archipelago is divided into two naval districts, commanded by royal navy captains.

Roman Catholicism is the official religion, and ecclesiastical law is the same as in other Spanish provinces. The convents have been suppressed and in many cases converted to secular uses. Laguna and Las Palmas are episcopal sees in the archbishopric of Seville.

Industry and Commerce.—Owing to the richness of the volcanic soil, agriculture in the Canaries is usually very profitable. Land varies in value according to the amount of water available, but as a rule commands an extraordinarily high price, irrigated land being worth ten or twelve times as much as the non-irrigable (*de secano*). Until 1853 wine was the staple product, and although even the finest brand (known as *Vidonia*) never equalled the best Madeira vintages, it was largely consumed abroad, especially in England. The annual value of the wine exported often exceeded £500,000. In 1853, however, the grape disease attacked the vineyards; and thenceforward the production of cochineal, which had been introduced in 1825, took the place of viticulture so completely that, twenty years later, the exports of cochineal were worth £556,000. France and England were the chief purchasers. This industry declined in the later years of the 19th century, and was supplanted by the cultivation of sugar-cane, and afterwards of bananas, tomatoes, potatoes, and onions. Bananas are the most important crop. Fishing is a very important industry, employing over 10,000 hands along some 600m. of the African coast, between Cape Cantin and the Arguin Bank. The chief ports are Las Palmas and Santa Cruz, which annually accommodate about 7,000 vessels of over 8,000,000 tons. In 1854 all the ports of the Canaries were practically declared free; but on Nov. 1, 1904, a royal order prohibited foreign vessels from trading between one island and another. This decree deprived the outlying islands of their usual means of communication, and, in answer to a protest by the inhabitants, its operation was postponed.

HISTORY

The Romans learned of the existence of the Canaries through Juba, King of Mauretania, whose account of an expedition to the islands, made about 40 B.C., was preserved by the elder Pliny. He mentions "Canaria, so called from the multitude of dogs of great size." Both Plutarch and Ptolemy speak of the Fortunate Islands, but from their description it is not clear whether the Canaries or one of the other island groups in the western Atlantic are meant (*see* ISLES OF THE BLEST). In the 12th century the Canaries were visited by Arab navigators, and in 1334 they were rediscovered by a French vessel driven among them by a gale. A Portuguese expedition, undertaken about the same time, failed to find the archipelago, and want of means frustrated a grandson of Alphonso X. of Castile, named Juan de la Cerda, who had obtained a grant of the islands and had been crowned king of them at Avignon, by Pope Clement VI. In 1402, Gadifer de la Salle and Jean de Béthencourt (*q.v.*) sailed with two vessels from Rochelle, and landed early in July on Lanzarote. Between 1402 and 1404 La Salle conquered Lanzarote and part of Fuerteventura, besides exploring other islands; Béthencourt meanwhile sailed to Cadiz for reinforcements. He returned in 1404 with the title of king, which he had secured from Henry III. of Castile. La Salle, thus placed in a position of inferiority, left the islands and appealed unsuccessfully for redress at the court of Castile. In Dec., 1406, Béthencourt left the Canaries, entrusting their government to his nephew Maciot de Béthencourt. Eight years of misrule followed before Queen Catherine of Castile intervened. Maciot thereupon sold his office to her envoy, Pedro Barba de Campos; sailed to Lisbon and resold it to Prince Henry the Navigator; and a few years afterwards resold it once more to Enrique de Guzman, count of Niebla. Jean de Béthencourt, who died in 1422, bequeathed the islands to his brother Reynaud; Guzman sold them to another Spaniard named Paraza, who was forced to re-sell to Ferdinand and Isabella of Castile in 1476; and Prince Henry twice endeavoured to enforce his own claims. In 1479 Spanish sovereignty over the Canaries was established by the Treaty of Alcaçova, between Portugal and Castile, and after much conflict the Spaniards under Pedro de Vera gained control over Grand Canary in 1483. Palma was conquered in 1491 and Tenerife in 1495. A movement for local autonomy in 1902 was suppressed by the troops from Spain. The islands thereafter were administered as a part of Spain. Under Primo de Rivera they were used as a place of exile for certain political opponents. In 1936 General Franco used the Canaries as the first base of the nationalist revolution, going from there to Spanish Morocco. (*See* SPAIN: *History.*)

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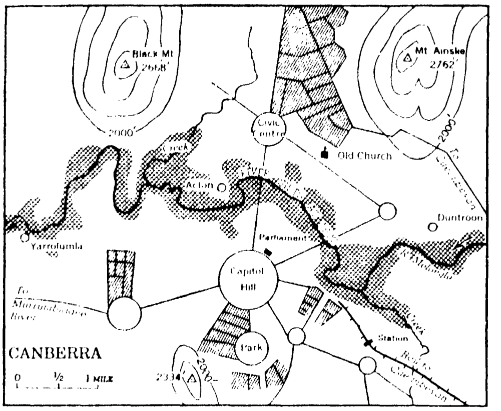
CANBERRA, the national capital of the Commonwealth of Australia, was established as the seat of Government under powers conferred by s. 125 of the Commonwealth Constitution Act, which received the assent of Queen Victoria on July 9 1900.

The provision for the establishment of a seat of Government was presented before the national conventions in various forms. The final convention, which agreed to a bill for submission to the people, sat in Melbourne from Jan. to March 1898. At a conference of premiers held in Melbourne in Jan. 1899 it was agreed and subsequently incorporated in s. 125 of the Constitution Act, that "The seat of Government of the Commonwealth shall be determined by the parliament, and shall be within territory which shall have been granted to or acquired by the Commonwealth, and shall be vested in and belong to the Commonwealth and shall be in the State of New South Wales, and be distant not less than 100 miles from Sydney. Such territory shall contain an area of not less than 100 square miles, and such portion thereof as shall consist of Crown lands shall be granted to the Commonwealth without any payment therefor."

Before the end of 1899 the Government of New South Wales appointed Alexander Oliver, president of the Land Appeal Court, a royal commissioner, to enquire into and report upon sites for the federal capital. Oliver submitted his report on Oct. 26 1900, and made Dalgety his first choice, and bracketed Canobolas (Orange) and Yass as his second choice. Not till Jan 14, 1903, was any further definite step taken. On that date the Federal Government appointed a royal commission of four to inquire into and examine sites near Albury, Armidale, Bombala, Lake George, Orange (Bathurst and Lyndhurst) and Tumut, with instructions that consideration was to be given to the following:

(1) Accessibility to the state capitals; (2) means of communication; (3) climate; (4) topography; (5) water supply; (6) drainage; (7) soil; (8) building materials; (9) fuel; (10) general suitability; (11) cost of resumption of site and area and Crown lands available; (12) any other material matters.

On July 16, 1903, the commissioners presented their report and submitted an order of preference for certain sites under the various headings of their terms of reference but made no definite recommendation in favour of any particular site. In a supplementary report dated Aug. 4, 1903, the commission gave special consideration to the advantages and disadvantages of the site at Dalgety.



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PLAN OF AUSTRALIA'S NEW FEDERAL CAPITAL AT CANBERRA

On Oct. 8, 1903, an exhaustive ballot was taken in the House of Representatives which resulted in Tumut receiving the selection. A bill was introduced into parliament naming Tumut as the site.

This bill also contained the provision that the territory granted to or acquired by the Commonwealth within which the seat of Government shall be, shall contain an area of not less than 1,000 square miles.

The Senate amended the bill by substituting Bombala for Tumut. The House of Representatives declined to accept the Senate's amendment and the bill lapsed. What has been termed the "Battle of the Sites" proceeded. No agreement was reached until the Federal House of Representatives, after an exhaustive ballot, decided on the Yass-Canberra site, which included proposed sites at Yass, Lake George and Canberra. The Senate agreed by a ballot to the site chosen by the House of Representatives.

The Seat of Government Act was assented to on Dec. 14, 1908, and during the following year the actual site of Canberra—the future capital city—was determined. The Seat of Government Acceptance Act was proclaimed on Dec. 15, 1909 and on Jan. 20, 1910, the governor-general issued a proclamation which brought the Seat of Government Acceptance Act into force two days later. This proclamation vested the territory in the Commonwealth. A further act providing for the provisional government of the territory was assented to on Nov. 25, 1910. The State of New South Wales surrendered an area of approximately 900sq.m., which embraces the uninhabited catchment area of the Cotter river and the valleys of the Molonglo and Queanbeyan rivers. Subsequently 212,000 acres were acquired from private owners at a cost of £775,000.

On April 30, 1911, the Commonwealth Government, in a world wide competition, invited designs for the capital city, for prizes of £1,750, £750 and £500. Of 126 designs submitted, the first prize was awarded to Walter Burley Griffin, of Chicago. A departmental board was subsequently appointed to report. It did not recommend the adoption of any of the designs, but submitted a design of its own which embraced certain features of the submitted designs and certain modifications of those designs. In June 1913 a change of Government occurred and the new Government rejected the departmental plan and adopted Griffin's plan with certain amendments. The foundation stones of a "commencement column" were laid on March 12, 1913, on Camp hill by the governor-general (Lord Denman), the prime minister (Andrew Fisher), and the minister for home affairs (King O'Malley).

The outbreak of war delayed building operations. The prince of Wales, during his visit in 1920, laid the foundation stone of the Capitol. A dam has been constructed to hold up the waters of the Cotter river and its tributaries. This ensures a splendid supply of crystal-clear water, sufficient for a population of 70,000 persons. Good roads have been constructed within the Federal capital area, water mains, sewers, electric light and power works, and brickworks have been installed. The city avenues and parks have been well laid out with ornamental trees and attractive gardens.

The temporary Parliament House was completed in time for the opening by the duke of York on May 9, 1927, of the first Federal parliament to sit at Canberra. It is a handsome structure and is elaborately furnished and appointed. Two secretariats which will temporarily house the permanent staffs have also been completed. The prime minister, Mr. Bruce, turned the first sod for the permanent secretariat in Oct. 1927. Attractive dwelling houses have been erected in the suburbs of Red Hill, Blandfordia, Acton, North and South Ainslie, Eastlake, Westridge and Manuka. Several hotels, boarding houses and guest houses have been opened. Excellent school accommodation has been supplied. There are extensive and attractive banking and shopping centres at Civic Centre (Ainslie) and Eastlake.

By the Seat of Government (Administration) Act which was assented to in July 1924, and which came into operation on Jan. 1, 1925, the administration of the territory was placed in the hands of a commission of three, of which Sir John Butters, K.B.E., is chairman. Of the three persons first appointed one shall be appointed for five years, one for four years, and the third for three years. Thereafter, each appointment shall be for a term not exceeding three years. The commission is subject to the control of the minister for home and territories. The commission, subject to the approval of the governor-general in council, may make by-laws and ordinances for the good government of the territory. The commission controls the lands of the territory and has power to levy and collect rates upon land, has charge of domestic housing and of the developmental works and administration of the territory.

The first ordinance, passed in 1911, when the administration of the territory was under an administrator, subject to the control of the minister for works and railways, contained a provision prohibiting the issue of licences for the sale within the territory of alcoholic liquors. That ordinance is still in force and will remain so until a plebescite is taken to determine the question. No date has yet been fixed, but the Government has expressed a view that the matter shall remain in abeyance until there is a "stable" population in the Federal capital. Up to the end of June 1928, the amount expended in the territory was £10,546,084. The population of the city proper in 1933 was 7,325; that of the whole federal capital territory, 8,947.

The city of Canberra is beautifully situated in an amphitheatre of wooded hills at an elevation of approximately 2,000ft. above sea level in 35° 15′ S. latitude and 149° 15′ E. longitude. It lies approximately 80m. from the coast, is distant by rail 204m. from Sydney, 429 from Melbourne, 912 from Adelaide, 929 from Brisbane and 2,600 from Perth. Ultimately it will be connected with the sea by a railway covering a distance of about 123m., terminating in Federal territory at Jervis bay. Meteorological information: Average annual rainfall 22·65in.; mean summer temperature 67·5°; mean winter temperature 41·8°.

The name "Canberra" is of aboriginal origin. It is pronounced with the accent on the first syllable as if it were spelt "Cannbra."

CANCALE, a fishing port of northwestern France in the department of Ille-et-Vilaine on the bay of Mont St. Michel, 9 mi. E.N.E. of St. Malo. Pop. (1936), 3,081. It is noted for its oysters and for the pretty head-dress of the Cancalaises. The old town (Cancale-Ville) stands on the cliffs, with the fishing village (La Houle) on the quay beneath. The harbour is protected by the rocks known as the *Rochers de Cancale*, a name frequently found on inn signs in France. In 1758 an English army under the duke of Marlborough landed there for the purpose of attacking St. Malo and pillaged the town. It was again bombarded by the English in 1779.

CANCELLI, in architecture, screens or parapets, similar to those used by the Romans, to divide off the judges' space in a basilica. The Latin name for these was *cancelli* (*cf.* the English legal use of the word "bar"). From their resemblance to such Roman screens the enclosures of the choir and chancel of a church are also known as cancelli. (*See* BASILICA, CHANCEL, CHOIR.)

CANCER ("The Crab"), in astronomy, the fourth sign of the zodiac denoted by the symbol ♋. The constellation contains a large loose cluster of stars known as Praesepe or the Beehive. The Tropic of Cancer is the northern limit of places on the earth where the sun can be vertically overhead.

CANCER, a term embracing several varieties of morbid new growth or tumour and, secondarily, the disease that results from the presence of these new growths and their mode of increase. Here, cancer will be considered as a disease; the microscopical appearances of the different varieties are described under TUMOUR, and the course of investigations under CANCER RESEARCH.

Though cancer affects man pre-eminently, it has been found in many other varieties of vertebrate animals, including fishes, and the cells constituting the new growths resemble in essential details the normal cells of the animal in which they arise. In every case of cancer the disease is local at first. In rodent cancer and in about a third of the cases affecting the neck of the womb it remains so throughout, but in the great majority of cases of all sites secondary growths or metastases occur sooner or later in distant parts of the body. Locally the growth extends by multiplication of the cells of which it is composed, destroying at the same time the surrounding tissues by pressure atrophy (*see* ATROPHY). Usually it degenerates and breaks down because the blood-supply of the tumour is insufficient to supply the needs of the growing cells. These processes occupy varying lengths of time according to the type of growth and its situation amongst other factors. Hence the duration of the disease varies within wide limits, but reckoning from the date of onset, as alleged by the patient, it is on an average two to three years. This is not all; even with cancer of the same site (*e.g.*, breast), the duration varies in individual cases between, perhaps, six months and as many or more years. In cancer of any part where interference with nutrition is great or important structures are exposed to pressure or ulceration the average duration of the disease and the difference between maximum and minimum are less. Such is cancer of the alimentary tract, particularly in its upper part. In other cases the type of tumour naturally runs a rapid course; such are cancer of testicle and of periosteum.

Early Symptoms.—Naturally the symptoms vary according to the part primarily affected, but it is very common for cancer to be quite painless at first, a fact which explains, in part, why patients, to their own grave detriment, are slow in seeking medical advice when they have discovered an abnormality. Moreover, cancer is often superposed on an antecedent condition which is itself non-cancerous; *e.g.*, some site of chronic irritation or a non-malignant tumour. A sudden increase in volume or rate of extension suggests that the pre-cancerous condition has become cancerous, but the actual transition from innocence to malignancy cannot be fixed even by means of the microscope. Thus the earliest symptoms of cancer in a part are in reality those of the pre-cancerous condition itself. When symptoms are present that can be ascribed, indubitably, to cancer the disease has already attained to some considerable size. These facts have an important bearing on treatment (*see* below) and prevention and must be considered in more detail.

Pre-cancerous Conditions.—Certain conditions are so often followed by local cancer that a causal relation between them has been assumed. Such are various forms of chronic irritation of which the following are the chief. Irritation by a jagged tooth or ill-fitting denture, syphilitic leukoplakia of tongue, smoking of clay pipes (lip), eating of hot rice (oesophagus, Japan), chronic ulcers at the pylorus, gallstones (gall bladder), leukoplakia of vulva, cicatrices in the neck of the womb following childbirth, chronic mastitis (breast), chronic ulcers of skin, use of the *kangri* by dwellers in Kashmir (skin of lower abdomen and inner surfaces of thighs), pressure of the *dhobi* string in Indian washermen (skin of shoulder), betel-nut chewing (inside of cheek), bilharziosis (bladder, rectum), aniline (bladder), soot (scrotum), tar (hands and arms), paraffins (hands, arms and scrotum), X-rays and radium (hands). These sources of chronic irritation may have ceased to act several years before the cancer appears or it may supervene during their action. In either case they induce at first a warty condition of skin or other part upon which the actual cancer is imperceptibly engrafted at one or more points. In addition, certain varieties of tumour, themselves non-malignant, may take on malignant characters, particularly if subjected to chronic irritation. Such are moles and warts, especially if irritated by application of acids or caustics for their removal, fibro-adenomata of breast, villous tumours of bladder, fibromyomata of uterus.

Subject to these considerations reference may be made to the earlier signs of cancer at a few of the sites more commonly affected. In the *breast*, a lump is felt beneath the skin or the nipple is retracted and raised above the level of the other nipple, or a small amount of blood-tinged fluid exudes from the nipple with or without pressure, or stabbing pains are felt particularly at night. In the *uterus*, haemorrhage independent of menstruation, or a blood-tinged discharge, sometimes foul-smelling, though this is a later sign, pain especially in the back. In the *rectum*, slight haemorrhage, often ascribed to haemorrhoids or piles, discharge of mucus, perhaps some alteration in shape of faeces. In the *stomach*, indigestion coming on at a fairly fixed interval after food, often relieved by vomiting. In the *lip*, a raised sore with base of cartilaginous hardness. In *tongue*, *cheek* and *floor of mouth* an ulcer with hard edges and base painful if touched by salt or highly seasoned foods. In *skin*, a small non-healing indolent ulcer, enlargement or ulceration of a pre-existing mole or wart. In *bladder*, haematuria, passage of small clots. In *prostate*, difficulty in micturition or defaecation. In *bone*, local pain, often severe, or local enlargement. Of course many of the symptoms enumerated are not diagnostic of cancer exclusively, but their frequent occurrence in cancer indicates immediate recourse to skilled medical advice. It will be noticed that the sites mentioned above are easily accessible. With parts more deeply situated diagnosis is often impossible apart from exploratory operation unless some symptom obtains (*e.g.*, persistent jaundice in cancer of the pancreas or liver obstructing the main bile ducts) and sometimes cancer is unsuspected till revealed by an autopsy.

Later Symptoms and Course of the Disease.—If a cancer runs its natural course it will extend until it reaches some free surface. Here, as the result of slight injury or because of local degeneration, putrefactive micro-organisms invade it, degeneration proceeds apace and a foul ulcer with thickened edges results. Long before this has occurred, however, in most cases cancer cells from the periphery of the mass have grown along the lymphatics to the nearest group of lymphatic glands and perhaps to further groups, or minute portions of the primary growth have been carried by the blood-stream to distant parts, particularly the liver or lungs. Wherever lodged, these transported cells multiply and form secondary growths or "metastases." These metastases undergo similar degenerative changes to those of the primary growth, but owing to their situation putrefaction does not occur readily. The total mass of metastases often greatly exceeds in size that of the primary mass. A cancer of the intestine weighing half an ounce may give rise to metastases in the liver weighing altogether 8–10 lb

When metastasis has taken place the symptoms associated with the primary mass may be greatly overshadowed by those due to the secondary growths. In cancer of the breast the local changes cause anxiety and a varying degree of pain. When the growth has reached the skin and broken down, the ulcerated surface is foetid and from its surface are absorbed into the system poisonous products of putrefaction. These interfere with blood formation so that a progressive anaemia (*see* ANAEMIA) sets in and the normal balance between numbers of red cells and leucocytes and numbers of different varieties of leucocytes is disturbed. The chemical composition of the blood is changed but not after a fashion characteristic of cancer unless it be that it contains more potassium than normal. This series of changes induces a general malnutrition, wasting and ill-health summed up under the name "cachexia."

But the secondary growths arising from this same cancer of breast may add their own peculiar symptoms. The enlarged glands in the armpit pressing on nerves and veins may produce in the arm very severe pain and a dropsical condition reaching to the hand so great that the affected limb is twice or more the size of that on the unaffected side. The other breast may become the seat of metastasis and the entire picture be repeated on that side also. Metastasis may occur in the thigh bone and lead to fracture, in the bodies of the vertebrae leading to severe pain from implication of nerve-roots, in the brain leading to excruciating headache or even insanity. Indeed, there are few varieties of cancer that metastasize so widely as that affecting the breast.

Cancer of the neck of the womb (cervix uteri) rarely metastasizes beyond the lumbar glands, but whether glands are secondarily involved or not (about one-third of the cases) the picture of the disease is essentially determined by local extension of the disease. Ulceration extends rapidly until the greater part or whole of the cervix is destroyed and a foul ulcer that bleeds very readily results. Growth followed by ulceration attacks the adjacent parts of the vagina and often involves the wall of the bladder or rectum or both. Hence fistulous openings are produced into these parts to the infinite discomfort of the patient. Growth extends into the broad ligaments, fixes the uterus with surrounding tissue into an immovable mass, and, involving the ureters, directly or indirectly, by way of an invaded and inflamed bladder, leads to changes in the kidneys whereby their structure and function become disorganized. (*See* KIDNEY, DISEASES OF.)

Cancer of the tongue or other parts of the mouth and of the pharynx lead to symptoms dependent upon their situation. Food cannot be taken with comfort and some kinds cause so much pain that they are refused entirely. The jaws, too, may become fixed to an extent that the handle of a spoon can barely be inserted between the teeth. One of the most trying symptoms is profuse salivation. Malnutrition, however, is not so great as might be expected owing to the rapid course run by the disease. From the constancy with which lymphatic glands in the neck are invaded, secondarily by growth and septic organisms from the mouth, ulceration is frequent into the great blood vessels in their neighbourhood and leads to profuse, even fatal, haemorrhage. Another common and disastrous occurrence is septic pneumonia due to inhalation of putrid material from the surface of the cancerous ulcer. In cancer of the oesophagus interference with swallowing is so great that early in the disease solids cannot be taken at all and wasting is extreme. Owing to the contiguity of the trachea ulceration often takes place into it and septic pneumonia results.

Site Distribution.—The primary implication of sites differs in the two sexes. In England and Wales, roughly speaking, in males 80% of cancer is primary in some part of the alimentary tract, in females, 80% is primary in uterus or breast. But apparently this distribution does not hold in all countries; in some cancer of stomach is returned as a cause of death, even in females, far more commonly than in England and Wales. How far the difference is real or dependent upon methods of registration, the standard of medical education, recourse to hospitals, etc., it is impossible to say. But it is certain that in Holland and in Italy, where death registration methods are comparable with those obtaining throughout Great Britain, cancer of cervix uteri does not predominate as it does in England and Wales. The reason for this difference, which is statistically significant, is unknown, though the Cancer Sub-Committee of the League of Nations instituted a special enquiry thereon, and examined a number of possible explanations. It follows that, quite apart from special forms of cancer associated with local customs, *e.g.*, kangri cancer in Kashmir, betel-nut cancer in the East generally, cancer of penis common in Hindus who do not circumcise, rare in Mohammedans who do, there is reason to believe that the site distribution of cancer is not identical throughout the world.

Viewed from the aspect of their microscopical characters (*see* TUMOUR) the different varieties of cancer show some well-marked site preferences. These depend upon the fact that the primary growth consists in a modification of normal cells in the part affected and subsequent multiplication of those altered cells. If the part normally contains pigment, *e.g.*, skin or choroid of eye, the cancer cells originating therefrom contain pigment also in great or small degree; if it originate from a member of the connective tissue group (*q.v.*), *e.g.*, bone, cartilage, fibrous tissue, the cancer cells retain in great or small degree the special characters of those tissues. The same is true for squamous, columnar and spheroidal epithelia (*q.v.*). Hence by microscopical examination it is often possible to narrow within certain limits the primary site of a growth. A pigmented cancer (melanoma) can only have originated in skin or choroid however widespread may be the distribution of secondary growths.

Very rarely a melanoma arises in the pineal body (*see* BRAIN) of man which normally is devoid of pigment, but phylogenetically, the pineal is the representative of a median eye, and in the Lacertilia it contains pigment. Similarly, a hypernephroma can only have originated in adrenal tissue, a squamous cell carcinoma in squamous epithelium, a spheroidal cell carcinoma in gland tissue of spheroidal character, a columnar cell carcinoma in gland tissue lined by columnar epithelium, a sarcoma from some member of the connective tissue group.

Age Distribution.—Cancer is pre-eminently a disease of adult and old age but no age is exempt. Moreover, if it be divided into its two great classes of carcinomata or epithelial cancers and sarcomata or connective tissue cancers a difference in age distribution appears. For whereas the carcinomata are rare before 30 and extremely rare before 20 and liability increases with advancing years (due correction being made for age distribution of the population), the sarcomata show a fairly even distribution throughout life. As a corollary, malignant disease in infancy or childhood, almost without exception, is sarcomatous and parts liable to sarcoma, *e.g.*, bone, kidney, are those commonly affected. In adult life or middle or old age it may be carcinoma or sarcoma, but probably the former since the total number of carcinoma cases greatly exceeds the total number of sarcoma cases.

In some instances, *e.g.*, cervix uteri, there is a fall in liability in advanced old age but this is counterbalanced by an increased liability at some other site, *e.g.*, skin, so that the statement that liability to cancer increases with increasing years is generally true. This does not mean that the greatest number of cancer cases seen are aged. On the contrary the greatest number falls between the ages of 45 and 65, uterine cases on the whole being a little younger than breast, and breast cases than skin. Even within the area of the same organ differences in age distribution occur, cancer of the body of the womb, on an average, affecting older women to a greater extent than that of the neck or cervix.

Civil State.—In the case of breast and uterus certain differences obtain in cancer incidence, between married and unmarried women. Correction being made for their respective numbers in the population, cancer of cervix is more common in the married, cancer of breast in the unmarried. It does not appear that the number of pregnancies has much influence upon the occurrence of cervical cancer, one childbirth being as liable to be followed by cancer as several. Cancer of the breast seems to be correlated with abeyance of the normal function and the occurrence therein of chronic inflammatory changes (chronic mastitis).

Cancer Mortality.—In England and Wales the death rate from cancer per million of the population, in 1926, was 1,362 as compared with 1,336 in 1925, 1,297 in 1924 and 1,267 in 1923. These figures do not indicate an actual rise in incidence, for important factors in the apparent rise are more accurate diagnosis, improved certification of the causes of death, and increased longevity resulting in a greater number of people reaching the age period of cancer than formerly. Probably, too, the greater attention attracted to the disease by recent national schemes of cancer research is reflected in the rise. It is noteworthy that in Switzerland where autopsies are common and death certification has long been highly efficient, the cancer death-rate has differed little from year to year during the past quarter century. In other civilized countries the figures are substantially of the same order as in England and Wales. From collected statistics for the United States registration area it has been estimated that the cancer death-rate for the whole country in 1920 was 834; in 1921, 860; in 1922, 868; in 1923, 894, and in 1924, 920 per million living.

Treatment.—In 1928 the official method of treating cancer remained wide surgical removal at the earliest possible date. When the disease is still local, efficient surgical removal may fairly be described as curative in the sense that the patient's expectation of life is as great as if he or she had not suffered from cancer. The stage of the disease in which operation is performed, however, fundamentally influences prognosis. Thus, in cancer of the breast, 90% of women undergoing the complete operation while the disease is still confined to the organ may expect to be alive and well ten years later, whereas of those in whom the disease has passed beyond the breast when they first seek medical advice 90% will be dead ten years later. The average period elapsing between strict localization to the breast and extension beyond its limits is no more than a few weeks or months It is probable that essentially the same is true of cancer at other primary sites but in some dissemination is even more rapid and in others satisfactory surgical intervention is difficult or impossible.

The above-mentioned considerations, combined with the natural reluctance of patients to undergo extensive operations, have led to continued search for other methods of dealing with the disease than surgery. Of these treatment by radium or X-rays (*see* RADIOTHERAPY, RADIUMTHERAPY) has established itself as in some measure effective. How far radiation is destined to replace surgery, as the mode of its action and technique of its application are better understood, it is impossible to say. Already there is statistical evidence that in cancer of the cervix uteri, on the basis of five years' survival, efficient radium treatment gives nearly as good results as efficient surgery and has the additional advantage of affording a five years' survival to some 12% of cases beyond the reach of surgery.

Treatment of Coley's mixed toxins of B. prodigiosus and Str. erysipelatis has, in his hands, been followed by good results in some cases of sarcoma. Blair Bell's treatment by intravenous injection of colloid lead is still in the experimental stage and, though highly dangerous, has given some striking results. No other method of treatment aiming at cure than the above is worthy of consideration and the majority are harmful.

The treatment of inoperable cancer is symptomatic; the pain, ulceration, anaemia, etc., are combated to afford the patient the utmost relief and length of life. Surgical procedures of various sorts such as ovariotomy (now discarded) lymphangeioplasty, an endeavour to provide alternative paths for the lymph in the enlarged arm often seen in cancer of the breast, local removal of the growth to diminish the ulcerating area have been employed but the usual methods in vogue are radiation and drugs. Radiation in most instances relieves pain, and, in some, causes a diminution in the rate of local progress, but, in others, appears to cause a wider dissemination of metastases and in septic conditions materially worsens the patient's condition. With regard to local treatment and drugs much may be done to ease the patient. Mild disinfectants and frequent change of dressings diminish local putrefaction, reduce foetor and the amount of toxic material liable to absorption; it is surprising how much benefit may accrue from keeping the cancerous ulcer clean.

In respect of drugs, the pain, with the sleeplessness it may entail, is the symptom calling most for attention. Those with the greatest experience are unanimous that opium and morphia should be reserved as a last resource for as long as possible, owing to the bad effects these drugs have upon the morale of the patients, the necessity for continuously increasing doses, the severity of the pain in the intervals between doses and the greater difficulty of nursing. For a long time a drink of warm milk, a dose of aspirin or of omnopon at night gives the needed relief, and the great majority of patients in an institute specially devoted to cancer cases never require opium or morphia from beginning to end of their illness.

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CANCER CONTROL

Cancer control is the practical application of the established facts and sound working opinions concerning the prevention and cure of cancer. Although, as has been indicated, no means has yet been discovered of completely suppressing or preventing cancer, there are various procedures which give some measure of protection against it. The present hope of reducing deaths depends upon the fullest possible employment of these protective procedures.

Looked at as a community problem, to control cancer it is necessary not only that the public should have information which will enable them to recognize the earliest suspicious symptoms, but be induced to apply for competent medical attention upon the first appearance of these signs. Periodical medical examinations are urged as a means of detecting cancer. Physicians, on their part, must be alert to come to an early decision as to the diagnosis and prompt and skillful in applying the proper treatment. To instruct the public and to give the medical profession a knowledge of the latest and most useful information on this subject is the object of an organized warfare against the disease, carried on in the United States since 1913 by the American Society for the Control of Cancer, composed of about 2,000 members and with official representatives in all the States of the Union. In the course of the year a large amount of printed matter in the form of circulars, booklets, newspaper articles, posters and magazine stories appears. There are lectures and scientific papers delivered, and radio talks given. In fact, every known means of publicity which is applicable for the instruction of the public upon the largest possible scale and with the least expenditure of money, is employed. The annual meeting of the society takes place on the first Saturday in March and a periodical has been issued by it every month since 1920, giving information of interest and service concerning the disease. And this is only one of many similar societies existing in most of the civilized countries of the world.

In 1926 an international meeting of representatives from most of the countries of Europe met in the United States under the auspices of the American Society for the Control of Cancer, in order to exchange experiences with regard to the methods available for prevention and treatment. During the course of the meeting resolutions were drawn up and unanimously agreed to as follows:—

(1) The causation of cancer is not completely understood, but it may be accepted that for all practical purposes cancer is not to be looked upon as contagious or infectious.

(2) Cancer itself is not hereditary, although a certain predisposition or susceptibility to cancer is apparently transmissible through inheritance. This does not signify that, because one's parent or parents or other members of the family have suffered from cancer, it will necessarily appear in other persons of the same or succeeding generation.

(3) The control of cancer, so far as this subject can be understood at the present time, depends upon the employment of measures of personal hygiene and certain preventive and curative measures, the success of which depends upon the intelligent co-operation of the patient and physician.

(4) Persons who have cancer must apply to competent physicians at a sufficiently early stage in the disease, in order to have a fair chance of cure. This applies to all forms of cancer. In some forms, early treatment affords the only possibility of cure.

(5) Cancer in some parts of the body can be discovered in a very early stage, and if these cases are treated properly the prospect for a permanent cure is good.

(6) The cure of cancer depends upon discovering the growth before it has done irreparable injury to a vital part of the body and before it has spread to other parts. Therefore, efforts should be made to improve the methods of diagnosis in these various locations and the treatment of the cancers so discovered.

(7) The public must be taught the earliest danger signals of cancer which can be recognized by persons without a special knowledge of the subject, and induced to seek competent medical attention when any of these indications are believed to be present.

(8) Practitioners of medicine must keep abreast of the latest advances in the knowledge of cancer in order to diagnose as many as possible of the cases of cancer which come to them.

(9) Surgeons and radiologists must make constant progress in the refined methods of technic which are necessary for the diagnosis and proper treatment not only of ordinary cases but of the more obscure and difficult ones.

(10) There is much that medical men can do in the prevention of cancer, in the detection of early cases, in the referring of patients to institutions and physicians who can make the proper diagnosis and apply proper treatment, when the physicians themselves are unable to accomplish these results. The more efficient the family doctor is the more ready he is to share responsibility with a specialist.

(11) Dentists can help in the control of cancer by informing themselves about the advances in the knowledge of the causes of cancer, especially with relation to the irritations produced by imperfect teeth and improperly fitting dental plates. They can also help by referring cases of cancer which they discover to physicians skilled in the treatment of cancer in this location. It may be doubted whether all dentists fully realize the help which can be obtained from X-ray photographs in revealing not only the state of the teeth but the condition of the bone surrounding them.

(12) Medical students should be instructed in cancer by the aid of actual demonstrations of cancer patients, and this to a sufficient extent to give them a good working knowledge of the subject.

(13) The most reliable forms of treatment, and, in fact, the only ones thus far justified by experience and observation, depend upon surgery, radium and X-rays.

(14) Emphasis should be placed upon the value of the dissemination of definite, useful and practical knowledge about cancer, and this knowledge should not be confused with that which is merely theoretical and experimental.

(15) Efforts toward the control of cancer should be made in two principal directions: (*a*) the promotion of research in order to increase the existing knowledge of the subject, and (*b*) the practical employment of the information which is at hand. Even with our present knowledge many lives could be saved which are sacrificed by unnecessary delay. (G. A. S.)

CANCER RESEARCH. This subject falls naturally into two periods divided by the beginning of the present century. From 1850 to 1900 investigation was on the clinical and anatomical sides and the great work of Virchow between 1850 and 1800 upon cellular pathology and upon the malignant new growths laid the foundation of our present knowledge concerning cancer. When it is remembered that staining methods for microscopical purposes were not introduced until about 1872 the accuracy of Virchow's descriptions becomes even more remarkable. Virchow laid great stress upon the importance of chronic irritation in the causation of new growths and in large measure this view still holds the field. Reference is made to it later. The rival theory put forward by Cohnheim about 1880 that new growths arise from embryological remnants included within the tissues owing to some slight error in development has, at the present time, few adherents. In the case of certain special varieties of tumour (teratomata, cysts), however, it is held to be a sufficient explanation.

Main Divisions.—As examination of cancer proceeded it became clear that it is not a single disease but rather a group of diseases having certain features in common. First there came the great division into (1) the carcinomata, growths built up on the type of squamous, columnar or spheroidal epithelium and (2) the sarcomata, growths built on the type of one of the members of the connective-tissue group. To these were added later (3) the endotheliomata, a group of somewhat undetermined characters, which are regarded as being derived from the flattened cells that line lymph spaces or channels or blood-vessels. In this way there has become recognized a long series of malignant growths with more or less defined microscopical characters.

Special Divisions.—Later it was found that the three main groups mentioned above were insufficient to include certain varieties of tumour arising in special organs, *e.g.*, muscle, lymphatic glands, testicle, adrenal, sympathetic ganglia, and special terms were applied to new growths originating in these parts. It was shown, further, that in some degree it is possible to correlate clinical with histological features, particularly so far as the primary growth is concerned. Thus it is probable that a primary cancer of external skin or of the lining to the alimentary tract between the lips and the lower end of the oesophagus will be a squamous-cell carcinoma, of intestine will be a columnar-cell carcinoma, of bone will be some variety of sarcoma, of cerebral meninges or of pleura will be an endothelioma. These tumours will breed true so that if secondary growths (metastases) are produced they will, within limits, resemble the parent growth in histological characters.

Local or Constitutional Origin.—To this 19th century period also belongs the great controversy whether the malignant growths are manifestations of a local or of a constitutional condition. The controversy is important in that treatment must depend largely upon the view held: if the disease be purely local it should be possible to eradicate it by surgery so long as it is dealt with before it passes from the local condition and becomes generalized; if, on the other hand, it be a manifestation of a constitutional or blood condition, local surgery must be ineffective. The local view received and still receives the greatest amount of assent, but it is becoming more generally accepted, even by those who hold that cancer depends upon local mechanical irritation, that some biochemical change of the tissues is necessary and that this change may be brought about by conditions affecting the body as a whole.

Bacteriological Results.—The remarkable results of bacteriological research about 1880, too, were not without effect, for attempts were made to show that cancer depends upon a micro-organism. That micro-organisms were cultivated from new growths is certain, but the varieties were so diverse that, no doubt, they depended upon faulty technique or upon prior and accidental infection of the growth. Moreover, inoculation of these micro-organisms into animals failed to produce new growths, though in some instances (torulae) tumour-like collections of inflammatory cells resulted. It is now generally agreed that no bacillus or micrococcus in the accepted sense of those terms is the cause of cancer.

Cancer not "Infectious."—Again, certain appearances met with in microscopical sections were regarded by their discoverers as being of an animal nature, parasitic and causative of the condition. It is now agreed that these appearances are due to the inclusion of tissue debris in living cells. It follows from what has been said above, that cancer is not an infectious disease in the sense that tuberculosis, diphtheria, typhus fever and malaria are infectious diseases. Many enquiries were carried out upon the subject of "cancer houses" and "cancer localities." Examples were adduced in which several persons inhabiting a single house or numbers dwelling in the same locality were said to have died of cancer. Careful examination, however, failed to show that they could not be explained by the average age distribution of the population, by improved diagnosis or by errors of random sampling. While, therefore, there is nothing to show that special cancer houses and localities do not exist, there is no satisfactory proof of their occurrence.

The Present Century.—Since the year 1900 cancer research has entered upon a new phase largely owing to the fact that modern experimental methods have been adopted. Special laboratories devoted to cancer research were instituted and within a few years were at work at the Imperial Cancer Research fund, The Middlesex Hospital, the Cancer hospital (London), the Christie hospital (Manchester), the Royal Cancer hospital (Glasgow), the Samariterhaus (Heidelberg), the Crocker Foundation, the Memorial hospital, the Rockefeller Institute (New York City), the Gratwick Foundation (Boston, Mass.). Recently a large institute for cancer research has been opened at Buenos Aires. In addition, associations for the study of cancer have been founded in several countries. These associations differ somewhat in their aims, but in most instances through their agency statistical and sometimes laboratory investigations are being carried out. The most important of these associations are the Cancer Sub-committee of the Health section of the League of Nations, which, of course, is international; the Cancer Committee of the Ministry of Health in Great Britain; the British Empire Cancer Campaign; local committees in Manchester, Liverpool, Birmingham, Leeds; l'Association Française pour l'Étude du Cancer; Komite für Krebsforschung and similar bodies in Belgium, Holland, Austria, Switzerland and Japan. It must be understood that the institutions mentioned above are exclusive of numerous bodies such as the Medical Research Council, various universities and teaching hospitals which further cancer research as part of their general activities, and often to a considerable degree, but have no special department devoted to the subject. In 1926 The British Empire Cancer Campaigns founded *The Cancer Review* in which publications directly or indirectly bearing upon the cancer problems are analysed. In 1928 a somewhat similar journal was issued in France.

Heredity in Cancer.—In Chicago a laboratory was built and equipped on the most approved plan for investigating the question of heredity and cancer in mice. From three original mice, stocks were raised ultimately numbering many thousands of which the full history of each individual from birth to death was recorded including an account of the autopsy. The experiment has been in progress for some 20 years and by special breeding Miss Maud Slye has produced two strains, all members of which and no members of which, respectively, suffer from new growth. She has also produced familial proclivity to new growths of a special type, *e.g.*, squamous-cell carcinoma, or affecting a special organ, *e.g.*, the liver. From these experiments there can be no doubt that a hereditary factor obtains in cancer, but it is only by controlled work of the kind mentioned and intense inbreeding that its existence can be demonstrated. Even in so segregated a population as that of Gol and Hemsedal, two parishes on the eastern slope of the mountains in the centre of Norway where intermarriage is common, the most that a study of five large cancer families in which 307 deaths had occurred between 1902 and 1921 showed was that the crude mortality rate from cancer for persons over the age of 35 was 18·2% for these families compared with 12·1% for the total population.

Other Statistical Enquiries.—Much time has been spent and many papers have been published on the question whether the incidence of cancer is increasing. It cannot be said that this question has been settled beyond dispute. Increased notification of deaths from cancer has undoubtedly occurred in practically all countries, but how far correction of the annual figures has to be made for increase of population, improved diagnosis, improved standard of health whereby a larger portion of the population reaches the cancer age, improved education and means of transport whereby a large proportion of the population comes under observation and treatment, it is impossible to say. Nevertheless it is the opinion of most authorities that even if due allowance be made for all these factors there is still evidence of a gradual increase in the incidence of cancer particularly at more advanced ages. The opinion often expressed that cancer affects persons at an earlier age than formerly is apparently without foundation.

Primary Sites.—Statistical enquiries in various countries have shown that the commonest primary site of the disease differs considerably. Thus in England and Wales notified deaths from cancer of uterus and of breast are more numerous than from gastric cancer, whereas the reverse is the case in Holland and Italy. This observation has been made the subject of exhaustive enquiry by the Cancer Sub-committee of the Health section of the League of Nations with the result that it is fully substantiated but all endeavours to correlate it with habits of the respective peoples have failed entirely. It is said that the same peculiarity concerns descendants of the same nationalities when they have emigrated to another country and this point is receiving attention at the present time.

Duration of Cancer.—Another useful statistical enquiry concerns the natural duration of the untreated disease from alleged onset to death. Papers have been published giving the information derived from four different institutions in Great Britain. These have been collected and analysed statistically by the Cancer Committee of the Ministry of Health and present a base line against which all forms of treatment can be measured.

Distribution by Races.—Enquiries in all parts of the world have shown that cancer affects all races of mankind and examination of lower animals has demonstrated its occurrence in them also. It may not be, and certainly in the case of lower animals is not the fact, that all species and varieties are affected with equal frequency. Thus the mouse is the subject of cancer more frequently than the rat, and the rabbit and guinea-pig are far less frequently affected than either. Inasmuch as dogs, cats, horses and cattle are relatively more frequently attacked by cancer it is considered that it is a disease of domestication. Similarly there appears with great probability to be a higher incidence of cancer in the more civilized races of mankind.

Experimental Transmission by Grafts.—The observation that cancer affects the lower animals has rendered experimental work possible. The fact was first shown over 40 years ago by Hanau who successfully transplanted a squamous-cell carcinoma from the vulva of a rat into the peritoneal cavity of other rats. Ten years later Morau succeeded in transmitting a mammary adenocarcinoma from a white mouse to other white mice. For many years the indications afforded by these experiments were not followed up, in part because of a doubt how far the analogy between growths in these lower animals and cancer affecting man holds good. Extensive research, however, carried out mainly by the Imperial Cancer Research fund, proved clearly their essential similarity, and from that time much knowledge has accrued from the experiments on malignant tumours of the mouse and rat. Amongst the conclusions reached was that on the rigorous specificity exhibited by growths. Thus a tumour of the mouse will not grow if inoculated into the rat or vice versa. Under special conditions temporary growth may occur, but these do not invalidate the truth of the general statement.

Susceptibility and Resistance.—As might be expected much work has been done on the question of susceptibility and resistance to transplanted grafts in the hope that it might throw light upon treatment in man. Important differences were shown to obtain between spontaneous growths in respect of the ease or difficulty with which they can be transplanted into other animals of the same species. In some cases grafts take in nearly 100% of experimental animals, in others failure is consistent, even with the greatest care. It was found, however, that inoculation of a graft beneath the skin of the animal bearing the primary tumour (autologous grafting) is almost always successful. This indicates some peculiarity of the animal bearing a spontaneous tumour but so far the difference has eluded explanation.

Blood Content.—It has been suggested that there is a larger amount of potassium in the blood and tissues of an animal bearing a spontaneous tumour. Supporting this view are the observations (*a*) that the blood and tissues of persons suffering from cancer contain more potassium than those of persons suffering from non-malignant diseases and (*b*) that if the potassium content of the blood of mice be raised by feeding them with potassium metaphosphate, transplanted grafts of a mouse carcinoma take in a larger proportion of cases, appear earlier and grow at a more rapid rate.

Immunity.—An important observation, repeatedly confirmed, is that if an animal spontaneously recover from a transplanted tumour it is immune to subsequent inoculations with the same tumour. This has been made the basis of innumerable attempts on the curative side, the most important of which consists in removal of a portion of the tumour, irradiation to a degree just sufficient to prevent growth of the cells on re-inoculation and the introduction of the irradiated mass beneath the skin of the original patient. In experiments on rats the method has been shown to confer a large degree of resistance against growth of inoculated grafts, though it is not so effective against established tumours. It has been found, also, that introduction into liver or spleen is more effective than beneath the skin. In man the results are not conclusive.

In all experiments upon resistance and susceptibility to cancer a great subject of difference amongst workers lies in their view as to the essential factor concerned. Some investigators hold that it is the fluids of the body that are of importance, the cellular elements being subsidiary. For others the cells, and particularly the lymphocytes, are the prime factor in resistance; if the particular line of treatment adopted be associated with accumulation of lymphocytes locally, resistance is high; if lymphocytes be few or absent, resistance is low. Experiments can be adduced supporting or refuting either contention but if it be allowable to use the analogy of immunity and susceptibility to bacterial disease it may well be that tissue fluids and cells take varying parts according to circumstances as yet hardly understood.

Serum Treatment.—Here it is convenient to consider attempts at treatment of cancer by various sera. Influenced by a belief in the microbial causation of cancer and the efficacy of antisera produced against such a disease as diphtheria, earlier workers had endeavoured without success to treat the disease by injection of ascitic or other serous fluids derived from cancer patients. More recently attempts have been made in the laboratory to produce an antiserum by the usual methods and test its efficiency against cancer cells growing *in vitro*. The growing cancer cells were found to be killed almost instantaneously by this antiserum whereas normal cells were unaffected and the method was applied *in vivo*, with the addition that contact between the antiserum and the cancer cells was rendered more intimate and prolonged by combining venous and lymphatic obstruction with introduction of the antiserum. Grafts were inoculated into the hind feet of rats and when they had reached a certain size the antiserum was introduced in the neighbourhood of one of the growths and was held in position to a large degree by constriction of the thigh. In a large proportion of cases the growth in this foot underwent absorption and not only so but at a little later date the growth in the other foot also disappeared. It would seem that the antiserum led to absorption of the growth to which it was locally applied and that in accordance with the general principle that absorption of a cancerous mass in an animal is associated with increased resistance to the same type of growth, absorption of the first growth in the treated foot led to absorption of the second growth in the untreated foot.

Criticisms.—The main criticisms of these important observations are (1) that the growth treated was of the transplanted and not of the spontaneous variety, (2) that the foot is by reason of its small size, large amount of bone and tendon, and smallness of its blood-vessels a region naturally somewhat unfavourable to growth of a transplanted tumour and (3) that the constriction, which, apparently, is essential to success, is itself an abnormal condition and might well turn the scale against a growth that was struggling for existence or at least was not growing freely. Workers with these animal tumours know well how widely the behaviour of grafts varies even under conditions that are apparently identical. Although the experiment is of great interest and full of suggestion it must not be assumed at present that it paves the way to an analogous treatment of cancer in man.

Tissue Culture in Vitro.—This method was popularized by Carrel. By its means it is possible to determine the action of various agents upon living cancer cells under controllable conditions. The technique itself is delicate. Originally the portions of living tissue were cultured in plasma, but the method has been simplified by adoption of a modified Ringer's solution with the addition of embryonic tissue juice. Subcultures must be made every two or three days, but under suitable conditions tissue can be kept alive and growing for prolonged periods. In 1922 the description was given of a ten-year old strain of fibroblasts originally obtained from the heart of a chick embryo and then in the 1860th generation; increase in size under the artificial conditions was as rapid as at first. Besides fibroblasts, large mononuclear cells and cartilage cells, each in pure culture, cardiac muscle from chick, duck, frog, etc., tissue from kidney, thyroid and from various animal tumours has been cultivated. It has been shown that foetal tissues are capable of growing *in vitro* 72 hours after death of the animal and in 1924 evidence was adduced that spleen, liver, kidney, ovary, lung and cornea from adult animals may develop *in vitro* many hours after death. The development very likely proceeds from surviving cells perhaps activated by the autolytic products of the dead ones. A remarkable point was shown in connection with *in vitro* cultures of kidney. It was possible to obtain cultures of fibroblasts or of renal cells and in each instance growth took place in all directions with production of a solid mass. But if fibroblasts were introduced into a mass already containing proliferated renal cells a tubulation occurred that recalled the microscopical structure of the kidney (*see* DEDIFFERENTIATION).

Experiments in Aetiology.—The frequency with which cancer of the tongue is associated with a jagged tooth or an ill-fitting denture, cancer of the lip with smoking of clay pipes, the occurrence of cancer of the skin in workers with paraffin and tar, of soot cancer in chimney-sweeps, arsenic cancer, kangri cancer amongst the Kashmiri users of the kangri basket, cancer of the cheek amongst betel-nut chewers, cancer of the bladder in workers with anilin and around the parasitic ova in persons infected with bilharzia, are examples where irritation caused by a mechanical agent seems to bear a causal relation to the cancer.

X-Ray Cancer.—Of recent years X-ray cancer has been added to the list, and a few cases of cancer of the skin have resulted from prolonged exposure to the gamma rays of radium. Lazarus-Barlow has found minute quantities of radium to exist in a large proportion of cancers examined for the purpose, and produced in the gall bladders of rabbits a condition indistinguishable from cancer by introducing into the gall bladder human gallstones into which small quantities of radium had been introduced artificially. The exact relation of chronic irritation to subsequent cancer is unknown, and there is no doubt that in an even larger number of cases chronic irritation occurs without any subsequent development of cancer. In most instances the chronic irritation must persist over a number of years and the actual cancerous condition is preceded by the formation of warty outgrowths and other local manifestations of cell destruction accompanied by cell proliferation.

Tar Cancer.—In the case of tar a cancerous condition of the skin has been produced in mice and rabbits, but hitherto never in rats, by repeated local painting with coal tar. The cancer is of the squamous variety and runs a normal course. Under the same conditions of painting the length of time before cancer supervenes varies between 3 and 18 months for individual mice. An observation that may have important bearings is that when growth has been produced in one part of the body by means of tar it is impossible to produce another cancer elsewhere by the same means. This is complementary to the experience derived from transplanted cancer in which resistance to one variety of new growth may coincide with susceptibility to another variety. Strenuous efforts have been made to isolate the carcinogenic principle in tar and crude paraffin oils but without success. On the other hand "tars" prepared from isoprene and acetylene by distilling at temperatures between 700 and 900° C. were some of the most effective cancer producers yet known.

Artificial Infection.—Fibiger succeeded in producing cancer of the stomach and tongue in rats by feeding them with cockroaches infected with *Spiroptera neoplastica*, and Bullock and his collaborators produced a malignant condition in rats by feeding them with *Taenia crassicollis*, a tapeworm infesting the cat. The sarcomatous growth occurred round the cysts formed in the liver by the tapeworm and was produced within a few weeks.

The Rous Experiments.—In the attempt to find some common factor behind the widely diverse conditions antecedent to cancer, attention was directed towards observations made by Peyton Rous on a chicken sarcoma that could be transmitted by inoculating with dead cells or, in the absence of cells, by a tumour extract that had passed through a Berkefeld filter. Subsequently Rous found two other varieties of sarcoma in hens which could be transmitted by filtered tumour juice. In each of the three instances the special characters of the original growth were repeated in the experimental tumours. He and his collaborators brought forward strong evidence that the filterable agent was a living but extremely small microbe.

Gye's Two Factors.—Although all attempts to discover a filterable virus in mammalian cancer had failed and successful transplantation can only be carried out by means of living cells, it occurred to Gye that two factors might be concerned in the production of one of these chicken sarcomata, viz.: a filterable virus and a specific factor derived from the animal. By special means he separated the two and found that either alone was insufficient to produce a tumour but in conjunction they were effective. He then applied these results to four standard malignant tumours in rats and mice and one human mammary cancer with the result that he obtained from all but one mouse tumour a factor he regards as almost certainly a filterable virus which can replace the virus of the Rous tumour in the production of a chicken sarcoma. The failure to transmit mammalian growths in the same fashion as the Rous chicken sarcoma he ascribes to the more rapid destruction of the mammalian specific factor, probably by oxidation. For the last-mentioned conclusion he has brought forward experimental evidence.

These researches, which are still in progress, have led Gye to *look on cancer—using the term in its widest sense—as a specific disease caused by a virus (or group of viruses). Under experimental conditions the virus alone is ineffective; a second specific factor obtained from tumour extracts ruptures the cell defences and enables the virus to infect. Under natural conditions continued irritation of tissues sets up a state under which infection can occur.* The filtered material isolated by Gye and supposed to contain a virus, after subculture, was examined photographically by Barnard with special optical apparatus, ultraviolet light and, where necessary, quartz in place of glass. Barnard obtained and has published appearances of a particular agent in the culture medium which he and Gye regard as the virus under discussion.

Filterable Virus.—This work, without doubt, is of great importance but caution must be exercised in its interpretation. Indeed, it still awaits confirmation in some essential points. Moreover, the occurrence of unsuspected minute bodies in what are regarded as normal animals has been shown in monkeys, rabbits and guinea-pigs, *e.g.*, in the work on lethargic encephalitis, and Rivers and Pearce while investigating varicella found in rabbits a filterable virus which, at first thought by them to be that of varicella, proved ultimately to be indigenous in rabbits. This possibility must be eliminated before Gye's observations can be taken to prove that his filterable virus came from the sarcoma as distinguished from the chicken. Moreover, Rivers and Pearce also found that rabbits bearing intratesticular growths of a transplantable tumour, first discovered in syphilised rabbits, are immune to their rabbit filterable virus, though the virus infects the growth itself and multiplies therein.

Specific Factors.—It may be that filterable viruses peculiar to certain animals exist but are unable to produce tumours until some "specific factor" is present, or that a filterable virus peculiar to new growths exists but also requires the presence of a specific factor, or it may be that the filterable virus inhabits the tumour and is, in a sense, accidental. It is clear that some stimulus for the increased and atypical multiplication of cells which characterizes the new growths is necessary but it seems that much more work is needed before it can be accepted that a filterable virus is aetiologically connected with all varieties of malignant new growth. For the sarcomata—with their many histological and clinical resemblances to infective and inflammatory conditions—causation by a particular filterable virus is more easily acceptable and it will be noted that Gye's experiments, with a single exception, are concerned with sarcomata. The great merit of his work lies in the experimental evidence it offers as to the interaction between an extrinsic and an intrinsic factor in tumour formation and the definiteness it aims at giving, at all events in certain instances, to the characters of the extrinsic factor.

Concluding Remarks.—Most of the work on biochemical lines is unsuited for remark here; Warburg of Berlin finds that tumour tissue splits up carbohydrates differently from normal tissue and has built thereon a hypothesis for the origin of tumours. Of the remainder much consists of diagnostic tests for cancer that have been put forward. Unfortunately none of these is sufficiently [illegible] ult: [illegible] ula

In view of the general belief that cancer in its earliest stages can often be successfully treated by surgery and of the frequency with which the disease first comes under observation at a stage when operation is impossible, a reliable diagnostic method is urgently needed. X-ray examination has facilitated diagnosis of internal cancer particularly when affecting the alimentary tract, but search must still continue for some chemical test applicable at an early date in the disease. Brief reference must be made to Dawson's recent work on the melanomata; from a consideration of all the data, and especially the pigment-forming function of epithelial cells, he concluded that the melanomata, usually termed melanotic sarcomata, are epithelial and therefore carcinomatous.

Action of Radium.—In treatment, research has been directed chiefly toward the action of radium and X-rays. At first employed empirically the scientific basis of their action is being discovered by degrees. The X-ray spectrum has been mapped out, and by means of apparatus of very high voltage (180–200 kv.) rays of wave-length and penetrating power approximating to the very short waves of gamma radiation have been produced. The biological action of rays of different wave-length has been studied and radiological treatment is becoming more scientific

There are still wide gaps in knowledge both on the physical and the biological sides and though immediate results can be foretold with some degree of accuracy in certain varieties of cancer, late results often appear to be fortuitous. Upon the whole, however, treatment of cancer by radiation is a method with which the clinician has to reckon. This is more than can be said concerning medicinal or dietetic methods, none of which has been supported so far by evidence that can be regarded as sufficient to warrant its serious consideration. Here exception must be made for the lead treatment introduced by Blair Bell which is undergoing vigorous examination in many centres.

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CANDELABRUM, a pedestal or shaft used to support a lamp or candle; in common usage limited to shafts for lamps or a group of candles, in contradistinction to candlestick for a single candle. The Romans, developing Hellenistic precedents, made them objects of great decorative richness. Two Roman types are found: the simpler, consisting of a slender shaft, often fluted, supported on a spreading base of animals' feet and acanthus scrolls, and carrying a flat shelf with vase-like mouldings. The multitude of such candelabra found in Pompeii proves them to have been a common form of household decoration. The more monumental type, either of marble or bronze, used in public buildings, had for the base a pedestal resembling a little altar which carried a heavy shaft, frequently decorated with row on row of acanthus leaves, but sometimes with a delicate moulded profile of baluster type, and a round shelf at the top. The lavishness of such examples made a great impression on Renaissance artists, and the general form known as the candelabrum shaft became a common decorative motive in the late 15th century, especially for the centre of pilasters. In modern work, exterior lighting fixtures often take candelabrum shapes.

CANDIA, the largest city of Crete (to which it has given its name), is situated on the northern shore in 35° 20′ N. lat. and 25° 9′ E. long. It is still surrounded by its extensive Venetian fortifications. The principal buildings are the Venetian loggia mutilated recently, the Prefecture, 14 mosques, the modern cathedral, two Greek churches, the Armenian church, the Capuchin monastery, the bazaars, the baths and some beautiful Venetian fountains. The town is the seat of a Greek archbishop. The highly interesting museum contains antiquities found during recent excavations. The chief trade is in oil and soap. The coasting trade is of considerable importance. Leather for home consumption is made and good wine is produced in the neighbourhood. The harbour is formed for the most part by the ancient moles, and was never deep enough to admit the larger vessels even of the Venetians, which were accustomed to anchor off the neighbouring island of Standia. The site of Candia, or, as it was till lately locally known, Megalocastro ("the great fortress"), has been supposed to correspond with that of the ancient *Heracleion*, the seaport of Cnossus, and this name is now officially revived. The ruins of Cnossus are about 3 mi. to the southeast. Founded by the Saracens in the 9th century, Candia was fortified by the Genoese in the 12th, and was greatly extended and strengthened by the Venetians in the 13th, 14th and 15th centuries. It was besieged by the Turks under the vizier Achmet in 1667, and was forced to surrender in 1669. During the German invasion of Crete in May 1941 the city suffered heavily. Pop. (1938 est.) 43,550. (*See* also CRETE.)

CANDIDATE, one who offers himself or is selected by others for an office or place, particularly one who puts up for election to parliament or to any public body. The word is derived from the Latin *candidatus*, clad in white (*candidus*). In Rome candidates for election to the higher magistracies appeared in the Campus Martius, the Forum and other public places, during their canvass, in togas with the white wool brightened by chalk.

CANDLE, a rod of fatty or waxy material through the centre of which runs a fibrous wick. Modern candles are the successors of the early rush-lights which consisted of the pith of rushes soaked in household grease. An improvement was made by the introduction of flax ("inkle") and cotton threads, which were dipped in tallow heated to a temperature slightly above its melting-point, and allowed to cool until the coating had solidified. Alternate dipping and cooling was continued until the desired thickness was obtained. The manufacture of such "tallow-dips"—one of the most ancient forms of illuminant—was for centuries a house industry. In Paris, in the 13th century, there was a guild of travelling candle-makers who went from house to house making candles.

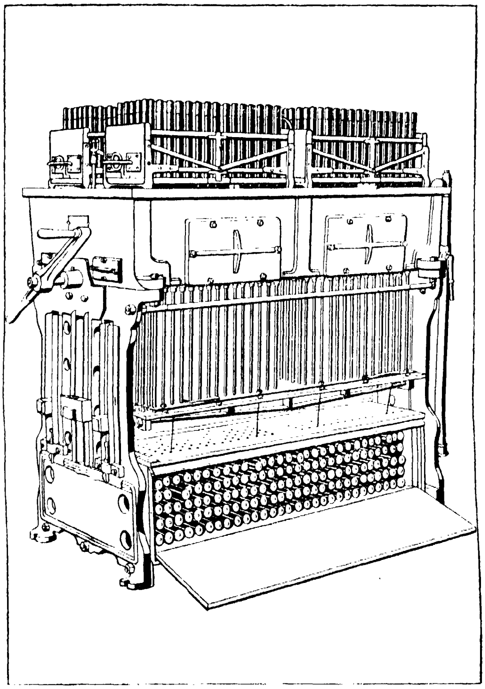

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FIG. 1.—CONTINUOUS WICKING CANDLE-MOULDING MACHINE, SHOWING WICK SPOOLS BELOW, CANDLE MOULDS IN CENTRE, AND EJECTION CLAMPS ABOVE

Beeswax candles have been used from early times and are mentioned by the Roman writers. For mystical reasons the Catholic Church prescribes beeswax candles for Mass and other liturgical functions.

Spermaceti, a white crystalline wax obtained from the head-cavity of the sperm or "right" whale, came into use in the latter half of the 18th century; the sperm candle, weighing one-sixth of a pound and burning 120 grains per hour was adopted by the (London) Metropolis Gas Act of 1860 as the "standard candle" in photometry. Owing to its extreme brittleness, spermaceti requires to be mixed with a small proportion of other material, such as beeswax.

Modern Candles.—The bulk of modern candles are made of paraffin wax (introduced about 1854), or stearine, or mixtures of these. The crude paraffin wax from mineral oil refineries is "sweated" in ovens at a temperature slightly below the required melting-point to free it from lower melting waxes and traces of oils, and is subsequently purified by steaming with animal charcoal and fuller's earth. As pure paraffin wax becomes plastic at temperatures considerably below its melting point, candles made from it are apt to bend, and it is usually stiffened with from 5 to 10% of stearine, which also makes the wax less transparent. Candles made from this mixture are known as "composite candles." The proportion of stearine is largely increased in candles intended for use in hot climates, and they may even be made entirely of stearine.

Ceresin, the hydrocarbon derived from ozokerite, or earth-wax, is also used as a candle-stiffener.

The manufacture of stearine is based on the researches of Chevreul, who, in 1815, showed that fats consist of fatty acids combined with glycerin. The glycerin must be removed, for, on incomplete combustion, it gives rise to the formation of acrid vapours, as may be noticed when a tallow candle is allowed to smoulder. The solid fats, tallow, palm oil and bone fat are split into fatty acids and glycerin (hydrolysed) by the following processes. In the *autoclave process*, which is used for good quality fats, the material is churned with water and 3–4% of lime or magnesia, with steam at 120 lb. pressure. The mixture separates into two layers—the glycerin "sweet-water" and a mixture of lime soap and fatty acids above. The lime soap is decomposed with dilute sulphuric acid and the washed fatty acids crystallized. The solid "stearine" is freed from the liquid oleic acid by pressing in a hydraulic press. In the *acid saponification process*, the fat is treated with 4–6% of concentrated sulphuric acid and hydrolysed with open steam. The resulting fatty acids are dark coloured and must be distilled with superheated steam before pressing. The yield of stearine is greater by the second process (60%), as the action of the acid converts some of the oleic acid into solid products. The *Twitchell process*, which consists in boiling the fat with half its bulk of water and a small proportion of a special emulsifying reagent, is suitable for low-grade fats. The fatty acids can be bleached by distillation.

Candle Wicks.—The wick is one of the most important factors in candle-making; unless it is of the size and texture proper to the material used, the candle will be unsatisfactory. The material generally employed is cotton yarn, which, except for tallow dips and tapers, is braided by machinery into an ordinary flat plait and "pickled." This process, invented by Cambacères in 1825, consists in impregnating the fibre with a very small quantity of mineral matter which helps to fuse the ash of the wick and prevent smoking. After a preliminary bleaching, the wick is soaked in a pickling solution of boracic acid and nitre, or sal ammoniac, or phosphate, or chlorate of ammonia, centrifuged to expel the bulk of the retained solution and dried. It is essential that the wick should be burnt in one direction only. Early wicks, which were not plaited or pickled, did not bend over to the outer oxidizing region of the flame and consequently were incompletely consumed, the char requiring to be removed by frequent "snuffing."

Tallow candles (dips) are manufactured on a commercial scale by the old "dipping" process, each dip adding about one-eighth inch to the diameter of the candle. Tallow dips are principally used by plumbers as a flux, and a considerable quantity by certain African natives for anointing.

The dipping process is unsuitable for beeswax candles; owing to the wax's property of contracting on cooling and its liability to stick, moulding is impracticable. Recourse is had to the somewhat primitive method of "pouring" the melted wax over a suspended wick until the required thickness is obtained. The candle is then rolled on a marble slab to impart uniformity of finish. The difference of the two processes is illustrated by the existence of two Livery companies in the City of London, the Tallow Chandlers and the Wax Chandlers.

Moulded Candles.—Moulding machines of the continuous wicking type, first made by Morgan in 1834, are used for the bulk of candle-making. Machines are made to produce from 80 to 512 candles at one charge, and the output is from two to three charges per hour. The machine consists of tubular moulds (slightly tapered to facilitate ejection of the candles), fixed in a tank to which steam or water can be admitted. The lower ends are closed by the tip-moulds which are carried each on a hollow piston-rod connected to a common bed-plate. The upper ends (butt-ends) open into a shallow trough. The moulds are made of tempered tin (98% purity) and the inner surfaces are polished. Above the apparatus are the "clamps" to hold the candles when ejected from the moulds. The spools of wick, one for each mould, are contained in a box under the machine. The wick is threaded through the piston, through a perforation in the centre of the tip-mould, and passes up the mould to be held centrally by the candle last ejected into the clamp. The moulds are heated to the required temperature and the molten material poured in, leaving excess in the trough. The candles are then cooled by filling the tank with cold water, the wicks cut at the top and the clamps emptied. The superfluous wax in the trough is scraped out, the bed-plate screwed up, and the candles ejected into the clamps. The temperature of the moulds before filling and the speed of cooling have to be varied according to the material being moulded.

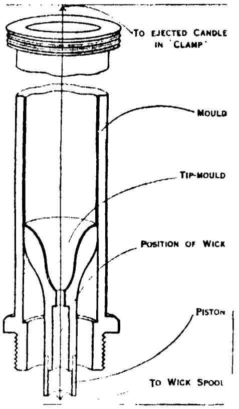

FIG. 2—LONGITUDINAL SECTION OF CANDLE MOULD SHOWING PARTS

Night-lights.—Short thick candles designed to burn six to ten hours, formerly made of coconut stearine, but now usually of a low-melting paraffin wax, are moulded similarly but without a wick; the latter, stiffened by a coating of hard wax, is subsequently fixed in a hole drilled through the wax cake. Great care is taken to avoid access of dust or dirt to the wax, as, since the flame is very small, the wick is easily clogged.

Tapers.—Tapers are made by "drawing" long strands of slightly twisted cotton yarn repeatedly through a bath of molten wax. The tapers are cut to length, the ends dipped in hot water and shaken. This process, called "feathering," removes the wax from one end, allowing a new taper to be lit easily without dripping wax. Small "birthday" and "Christmas" candles are made by this process, and also the "bougies" used in metal casting

On the continent a candle with an air-passage down its length, supposed to minimize guttering, is popular.

Ornamental candles are made of wax stained with aniline dyes and decorated with transfers or by handwork.

A hot-flame, smokeless candle, giving very little light, made from the esters of amino- or imino-acids together with a small quantity of an oxidizing salt such as ammonium nitrate, has been patented in Germany.

See J. Lewkowitsch, *Oils Fats and Waxes* (1923); L. L. Lamborn, *Soaps, Candles and Glycerine* (New York, 1906); Sadtler and Matos, *Industrial Organic Chemistry* (1923); Groves and Thorp, *Chemical Technology*, vol. ii. "Lighting" (1895) (for history); *Catholic Encyclopedia* (for ritualistic use). (E. L.; G. H. W.)

CANDLEMAS, the Church festival, celebrated on Feb. 2, in commemoration of the presentation of Christ in the Temple; called in the Greek Church Ὑπαπάντη τοῦ Κυρίου ("the meeting of the Lord," *i.e.*, with Simeon and Anna), in the West the Purification of the Blessed Virgin (Lat. *Candelaria, Festum candelarum sive luminum*, etc.). The late 4th-century pilgrim Etheria (Silvia) describes its celebration at Jerusalem on Feb. 14 (40 days after Epiphany; the Armenians still keep it on this day) as "the Coming of the Son of God into the Temple." The celebration spread from Jerusalem, being moved to Feb. 2, 40 days after the newly established feast of Christmas. In 542 it was established throughout the Eastern empire by Justinian. In the West, we find it (entitled, as now, Purification of the Blessed Virgin Mary) in the 8th-century *Gelasian Sacramentary*, which embodies a much older tradition; the procession was introduced by Pope Sergius I. (687–701). The blessing of candles did not come into common use until the 11th century.

In the East it has always been observed as a festival of Christ, in the West it is pre-eminently a festival of the Virgin Mother.

See L. Duchesne, *Christian Worship* (Eng. trans., London, 1904); *Catholic Encyclopedia*, vol. iii. (1908).

CANDLEPOWER (or LUMINOUS INTENSITY), is a characteristic of a light source. Candlepower of a given source in a given direction may be defined as the luminous flux (lumens) per unit solid angle (steradians) in the divergent light cone whose apex is at the source and whose axis is in the given direction.

The concept is a relic of the days of candlelight. For many years lamps were rated by visual comparison with an actual candle. Edison's early incandescent lamps, for example, were rated at 16 candlepower. But this candlepower rating of lamps has been replaced in most cases by a rating in lumens or in watts, and the concept of candlepower is of dwindling importance (*see* PHOTOMETRY).

The candlepower of any source (no matter what its size) can be obtained from a measurement of pharosage (lumens per unit area) and distance. Multiply pharosage by distance squared to get candlepower, being careful to use sufficient distance.

Various physical standards have been employed in place of an actual candle. The Harcourt pentane lamp has been used in Great Britain and the United States, while the Hefner amylacetate lamp has been used in Germany In 1909 the international candle was defined on the basis of groups of carbon-filament incandescent lamps kept at the national standardization laboratories. In 1939, the Commission Internationale de l'Eclairage in its sessions at Scheveningen, Neth., agreed on a new standard candle equal to 1/60 of the luminous intensity per square centimetre of a Planckian radiator operating at the temperature of solidification of pure platinum. The new candle, which differed slightly from previous units, was to have been adopted internationally on Jan 1, 1940. The war intervened, however, and at its close in 1945 the new candle was still a subject for international consideration. (P. MN.)

CANDLESTICK, a receptacle, made in various forms, for holding a candle. The word was formerly used for any kind of support on which lights, whether candles or lamps, were fixed. The first candlesticks were perhaps made for ecclesiastical purposes, either for ordinary illumination or for some particular ceremony; their use as a household appliance did not come into notice until the middle ages. The domestic types were very simple in design, so naturally the history of candlesticks deals largely with those of the church. Moses was commanded to make a candlestick for the tabernacle, of hammered gold, a talent in weight, and consisting of a base with a shaft rising out of it and six arms, and with seven lamps supported on the summits of the six arms and central shaft. When Solomon built the temple, he placed in it ten golden candlesticks, five on the north and five on the south side of the Holy Place. After the Babylonish captivity the golden candlestick was again placed in the temple, as it had been before in the tabernacle by Moses. On the destruction of Jerusalem by Titus, it was carried with other spoils to Rome. Representations of the seven-branched candlestick occur on the arch of Titus at Rome, and on antiquities found in the catacombs at Rome. The primitive form of candlestick was a torch made of slips of bark, vine tendrils or wood dipped in wax or tallow, tied together and held in the hand by the lower end, such as are frequently figured on ancient painted vases. The next step was to attach to them a cup (discus) to catch the dripping wax or tallow.

During the 11th and 12th centuries a certain amount of ornamentation appeared, first a dragon holding on his back the sconce for the candle. This sconce was provided with a short spike on which the candle could be pushed down; later a socket was used instead of the spike. Previous to the 17th century, iron, latten, bronze and copper were chiefly used, but thenceforward the most elegant examples were chiefly of silver though in more modern periods Sheffield plate, silver plate and china became exceedingly popular. Sometimes the base and sconce are of one material and the pillar of another, as when the former are of silver and the pillar of marble or china; the choice and combination of materials are, indeed, infinite The golden age of the candlestick lasted, roughly speaking, from the third quarter of the 17th century to the end of the 18th. The later Jacobean, Queen Anne and early Georgian forms were often extremely elegant, with broad bases, round, oval or square, and swelling stems. Fine examples of these periods, especially when of silver, are much sought after and command ever higher prices. As with most domestic appliances, the history of the candlestick shows an increasing tendency towards simplicity, the most elaborate and fantastic forms, animals and reptiles, the monstrous creatures of mythology, lions and men-at-arms, angels and cupids, having gradually given place to architectural motives such as the baluster stem and to the classic grace of the Adam style. Artistically the candlestick in its modern form is among the most important of household furnishings, and many of the various types have been handed down to the modern chandelier (*q.v.*).

CANDLISH, ROBERT SMITH (1806–1873), Scottish divine, was born at Edinburgh on March 23, 1806, and spent his early years in Glasgow, where he graduated in 1823. After short assistant pastorates at St. Andrew's, Glasgow, and Bonhill, Dumbartonshire, he obtained a settled charge as minister of the important parish of St. George's, Edinburgh. Here he came to be regarded as one of the ablest preachers in Scotland. His first Assembly speech, delivered in 1839, placed him at once among the leaders of the party that afterwards formed the Free Church, and his influence in bringing about the Disruption of 1843 was inferior only to that of Thomas Chalmers. After Chalmers's death in 1847 he was the most prominent leader in the Free Church. In the year 1862 he succeeded William Cunningham as the principal of New college with the understanding that he should still retain his position as minister of St. George's. He was a prolific writer. He died on Oct. 19, 1873.

See William Wilson, *Memorials of R. S. Candlish, D. D.* (1880), with a chapter on his position as a theologian by Robert Rainy.

CANDOLLE, AUGUSTIN PYRAME DE (1778–1841), Swiss botanist, was born at Geneva on Feb. 4, 1778. He studied at Geneva and settled in Paris in 1796. His *Plantarum Succulentarum Historia* (4 vols., 1799–1829) and *Astragalogia* (1802) introduced him to the notice of Cuvier and to J. B. Lamarck, who confided to him the publication of the third edition of the *Flore française* (1805–15). The *Principes élémentaires de botanique*, printed as the introduction to this work, contained the first exposition of his principle of classification according to the natural as opposed to the Linnean or artificial method. In 1804 he published his *Essai sur les propriétés médicales des plantes*, etc., and soon after, in 1806, his *Synopsis plantarum in flora Gallica descriptarum.* At the desire of the French Government he spent the summers of the following six years in making a botanical and agricultural survey of the whole kingdom, the results of which were published in 1813. He lectured on botany at Montpellier (1807–16) till he returned to Geneva to fill the chair of natural history there. The rest of his life was spent in an attempt to elaborate and complete his "natural" system of botanical classification, embodied in his *Regni vegetabilis systema naturale*, of which two volumes only were completed (1817–21). In 1824 he began a less extensive work of the same kind his *Prodromus systematis regni vegetabilis*, 7 vols. He died on Sept. 9, 1841, at Geneva.

His son, ALPHONSE LOUIS PIERRE PYRAME DE CANDOLLE, born at Paris on Oct 27, 1806, succeeded to his father's chair. He published continuations of the *Prodromus* in collaboration with his son, Anne Casimir Pyrame de Candolle (1836–1918); *Géographie botanique raisonnée* (1855); *Lois de la Nomenclature botanique* (1867); *Origine des plantes cultivées* (1883); and numerous other botanical works. He died at Geneva on April 4, 1893.

See A. de Candolle, *Mémoires et Souvenirs d'Augustin Pyrame de Candolle* (1862); A. Engler, *Alphonse de Candolle* (1893).

CANDON, a municipality (with administrative centre and 35 *barrios* or districts) of the province of Ilocos Sur, Luzon, Philippine Islands, on the west coast, about 200 mi. N. by W. of Manila by land and 233 mi. by water. Pop. (1939) 20,528 (a gain of 578 since 1918), of whom 9,572 were males, and 2 were whites. It is a place for the export of sugar produced elsewhere in the province, and palay (rice) and tobacco are grown extensively in the surrounding country. Copra is also exported, and the coco palm flourishes there more extensively than elsewhere in the province. An extensive trade is carried on with the primitive mountaineers in the interior. The vernacular is Ilocano for all classes. Of its inhabitants between the ages of 6 and 19, inclusive, 41·9% were reported as attending school, and of those 10 years old and over 55·4% were reported as literate. The number of parcels of land declared for taxation in 1938 was 10,343 and the number of owners 6,491. (C. S. L.)

CANDY: *see* CONFECTIONERY MANUFACTURE.

CANDYTUFT (*Iberis*), small Eurasian herbs (family Cruciferae) with white, purplish or red flowers, the outer petals of which are longer than the rest. Several species are known as garden plants and are of easy culture in ordinary garden soil if well exposed to sun and air. The common candytuft of gardens is *I. umbellata*, a hardy annual, native of southern Europe, and known in a number of varieties differing in colour of flowers. *I. amara* (rocket candytuft) has long finger-shaped clusters of fragrant white flowers and is also an annual.

Some species have a shrubby growth and are perennials; the best-known is the common edging candytuft, *I. sempervirens*, a much-branched plant about a foot high with long racemes of white flowers. The foliage is evergreen in mild climates. Both kinds need plenty of moisture to flower freely.

CANE, a name applied to many plants which have long, slender, reed-like stalks or stems, *e.g.*, the sugar-cane, the bamboo-cane. From the use as walking-sticks the name "cane" is given to sticks, irrespective of the source from which they are derived. Properly it should be restricted to a peculiar class of palms, known as rattans, included under the genera *Korthalsia, Plectocomia, Calamus* and *Daemonorops*. The plants are found throughout the islands of the Indian Archipelago, the Malay Peninsula, China, India and Ceylon; and also in Australia and Africa. The slender stems rarely exceed an inch in diameter and are generally much smaller. They creep or trail to an enormous length, often reaching 500 or 600ft., and support themselves on trees or bushes by recurved spines borne on the stalk or back of the midrib of the leaf, or by stiff hooks replacing the upper leaflets. In some cases the midrib is elongated beyond the leaflets to form a long whip-like structure, bearing recurved hooks at intervals. The natives in preparing the canes for the market, strip off the leaves by pulling the cut plant through a notch made in a tree. The canes always present distinct rings at the junction of the sheathing leaves with the stem.

They assume a yellow colour as they dry.

Canes, on account of their lightness, length, strength and flexibility, are used for a great variety of purposes by the inhabitants of the countries in which they grow. Split into thin strips they are twisted to form ropes and ships' cables. A more important application, however, is for basket-work, and for making chairs, couches, pillows, etc.

Much of the beautiful and elaborate basket-work of the Chinese and Japanese is made from thin strips of cane, which are also used by the Chinese for larger works, such as houses and sheds.

A large trade is carried on in canes and rattans, the principal centres being Batavia, Sarawak, Singapore, Penang and Calcutta. In addition to the varieties used for walking-sticks, whip and umbrella handles, etc., the common rattans are in extensive demand for basket-making, the seats and backs of chairs, etc., and for purposes where their strength and flexibility make them efficient substitutes for whalebone. The walking-stick "canes" of commerce include many varieties, some of which, however, are not the produce of trailing palms. The well-known Malacca canes are obtained from *Calamus Scipionum*, the stems of which are much stouter than is the case with the average species of *Calamus*.

CANEA or **KHANIA,** the principal seaport and, after 1841, the capital of Crete, finely situated on the northern coast of the island, about 25 mi. from its western extremity, on the isthmus of the Akrotiri peninsula, which lies between the bay of Canea and the bay of Suda (latitude 35° 31′ N., longitude 24° 1′ E.). Surrounded by a massive Venetian wall, it forms a closely built, irregular and overcrowded town, though of late years a few of its streets have been widened. Many houses are of wood; but the more important buildings are of more solid materials. There are Turkish mosques, Greek churches and a Jewish synagogue; a Venetian structure serves as a military hospital. The town is the seat of a Greek suffragan to the metropolitan at Candia, and the official residence of the European consuls. The harbour, formed by an ancient transverse mole nearly 1,200 ft. long, and protected by a lighthouse and a fort, once admitted vessels of considerable tonnage, and has been partially dredged, but large vessels have to anchor outside, or make use of Suda bay. The principal articles of trade are oil, soap and leather. The fosse is laid out in vegetable gardens; public gardens have been constructed outside the walls; and artesian wells have been bored by the government. To the east of the town a large village was inhabited, under Turkish rule, by natives of Egypt and Cyrenaica, boatmen, porters and servants, but most of these have quitted the island. About a mile off on rising ground is Khalepa, where the consuls and merchants reside. Canea probably occupies the site of the ancient Cydonia. During the Venetian rule it was one of the strongest cities in the island, but it fell into the hands of the Turks in 1646, several years before the capture of Candia. In 1856 it suffered from an earthquake. During the German invasion of Crete in 1941 the city suffered heavily. Pop. (1938) 36,810. *See* also CRETE.

CANE FENCING is the art of defending oneself with a walking-stick (Fr. *canne*). It may be considered to be single-stick fencing without a guard for the hand, with the important difference that in cane-fencing the thrust is as important as the cut, and thus *canne* approaches nearer to sabre-play. The cuts are practically identical with those of the single-stick (*q.v.*), but they are generally given after one or more rapid preliminary flourishes (*moulinets*, circles) which the lightness of the stick facilitates, and which serve to perplex and disconcert an assailant. The thrusts are similar to those in foil-play, but are often carried out with both hands grasping the stick, giving greater force and enabling it to be used at very close quarters. The canes used in French fencing schools are made of several kinds of tough wood and are about three feet long, tapering towards the point. As very severe blows are exchanged, masks, gloves, padded vests and shinguards, similar to those used in football, are worn. Cane fencing never enjoyed any great measure of popularity in England or the United States. (A. R. H.)

CANEPHORAE, "basket-bearers," the title given of old to Athenian maidens of noble family, annually chosen to carry on their heads baskets with sacrificial implements and apparatus at the Panathenaic and other festival[illegible]te[illegible] also in the form of canephores, is applied, in architecture, to figures of both sexes which carry laden baskets on their heads or shoulders. They are sometimes used structurally as caryatides (*q.v.*), and sometimes decoratively as in many of the Renaissance Italian villas.

CANE SUGAR: *see* SUGAR.

CANES VENATICI ("the Hounds," or "the Greyhounds"), in astronomy, a constellation of the northern hemisphere named by Hevelius in 1690, who compiled it from the stars between the older asterisms Ursa Major, Boötes and Coma Berenices. The constellation contains a famous spiral nebula first described by Lord Rosse (N.G.C. 5,194); also a bright globular cluster (Messier 3).

CANEVA, CARLO (1845–1922), Italian soldier, was born at Tarcento (Friuli) April 22, 1845, and entered the Italian army in 1866. He served in the African campaign of 1897 and in 1902 was promoted lieut.-general. Caneva commanded one side in the much-discussed manoeuvres of 1911, his opponent being Cadorna and it was probably owing to the result of the manoeuvres, in which Caneva was declared victor, that he was selected to command the Tripoli expeditionary force in Oct. 1911. Caneva was given a thankless task, being sent to occupy the coast towns in the belief that the Turkish garrison, unsupported by the tribesmen, could be easily overcome. He was recalled in Sept. 1912, and retired shortly afterwards. He presided over the commission that was appointed to enquire into the Caporetto disaster of 1917. He died Sept. 25, 1922.

CANGAS DE ONÍS or **CANGAS,** a town of northern Spain, in the province of Oviedo, on the right bank of the river Sella. It lies in a fertile, well-watered, partly wooded, undulating region, on the branch railway from Arriondas to Covadonga. Pop. (1940) 1,932 (mun., 9,936). Cangas de Onís trades chiefly in live-stock and coal and copper from the neighbouring mines. It was the residence of the first Spanish kings after the spread of the Moors over the Peninsula. Here in the 8th century lived King Pelayo, who started the Christian reconquest of Spain. His historic cave of Covadonga is only 8 mi. distant. A Roman bridge of fine proportions crosses the Sella.

CANGAS DE TINÉO or **DE NARCEA,** a town of N. Spain, in Oviedo province, on the river Narcea. Pop. (1940) 2,431 (mun., 21,296). There is no railway, but a road runs through Tinéo, Grado and the adjacent coal-fields, to the ports of Cudillero and Avilés. The inhabitants have thus an accessible market for the farm produce of the surrounding hills, for the cloth and leather manufactured in the town, for the coal and lead from the neighbouring mines and for the marble quarried in the district.

CANGUE or **CANG,** the European name for the Chinese *Kia,* a portable pillory, carried by offenders convicted of petty offences. It consists of a square wooden collar about 4ft. square weighing from 20 to 60 lb., through a hole in which the victim's head is thrust. It fits tight to the neck and must be worn day and night for the period ordered.

CANICHANAN, a linguistic stock of South American Indians, consisting of a single tribe, the Canichanas. There is doubt as to the validity of the stock. The Canichanas lived in northern Bolivia on the Machupo and Mamore rivers between 13° and 14° S. Latitude. The remnants are still to be found at the missions of San Pedro and Trinidad. They were originally a warlike people, raiding and attacking their more peaceable Arawakan neighbours. They lived in entrenched villages and subsisted mainly on the products of fishing and hunting. They had the reputation of being cannibalistic. In general their culture resembled that of the nomadic tribes of the Chaco, rather than their sedentary agricultural neighbours.

See A. D'Oribgny, *L'Homme Americain* (Paris, 1839).

CANINE DISTEMPER. Distemper is an acute, contagious and infectious disease of dogs, septicaemic in nature and transmissible to certain other carnivorous animals. The condition occurs in all countries possessing a canine population. The early history of distemper has been lost in antiquity, but possibly it was introduced into Europe during the middle of the 18th century. Carré, in 1905, and later, Lignières, ascribed the cause of the disease to a filtrable virus. Ferry, McGowan and Torrey (1910–11) isolated a small, gram-negative bacillus, named by Ferry *B. bronchiseplicus.* In 1923, the editors of the *Veterinary Journal* and the *Field* inaugurated the *Field* Distemper Research Fund, and since that date the disease has been the subject of extensive scientific research, carried out by veterinary and medical workers, under the Medical Research Council.

Although distemper is endemic in countries possessing a canine population, the disease becomes epidemic at varying intervals, and outbreaks may assume an exceptionally severe form with a heavy mortality; in many of the animals which survive, a permanently impaired constitution remains. Large towns are seldom free from the disease. A few animals appear to possess a more marked power of resistance, but it is probable that many of these have developed the disease and acquired a degree of immunity, without being subjected to the secondary complications, which are more usually the causes of the various sequelae.

Young animals are more susceptible than old; in suckling puppies the condition is often rapidly fatal. Weakly animals and pedigree dogs, in which blood interrelationships exist, are generally less resistant than coarsely bred animals. Healthy animals may contract the disease by exposure to the crude or filtered nasal discharge of affected animals, and the same is true of the blood and body fluids, the secretions and excretions. This applies more especially in the early stages of the disease.

The disease is air borne, but mediate and immediate contagion are the more fruitful sources; drinking bowls, feeding utensils, brushes, the clothing and boots of attendants and contamination voided by infected dogs (more especially those in the early stages of the complaint) are all sources of infection. The early stages of the disease may pass unobserved; after exposure, an incubation period of 3–5 days elapses, *malaise* supervenes, and the thermometer reveals a temperature of 105°–106° F. This initial pyrexia is speedily followed by a fall of body heat to the region of normal, but the temperature may again rise after a few days. The patient is very infective during this period.

The most favourable course is towards resolution, and, save for some loss of condition and slight *malaise,* the disease may remain undetected; far more commonly, however, secondary infections supervene. Organisms, normally present in, and non-pathogenic to, the animal, may assume virulence; also extraneous infections may be acquired, especially in animals existing in unhygienic and overcrowded surroundings. Predisposing causes, such as chills and getting wet also play a part.

A virulent form of the disease is sometimes met with, characterized by persistent high temperature, asthenia, marked depression and death within a few days. The acute form is characterized by fever, often remittent, and the onset of symptoms showing a wide divergency. Although some of the symptoms may remain constant over a series of cases, they may be modified, or entirely absent, and the virus may appear to select some special group of organs, such as the respiratory, the alimentary tract, the central nervous system, the mucous membranes or the skin.

General *malaise,* rigors, capricious or complete loss of appetite, vomiting, diarrhoea or dysentery, may be some of the symptoms shown; also serous, muco-purulent or sanguineous, discharges from the conjunctival and catarrhal mucous membranes; matting of the orbital hair and scalding of the eyelids, photophobia, ophthalmia, iritis, ulceration of the cornea, protrusion of Descemet's membrane, synechia, and even extrusion of the lens; ulceration of the nostrils; herpetic rash round the lips, stomatitis, ulceration of the gums, lips, tongue and fauces. A characteristic short, moist cough is very common and indicates an inflammation or catarrh of the larynx which may be the onset of broncho-pneumonia; later, mouth breathing and pouching of the lips indicate that the lungs are the seat of consolidation. Vomiting may be troublesome; at first catarrhal in character it becomes watery and bile stained. The small intestine and lower portions of the alimentary tract becoming involved, there supervenes profuse diarrhoea, which becomes foetid and haemorrhagic.

Nervous symptoms may occur at any stage of the disease, or during convalescence, and are of grave significance. The animal may show hypersensitiveness to sounds; epileptiform fits and convulsive muscular spasms, with chattering teeth and foaming jaws, terminating in unconsciousness or a meningitis in which the patient is partially or completely blind, wandering about in circles or standing with its head pressed up against the side of the kennel; partial, or complete, paralysis, especially of the hind quarters and the sphincters of anus and bladder. One of the commonest sequelae to recovery from the nervous forms of distemper is a persistent twitching of the muscles known as chorea; unfortunately this is usually permanent. In some cases a vesicular eruption develops which becomes pustular and may be confluent. If abraded, the vesicles are apt to form raw areas; otherwise they form dry, brownish scabs. These are to be looked for on hairless portions of the skin, such as under the armpits, thighs, and around the lips. Eruptions of this kind are, however, also seen in other conditions in puppies, such as teething.

The average duration of the disease is from a month to six weeks, the percentage of recoveries varying with the virulence of the disease. Catarrhal forms, associated with a free discharge from the nose and eyes, even when associated with some degree of broncho-pneumonia or gastro-intestinal catarrh, yield the highest percentage of recoveries. Skin lesions are troublesome, but comparatively unimportant, except as tending to exhaust the individual. Vomiting and diarrhoea, if severe, are of the utmost gravity as, naturally, they interfere with the nutrition of the patient, causing exhaustion and emaciation. The most hopeless type is that showing brain involvement associated with frenzy, convulsions or coma. Paralysis will often yield to proper treatment and skilful nursing, but convalescence may take weeks, or even months, to establish.

Treatment.—Skilled nursing and attention to body hygiene are of extreme importance. The patient should be kept warm and free from draughts, but allowed plenty of fresh air; a flannel jacket is a useful adjunct. The temperature of the kennel or sick room should be as constant as possible. The eyes should be kept clean by the aid of antiseptic lotions and ointments, although, even with the utmost care, ulceration and permanent blindness may ensue; especially in the breeds (such as Pekinese, pugs and bulldogs) with prominent eyes. In the mouth antiseptics should be regularly employed to cleanse the gums, as these sometimes ulcerate and necrose. Food should be nourishing and easily digestible. The form and method of feeding must vary with the condition of the patient; milk, eggs, sponge cake, the various infant and invalid foods, meat extracts, liquid broth, boiled fish, and in the convalescent stages raw shredded or lightly-cooked beef and boiled rabbit or chicken. Rectal feeding by means of nutrient suppositories or peptonized foods is a useful help. With high fever and gastric complications a lump of ice placed on a piece of flannel in a saucer often appears to give relief.

There is no specific cure to suit every case, and treatment must be modified according to the symptoms shown. Expectorants, febrifuges, alimentary sedatives, astringents and antiseptics, nervine sedatives and, in the later stages tonics, all find uses. Various vaccines and anti-distemper sera have been advocated, but so far the results have not been satisfactory.

Laidlaw and Dunkin, working under the auspices of the *Field* Distemper Research Committee, have recently (1928) confirmed Carré's finding that the disease is due to a filter-passing virus (*see* FILTER-PASSING VIRUSES), and they have succeeded in conferring an immunity on the ferret; on the dog, however, their work is not yet complete and, although the reports published are very encouraging, it is too early yet to form any definite opinion. It is certain, however, that the possibility of immunization offers the best hopes, and, if success can eventually be achieved, an inestimable boon will have been conferred upon the canine world.

(F. T. G. H.)

CANINI, GIOVANNI AGNOLO (1617–1666), Italian designer and engraver, was born at Rome. He was a pupil of Domenichino and afterwards of Antonio Barbalonga. He painted some altar-pieces at Rome, including two admired pictures for the church of San Martino a' Monti, representing the martyrdom of St. Stephen and of St. Bartholomew. Having accompanied Cardinal Chigi to France, he was encouraged by the minister Colbert to carry into execution his project of designing from medals, antique gems and similar sources a series of portraits of the most illustrious characters of antiquity, accompanied with memoirs; but shortly after the commencement of the undertaking Canini died at Rome. The work, however, was continued by his brother Marcantonio, who, with the assistance of Picard and Valet, completed and published it in 1669, under the title of *Iconografia di Gio. Ag. Canini.* It contains 150 engravings. A reprint in Italian and French appeared at Amsterdam in 1731.

CANISIUS, PETER, also Kannees, Kanys (1521–1597), Jesuit scholar, was born in Nijmwegen, Holland, on May 8, 1521. He was educated at Cologne, and after becoming a Jesuit in 1543, taught successively at the universities of Cologne, Ingolstadt and Vienna. Perhaps more than any of his contemporaries, Canisius delayed the advance of Protestantism by his participation in the religious discussions at Worms, at the Council of Trent and the Diet of Augsburg, by his friendship with the emperor and numerous magnates, by his zealous preaching in various German towns, by the extension of his own order and especially by his desire to provide worthy and scholarly priests. In 1580 he settled in Freiburg i/B. where he died on Dec. 21, 1597. He was beatified on Nov. 20, 1869 and was canonized in 1925.

His chief writings are the triple *Catechism* (1555–58); *Divi Cyrilli archiepiscopi Alexandrini Opera* (1546); *D. Leonis Papae I. . . . Opera* (1546), *Epist. B. Hieronymi . . . selectae* (1562). His *Epist. et Acta* were edited by Braunsberger (5 vols., Freiburg i/B., 1896). *See* also Raderus, *De Vita Canisii* (Munich, 1614); O. Braunsberger, *Petrus Canisius, ein Lebensbild* (Freiburg i/B., 1917); J. Metzler, *Petrus Canisius, ein charakterbild* (1925), and Le Bachelet's article in *Dict. de Cath. Theol.*

CANIS MAJOR ("Great Dog"), in astronomy, a constellation placed south of the Zodiac, just below and behind the heels of Orion. *Canis minor,* the "little dog," is another constellation, also following Orion and separated from Canis major by the Milky Way. Both these constellations, or at least their principal stars, Sirius in the Great Dog and Procyon in the Little Dog, were named in very remote times, being referred to as the "dogs of Orion" or in equivalent terms. Sirius is the brightest star in the heavens; and the name is connected with the adjectives σειρός and σείριος, scorching. It may possibly be related to the Arabic *Sirāj,* thus meaning the "glittering one." Hommel has shown that Sirius and Procyon were "the two *Si'ray*" or glitterers. It is doubtful whether Sirius is referred to in the Old Testament. By some it has been identified with the Hebrew *mazzaroth,* the *Lucifer* of the Vulgate; by others with *mazzaloth,* the *duodecim signa* of the Vulgate; while Prof. M. A. Stern identifies it with the Hebrew *kimah,* which is rendered variously in the Vulgate as Arcturus, Hyades and Pleiades. (*See* G. Schiaparelli, *Astronomy in the Old Testament* [1905].) The inhabitants of the Euphrates valley included both constellations in their stellar system; but considerable difficulty is encountered in the allocation of the Babylonian names to the dominant stars. With the Egyptians Sirius assumed great importance. Appearing with the sun when the Nile was rising, Sirius was regarded as a herald of the waters which would overspread the land, renewing its fertility and promising good harvests for the coming season. Hephaestion records that from its aspect the rise of the water was foretold, and the Roman historian Florus adds that the weather was predicted also. Its rising marked the commencement of their new year, the *annus canarius* and *annus cynicus* of the Romans. It was the star of Sept or Sothis, and, according to one myth, was identified with the goddess Hathor—the Aphrodite of the Greeks. It was the "second sun" of the heavens, and according to Maspero (*Dawn of Civilization,* 1894) "Sahū and Sopdīt, Orion and Sirius, were the rulers of this mysterious world of night and stars."

The Greeks, borrowing most of their astronomical knowledge from the Babylonians, held similar myths and ideas as to the constellations and stars. Sirius was named Σειρός, Κύων (the dog) and τὸ ἄστρον, the star; and its heliacal rising was associated with the coming of the dry, hot and sultry season. Hesiod tells us that "Sirius parches head and knees"; Homer speaks similarly, calling it κακὸν σῆμα, the evil star, and the star of late summer (ὀπώρα) the rainy and stormy season. Procyon (Προκύων) was so named because it rose before Κύων. The Euphratean myth of the dogs has its parallel in Greece, Sirius being the hound of the hunter Orion, and as recorded by Aratus always chasing the Hare; Pindar refers to the chase of Pleione, the mother of the Pleiades, by Orion and his dogs. Similarly Procyon became Maera, the dog of Icarius, when Boötes became Icarius and Virgo his daughter Erigone.

The Romans adopted the Greek ideas. They named the constellation *Canis,* and Sirius was known as *Canis* also, and as *Canicula.* Procyon became *Antecanem* and *Antecanis,* but these names did not come into general use. They named the hottest part of the year associated with the heliacal rising of Sirius the *Dies caniculares,* a phrase which has survived in the modern expression "dog-days"; and the pestilences which then prevailed occasioned the offering of sacrifices to placate this inimical star. Festus narrates, in this connection, the sacrificing of red dogs at the feast of Floralia, and Ovid of a dog on the Robigalia. The experience of the ancient Greeks that Sirius rose with the sun as the latter entered Leo, *i.e.,* the hottest part of the year, was accepted by the Romans with an entire disregard of the intervening time and a different latitude. (*See* SIRIUS.)

CANISTER, another name for case shot, an artillery projectile for use at close quarters (from Lat. *canistrum,* a wicker basket).

CANITZ, FRIEDRICH RUDOLF LUDWIG, FREIHERR VON (1654–1699), German poet and diplomatist, was born at Berlin on Nov. 27, 1654. He attended the universities of Leyden and Leipzig, travelled in England, France, Italy and Holland, and was appointed groom of the bedchamber (*Kammerjunker*) to the elector, Frederick William of Brandenburg, whom he accompanied on his campaigns in Pomerania and Sweden. In 1697 the elector, Frederick III., made him a privy councillor, and the emperor, Leopold I., created him a baron of the empire. He died at Berlin in 1699. Canitz's poems (*Nebenstunden unterschiedener Gedichte*) are for the most part dry and stilted imitations of French and Latin models.

A complete edition of Canitz's poems was published by U. König in 1727; *see* also L. Fulda, *Die Gegner der zweiten schlesischen Schule*, ii. (1883).

CAÑIZARES, JOSE DE (1676–1750), Spanish dramatist, was born at Madrid on July 4, 1676, entered the army and retired with the rank of captain in 1702 to act as censor of the Madrid theatres, and steward to the duke of Osuna. In his 14th year Cañizares recast a play by Lope de Vega under the title of *Las Cuentas del Gran Capitán*, and he speedily became a fashionable playwright. His originality, however, is slight, and *El Dómine Lucas*, the only one of his pieces that is still read, is an adaptation from Lope de Vega. Cañizares produced a version of Racine's *Iphigénie* shortly before 1716, and is to some extent responsible for the destruction of the old Spanish drama. He died on Sept. 4, 1750, at Madrid.

CANNAE, an ancient village of Italy, near the river Aufidus, situated on a hill above the right bank, 4m. S.W. from its mouth, and about 6m below Canusium (*q.v.*). It is celebrated for the disastrous defeat which the Romans received there from Hannibal in 216 B.C. In later times the place became a *municipium*, and unimportant Roman remains still exist upon the hill known as Monte di Canne. In the middle ages it became a bishopric, but was destroyed in 1276.

There has been considerable discussion as to whether the battle took place on the right or the left bank of the Aufidus, and above or below Cannae; but Kromayer's careful study both of the ancient authorities and of the ground leaves no room for further doubt. According to him, the battlefield is to be sought in the low ground below the village, and on the right bank of the river, which may well have changed its course to some slight extent, where it would seem neither side can have derived any appreciable advantage from the terrain.

After the operations round Gerunium (*see* CALLICULA) the Roman and Carthaginian armies lay opposite to one another there until the beginning of the summer of 216 B.C., when Hannibal took the Roman generals by surprise by a rapid march to Cannae, where he seized the Roman stores of provisions, which had been gathered from the neighbourhood of Canusium and were concentrated there; he then encamped on the high ground above the river valley, to the south-west of the village. He probably took the easier and shorter route by Arpi, a distance of some 65m., in as much as that followed later by the Via Traiana is longer and more hilly. The Roman forces followed, but kept on the seaward side of him, so as to be able to obtain supplies with greater ease. They fought a successful skirmish with his cavalry and light troops between Salapia and Aufidena, after which the consuls, Aemilius Paullus and Terentius Varro, who were in command of the Roman army reached the left bank of the Aufidus. Here they encamped in the plain, throwing a third of their troops onto the right bank of the river, which presented no great obstacle, and establishing a smaller camp there. Hannibal then, in order to persuade his enemy to accept battle, led the bulk of his troops over to the left bank of the river, but the offer was refused. Varro in his turn offered battle on the right bank, and Hannibal accepted the challenge. The Romans now faced south, with their right wing resting on the river, and the sea about 3m. in their rear. They had adopted an exceptionally deep formation, each maniple having a front of only six men and a depth of 24, which, as we shall see had its bearing on the sequel.

Hannibal, who had only about 40,000 infantry to oppose to the 70,000 Roman foot, placed the Gauls and Spaniards (about 25,000 men in all) in the centre, in a crescent shaped formation, the units in the middle being heavier and pushed farther forward, while the sides were more lightly held by units in echelon, an arrangement which gave the necessary connection with the 7,000 Libyan heavy infantry who were placed on the wings. The whole formation was of course concealed from the Romans by a screen of light troops, about 8,000 in number. The result of these cleverly concealed dispositions was to leave the Roman wings entirely in the air, so that when they found that there were no troops in front of them it was inevitable that they should advance too far and lose touch with their centre. The latter, on the other hand, was at once heavily engaged with Hannibal's Gauls and Spaniards, and, despite their desperate resistance, was at first successful. Hannibal, it is true, had so disposed his line that his centre instead of losing touch as it gave ground, was driven closer together, and so at first actually became stronger; but after the rectilinear position was reached from which the original advance had been made, this advantage became less; and when it gave way still further, the day seemed to be lost. Indeed it can only have been then that the Roman troops that escaped the slaughter of Cannae managed to break through the Carthaginian line. This, was, however, the moment for which Hannibal had been waiting. As soon as the shortened Roman front pressed so far forward that the Libyan heavy troops could fall on their flanks, the latter, supported by the light troops, attacked the legions on the wings, and prevented them from joining in the break through in the centre. The Roman forces were thus partially encircled, and their discomfiture was completed by Hasdrubal's cavalry (about 10,000 men in all) who, after routing in turn both the Roman cavalry wings, attacked them in the rear. Hannibal, who had taken his own place in the centre, must before this have succeeded in stopping the rout and restoring his front at this point. The Romans were, however, still superior in numbers, and it was only owing to the lack of capacity of independent manoeuvre of the individual units that they were unable to prevent themselves from being surrounded in the first instance; while the exceptional narrowness of front and the great depth in which the Roman legions had been drawn up for battle rendered it possible for Hannibal to surround them with a ring of troops through which they were, in the state of disorder into which they had fallen, quite unable to force a way, and were therefore cut down almost to a man. The 20,000 odd men who had broken through the Carthaginian centre were unable to effect a diversion, and when they saw their comrades surrounded, followed the example of those who had escaped at Trebia and Trasimenus, and marched to Canusium, the modern Canosa. Hannibal preferred not to besiege them there (an operation which might have taken him months) and instead of this marched through Apulia and Samnium to Capua, most of the towns through which he passed with his victorious army declaring themselves in his favour. The 10,000 Romans who were left in the main camp had nothing left but to surrender.

This was the worst defeat that the Romans had suffered at the hands of Hannibal; and yet his victory which gained him the practical annihilation of the Roman army may be said at one time to have hung upon a hair. The Roman generals never gave him another opportunity of a pitched battle, and while they did not give up operations in the open, they tried to wear down Hannibal's strength gradually by operation against him not with large armies, but with a number of smaller forces generally composed of a couple of legions apiece. The character of the warfare was thus completely altered. This and the fact that Polybius' narrative is only fragmentary from this point onwards explain the impossibility of following the operations of 216–207 in such detail as before.

The similarity of the tactics of Hannibal and of the result of the battle to that of the Trebia is striking; in both, the defeat of the Roman cavalry rendered it possible to outflank and consequently surround their infantry, while in both cases (and at Trasimenus also) the Roman centre was able to break through in considerable force, but without being able, or even attempting, to redeem the fortunes of the day.

See J. Kromayer, *Antike Schlachtfelder* (1912) iii. i. 278 *sqq.* for an authoritative treatment of the whole question. (T. A.)

CANNAN, EDWIN (1861–1935), British economist, was educated at Clifton college and Balliol college, Oxford. He became lecturer in political economy in London university in 1897 and professor of political economy in 1907. He retired in 1927. His principal works are: *History of the Theories of Production and Distribution* (2nd ed., 1903), *History of Local Rates in England* (2nd ed., 1912); *Wealth* (1914); *Money* (5th ed., 1926), and an edition of Adam Smith. Cannan's chief services to economic theory have been on the theory of money, on questions of demography and in clarifying and modernizing the theory of supply and demand as laid down by Adam Smith.

See his *An Economist's Protest* (1928); and an introduction by Hugh Dalton to *London Essays in Economics in Honour of Edwin Cannan* (1927).

CANNANORE, town, British India, in the Malabar district of Madras, on the coast, 58 mi. N. from Calicut and 470 mi. by rail from Madras. Pop. (1941) 34,649. Cannanore belonged to the Kalahasti or Cherakal rajas till the invasion of Malabar by Hyder Ali. In 1498 it was visited by Vasco da Gama, who made a treaty with the raja, and built a fort in 1505. In 1656 the Dutch effected a settlement and built the present fort, which they sold to Ali Raja in 1771. It is now a military cantonment. In 1783 Cannanore was captured by the British, and the reigning princess became tributary to the East India Company. Here is the residence of the Moplah chief, who owned most of the Laccadive islands till 1911, when they were ceded, and the ruler was given a pension. There are cotton mills and biscuit works. Pepper, copra and coir are exported. Cannanore is a military station.

CANNEL COAL, a brightly burning coal rich in hydrogen, supposed to take its name from "candle." Cannel coal is found in Lancashire, England, and in Kentucky and Indiana, in the United States. It burns well in open fireplaces, and is also used to enrich gas made from other coal. (*See* COAL AND COAL MINING.)

CANNES, a winter resort of southeast France, in the department of Alpes Maritimes, on the Mediterranean, 19 mi. S.W. of Nice. Pop. (1936) 41,851. It enjoys a southern aspect on the Golfe de la Napoule, with the Estérels to the west. Previous to 1834, when its beauty and healthy climate first attracted the attention of Lord Brougham, it was an ancient little hill-town built on Mont Chevalier, which projects seawards and is crowned by the church (mainly 17th century, with a Romanesque chapel) and château (1070–1385). Of its early history little is known, save that it was twice destroyed by the Saracens in the 8th and 10th centuries, and was recolonized from Genoa. It is now one of the most fashionable resorts of the Riviera, the new town (La Bocca) having grown on either side of the old. A beautiful promenade runs along the beach.

Near the harbour, from which the Iles des Lérins are reached, lies the huge Casino Municipal. On the north, the modern town climbs up to Le Cannet (pop. 8,924), while on the east it practically extends along the coast to Golfe Jouan (3½ mi.), where Napoleon landed on March 1, 1815, on his return from Elba. From Cannes a railway runs north (12½ mi.) to Grasse. The country around is very beautiful and highly fertile; orange and lemon trees are cultivated, while olives, almonds, figs, peaches, grapes and other fruits are grown in abundance, and form, with fish, the chief exports of the town. Essences of various kinds are manufactured, and flowers extensively cultivated. Opposite the town is the island of Ste. Marguerite (one of the Lérins), in the citadel of which the Man with the Iron Mask was confined from 1687 to 1698, and which acquired notoriety as the prison whence Marshal Bazaine escaped in August 1874. On the other chief island (St. Honorat) of the Lérins is the famous monastery (5th century to 1788) which rose to great fame in the 6th century. The monastery is now occupied by Cistercians. On the island is an old castle (1088) while the shores have several ruined chapels.

CANNES, CONFERENCE OF (Jan. 6–13, 1922), a meeting of the Supreme Council of the Allies with the primary object of considering the Anglo-French suggestions for reparations, drafted at the preliminary Conference of London on Dec. 18–22, 1921 (*see* LONDON, CONFERENCES OF). The conference opened with a criticism of the Anglo-French suggestions by the French Minister of Finance, who was supported by the Belgian representative. After long and complicated discussions this resulted in a modification of the London suggestions, and representatives of Germany, as well as the Reparation Commission, were summoned to Cannes to make proposals on the basis of the agreement finally reached between the Allies.

But wider questions of security and reconstruction were broached by Mr. Lloyd George in a memorandum submitted to M. Briand on Jan. 4, which declared that the three problems of reparations, security, and reconstruction were inter-related, and that any general scheme for European reconstruction must include Russia; and in which he offered to conclude an agreement by which Great Britain would pledge herself to assist France with all her forces in the event of unprovoked German aggression upon French soil. Mr. Lloyd George warned M. Briand that the British Empire would not be willing to incur military commitments in Central and Eastern Europe.

On Jan. 6 Mr. Lloyd George proposed the summoning of a general Reconstruction conference to which both Soviet Russia and the United States were to be invited, and this proposal was adopted by the Supreme Council, together with an outline agenda. Meanwhile M. Briand had been making counter-proposals respecting the Anglo-French pact. The guarantee must be reciprocal, and supplemented by a technical military convention. This second condition would probably have proved an insuperable obstacle from the British point of view, but M. Briand was violently attacked in the French Senate and Chamber in the belief that he was giving way unduly to Mr. Lloyd George. As a consequence he resigned on Jan. 12, and therewith the Conference came to a premature close. Its main results were the provision for the Genoa Conference and the avoidance of a deadlock over Reparations.

See British White Paper, *Resolutions adopted by the Supreme Council at Cannes, Jan. 1922, as the basis of the Genoa Conference* (Cmd. 1621 of 1922); A. J. Toynbee, *Survey of International Affairs, 1920–23* (1925).

CANNIBALISM, the eating of human flesh by men (from a Latinized form of Carib, the name of a South American tribe, originally from the West Indies), also called "anthropophagy," from Greek words meaning the eating of men. Evidence has been found in some of the palaeolithic deposits which point to occasional cannibalism. Herodotus, Strabo and others tell of peoples like the Scythian Massagetae, a nomad race north-east of the Caspian sea, who killed old people and ate them. In the middle ages reports, by Marco Polo and others, attributed cannibalism to the wild tribes of China, the Tibetans, etc. Cannibalism prevailed until recently, over a great part of West and Central Africa, New Guinea, Melanesia (especially Fiji), Australia, New Zealand, the Polynesian islands, Sumatra, other East Indian islands in South America, and in earlier days in North America. Sporadic cannibalism occurs among more civilized peoples as a result of necessity or as a manifestation of disease.

Classification.—Cannibalistic practices may be classified according to (1) the motives of the act; (2) the ceremonial regulations; (3) whether the victims are actually killed for food or whether only such are eaten as have met their death in battle or other ways.

Food cannibalism for the satisfaction of hunger may occur sporadically as a result of real necessity or may be kept up for the simple gratification of a taste for human flesh. Cannibalism from necessity is found not only among the lower races, such as the Fuegians or Red Indian tribes, but also among civilized races, as the records of sieges and shipwrecks show. Simple food cannibalism is found in West Africa. Human flesh formerly was exposed for sale in the market, and some tribes sold the corpses of dead relatives for consumption as food. The practice of devouring dead kinsfolk as the most respectful method of disposing of their remains, in a small number of cases, is combined with the custom of killing the old and sick, but in the great majority of peoples it is simply a form of burial, in parts of Australia, Melanesia, Africa and South America, and less frequently elsewhere. To this group belong the customs described by Herodotus with, as a variant form, the custom of using the skull of a dead man as a drinking cup. Another modification of an original ritual cannibalism is the custom of drinking the ashes of the dead, practised by some African and South American tribes. The custom of holding burial feasts has also been traced to the same origin. Another form of cannibalism is the custom of partaking of the products of putrefaction as they run down from the body. The Australians smoke-dry the bodies of tribesmen; and consume the portions of the body which are rendered liquid by the heat. Ritual cannibalism shades over into and may have been originally derived from magical cannibalism, of which three subspecies may be distinguished. (i.) Savages eagerly desire some foods in order that they may, by partaking of the flesh, also come to partake of the mental or bodily peculiarities of the man or animal from which the meat is derived; thus, eating the heart of a lion is recommended for a warrior to make him brave; analogous motives lead to the eating of those slain in battle, both friends and foes. (ii.) An entirely different kind of magical cannibalism consists in the consumption of a small portion of the body of a murdered man, in order that his ghost may not trouble the murderer. (iii.) The practice is also said to have the effect of causing the relatives of the murdered man to lose heart or to prevent them from exercising the right of revenge. It may point to a reminiscence of a ritual eating of the dead kinsman. The custom of eating food offered to the gods is widespread, and we may trace to this origin Mexican cannibalism, perhaps, too, that of Fiji. For the origin of penal and revenge cannibalism, we may perhaps look to that of protective magic, but there may also be some idea of influencing the lot of the criminal in a future life; and the whole of the body is seldom eaten in protective cannibalism. Other cases, especially where the victim is an enemy, may be due to mere fury and bravado. In the west of North America a peculiar kind of cannibalism was confined to a certain body of magicians termed "Hametzen" and a necessary condition of admission to their order. Another kind of initiatory cannibalism prevailed in the south of Australia, where a magician had to eat a portion of a child's body before he was admitted.

Most kinds of cannibalism are hedged round with ceremonial regulations. Certain tribes go to war to provide human flesh; in other cases it is only the nearest relatives who may not partake of a body; in other cases it is precisely the nearest relatives on whom the duty falls. Sometimes the killer of the victim does not partake in the feast; in other cases the whole of the clan to which belonged the man for whom revenge is taken abstains also; elsewhere, this clan, together with any others of the same intermarrying group, takes part in the feast to the exclusion of (*a*) the clan or group with which they intermarry and (*b*) all outside clans. Some peoples forbid women to eat human flesh; in others, certain classes may be forbidden to eat it. But the variations are too numerous for any general account to be given of ceremonial limitations.

Origin.—The multiplicity of forms and the diversity of ceremonial rules point to a multiple origin. We shall probably be justified in referring all forms of endo-cannibalism to a ritual origin; otherwise the limitation is inexplicable; on the other hand exo-cannibalism, in some of its forms, and much of the extension of endo cannibalism, must be referred to a desire for human flesh, grown into a passion.

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CANNING, CHARLES JOHN, EARL (1812–1862), English statesman, governor-general of India during the Mutiny of 1857, was the youngest child of George Canning, and was born in London on Dec. 14, 1812. In 1836 he entered parliament and filled in succession the offices of under-secretary for foreign affairs, commissioner of woods and forests and postmaster-general. From 1837, on the death of his mother, he had sat in the House of Lords as Viscount Canning. In July 1855 Lord Palmerston offered him the governor-generalship of India, and Lord Canning took up his duties at the close of Feb. 1856.

He was soon faced with a dangerous situation in Afghanistan, which involved Great Britain in war with Persia at the beginning of 1857. The policy Canning laid down for dealing with the question of Afghanistan was in principle that which he used to cope with the Mutiny and with the difficulties of its suppression and the subsequent reorganization of northern India. It was to give help liberally whenever it was needed for honest purposes, to punish wrong-doing quickly and sharply, to discourage tribal feuds on the *divide et impera* theory, and to be always better than his promises.

When the existence of British rule in India was at stake, he reinforced the British troops by intercepting the regiments being sent out to China and transferring them to the scene of the Mutiny on his own responsibility. In Oct. he issued the proclamation, which earned for him the name of "Clemency" Canning. British residents in India and the British public at home were clamouring for indiscriminate reprisals on the inhabitants of the disaffected areas. He maintained that, although he was prepared to strike down resistance without mercy wherever it showed itself, once resistance was over, "deliberate justice and calm patient reason" were to resume their sway. Hence not only did Canning do all that was possible to check the spread of the Mutiny and to re-establish order in north India, but his work of reconstruction established a more liberal policy and a sounder financial system, and left the people more contented than they had been before.

While rebellion was raging in Oudh he issued a proclamation declaring the lands of the province forfeited; and this step gave rise to much angry controversy. Lord Ellenborough, Secretary for India in Lord Derby's administration, published the despatch in which he had censured the viceroy for the proclamation. So strong was the condemnation of the article that Lord Ellenborough resigned. Canning, however, remained at his post, although strongly tempted to resign on account of the implied censure of the Government. In April 1859 he received the thanks of both Houses of Parliament for his services during the Mutiny. He was also made an extra civil grand cross of the order of the Bath, and in May of the same year was raised to the dignity of an earl. On his return to England he seemed destined to become Palmerston's successor, but the strain of his years in India, aggravated by the death of his wife towards the end of his term of office, had undermined his health. He died in London on June 17, 1862. About a month before his death he was created K.G. As he died without issue the title became extinct.

See Sir H. S. Cunningham, *Earl Canning* ("Rulers of India" series) (1891); A. J. C. Hare, *The Story of Two Noble Lives* (1893); Lord Edmond Fitzmaurice, *The Life of Lord Granville*, vol. i. (1906).

(E. F. M.-S.)

CANNING, GEORGE (1770–1827), British statesman, was born in London on April 11, 1770. The Cannings came originally from Bishop's Canynge in Wiltshire, but in 1618 one of the family received the grant of the manor of Garvagh in Londonderry, Ireland. The father of the statesman, also named George, was the eldest son of Mr. Stratford Canning of Garvagh. He quarrelled with and was disowned by his family. Coming to London he was called to the bar, eking out a precarious livelihood, partly in the wine trade and partly in literature. In May 1768 he married Mary Annie Costello, and died on April 11, 1771, exactly one year after the birth of his son. His widow, left entirely destitute and cut off by her husband's family, went on the stage in order to support herself and her son, and married a dissolute and brutal actor of the name of Reddish. From his evil influence and upbringing Canning was rescued by the good offices of Moody, another actor, who approached his relatives in order to secure a more suitable education for the talented boy. An uncle, Stratford Canning, his father's younger brother, took charge of him, and his grandfather relented sufficiently to settle on him an estate to the value of £200 a year. Sheridan and Fox frequented the house, and it was Fox who persuaded Stratford Canning to send his nephew to Eton in 1781. There and later at Oxford he became an accomplished classical scholar. His oratory was of so high an order that Sheridan referred to him as the rising hope of the Whigs, while his contributions to the *Microcosm*, a journal published by a group of Etonians, showed already the subtle humour and boisterous wit for which he later became famous.

In 1792 he came down from Oxford, where, according to Lord Holland, he had been noted as a Jacobin and hater of the aristocracy. He intended to read for the bar, but politics proved too great an attraction. In Sheridan's company he at first frequented Devonshire house and Carlton house, the strongholds of the Whigs, but when he entered parliament for the borough of Newton, Isle of Wight, in July, 1793, it was as a supporter of Pitt. There were three reasons for this change of party. First must be ranked the personal influence of Pitt, whose acquaintance Canning had made soon after his arrival in London. Self-interest dictated separation from a party controlled by the great "revolution families"—Cavendishes, Russells, Bentincks—who never allowed any man, however able, who did not belong to their connection to rise to the first rank. Lastly, the development of the French Revolution into a militant power for the overthrow of existing institutions in other countries drove him into opposition to its principles, and he regarded the Whig reformers as Jacobins and distrusted them accordingly. He soon won the reputation of being the most brilliant speaker on the Ministerial side, in opposition to such famous orators as Burke, Fox and Sheridan. His political patrons took care to provide for his private as well as his official prosperity, and their favour secured him a marriage with Miss Joan Scott, who possessed a fortune of £100,000, on July 8, 1800. One of the four children of this marriage became known to history as Earl Canning.

The public life of Canning falls into four stages. From 1793 to 1801 he was the devoted follower of Pitt, was in minor though important office, and was the wittiest of the defenders of the Ministry in parliament and in the press. From 1801 to 1809 he was partly in opposition, partly in office, fighting for the foremost place. Between 1809 and 1822 there was a period of comparative eclipse, during which he was indeed at times in office but in a very subordinate capacity, and was regarded with general mistrust. From 1822 to his death in 1827 he was the most powerful influence in English, and one of the most powerful in European politics.

In 1796 Canning became under-secretary for foreign affairs, an office of extreme delicacy, placed as he was between Pitt, his friend and prime minister, and Lord Grenville, his immediate chief. During the negotiations for peace with the Directory at Lille in 1797 he was the medium through which their often conflicting instructions reached Lord Malmesbury, the ambassador conducting the negotiations. Pitt and Grenville were mutually suspicious, although they were united in deceiving the Cabinet as to the real nature of the discussions. The part he was forced to play gained for Canning an unfortunate reputation for trickery. From November 20, 1797, until July 9, 1798, he was one of the most active and certainly the most witty of the contributors to the *Anti-Jacobin*, a weekly paper started to ridicule the French republicans, and to denounce their brutal rapacity and cruelty. In 1799 he left the Foreign Office and was named one of the twelve commissioners for India and became in 1800 joint paymaster of the forces. Although debarred from a seat in the Cabinet by the difficulties which then existed for a poor man to attain high office, and by the prejudice due to his defection from the Whig Party, a prejudice increased by his merciless wit, which "would have fetched the hide off a rhinoceros," he exercised more influence as the chief confidant of Pitt than most Cabinet ministers.

When Pitt resigned in 1801 Canning resigned with him, but proved an insubordinate follower. In 1802 he resigned his candidature for Newport and was returned as an independent member for the Irish borough of Tralee. His violent attacks on Addington damaged his own reputation as much as his victim's, while his attempts to act as a political go-between in Ministerial arrangements were unfortunate. On the formation of Pitt's second Ministry, he took the post of treasurer of the navy on May 12, 1804, but left office on Pitt's death on January 21, 1806. He refused to take office in Fox's Ministry of "all the talents," although he was offered the leadership of the House of Commons. After the death of Fox he joined the duke of Portland's Administration as secretary of state for foreign affairs, a post which he held from March 1807 to September 1809.

During these years Canning had a large share in the vigorous policy which defeated the secret articles of the Treaty of Tilsit by the seizure of the Danish fleet. This high-handed action did not pass without censure, but his defence in the House of Commons silenced his accusers, although he could not disclose the source from which he had gained his secret information. He threw himself eagerly into the prosecution of the Peninsular War, for he realised that Spain was Napoleon's vulnerable point. Unfortunately his tenure of office ended in circumstances which left him in deep discredit. Canning found that the War Office continually hampered him in the carrying out of his schemes, and he suggested to the duke of Portland that Castlereagh, secretary for war and the colonies, should be given another office, not on the ground of incompetence, but of incompatibility of policy. The duke, a sickly and vacillating man, took no steps in the matter, and after six months, when he found that his wishes were disregarded, Canning resigned. At that point Castlereagh heard of the negotiations but was misinformed as to their true content. Thinking that Canning had demanded his dismissal on the ground of incompetence and yet had continued to be his colleague, Castlereagh challenged him on September 19, 1810. In the duel on Putney heath which followed Canning was wounded in the thigh. Public opinion was strong against him, especially as the death of the duke of Portland made it impossible for him to clear himself, and he was regarded with mistrust. For twelve years he remained out of office or in inferior places, but his ability made it impossible that he should remain obscure. In 1810 he was a member of the bullion committee, and his speeches on the report showed his mastery of the subject. His reputation for economic knowledge recommended him to the electors of Liverpool, which city adopted him as its member in 1812, a connection which lasted until 1822 and which taught him a great deal of the commercial and democratic needs of the time. In 1816 he entered office as president of the board of control in Lord Liverpool's Cabinet, in which Castlereagh, with whom he had become reconciled, was secretary of state for foreign affairs. Under his direction Hastings waged a successful war against the Pindaris and the Mahratta confederacy, whereby their dominions were brought under the rule or protectorate of Great Britain. He also began the practice of appointing distinguished members of the East India Company to high administrative posts, instead of filling them invariably with men sent out from England. In this way Monro and Elphinstone owed their original appointments to him. In 1820 he resigned his post in order to avoid taking any part in the proceedings against a lifelong friend of his wife, Queen Caroline, the wife of George IV.

Canning returned to office on the suicide of Castlereagh in 1822. He had accepted the governor-generalship of India, and he refused to remain in England unless he received the "whole inheritance" of Castlereagh—the foreign office and the leadership of the House of Commons. He held that position from September 1822 until April 1827, when he became prime minister in succession to Lord Liverpool, but even before this he was the real director of the policy of the Cabinet—as Castlereagh had been from 1812 to 1822.

His fame as a statesman is based mainly on the foreign policy which he pursued in those years—the policy of non-intervention—and of the patronage, if not the actual support, of national and liberal movements in Europe. This policy had already been laid down in a State paper of May 5, 1820, so that it can safely be asserted that Castlereagh's views must have been influenced by Canning, since the policy therein contained was contrary to that pursued by Castlereagh during most of his term of office. At the congress of Verona the duke of Wellington defined England's position according to his instructions as one of "neutrality but not of indifference," and the point-blank refusal of England to join the Powers in their intervention in Spain was the death-blow to the system of congresses and the beginning of a new era in Europe. His eloquence has associated with his name the responsibility for British policy. No speech of his is perhaps more famous than the one in which he claimed the initiative in recognizing the independence of the revolted Spanish colonies in South America in 1823: "I resolved that, if France had Spain, it should not be *Spain with the Indies. I called the New World into existence to* redress the balance of the Old" (December 12, 1826).

It has been well said that Portugal owed to Canning her security, Greece and the South American republics their existence, while it was owing to his influence that the Holy Alliance was dissolved and liberalism introduced into European diplomacy, for he was the first statesman to advance the doctrine of nationality.

When Lord Liverpool was struck down in a fit on February 17, 1827, Canning was obviously marked out as his only possible successor. Although the duke of Wellington, Sir Robert Peel and several other members of the Ministry, moved perhaps by personal animosity and certainly by dislike of advocacy of the claims of the Roman Catholics, refused to serve under him, he succeeded in forming a Ministry in April. His health, however, broke down under the strain. He had caught cold at the funeral of the duke of York in January and never recovered. He died on August 8, 1827, at Chiswick in the house of the duke of Devonshire, in the same room in which Fox had died, and was buried at the feet of Pitt.

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(E. F. M.-S.)

CANNING, COMMERCIAL. The history of canning goes back to the year 1795 when the French Government offered a prize of 12,000 francs for the discovery of a practical method of food preservation. France was in the grip of a revolution at home and at the same time was at war with several hostile European nations. Consequently, the need for adequate food supplies for her army and navy was acute. It was not until 1809, however, that Nicolas Appert, a Parisian confectioner, succeeded in preserving certain foods in especially made glass bottles which had been kept in boiling water for varying lengths of time. Although there is one previous reference in literature to the inadvertent preservation of food by heat sterilization (Spallanzani, 1765), credit for the discovery of the canning process is given to Appert. In the next year, 1810, his work was made known publicly in a treatise entitled "The Book for All Households or the Art of Preserving Animal Substances for Many Years." The grateful Government awarded Appert the prize. The underlying principle of the various methods of food preservation is basically the same; the development of conditions within a food—temporary or sustained—which are unfavourable for the growth of spoilage organisms. Thus, for example, if a food be chilled, heated or desiccated, or if it be made excessively acid by some proper means, it immediately becomes an unfavourable medium for the development of micro-organisms. In commercial canning, carefully prepared raw food contained in a sealed container is subjected to definite elevated temperatures for the proper period of time and then cooled. Heating the contents of the can produces an unfavourable temperature environment for spoilage organisms which may be present in the food; consequently such organisms are destroyed and their growth inhibited. The permanently sealed can then prevents reinfection of the food by spoilage organisms present in the air. This is the basic principle of commercial canning.

It was by patient trial and error in his experiments that Appert was able to give directions for conserving the many products listed in his treatise. He could give no logical explanations. He believed, however, that the application of heat to a sealed container, together with the exclusion of air, combined to retard or eliminate the process of decomposition. Science was of little assistance, since chemistry was in its infancy and bacteriology was unknown. It was half a century later—about 1860—that the true causes of food spoilage came to be understood as a result of Pasteur's work. It was another third of a century before his theories were applied specifically to the canning industry.

In 1895, Prescott and Underwood, working together at the Massachusetts Institute of Technology, first traced spoilage of certain lots of canned corn to imperfect sterilization (heat processing). This early work was followed by that of Russell, Macphail, Barlow, and others. Organized research into the problems of the industry was begun by the United States Department of Agriculture and by several universities, followed by the inauguration of the long-range programs of the National Canners Association, and of the research departments of the leading can manufacturers. As a result of studies and investigations in every phase of the industry, the canned food industry may be truly said to be on a scientifically controlled basis.

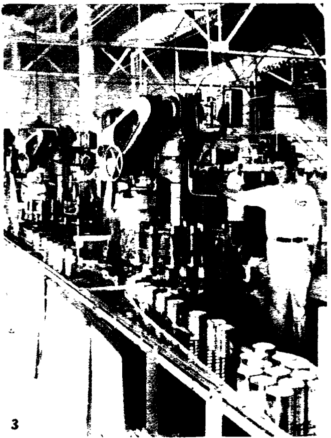
I. IN THE UNITED STATES

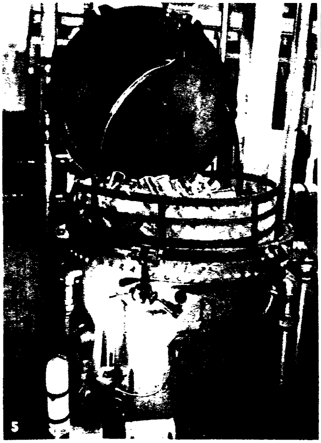
Knowledge of the industry was brought to America from England, and by the year 1820 William Underwood and Thomas Kensett were engaged in the commercial production of canned foods, in Boston and New York respectively, using the Appert process. It was not until 1839, however, that tin coated steel containers (tin cans) came into widespread use in America. Peter Durand, an Englishman, conceived and patented the idea of using tin cans instead of bottles. The phenomenal growth of the industry in the U.S.A. and throughout the world in the past century may be attributed (aside from the scientific approach) to the development of (1) the art of container manufacture of both tin cans and glass jars and bottles, (2) the canning processes themselves, and (3) canning machinery. The United States has become the greatest producer and consumer of canned foods in the world.

The present day tin can, which is 98.5% of sheet steel with a thin coating of tin, is manufactured on wholly automatic lines of machinery at a rate in excess of 300 cans per minute. In contrast, in can manufacturing operations a little over a generation ago, a skilled artisan could make 600 cans in a ten-hour day. The improvement of the tin can as the cheapest and most serviceable container for mass production is marked by the advent of the sanitary, or open-top, can about 1905–08. This development answered many of the canner's practical problems by eliminating the use of solder in sealing the can and a perfect closure was guaranteed by the "double seamed" top and bottom. In a typical year, the industry uses 10,000,000,000 tin cans for the nation's harvests.

On the other hand, in order to understand the growth of the industry to its present size, the great advances in the art of canning itself must be reviewed. Perhaps the greatest obstacle to volume production was the time necessary for processing the filled cans of food in boiling water. With the discovery in 1861, by Isaac Solomon of Baltimore, that calcium chloride added to boiling water raised the temperature of processing from 212° to 240° F. or higher, the time necessary to insure relative safety in the process was reduced from four or five hours to a mere 25 to 40 minutes. Thus, the average production in a first class cannery was stepped up from 2,500 cans to about 20,000 cans per day. This innovation, together with the impetus given by the Civil War requirements, brought almost immediate prosperity to the young industry. In the next decade, an advance which put the above in the discard was the invention in 1874 of the closed, steam pressure retort by A. K. Shriver of Baltimore. The resultant high temperatures under the complete control of the operator shortened the time necessary for effective processing and reduced accidents and spoilage to a new minimum.

In the meantime, hand labour in the cannery was being largely supplanted by semi-automatic and later by wholly automatic machinery, thus increasing output, reducing costs, and permitting wider use of canned products. In order to illustrate this point, it is necessary to mention only a few machines such as the washers, graders, peelers, corn huskers and cutters, bean snippers, filling machines, and a long list of others which have helped make high-speed production possible.





BY COURTESY OF AMERICAN CAN COMPANY

CANNING IN AMERICAN FACTORIES

1. Large peach cannery in California
2. Hawaiian pineapple cannery, where machines slice off the ends of the fruit, peel it to fit the cans and cut out the cores at the rate of 100 per minute
3. Filled cans of grapefruit entering a machine which closes the tops by a "double seaming" operation
4. Sealed cans being conveyed from a "double seaming" machine
5. Crate of canned peas being lowered into a retort (steam pressure cooker), to receive a heat treatment which preserves the contents indefinitely
6. After being cooked in a retort, the cans are thoroughly cooled in a continuous-conveyor tank

It may be seen then that each branch of the greater industry has contributed its share in the great advances that have been made in canning in the United States. Without the all important work of the scientist, without the perfection of the tin container, or the many contributions of the canning machinery manufacturers, it would be manifestly impossible for the industry to produce canned foods of the highest quality for a few cents per can.

Products Used in Canning.—From an early beginning along the Atlantic seaboard in the U.S.A. the industry has grown to a point where there are some 3,000 canneries in 45 of the 48 States, as well as in Hawaii, Alaska, and Puerto Rico. Only Nevada, North Dakota, and Rhode Island have no canneries. According to latest count, there are over 300 canned food items available, a variety which includes almost every fruit, vegetable, meat, or marine product used in America. In addition, there are many specialty products packed in smaller quantities. The location of the canneries is largely dependent on the growing areas of the product to be packed. As the great fruit growing area, California is listed in the 1937 Census as having 406 establishments, the great proportion of which would be fruit canneries situated near the orchards. Other geographical areas are noted for a specialty, *i.e.*, Hawaii for pineapple, Alaska for salmon, etc.

In practice, the relationship between grower and canner is particularly close, and the growing of crops for canning has become a highly specialized branch of agriculture. As a result of the work conducted by the Federal and State Departments of Agriculture, State universities, experiment stations and by the canners themselves, great advances have been made in this particular field. In order to secure uniformity in growing conditions and to insure uniformity in the raw product, the local canner contracts with the neighbouring farmers for an acreage sufficient for the normal capacity of his cannery, and either supplies or specifies the seed to be used. In this way, the canner is able to turn out a superior product, grown from the same seed, supervised during the period of growth by qualified fieldmen and harvested at the proper maturity. The period of time elapsed between picking and canning is seldom more than three or four hours. This disproves the popular belief held years ago that only that part of a crop was canned that could not be sold at market. Moreover, the products now available to the consumer, manufactured by modern cannery practices, are among the safest foods which reach the table. The heat processes to which canned foods are subjected during the canning procedures destroy not only spoilage bacteria, but also any pathogenic bacteria capable of causing food poisoning, which might be present on the raw material. Chemical preservatives are not needed to insure the preservation of canned foods and none are used. In addition, only edible plant varieties are canned. Consequently, there is no hazard to the consumer from bacteria or from bacterial, chemical, or plant poison.

As far as the nutritive aspects of canned foods are concerned, modern canning practices embody procedures and methods designed to protect the vitamin and mineral content of the food. Canned foods, whether in tin or glass, are as safe and wholesome as similar foods prepared for the table by the best home methods.

Operations Employed in Commercial Canning.—The operations employed in commercial canning procedures are dependent upon the nature of the product being packed. There are, however, certain operations all or most of which are included in canning procedures for fruits, vegetables, milk, fish, meat, or the so-called specialty or formulated products (soups, pork and beans, spaghetti, etc.). These operations may be grouped as follows:

Cleansing.—All raw materials used in canning must be thoroughly cleaned. Cleansing is usually effected by automatic passage of the raw food material through tanks of water or under high pressure water sprays. For certain products washing machinery of special design is used (flotation washers for whole kernel corn and peas). It is essential that only potable water be used. Some products (peas, spinach) receive a dry cleaning by subjecting them to air blasts or by means of shaking devices which remove inedible or extraneous materials prior to water washing.

Preparatory Operations.—These operations are quite varied in character but have as their primary objects the removal of inedible or undesirable portions of the food and conversion of the food into the desired or necessary form for subsequent canning operations. Preparatory operations include sorting, trimming, vining (peas), husking, cutting, silking (corn), size or maturity grading (peas), sectioning (citrus fruits), slicing, dicing, peeling and coring (fruits), pitting (cherries), soaking (dry beans, cherries), straining or pureeing (infant foods), extraction (fruit and vegetable juices), homogenization (milk, some juices or pureed foods), evaporation (milk), etc. Many of these operations are performed by special machinery; in other instances hand operations are required. These operations either precede or follow other canning operations such as cleansing or blanching.

Blanching.—Some products (beets, carrots, spinach, peas) require a blanch or immersion in hot water or steam to drive gases from their cells and shrink or wilt the product in order to obtain desired or legal weight of food in the final container. The blanch must sometimes precede certain preparatory operations (peeling, slicing, dicing). Occasionally the necessary shrink must be obtained by a pre-cook rather than by blanching (certain meat products). In addition to its other functions, with certain products the blanch serves as an additional cleansing operation, to remove objectionable flavouring materials acquired by such raw foods from inedible portions of plants ("vine flavour," peas).

Filling and Exhausting.—Automatic filling machines adaptable to specific products or to types of products (solid, semi-solid or liquid products) and capable of high speed operation are employed to place the prepared food in the can. The washed, open cans are mechanically conveyed to and from the filling machines. With some products (certain fruits, tomatoes) hand filling methods are used.

After filling, the open cans containing the food, especially that of non-homogeneous type, are usually thermally "exhausted" by passing them automatically through a hot water or steam bath in an "exhaust-box." Thermal exhausting heats and expands the food and releases gases (carbon dioxide and oxygen) from the cells. Air is also excluded by expansion of the food; thus, after sealing, heat sterilizing, and cooling the can, the contraction of the contents produces a partial vacuum in the container. The prime purposes of the exhausting operation are to exclude gases from the can—particularly oxygen—and prevent strain on the container by expansion of the contents during heat sterilization, as well as to avoid undesirable oxidative effects on the container and the food during storage. In addition, maintenance of a vacuum within the can is important to prevent occurrence of distended can ends or a so-called "flipper" condition in which the end of the container becomes convex with jarring or upon percussion but regains its normal concave position when pressed in by hand. Unless an adequate internal vacuum is provided, flippers may result when the cans are subjected to high temperatures in storage, or when shipped from a low to a high altitude. While the contents of flipped cans produced by these causes are wholesome, such cans are not merchantable. Thermal exhausting may also be effected by having the food hot when it is put into the cans (cream style corn). Certain products (corn-on-the-cob, coffee, salmon) are largely packed by the vacuum pack method in which mechanical exhausting is effected by the use of specially designed vacuum can-sealing machines. These machines withdraw air and other gases from the cans by use of a high vacuum and immediately seal the cans while still under vacuum.

Can Sealing, Closing, or Double-Seaming.—Special automatic sealing (closing or double-seaming) machines capable of operating at variable speeds (from 10 to 250 cans per minute, depending upon the can size and the nature of the product) are used to seal or close the covers on the sanitary style or type of can. The cans are usually mechanically conveyed to and from the sealing machine where the covers are placed on the can automatically and the sealing operation completed. The "curl" on the can cover and the flange on the can body are first rolled into position and then flattened together. The thin layer of gasket material or "compound" originally present in the rim of the cover is dispersed between the layers of metal insuring an hermetic seal on the container. As described, some vacuum closing machines of special design mechanically exhaust the can just before the double-seam is formed, other special types of closing machines permit sealing cans in an atmosphere of an inert gas such as nitrogen, carbon dioxide, or helium (vita-packing and the "L.O.C." method). The vent-hole types of cans (evaporated milk, certain meat products) are sealed on special "tipping" machines which close the vent-hole with a small drop of solder.

Heat Sterilization or Thermal Processing.—This is one of the most important operations in the canning procedure and essentially consists of subjecting the food—usually contained in the sealed can—to a known temperature for a period of time adequate to destroy spoilage and pathogenic organisms which might be present on the raw food material. Canners follow time and temperature processing schedules scientifically established as adequate for their products by laboratories associated with the canning industry. The heat treatments necessary to effect preservation of canned foods are determined by a number of factors, important among these being the active acidity, or pH, of the food or food product. The "acid foods"—with pH values of 4·5 or less—may be adequately processed by subjecting them to the temperature of boiling water (212° F. or 100° C.) for the proper length of time. The "non-acid foods" with pH values higher than 4·5 must be processed at higher temperatures. Most commercial processing temperatures for such foods fall in the range of 240° F. (116° C.) to 265° F. (130° C.); however, 240° F. is the processing temperature commonly employed. This temperature is attained by use of steam under pressure in a closed chest or canner's "retort." Steam pressure of approximately 10lb. corresponds to a processing temperature of 240° F.

Thermal processing equipment is of two general types: "still" retorts for batchwise operation, and the so-called "continuous cookers." Both types operate either at 212° F. for the acid foods or under steam pressure for the non-acid products; in either case the time of processing or "cooking" is regulated so as to subject the cans to the processing temperature for the proper length of time. More recent processing installations include automatic retort controllers which regulate and record the process applied. In one State (California) canners of non-acid products are required by law to equip their retorts in this manner. For specific products (evaporated milk) special processing equipment is available which either agitates or revolves the cans during the process cycle. The more acid foods and food products (berry and citrus fruits) may be sterilized by filling into the cans at certain temperatures, and inverting the containers for a short period to sterilize the can covers while sterilizing the cans. This is also the underlying principle in the "flash sterilization" method for preservation of the acid food juices.

Cooling, Labelling, Casing and Storage.—Following thermal processing, the sealed cans are cooled in cold water or in air. In water cooling, the hot cans are conveyed immediately after thermal processing is completed through tanks of cold water or through cold water sprays; cans of large diameter must be "pressure cooled" by water under pressure. Pressure cooling prevents outward straining or buckling of the can ends while gradual reduction occurs of the internal pressure of the cans produced by the sterilization. Water cooling is continued until the can contents have an average temperature of about 100° F. When the food is at this temperature, it usually contains sufficient heat to dry the cans and prevent external rusting of the tin container. In air cooling, the cans are stacked or "ricked" in rows so as to permit free air circulation. Many foods cannot be cooled suitably in air. Cans are labelled by special labelling machines; cans may be placed in fibre or wooden cases by hand or by special machines designed for that purpose. Frequently, cans are stored—cased or uncased—without labelling and the labelling operation performed just prior to shipment. Canned foods are stored in cool dry warehouses which are not subject to wide variations of temperature or humidity.

Canned Food Production Statistics. Production statistics for certain canned commodities for the years 1933 to 1938, inclusive, are given in the table.

Nutritive Values of Canned Foods. A considerable amount of investigation has been devoted to the effects of commercial canning on foods. Canning procedures are without practical effect on the proximate components of foods (protein, carbohydrates, fat, etc.). When syrups or brines containing sugars are added in canning, the natural carbohydrate contents of the foods are enhanced. Many researches have also established the effect of canning on the known vitamins.

In general vitamin A and carotene (provitamin A), if protected from atmospheric oxygen, are not materially affected by the heat treatments given canned foods. Vitamin D, riboflavin—the factor formerly designated as vitamin G—and also the P-P or pellagra-preventive factor appear to be unaffected by commercial canning. The stability of vitamin B_1 is dependent not only upon the heat treatment accorded it, but also upon the acidity (pH) of the food in which it is contained. For the more acid foods there is practically no loss of this vitamin during canning; in the less acid foods, which require longer processing times at higher temperatures, the degree of retention is not so great. Vitamin C, which is generally considered to be the most labile of all the vitamins, is especially subject to destruction at elevated temperatures under conditions which permit free access to atmospheric oxygen. In canning, however, the food is protected to a large degree from contact with oxygen, consequently the antiscorbutic factor is well retained in canned foods. Protective measures employed in commercial canning combine to insure that vitamins are retained in high degree. Such measures include the use of selected raw materials at the optimum state of maturity; prompt handling of the harvested crop; rapid inactivation of enzymes, removal of respiratory oxygen; and exclusion of air to a maximum extent during canning.

*Recent Canned Food Production Figures in the U.S.A.**

	1934	1935	1936	1937	1938
Fruits†					
Apples	2,581,162	2,331,581	2,620,373	2,072,328	1,755,624
Applesauce	1,892,187	1,887,256	2,353,250	3,161,001	1,526,551
Apricots	2,075,631	3,332,814	2,082,467	5,727,096	1,729,480
Blackberries	746,301	486,651	506,341	403,218	534,248
Raspberries	531,068	517,746	388,581	623,561	319,287
Cherries, Red Pitted	1,855,043	2,562,683	1,450,355	2,171,082	1,694,813
Cherries, Sweet	526,162	535,393	569,785	518,076	730,232
Grapefruit	2,308,352	3,747,822	2,410,004	4,270,740	3,654,697
Grapefruit Juice	730,844	2,556,124	2,235,699	6,016,240	8,021,828
Peaches	8,936,335	11,746,034	11,566,593	13,002,140	10,401,016
Pears	6,163,302	4,766,874	6,104,365	5,115,062	4,848,000
Plums	266,855	152,016	110,040	285,532	70,086
Prunes	1,130,765	1,757,457	1,801,363	1,607,271	931,087
Grapes	[illegible]	105,998	108,667	121,859	93,532
Figs	222,670	210,530	313,036	412,481	260,299
Pineapple (Hawaiian)	9,000,000	10,000,000	12,000,000	12,500,000	10,000,000
Pineapple Juice (Hawaiian)	2,000,000	2,500,000	5,000,000	7,500,000	5,000,000
Fruit Salad	1,381,723	1,316,547	[illegible]	1,250,192	938,455
Fruit Cocktail	1,167,851	1,040,097	2,156,868	3,152,313	1,041,814
Strawberries	168,076	181,037	133,206	126,031	94,860
Loganberries	352,045	225,376	164,613	66,078	105,786
Gooseberries	34,171	40,349	57,379	87,105	17,287
Blueberries and Huckleberries		212,188	252,138	411,088	185,009
Orange Juice	342,078	1,107,200	1,227,186	1,016,030	1,306,183¶
Lemon Juice		150,000	306,000	[illegible]	425,000¶
Vegetables‡					
Asparagus†	2,146,131	2,316,958	2,796,091	2,793,006	2,103,214
Beans					
Green	5,157,128	6,631,152	5,675,306	8,051,119	9,108,033
Lima†	1,280,812	1,133,776	1,512,737	1,310,010	1,863,486
Wax	1,113,234	1,120,955	954,070	1,370,724	1,866,061
Beets	2,196,116	2,161,765	[illegible]	3,216,193	[illegible]
Carrots				916,486	703,655
Corn	11,267,867	[illegible]	14,621,189	[illegible]	20,466,318
Peas	[illegible]	[illegible]	[illegible]	[illegible]	25,158,047
Pumpkin & Squash†	1,381,121	[illegible]	1,707,813	1,507,298	1,195,177
Spinach	3,663,131	[illegible]	4,113,167	[illegible]	[illegible]
Tomatoes	22,376,340	[illegible]	[illegible]	26,076,091	22,966,184
Tomato Juice†	5,703,920	9,286,709	13,161,866	13,111,072	8,912,894
Milk§					
Evaporated and condensed milk	[illegible]	[illegible]	[illegible]	[illegible]	

*These figures were adapted from National Canners Association bulletin, *Canned Food Pack Statistics* 1938, Parts 1 and 2, and from Western Canner and Packer, *Yearbook*, 1939.

†On basis of actual cases packed.

‡On basis of cases of No. 2 cans packed, unless indicated by †.

§On basis of cases of 14½ oz. cans packed.

¶Provisional figure.

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II. IN THE BRITISH EMPIRE

Great Britain.—The canning industry was of considerable importance in Great Britain before 1914, and an export trade had been developed. War demands gave a great impetus to the industry, though the export trade was temporarily reduced. Another impetus came in 1925 with the establishment of the National Food Canning Council, and factories with the most up-to-date American machinery were established at Wisbech, Hereford, Evesham and in Kent. The number of fruit and vegetable canneries rose from approximately 12 in 1925 to 85, in 1935, and was about 70 in 1938. Particularly did the production of condensed milk rise rapidly, to about 2,500,000 cwt. in 1937. Production of canned fish in 1935 was approximately 180,000 cwt. valued at £387,000; the production of canned fruit was about 462,000 cwt., that of preserved meat about 233,000 hundredweight. Accurate statistics on canned vegetables are not kept.

Canada.—After 1910 the canning industry in Canada developed rapidly. Packing and canning factories were established in many parts of the Dominion, and the closest attention has been given to grading and standardization. The total value of production in 1900 did not exceed $8,250,000, whereas in 1930 it had risen to more than $55,000,000 and in 1937 to $62,194,905. In the latter year there were 773 establishments engaged in packing and canning. Production was as follows:

	Unit	Quantity	Value ($)
Canned fish	case	2,217,708	13,619,606
Canned fruits	"	2,120,413	5,251,981
Canned vegetables	"	9,611,050	17,117,580
Canned meats	lb.	6,093,546	1,318,900
Canned soups	case	2,426,739	6,021,687
Other canned foods	—	—	8,786,959
Concentrated milk products			10,078,192

New Zealand.—In New Zealand the largest share of the industry is taken by canned meats. Sheep and ox tongues, boiled mutton and beef, corned mutton and beef, and meat extract are the principal commodities. Jams, canned fruits and fish are also produced.

Australia.—The canning of fruit products leads all other types in Australia. Production of canned fruits in 1937, excluding berries, was 2,518,000 cases, of which 1,699,000 were exported. In 1937–38 there were 77 factories with a total output value of £5,737,000.

South Africa.—Manufacture of canned fruits in South Africa rose from an output of 2,694,000lb. in 1920–21 to 19,443,000lb. in 1935–36, then dropped to 13,105,000lb. in 1936–37 (including the production of members of the South African Food Canners' Council only). South Africa exports canned crawfish in small quantities, and the total manufacture of other canned fish commodities amounts to about £25,000 annually. Vegetables are also canned.

Malaya.—There is a large canned pineapple industry, first established in 1888 and now almost entirely controlled by Chinese. In 1937 and 1938 exports exceeded 60,000 tons.

III. IN OTHER COUNTRIES

Germany has a large production of canned vegetables which averages more than 100,000,000 cans per year, mostly for domestic consumption; in 1937 exports were only 12,000 hundredweight. Italy is a major producer of canned tomatoes (usually more than 400,000 tons annually) and also has an export trade in other vegetables and fruits. Norway is a large producer of canned fish, principally herring; in 1937 it exported 712,000 cwt. valued at £1,837,000. Portugal accounts for 65% of the sardine exports from Europe; Spain is second with about 33%. France, Belgium, Denmark, Italy and Russia are other exporters of canned fish. The Netherlands' principal canning industry is condensed and evaporated milk, of which 3,392,000 cwt. were manufactured in 1937.

The canning industry has expanded rapidly in Japan, advancing from a production of 3,722,000 cases in 1926 to 8,672,196 cases valued at 113,311,717 yen in 1935. Canned seafood accounts for more than half the output, followed by canned fruit, canned meat and milk and canned vegetables. In 1938 the exports of all canned products from Japan had risen to 7,157,219 cases. (A. F. W.; X.)

CANNIZZARO, STANISLAO (1826–1910), Italian chemist, was born in Palermo on July 13, 1826. In 1845–46 he acted as assistant to Rafaelle Piria (1815–65), known for his work on salicin, who was then professor of chemistry at Pisa and subsequently occupied the same position at Turin. He took part in the Sicilian Revolution and on the collapse of the insurgents he escaped to Marseille, and reached Paris in Oct. 1849. There he worked in the laboratory of M. E. Chevreul, and in conjunction with F. S. Cloëz (1817–83) prepared cyanamide by the action of ammonia on cyanogen chloride in ethereal solution (1851). In the same year he was appointed professor of physical chemistry at the National College of Alexandria, where he discovered that aromatic aldehydes are decomposed by alcoholic potash into a mixture of the corresponding acid and alcohol, *e.g.*, benzaldehyde into benzoic acid and benzyl alcohol ("Cannizzaro's reaction"). In the autumn of 1855 he became professor of chemistry at Geneva university, and six years later, after declining professorships at Pisa and Naples, accepted the chair of inorganic and organic chemistry at Palermo. There he spent ten years, studying the aromatic compounds and continuing to work on the amines, until in 1871 he was appointed to the chair of chemistry at Rome university. Apart from his work on organic chemistry, which includes also an investigation of santonin, he rendered great service to the philosophy of chemistry when in his memoir *Sunto di un corso di Filosofia chimica* (1858) he insisted on the distinction, till then imperfectly realized, between molecular and atomic weights, and showed how the atomic weights of elements contained in volatile compounds can be deduced from the molecular weights of those compounds, and how the atomic weights of elements of whose compounds the vapour densities are unknown can be ascertained from a knowledge of their specific heats. For this achievement, of fundamental importance for the atomic theory in chemistry, he was awarded the Copley medal by the Royal Society in 1891. Cannizzaro entered the Italian senate in 1871. He became its vice-president and a member of the Council of Public Instruction and in other ways he rendered important services to the cause of scientific education in Italy. He died in Rome on May 9, 1910.

CANNOCK, an urban district of Staffordshire, England, in the district known as Cannock Chase, 8 mi. N.W. of Walsall by the L.M.S.R. Pop. (1938), 36,730. Area 12.7 sq.mi. The church of St. Luke is Perpendicular, enlarged in modern times. The famous political preacher, Henry Sacheverell, held his first curacy there in the 18th century. Cannock is a great mining centre, with subsidiary metal-working industries. Cannock Chase, a tract generally exceeding 500 ft. in elevation, extends on an axis from northwest to southeast over some 56.2 sq.mi. It was a royal preserve, and although much is uncultivated, it is also a rich coalfield. Brownhills, Burntwood and Chase Town, Great Wyrley, Hednesford, Hammerwich and Pelsall are mining settlements; while Rugeley, Tamworth, Short Heath and Wednesfield are all included in the Cannock Chase field.

CANNON, ANNIE JUMP (1863–1941), U.S. astronomer, was born at Dover, Del., on Dec. 11, 1863. She graduated at Wellesley college, Wellesley, Mass., in 1884, and did special work in astronomy at Radcliffe college, Cambridge, Mass. She was an assistant at the Harvard college observatory, Cambridge, Mass., 1897–1911, and after 1911 the curator of astronomical photographs. The monumental *Henry Draper Catalogue* of stellar spectra which was published in sections between 1918–24, together with the catalogue of the *Henry Draper Extension*, comprise her principal contribution to astronomy. The importance of this work to all problems of modern stellar astronomy cannot be overemphasized. In addition to the catalogues of stellar spectra, she discovered many new variable stars and five novae or new stars.

CANNON, JOSEPH GURNEY (1836–1926), American politician, was born in Guilford, N.C., on May 7, 1836. In 1858 he was admitted to the Illinois bar and from 1861 to 1868 he was a state's attorney. He settled at Danville, Ill., entered politics and was elected Republican representative in Congress for the periods 1873–91, 1893–1913 and 1915–23, retiring in his 87th year after serving for a total of 46 years in the House of Representatives, of which he was speaker for eight years, 1903–11. Although usually alining himself with the more conservative groups on questions of national policy, he was personally liked by the members of all factions and was popularly known as "Uncle Joe" Cannon. He died at Danville, Ill., on Nov. 26, 1926.

See L. White Busbey, *Uncle Joe Cannon* (1927).

CANNON, a gun or piece of ordnance. The word, first found about 1400 (there is an indenture of Henry IV. 1407 referring to *canones, seu instrumenta Anglicè gunnes vocata*), has been commonly applied to any form of firearm fired from a carriage or fixed mounting, in contradistinction to "small-arms," which are fired without a rest or support. An exception must be made, however, in the case of *machine guns*, and the word as used in modern times may be defined as follows: "a piece of ordnance mounted upon a fixed or movable carriage and firing a projectile of greater calibre than 1in." In French, however, the term *canon* has been applied to the barrel of small arms, and also, as an alternative, to *mitrailleuse* or *mitrailleur*, to machine gun, as well as to ordnance properly so-called. For details *see* ARTILLERY; GUN, MACHINE; ORDNANCE; SMALL ARMS, THE DEVELOPMENT OF, etc. For "cannon" in billiards *see* BILLIARDS

In the 16th and 17th centuries the "cannon" in England was distinctively a large piece, smaller natures of ordnance being called by various special names, such as culverin, saker, falcon, demi-cannon, etc. We hear of Cromwell taking with him to Ireland (1649) "two cannon of eight inches, two cannon of seven, two demi-cannon, two twenty-four pounders," etc.

Sir James Turner, a distinguished professional soldier contemporary with Cromwell, says: "The cannon or battering ordnance is divided by the English into Cannon Royal, Whole Cannon and Demi-Cannon. The first is likewise called the Double Cannon, she weighs 8,000 pound of metal and shoots a bullet of 60, 62 or 63 pound weight. The Whole Cannon weighs 7,000 pound of metal and shoots a bullet of 38, 39 or 40 pound The Demi-

Cannon weighs about 6,000 pound and shoots a bullet of 28 or 30 pound. . . . These three several guns are called cannons of eight, cannons of seven and cannons of six." The generic sense of "cannon," in which the word is now exclusively used, is found along with the special sense above mentioned as early as 1474. Yet another definition of "cannon," introduced by Lieut.-Col. Peter Hawker (1786–1853), patron saint of the shot-gun enthusiast, is "to bring down with a single shot, two birds crossing in their flight."

"Artillery" and "ordnance," however, were the more usual terms up to the time of Louis XIV. (*c.* 1670), about which time heavy ordnance began to be classified according to the weight of its shot, and the special sense of "cannon" disappears.

CANNON-BALL TREE (*Couroupita guianensis*), a native of tropical South America (French Guiana), which bears large spherical woody fruits, containing numerous seeds, as in the allied genus *Bertholletia* (Brazil nut). The timber is of value.

CANO, ALONZO (1601–1667), Spanish painter, architect and sculptor, was born at Granada. He learned architecture from his father, Miguel Cano, painting from Pacheco and sculpture from Juan Martinez Montañes. As a sculptor his most famous works are the Madonna and Child in the church of Nebrissa, and the colossal figures of San Pedro and San Pablo. As an architect he indulged in too profuse ornamentation, and gave way too much to the fancies of his day. Philip IV. made him royal architect and king's painter, and gave him the church preferment of a canon. His more important pictures are at Madrid. Cano was notorious for his ungovernable temper.

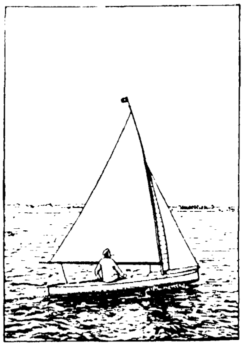
CANO, MELCHIOR (1509–1560), Spanish theologian, born at Tarançon, New Castile, joined the Dominican order in 1523 and succeeded to the theological chair in the University of Salamanca. He violently opposed Bartolomé Carranza, also a Dominican and afterwards archbishop of Toledo, and took part in condemning him for heresy. After attending the Council of Trent in 1545, he was sent by Jesuit influence, in 1552, as bishop of the Canaries. His personal influence with Philip II., however, procured his recall and he became provincial of Castile. In 1550 he wrote his famous *Consultatio theologica*, advising the king to resist the temporal encroachments of the papacy, thus making Spain less dependent on Rome. Hence Paul IV. styled him "a son of perdition." The reputation of Cano rests on his *De Locis theologicis*, a work written in the humanist form and advocating, in place of scholastic subtleties in dogmatic theology, a return to patristic erudition and a scientific basis. Cano died at Toledo on Sept. 30, 1560.

See the Dominican *Mandonnet*, in *Dict. of Cath. Theol.* (1904).

CANOE, a general term for a boat sharp at both ends, originally designed for propulsion by one or more paddles (not oars) held without a fixed fulcrum, the paddler facing the bow. As the historical native name for certain types of boat used by savages (Columbus found the word *canoa* in use in the West Indies; it has a curious resemblance to the French *canot*, a boat) it is applied in such cases to boats which are open within from end to end, and the modern "Canadian canoe" preserves this sense. The name is used in some countries for craft differing from such boats by being covered in with a deck except for a "well" or cockpit where the paddler sits. Modern developments are the cruising canoe, combining the use of paddle and sails, and the racing canoe, equipped with sails only.

The primitive canoes were light frames of wood over which skins, as in the old British coracle (*q.v.*) or in the Eskimo canoe or "kayak" (*q.v.*), or the bark of trees, as in the North American Indians' birch-bark canoe, were tightly stretched. The modern canvas covered canoe, built on Indian lines, was a natural development of this idea. Primitive peoples also used and still use the "dug-out," made from a tree hollowed by fire after the manner of Robinson Crusoe. Many of these are wonderfully carved and ornamented with inlay, and are of considerable size and carrying capacity; one in the New York Natural History museum from Queen Charlotte's island is 63ft. long, 8ft. 3in. wide, and 5ft. deep, cut from a single log. The "war canoe" of paddling races is its modern successor.

In the islands of the Pacific and elsewhere dug-out canoes are handled with great skill by the natives, who make long sea voyages in them, often stiffening them by attaching another hull (*see* PROA and SHIP); in New Zealand the Maoris were formerly masters of the art of dug-out canoe construction, some of their ancient war canoes being of huge size. Along the coast of West Africa the fisher tribes still use large dug-out canoes for fishing at sea, remaining out of sight of land for days, and the return of the fishing canoes each with its large square sail set on sprits and travelling at great speed is a picturesque sight still to be witnessed all along the coast. In the earlier part of the 19th century, what was known as a "canoe" in England was the short covered-in craft with a "well" for the paddler to sit in, which was popularly used for short river practice; and this type still survives. But the sport of canoeing in any real sense dates from 1865, when John MacGregor (*q.v.*) designed the canoe "Rob Roy" for long journeys by water, using both double-bladed paddle and sails, yet light enough (about 70lb.) to be carried over land. The general type of this canoe is built of oak with a cedar deck; the length is from 12ft. to 15ft., the beam from 26in. to 30in., the depth 10 in. to 16 in. The paddle is 7ft. long and 6in. wide in the blade. The canoeist sits low in the cockpit, and in paddling dips the blades first on one side and then the other.


RACING CANOE, "B" CLASS, ROYAL CANOE CLUB, ENGLAND

The sliding gunter mainsail and roller foresail are shown

The Royal Canoe Club.—In 1866 the Royal Canoe Club was formed in England, and the prince of Wales (afterwards Edward VII.) became commodore. Its headquarters are at Kingston-on-Thames and it is still the leading organization. There is also the British Canoe Association, devoted to cruising. After the English canoes were seen in Paris at the exhibition of 1867, others like them were built in France. Branches and clubs were also formed at various centres in Great Britain. Sea voyages in canoes are no longer uncommon, and many rivers were explored by members of the Royal Canoe Club in inaccessible parts, like the Jordan, the Kishon, and the Abana and the Pharpar at Damascus, as well as the Lake Menzala in the Delta of the Nile, and the Lake of Galilee and Waters of Merom in Syria. The New York Canoe Club was founded in 1871.

The late W. Baden Powell and E. B. Tredwen, both members of the Royal Canoe Club, modified the "Rob Roy" and constructed paddlable sailing canoes, known as the "Nautilus" and "Pearl" respectively, by the introduction of a centre-board and yawl rig, and in 1886 Paul Butler of Lowell, Mass., added a sliding outrigger seat allowing the canoeist to slide out to windward as shifting ballast. This type of canoe was universal in racing till, under the influence of the late Linton Hope's designs, the Royal Canoe Club developed the "B" class canoe which in Great Britain has entirely taken its place as a racing machine and is a wonderful sea boat withal. These vessels are 17ft. long, 3ft. 6in. in beam and 1ft. in depth, decked, with the exception of the steering well, and are divided into three compartments by two watertight bulkheads. Out-board seats are barred. The rig is sloop with sliding gunter or Bermuda mainsail and roller foresail, the total sail area being 150 sq.ft. Speeds up to 10m. per hr. have been attained by these canoes in the Royal Canoe Club's races.

In the paddling races of the Royal Canoe Club, both the open Canadian type of canoe is used with single-bladed paddles, and a partly decked, very long, light and shallow type for team racing, propelled by double-bladed paddles. In Canada team racing with single bladed paddles in "war canoes" is a popular amateur sport. The "Canadian," an all wood canoe, clinker or carvel built with mahogany, cedar or basswood planking always popular in Canada and the canvas covered canoe with cedar hull, chiefly of United States manufacture, both on the general lines of the Indian birch-bark, are as common on American rivers as the punt is on the Thames and are similarly used.

See MacGregor *A Thousand Miles in the "Rob Roy" Canoe, The "Rob Roy" on the Baltic,* etc.; W. Baden Powell, *Canoe Travelling;* W. L. Alden, *Canoe and the Flying Proa;* J. D. Hayward, *Camping out with the British Canoe Association;* C. B. Vaux, *Canoe Handling;* Stephens' *Canoe and Boat Building.*

The United States.—The canoe in the United States is the direct descendant of the American Indian's birch-bark canoe and, being indigenous, it has a wider range of use than any other small water-craft. Although it is considered unsafe by persons unacquainted with its possibilities, its graceful appearance and the romance associated with it impart a glamour even to the uninitiated. The white man found the Indian's birch-bark a perfectly developed craft and promptly adopted it. The early explorers, the frontiersmen, all used the canoe. They and the Indians are inseparably bound with the canoe in the mind of a boy, and the youthful longing thus created to own a canoe is often the first to be fulfilled. Three other factors have been influential in the increased popularity of the canoe: the vogue of outdoor sports; the almost national ability to swim, both greatly accelerated by World War I; and the use of larger canoes. The fatalities for which the canoe was formerly blamed have decreased, not due to better handling of the craft, but to the fact that an upset to-day means only a ducking, and to the use of the 17 ft. canoe which is much harder to capsize than the smaller models favoured in earlier years.

Canoes are still built in almost any size from 10 ft. up, but the usual size in the United States is 17 ft. long and 34 in. wide. Its depth ranges from 12 to 14 in., the ends rising 4 to 6 in higher. This size was gradually accepted as canoemen found few lengthy portages in their usual waters and discovered that it was still within the limits that one man could conveniently handle

In Canada, where long carries militate against the weight of the larger canoe, the general size is 16 ft. by 30 in. beam. The all wooden canoe is the favourite in Canada, while the canvas-covered craft is the more commonly used in the United States. The all wood is faster, the canvas-covered is more buoyant The original birch-bark canoe, while almost impossible to obtain now, is slower than either of the other two, but it will keep going under stress of wind or water that would drown any other type.

Prior to the widespread use of the canoe which developed the 17 ft. craft, a great variety of sizes was tried. The earlier canoeman ordered his craft according to his weight, just as he bought his clothes according to his size. The ultimate in this line was the "Sairy Gamp," the 10½ lb. clinker-built cedar canoe used by George W. Sears (Nessmuk). This canoe, 10 ft. long by 26 in. beam, is now in the Smithsonian Institution, Washington, D C At the same time the sail-and-paddle canoe flourished and the canoe with 3-ft. decks and cockpit coamings, canoe tents, and canoe awnings.

One of the best known and most typical canoes of that period, "Rob Roy," found many adherents in the United States.

Modern canoemen, however, are almost unanimous in their preference for a camp on shore entirely separated from the canoe (*see* CAMPING). With the disappearance of the canoe-tent idea, the sail-and-paddle canoe was entirely superseded by the out-and-out sailing canoe and the simple, open paddling canoe, although the one may be paddled and the other sailed. Sailing canoes in the United States are used almost exclusively for racing, although they were formerly used considerably for cruising. A notable cruise was that of "Yakaboo," in 1911, sailed by Frederic A. Fenger northward through the Lesser Antilles.

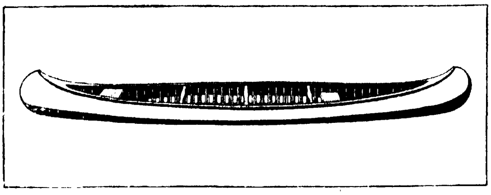
The customary size to which sailing canoes are built is 16 ft. by 30 in. beam. Equipped as they are with centre-boards, rudders, decks and sliding seats to utilize the weight of the sailor as ballast, they are virtually small yachts. They are rigged with two masts, each carrying a batwing or Bermuda sail, the division spreading about 60% of the area in the foresail. These tiny racers have been known to outsail yachts of twice their size. Their development is largely based on the work of Paul Butler, an enthusiastic canoeman who invented the sliding seat, clutch cleats and reefing gears; built hollow spars and other accessories; introduced the sliding tiller, watertight bulkheads and self-bailing cockpits, all features in use to-day. They provide such excellent competitive sport that they have recently been adopted for class racing by several yacht clubs.

The organization and advancement of canoe racing, both sail and paddle, however, belongs to the American Canoe Association. The New York Canoe Club, its predecessor in the field, was too localized to wield the influence exerted by the A C A. The association, which was founded in 1880, also encouraged canoe cruising and the general use of the craft. In 1928 it was the controlling canoe organization in the United States and Canada. In its six divisions it covered the entire country and included the majority of the important canoe clubs.

See R. E. Pinkerton, *The Canoe* (1923); Nessmuk, *Woodcraft* (1895); S. Edward White, *The Forest* (1903); W. H. Miller, *Canoeing, Sailing and Motor Boating* (1928). (W. A. Go)

Canoe Racing in the United States has developed under the guidance and rules of the American Canoe Association since that body was formed in 1880. The canoes in use in the early part of this period were of varied design, gradually becoming standardized until now two general types of canoes only are used for racing: the decked sailing canoe, fitted with centre-board, rudder and sliding seat, and the open canoe, generally built of white cedar strips without canvas covering The decked sailing canoe was originally permitted as great a sail area as the boat could carry. It was this latter consideration which led Paul Butler, of Lowell, Mass., trophy winner in 1892 and 1893 to develop the sliding seat, thus enabling the lightweight man to throw his weight over-side to offset the normal advantage of the heavier man.

All of the trophy winning boats with the exception of Hilding Froling's "Doris" canoes (1921 and 1927) were 16 × 30's (16 ft. long by 30 in beam). In 1907 George P. Douglass, several times trophy winner in decked canoe and cruising canoe races, began to advocate the use of larger boats with proportionately greater sail area, but in 1909 a rule was passed limiting the sail area to 90 sq.ft., thus effectively blocking the building of larger craft. Not until 1917, when Douglass, supported by Froling renewed the advocacy of the larger boat, were the rules changed to provide a sliding scale of sail area in proportion to boat dimensions Slowly, but with gaining favour, this privilege has been accepted until now there are several canoes with dimensions varying from 17′×34″ to 18′×42″, all built after designs by Froling. The sail types have varied from the bat-wing and lateen to the two leg-o-mutton with standing mast, now in use. While the decked sailing canoe has been recognized as the finest type of canoe sailing machine, it has frequently been outnumbered at regattas by the open or cruising canoe rigged with lateen sail and lee-boards



AMERICAN CANOE, MODELLED AFTER THE INDIANS' BIRCH-BARK CRAFT ITS LIGHINESS AND SHAPE MAKE IT FAST EASY TO HANDLE AND IDEAL FOR SHALLOW WATERS

Paddling racing has developed a few boat designs only, but by reason of the use of single and double-blade paddles and the possibility of manning a canoe with several paddlers, the number of different events at an A C.A. regatta is large There are two standard one- or two-man canoes. One is known as the cruising canoe. It is not as sea-worthy as other boats used for cruising only, having straight sides and being shorter on the water-line, but its combined speed and relative sea-worthiness make it popular. The other boat is known as the racing paddling canoe. It is frail, but very speedy, being drawn in from the gunwales to the keel so as to have a V shape. A larger boat, 20′ × 30″, known as the Club Four, is used with four paddlers, using single or double blades. War canoes, manned by nine men with single blades, are used by a few clubs, principally those located in New England.

The American Canoe Association became a member of the Amateur Athletic Union in 1926, and canoe racing was included on the programs of the 1932 and 1936 Olympics. (L. W. Hu.)

How to Handle a Canoe.—The most popular canoes among Indians, guides, hunters, voyagers and pleasure seekers are built of cedar and spruce and covered with heavy canvas. They run in length from the 12 ft. "junior" model to the 30 ft. war canoe or freight carrier. The canoe in most favour is from 16 ft. to 20 ft. long.

This canoe may be paddled by one person with a single blade paddle which may be used continuously on one side without propelling the craft off its straight course. At the end of each stroke the voyager steers his boat by an overhand twist of the paddle. The trick is accomplished with the hand at the upper end of the paddle. This hand holds the paddle as it would the upper end of the handle of a snow shovel. At the end of each stroke the hand and paddle are so turned that the back of the hand is turned out toward the water on the same side of the canoe on which one is paddling. The blade of the paddle is kept in the water long enough to bring the canoe back on its course after each thrust of the paddle. The blade should be feathered on the recover stroke. It is better to paddle a canoe on the side opposite to that on which the wind strikes the hull. Thus the thrust of the paddle offsets the thrust of the wind. This obviates a great deal of the steering effort. Indeed if the wind blows hard enough a paddler may not be able to navigate his craft in a side wind. He may have to paddle straight in the eye of the breeze or run before it or go ashore and wait until the wind stops blowing.

A lone paddler should kneel in the canoe about one-third of the length of the boat from the stern. A thwart is placed there for this purpose. It is never good practice to try to sit on the stern seat unless there is a load of dunnage in the bow or thereabouts, or a second person in the boat. The paddler rests the buttocks partly on and partly against the aforementioned thwart. In heavy weather it may be necessary to move up almost to the centre of the craft in order to control it. In running before the wind or straight into the wind the ordinary position is safe. If a person cannot kneel down (owing to stiff knee joints or other cause) it is best to place a billet of wood in the bow provided no baggage is to be transported. Never place stones in the bow of a canoe. They will sink the boat in case of a tip-over. If capsized in a canoe hang on to the craft until it drifts ashore or is picked up by another boat. It will not sink unless loaded, in which case the operator may turn the boat all the way over and jettison the cargo. He then has the canoe for a life raft and it will float for months. Do not try to climb up on an overturned canoe. Just rest the hands lightly on rail or stem. There is enough cedar in the hull to float several people.

A properly trimmed canoe for ease in paddling should have the bow slightly higher out of the water than the stern. In the rapids a canoe should be bow-light going up stream when propelled by either pole or paddle. Going down stream it should be bow-heavy. Going ashore through the surf the canoe should be bow-heavy. Going out through the surf it should be bow-light.

(P. Mo.)

CANON. The Greek word *κανών* means primarily a straight rod, and metaphorically what serves to keep things straight, a rule. In Gal. vi. 16 it means rule or measure, in 2 Cor. x. 13, 15, 16, what is measured, a province. The word canon is used in various senses, mostly signifying either a rule or else a list (*e.g.*, of books containing the rule).

Music.—A canon in part-music is a composition in which the successive parts repeat the same melody, each beginning at a stated period after its precursor. (*See* also under FUGUE, CONTRAPUNTAL FORMS and MUSIC.) When the first part completes its rhythmical sentence before the second enters, and then continues the melody as an accompaniment to the second, and so on for the 3rd or 4th, this form of canon in England was styled a "round" or "catch"; the stricter canon being one in which the succession of parts did not depend on the ending of the phrase. But outside England catches and canons were undifferentiated.

(H. C.)

The Church Dignitary.—A canon is a person who possesses a prebend in a cathedral or collegiate church. The name is probably derived from the list (*matricula*) of the clergy belonging to a church, *κανών* being thus used in the Council of Nicaea. In the synod of Laodicea the adjective *κανονικός* is found in this sense; and during the 6th century the word *canonicus* occurs commonly in western Europe in relation to the clergy belonging to a cathedral or other church. Eusebius, bishop of Vercelli (d. 371), lived with his clergy, leading a semi-monastic life in common and according to rule; and St. Augustine led a similar manner of life with his clergy at Hippo. St. Gregory's injunction to St. Augustine that at Canterbury the bishop and his clergy should live a common life together, similar to the monastic life in which he had been trained, is familiar; that these "clerics" at Canterbury were not monks is shown by the fact that those of them in the lower clerical grades were free to marry and live at home, without forfeiting their position or emoluments as members of the body of cathedral clergy (Bede, *Hist. Eccl.*, i. 27). This mode of life for the secular clergy, which became common in the West, came to be called *vita canonica*, canonical life, and was the object of various enactments of councils during the 6th, 7th and 8th centuries. Chrodegang, bishop of Metz (*c.* 750), composed a rule for the clergy of his cathedral, which was mainly an adaptation of the Benedictine Rule for secular clergy living in common. Chrodegang's Rule was adopted in many cathedral and collegiate churches. In 816 the synod of Aix-la-Chapelle (see *Mon. Germ. Concil.*, ii. 307) made further regulations for the canonical life, which became the law in the Frankish empire for cathedral and collegiate churches. The Rule of Chrodegang was supplemented and made less monastic in character. Each canon was allowed a dwelling-room within the cloister, and retained the use of his private property. The chief duty of the canons was the performance of the church services.

The canonical life thus regulated subsisted in the 9th and 10th centuries; but there was a constant tendency to relax the bonds of the common life. In England, by the middle of the 10th century, the prescriptions of the canonical life seem to have fallen into desuetude, and in nine cathedrals the canons were replaced by Benedictines. The turning point came in 1059, when a synod held at the Lateran abolished the Aix-la-Chapelle regulations, and imposed a stricter rule. Out of this reforming movement grew the religious order of Canons Regular or Augustinian Canons (*q.v.*), while the opposite tendency produced the institute of secular canons. The revenues of the cathedral were divided between the bishop and the clergy, so that each member of the clergy received his own separate income. All attempts at leading any kind of common life were frankly abandoned. In England the introduction of this order of things was due to St. Osmund (d. 1099). The nature and functions of the institute of secular canons are described in the article CATHEDRAL.

See Du Cange, *Glossarium*, under "Canonicus"; Amort, *Vetus Disciplina Canonicorum* (1747), to be used with caution for the earlier period; C. du Molinet, *Réflexions historiques et curieuses sur les antiquités des chanoines tant séculiers que réguliers* (1674); Herzog, *Realencyklopädie* (3rd ed.), art. "Kapitel"; Wetzer und Welte, *Kirchenlexicon* (2nd ed.), art. "Canonica vita" and "Canonikat." The history of the canonical institute is succinctly told, and the best literature named, by Max Heimbucher, *Orden und Kongregationen*, i. sec. 55 (1896); also by Otto Zöckler, *Askese und Mönchtum*, pp. 422–425 (1897). On mediaeval secular canons a standard work is Chr. Wordsworth's *Statutes of Lincoln Cathedral* (1892–97); *see* also an article thereon by Edm. Bishop in *Dublin Review*, July 1898.

(E. C. B.)

In the Church of England the canons of cathedral or collegiate churches retain their traditional character and functions, though they are now, of course, permitted to marry. Their duties, as defined by the canons of 1603, included residence at the cathedrals and preaching in the cathedral and other churches of the diocese. A canon may hold a benefice in addition to his prebend, but may not make his canonry an excuse for neglecting his cure. The act of 1840 reduced the number of canonries, and made some applicable to the endowment of archdeaconries and professorships. The obligatory period of residence, hitherto varying in different churches, was fixed at three months. The right of presentation to canonries is now vested in the Crown, in the lord chancellor, the archbishop or the bishop of the diocese. In the old cathedrals the title of honorary canon is conferred by the bishop as a mark of distinction. In new cathedrals, where no endowment exists for a chapter, the bishop may appoint honorary canons to act as a cathedral body. (*See* CATHEDRAL.)

Minor canons, sometimes styled priest-vicars, whose function is mainly to sing the service, are appointed by the dean and chapter. They may hold a benefice if it lies within six miles of the cathedral. In Protestant Continental churches canons as ecclesiastical officers have ceased to exist. In Prussia and Saxony, however, certain chapters, secularized at the Reformation, still exist; but the canons (*Domherren*) are usually laymen, cadets of noble families.

See Phillimore, *Eccles. Law,* 2 vols. (1895).

The Scriptures.—The term canon as applied to the Old and New Testaments in the sense of a list or catalogue of sacred writings is first clearly noted in the fourth century. St. Athanasius in his *Epistola de decretis Nicaeni Synodi* (*c.* 350) says of the *Pastor Hermae*, Μὴ ὂν ἐκ τοῦ κανόνος. And in the famous *Epistola Paschalis 39* he uses τὰ κανονιζόμενα to designate the books which are held by tradition and faith to be divinely inspired. These are distinguished from books which are "not canonized" (οὐ κανονιζόμενα) and from apocryphal and heretical books. The force of the passive participle evidently denotes that the books are subject to an action whereby they are canonized. This signification is also found in the 59th canon of the Council of Laodicea (*c.* 360): non-canonical books (ἀκανόνιστα βιβλία) are not to be read in church; only the canonical books of the Old and New Testaments may be read (ἀλλὰ μόνα τὰ κανονικὰ τῆς καινῆς καὶ παλαῖας διαθήκης).

Previously, however, other terms had been employed to express the same idea of a catalogue of books. Clement of Alexandria speaks of the collection as the "testament" (διαθήκη) composed of two parts, the "old" (παλαιά) and the "new" (καινή). And "the writings" (αἱ γραφαί) with or without an accompanying adjective (ἅγιαι, ἱεραί, θεῖαι, κυριακαί) of the Christian collection were opposed to other literature.

The words κανών, κανονικός were received into the Latin language in the fourth century, with the signification of the Greek κανονιζόμενα.

Thus Origen in his *De oratione* translates what seems to have been originally κανών by "in canone est." And St. Augustine frequently uses the adjective "canonical" in reference to the books of Scripture. (E. C. B.; W. A. P.; S. D.; X.)

CANON CITY, a city of south-central Colorado, U.S.A., at the entrance to the Royal Gorge of the Arkansas river (1,100ft. deep) and at the head of the beautiful irrigated Arkansas valley, which is covered with gardens, farms and orchards; the county seat of Fremont county. It has an elevation of 5,344ft.; is on Federal highway 50; and is served by the Denver and Rio Grande Western and the Santa Fe railways. Good roads lead to the top of the gorge, which is spanned by a suspension bridge 1,500 ft long and 1,053 ft. above the bed of the river. Population in 1940, 6,690.

A rich coal-field to the south produces about 800,000 tons a year, and there are sandstone quarries and lime kilns near by. The city has smelters and brickyards. There are hot mineral springs in the vicinity, and the city natatorium is supplied with hot water from Artesian wells. The State penitentiary is located here. On Oil Creek, 8–10m. N.E., is a spot called Garden park, which has furnished many museums with skeletons of armoured dinosaurs and other prehistoric animals. Adjoining the city on the south is the San Isabel National forest.

Lieut. Pike, after whom Pikes Peak (*q.v.*) is named, camped here in 1806. A town sprang up during the gold rush of 1859–60, and its early growth was stimulated by the discovery of oil in the county in 1872.

CANONESS, a female beneficiary of a religious college. The title first occurs in the 8th century, applied to communities of women vowed to obedience and chastity, though not to poverty, and generally under a rule less strict than that of nuns. The canonesses often taught girls, and also embroidered ecclesiastical vestments and transcribed liturgical books. A distinction grew up between regular and secular canonesses, the latter being of noble family and not practising austerity. Some of their abbesses were notable feudal princesses. In Germany several foundations of this kind still exist as Protestant institutions (*Stifter*), requiring of their members only celibacy and obedience to their superior during membership. They are now practically almshouses for the unmarried daughters of noble families or of deserving officials. The head is entitled abbess, prioress or provostess (*Pröbstin*), and the canonesses (*Stiftsdamen*) meet periodically in *Konvent* to discuss the affairs of the community. Some quaint pre-Reformation customs still survive, *e.g.*, at Schleswig where the *Konvent* is held, on the day of the patron saint (St. John the Baptist), in a room draped in black, with a wax head of St. John on a charger in the centre of the table.

CANONIZATION in its widest sense, an act by which in the Christian Church the ecclesiastical authority grants to a deceased believer the honour of public *cultus.* In the early Church there was no formal canonization. The *cultus* applied at first to local martyrs, and it was only in exceptional circumstances that a kind of judiciary enquiry and express decision became necessary to legitimate this *cultus.* The peculiar situation of the Church of Africa explains the *Vindicatio martyrum*, which was early practised there (*Optatus Milevit*, i. 16). Gradually the canonization of saints came to be included in the centralizing movement which reserved to the pope the most important acts of ecclesiastical power. The earliest acknowledged instance of canonization by the pope is that of Ulric of Augsburg, who was declared a saint by John XV. in A.D. 993. From that time the pontifical intervention became more frequent, and, in practice, the right of the bishops in the matter of canonization grew more restricted. In 1170 the new right was sufficiently established for the Pope Alexander III. to affirm that the bishops could not institute the *cultus* of a new saint without the authority of the Roman Church (Cap. *Audivimus*, Decret. *De Rell. et venerat. Sanctorum*, iii, 115). In the 12th and 13th centuries the method of canonization was summary and the inquiry was as rapid as the judgment; *e.g.*, St. Thomas of Canterbury (died 1170, canonized 1173), St. Peter of Castelnau (died Jan. 15, 1208, canonized on Mar. 12 the same year), St. Francis of Assisi (died 1226, canonized 1228), and St. Anthony of Padua (died 1231, canonized 1232).

At this period there was no marked difference between canonization and beatification. In modern practice, as definitively settled by the decrees of Pope Urban VIII. (1625 and 1634), the two acts are totally distinct. Canonization is the solemn and definitive act by which the pope decrees the plenitude of public honours. Beatification consists in permitting a *cultus*, the manifestations of which are restricted, and is merely a step towards canonization.

The procedure at present followed at the Roman curia is either *exceptional* or *common.* The approval of immemorial *cultus* comes within the category of exceptional procedure. Urban VIII., while forbidding the rendering of a public *cultus* without authorization from the Holy See, made an exception in favour of the blessed who were at that time (1625) in possession of an immemorial *cultus, i.e.*, dating back at least a century (1525). The procedure ***per viam casus excepti*** consists in the legitimation of a *cultus* which has been rendered to a saint for a very long time. The causes of the martyrs (*declarationis martyrii*) also are exceptional.

The *common* procedure is that in which the cause is prosecuted *per viam non cultus.* It is, in reality, a suit at law, pleaded before the tribunal of the Congregation of Rites, which is a permanent commission of cardinals, assisted by a certain number of subordinate officers and presided over by a cardinal. The supreme judge in the matter is the pope himself. The ***postulator,*** who is the mandatory of a diocese or ecclesiastical commonalty, is the solicitor. He must furnish the proofs, which are collected according to very stringent rules. The *promoter of the faith*, popularly called "the devil's advocate" (*advocatus diaboli*), is the defendant, whose official duty is to point out to the tribunal the weak points of the case.

The first decisive step is the *introduction of the cause*. If, by the advice of the cardinals who have examined the documents, the pope pronounce his approval, the servant of God receives the title of "Venerable," but is not entitled to any manifestation of *cultus*. The essential part of the procedure consists in three distinct proceedings: (1) to establish a reputation for sanctity, (2) to establish the heroic quality of the virtues, (3) to prove the working of miracles. A favourable judgment on all three of these tests is called the decree *de tuto*, by which the pope decides that they may safely proceed to the solemn beatification of the servant of God (*Tuto procedi ad solemnem V.S D.N. beatificationem*). In the ceremony of beatification the essential part consists in the reading of the pontifical brief, placing the Venerable in the rank of the Blessed, which is done during a solemn mass, celebrated with special rites in the great hall above the vestibule of the basilica of St. Peter.

The process of canonization, which follows that of beatification, is usually less lengthy. It consists principally in the discussion of the miracles (usually two in number) obtained by the intercession of the Blessed since the decree of beatification. After a great number of formalities and prayers, the pope pronounces the sentence, and indicates eventually the day on which he will proceed to the ceremony of canonization, which takes place with great solemnity in the basilica of St. Peter.

The Greek Church, represented by the patriarch of Constantinople, and the Russian Church, represented by the Holy Synod, also canonize their saints after a preliminary examination of their titles to public *cultus*.

See J. Fontanini, *Codex Constitutionum quas summi pontifices ediderunt in solemni canonizatione sanctorum* (Rome, 1729, a collection of original documents); Pr. Lambertini (Pope Benedict XIV.), *De servorum Dei beatificatione et beatorum canonizatione* (Bologna, 1734–38), several times reprinted, and more remarkable for erudition and knowledge of canon law than for historical criticism; Al. Lauri, *Codex pro postulatoribus causarum beatificationis et canonizationis, recognovit Joseph Fornari* (Romae, 1899); F. W. Faber, *Essay on Beatification, Canonization, etc* (1848); A Boudinhon, *Les Procès de béatification, et de canonisation* (1905); E. Golubinskij, *Istorija Kanonizaçii sviatich v russkoj çerkvi* (Moscow, 1903). (H. De.)

CANON LAW. Canon law, *ius canonicum*, is the sum of the laws framed by the ecclesiastical body for its own regulation. It concerns the constitution of the Church and the relations between it and other bodies, religious and civil, and also matters of internal discipline. Canon law has been developed to a considerable extent chiefly under ecclesiastical hierarchies of the authoritarian type, and especially in the Roman Church.

The theory of Canon Law implies that its *sources* are of such a nature as to be binding upon the whole religious body, or at least upon a specified portion of it. In the highest rank are placed Christ and the Apostles, whose dispositions for the constitution and government of the Church are contained in the New Testament, completed by tradition. To the Apostles succeeded the episcopal body, with its chief the bishop of Rome, the successor of St. Peter, whose legislative and disciplinary power, by a process of centralization, underwent a slow but uninterrupted development. It is, then, to the episcopate, assembled in ecumenical council, and to its chief, that the function of legislating for the whole Church belongs.

We proceed briefly to describe those texts and collections of canons which to-day form the ecclesiastical law of the western Church: (1) up to the *Decretum* of Gratian, (2) up to the council of Trent, (3 and 4) up to the present day, including the codification ordered by Pius X.

From the Beginning to the Decretum of Gratian.—At no time, and least of all during the earliest centuries, was there any attempt to draw up a uniform system of legislation for the whole of the Christian Church. The various communities ruled themselves principally according to their customs and traditions which, however, possessed a certain uniformity resulting from their close connection with natural and divine law. Strangely enough, those documents which bear the greatest resemblance to a small collection of canonical regulations, such as the Didache, the Didascalia and the Canons of Hippolytus, have not been retained, and find no place in the collections of canons, doubtless for the reason that they were not official documents. The only pseudo-epigraphic document preserved in the law of the Greek Church is the small collection of the eighty-five so-called "Apostolic Canons" (*q.v.*). The compilers, in their several collections, gathered only occasional decisions, the outcome of no predetermined plan, given by councils or by certain great bishops.

These compilations began in the East. It appears that in several different districts canons made by the local assemblies were added to those of the council of Nicaea which were everywhere accepted and observed. The first example seems to be that of the province of Pontus, where, after the twenty canons of Nicaea were placed the twenty-five canons of the council of Ancyra (314), and the fifteen of that of Neocaesarea (315–320). These were afterwards increased to over 150, and formed a collection so well known that at the council of Chalcedon (451) several of them were read out and referred to by number. It was further increased by the twenty-eight (thirty) canons of Chalcedon; about the same time were added the four canons of the council of Constantinople of 381, under the name of which also appeared three (or seven) other canons of a later date. Towards the same date, also, the so-called "Apostolic Canons" were placed at the head of the group. Such was the condition of the Greek collection when it was translated and introduced into the West.

In the course of the 6th century the collection was completed by the addition of documents already in existence, but which had hitherto remained isolated, notably the canonical letters of several great bishops, Dionysius of Alexandria, St. Basil and others. It was at this time that the Latin collection of Dionysius Exiguus (*see* below) became known; and just as he had given the Greek councils a place in his collection, so from him were borrowed the canons of councils which did not appear in the Greek collection—the twenty canons of Sardica (343), in the Greek text, which differs considerably from the Latin; and those of the council of Carthage of 419, which itself included, more or less completely, in 105 canons, the decisions of the African councils. Soon after came the council *in Trullo* (692), also called the *Quinisextum*, because it was considered as complementary to the two councils (5th and 6th ecumenical) of Constantinople (553 and 680), which had not made any disciplinary canons. This assembly elaborated 102 canons, which did not become part of the Western law till much later, on the initiative of Pope John VIII (872–881). Now, in the second of its canons, the council *in Trullo* recognizes and sanctions the Greek collection above mentioned; it enumerates all its articles, insists on the recognition of these canons, and at the same time prohibits the addition of others. This collection, together with the 22 canons of the council of Nicaea in 787, forms the official canon law of the Greek Church[1].

For several centuries there is no mention in the West of any but local collections of canons, and even these are not found till the 5th century; we have to come down to the 8th or even the 9th century before we find any trace of unification. This process was uniformly the result of the passing on of the various collections from one region to another. The most remarkable, and the most homogeneous, as well as without doubt the most ancient of these local collections is that of the Church of Africa. It was formed, so to speak, automatically, owing to the plenary assemblies of the African episcopate held practically every year, at which it was customary first of all to read out the canons of the previous councils. The African collection has not come to us directly: we have two incomplete and confused arrangements of it, in two collections, that of the *Hispana* (*see* below) and that of Dionysius Exiguus. The latter reproduces more or less fully, almost all the synods of the collection; this was the celebrated

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[1] For the further history of the law of the Greek Church and that of the Eastern Churches, *see* Vering, *Kirchenrecht*, §§ 14–183 (ed. 1893). The Russian Church, as we know, adopted the Greek ecclesiastical law.

Concilium Africanum, so often quoted in the middle ages, which was also recognized by the Greeks.

The Roman Church, even more than the rest, governed itself according to its own customs and traditions. Up to the end of the 5th century the only canonical document of non-Roman origin which it officially recognized was the group of canons of Nicaea, under which name were also included those of Sardica. The local law was founded on usage and on the papal letters called *decretals*. The latter were of two kinds: some were addressed to the bishops of the ecclesiastical province immediately subject to the pope; the others were issued in answer to questions submitted from various quarters; but in both cases the doctrine is the same. At the beginning of the 6th century the Roman Church adopted the collection drawn up at that time by the monk Dionysius, known by the name of Dionysius Exiguus (*q.v.*). At the desire of Stephen, bishop of Salona, he undertook the task of making a new translation, from the original Greek text, of the canons of the Greek collection. The manuscript which he used contained only the first fifty of the Apostolic Canons; these he translated, and they thus became part of the law of the West. This part of the work of Dionysius was not added to later; it was otherwise with the second part. This embodied the documents containing the local law, namely 39 decretals of the popes from Siricius (384–398) to Anastasius II. (496–498). As was natural this collection received successive additions as further decretals appeared. The collection formed by combining these two parts remained the only official code of the Roman Church until the labours undertaken in consequence of the reforming movement in the 11th century. In 774 Pope Adrian I. gave the twofold collection of the Scythian monk to the future emperor Charlemagne as the canonical book of the Roman Church; this is what is called the *Dionysio-Hadriana*. This was an important stage in the history of the centralization of canon law; the collection was officially received by the Frankish Church, imposed by the council of Aix-la-Chapelle of 802, and from that time on was recognized and quoted as the *liber canonum*. The *Dionysio-Hadriana* did not, when introduced into Gaul, take the place of any other generally received collection of canons. In this country the Church had not been centralized round a principal see which would have produced unity in canon law as in other things; even the political territorial divisions had been very unstable. The only canonical centre of much activity was the Church of Arles, which exercised considerable influence over the surrounding region in the 5th and 6th centuries. Evidently the impulse towards unity had to come from without; it began with the alliance between the Carolingians and the Papacy, and was accentuated by the recognition of the *liber canonum*.

In Spain the case, on the contrary, is that of a strong centralization round the see of Toledo. Thus we find Spanish canon law embodied in a collection which, though perhaps not official, was circulated and received everywhere; this was the Spanish collection, the *Hispana*[1]. The collection is well put together and includes almost all the important canonical documents. In the first part are contained the councils, arranged according to the regions in which they were held: Greek councils, following a translation of Italian origin, but known by the name of *Hispana*, African, Gallican and Spanish councils. Nearly all these were held at Toledo, beginning with the great council of 589. The series continued up to 694 and was only interrupted by the Mussulman invasion. Finally, the second part of the *Hispana* contains the papal decretals, as in the collection of Dionysius. From the middle of the 9th century this collection was to become even more celebrated; for, as we know, it served as the basis for the famous collection of the False Decretals.

The churches of Great Britain and Ireland remained still longer outside the centralizing movement. Their contribution towards the later system of canon law consisted in two things: the Penitentials and the influence of the Irish collection, the other sources of local law not having been known to the predecessors of Gratian nor to Gratian himself. The Penitentials are collections intended for the guidance of confessors in estimating the penances to be imposed for various sins, according to the discipline in force in the Anglo-Saxon countries. They are all of Anglo-Saxon or Irish origin, and although certain of them were compiled on the continent, under the influence of the island missionaries, it seems quite certain that a Roman Penitential has never existed[1]. They are, however, of difficult and uncertain ascription, since the collections have been largely amended and remodelled as practice required. Among the most important we may mention those bearing the names of Vinnianus (d. 589), Gildas (d. 583), Theodore of Canterbury (d. 690), the Venerable Bede (d. 735) and Egbert of York (732–767); the Penitentials which are ascribed to St. Columbanus, the founder of Luxeuil and Bobbio (d. 615), and Cumean (Cumine Ailbha, abbot of Iona); in the Frankish kingdom the most interesting work is the Penitential of Halitgar, bishop of Cambrai[2] from 817 to 831. As penances had for a long time been lightened, and the books used by confessors began to consist more and more of instructions in the style of the later moral theology (and this is already the case of the books of Halitgar and Rhabanus Maurus), the canonical collections began to include a greater or smaller number of the penitential canons. The Irish collection[3], though it introduced no important documents into the law of the Western Church, at least set canonists the example of quoting passages from the Scriptures and the writings of the Fathers. This collection seems to date from the 8th century; besides the usual sources, the author has included several documents of local origin, beginning with the pretended synod of St. Patrick.

In the very middle of the 9th century a much enlarged edition of the *Hispana* began to be circulated in France. To this rich collection the author, who assumes the name of Isidore, the saintly bishop of Seville, added a good number of apocryphal documents already existing, as well as a series of letters ascribed to the popes of the earliest centuries, from Clement to Silvester and Damasus inclusive, thus filling up the gap before the decretal of Siricius, which is the first genuine one in the collection. The other papal letters only rarely show signs of alteration or falsification, and the text of the councils is entirely respected[4]. For a study of the historical questions connected with the famous False Decretals, *see* the article DECRETALS; here we have only to consider them with reference to the place they occupy in the formation of ecclesiastical law. In spite of some hesitation with regard rather to the official character than to the historical authenticity of the letters attributed to the popes of the earlier centuries, the False Decretals were accepted with confidence, together with the authentic texts which served as a passport for them. All later collections availed themselves indiscriminately of the contents of this vast collection, whether authentic or forged without the least suspicion.

The False Decretals did not greatly modify nor corrupt the Canon Law, but they contributed much to accelerate its progress towards unity. For they were the last of the chronological collections, *i.e.*, those which give the texts in the order in which they appeared. From this time on, canonists began to exercise their individual judgment in arranging their collections according to some systematic order, grouping their materials under divisions more or less happy, according to the object they had in view. This was the beginning of a codification of a common canon law, in which the sources drawn upon lose, as it were, their local character. This is made even more noticeable by the fact that, in a good number of the works extant, the author is not content merely to set forth and classify the texts; but he proceeds to discuss the point, drawing conclusions and sometimes outlining some controversy on the subject, just as Gratian was to do more fully later on. During this period, which extended from the end of the 9th century to the middle of the 12th, we can enumerate about forty systematic collections, of varying value and circulation, which played a greater or lesser part in preparing the juridical renaissance of the 12th century, and most of which were utilized by Gratian.

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[1] *Collectio canonum Ecclesiae Hispanae* (1808); reproduced in Migne, *P. L.* 84.

[1] This is proved by M. Paul Fournier, "Étude sur les Penitentiels," in the *Revue d'histoire et de littérature religieuses*, vol. vi. (1901), pp. 289–317, and vol. vii., 1902, pp. 59–70 and 121–127.

[2] In Migne, *P. L.* 105, col. 651.

[3] Edited by Wasserschleben (Giessen, 1874). *See* also P. Fournier, "De l'influence de la collection irlandaise sur la formation des collections canoniques," in *Nouvelle Revue historique de droit français et étranger*, vol. xxiii. note 1.

[4] The collection of the False Decretals has been published with a long critical introduction by P. Hinschius, *Decretales Pseudo Isidorianae et capitula Angilramni* (Leipzig, 1863). For the rest of the bibliography, *see* DECRETALS.

The Work of Gratian.—The work of Gratian, though prepared and made possible by those of his predecessors, greatly surpasses them in scientific value and in magnitude. It is certainly the work which had the greatest influence on the formation of canon law; it soon became the sole manual, both for teaching and for practice, and even after the publication of the decretals was the chief authority in the universities. Gratian is lacking in historical and critical faculty; his theories are often hesitating; but on the whole, his treatise is as complete and as perfect as it could be; so much so that no other work of the same kind has been compiled, just as there has never been made another Book of the Sentences. These two works, which were almost contemporary, were destined to have the same fate; they were the manuals, one for theology, the other for canon law, in use in all the universities, taught, glossed and commented on by the most illustrious masters. From this period dates the more marked and definitive division between theology and ecclesiastical law.

Gratian published, probably in 1148, his treatise called at first *Concordantia discordantium canonum*, but soon known under the name of the *Decretum*. Nowadays, and for some time past, the only part of the *Decretum* considered is the collection of texts; but it is actually a treatise, in which the author endeavours to piece together a coherent juridical system from the vast body of texts, of widely differing periods and origin, which are furnished by the collections. These texts he inserts bodily in the course of his dissertation; where they do not agree, he divides them into opposite groups and endeavours to reconcile them; but the really original part of his work is the *Dicta Gratiani*, inserted between the texts, which are still read. Gratian drew his materials from the existing collections, and especially from the richer of them; when necessary, he has recourse to the Roman laws, and he made an extensive use of the works of the Fathers and the ecclesiastical writers; he further made use of the canons of the recent councils, and the recently published decretals, up to and including the Lateran council of 1139. His immense work consists of three parts (*partes*). The first, treating of the sources of canon law and of ecclesiastical persons and offices, is divided according to the method of Paucapalea, Gratian's pupil, into 101 *distinctiones*, which are subdivided into *canones*. The second part consists of 36 *causae* (cases proposed for solution), subdivided into *quaestiones* (the several questions raised by the case), under each of which are arranged the various *canones* (canons, decretals, etc.) bearing on the question. The third part, which is entitled *De Consecratione*, gives, in five *distinctiones*, the law bearing on church ritual and the sacraments.

Considered from the point of view of official authority, the *Decretum* occupies an intermediate position very difficult to define. It is not and cannot be a really official code, in which every text has the force of a law. There was as yet no idea of demanding an official compilation. The *Decretum* has thus remained a work of private authority and the texts embodied in it have only that legal value which they possess in themselves. On the other hand, it actually enjoys a public authority which is unique; for centuries it has been the text on which has been founded the instruction in canon law in all the universities; it has been glossed and commented on by the most illustrious canonists; it has become, without being a body of laws, the first part of the *Corpus iuris canonici*, and as such it has been cited, corrected and edited by the popes. It has thus by usage, obtained an authority perfectly recognized and accepted by the Church[1].

Gratian's collection, for the very reason that it had for its aim the creation of a systematic canon law, was a work of a transitional character. Henceforth a significant differentiation began to appear; the collections of texts, the number of which continued to increase, were clearly separated from the commentaries in which the canonists continued the formation and interpretation of the law. Thus the way was prepared for official collections. The disciples of Gratian, in glossing or commenting on the *Decretum*, turned to the papal decretals, as they appeared, for information and the determination of doubtful points. Their idea, then, was to make collections of these points, to support their teaching; this is the origin of five large *Compilationes* which were afterwards embodied in the collection of Gregory IX. These compilations were intended by their authors to complete the *Decretum* of Gratian; in them were included the decretals called *extravagantes*, i.e., *quae vagabantur extra Decretum*. The most important is the *Breviarium extravagantium*, compiled about 1190 by Bernard of Pavia.

The result of these and numerous other supplements to Gratian's work, apart from the inconvenience caused by their being scattered, was the accumulation of a mass of material almost as considerable as the *Decretum* itself, from which they tended to split off and form an independent whole, embodying as they did the latest state of the law. From 1230 Gregory IX. wished to remedy this condition of affairs, and gave to his penitentiary, the Dominican Raymond of Pennaforte, the task of condensing the five compilations in use into a single collection, freed from useless and redundant documents. Raymond does not attempt any original work; to the texts already included in the *Quinque compilationes*, he adds only nine decretals of Innocent III. and 196 chapters of Gregory IX. This first official code was the basis of the second part of the *Corpus iuris canonici*.

Gregory IX. wished to supersede the *compilationes*, but he had no idea of superseding the *Decretum* of Gratian, still less of codifying the whole of the canon law. Though his collection is still in theory the chief monument of ecclesiastical law, it only marked a certain stage and was before long to receive further additions. The reason for this is that in most cases the decretals did not formulate any law, but were merely solutions of particular cases, given as models. Two important results, however, were achieved. on the one hand, supplementary collections on private authority ceased to be made, for this Gregory IX. had forbidden; on the other hand, the collections were no longer indefinitely swelled by the addition of new decisions in particular cases, those already existing being enough to form a basis for the codification of the abstract law; and for this reason subsequent collections contain as a rule only the "constitutions" of popes or councils, *i.e.*, rules laid down as of general application. Two new official collections followed. The first was prepared by a committee of canonists under Boniface VIII., and published in 1298. As it came as an addition to the five books of Gregory IX., it was called the sixth book, the *Liber Sextus*. It includes the constitutions subsequent to 1234, and notably the decrees of the two oecumenical councils of Lyons; the last title, *de regulis iuris*, contains no less than eighty-eight legal axioms, mostly borrowed from Roman law. The next collection, the *Clementinae*, was prepared under the care of Clement V., and even promulgated by him in consistory in March 1314; but, in consequence of the death of the pope, which took place almost immediately after, the publication and dispatch of the collection to the universities was postponed till 1317, under John XXII. It includes the constitutions of Clement V., and above all, the decrees of the council of Vienne of 1311, and is divided, like preceding collections, into books and titles; it is cited in the same way, with the additional indication *Clem-(entina)*.

At this point the official collections stop. The two last, which have found a place in the editions of the *Corpus*, are collections of private authority, but ones in which all the documents are authentic. Evidently the strict prohibition of the publishing of collections not approved by the Holy See had been forgotten. The *Extravagantes* (i.e. *extra collectiones publicas*) of John XXII. number 20, and are classified under fourteen titles. The *Extravagantes communes* (*i.e.* coming from several popes) number 73, from Boniface VIII. to Sixtus IV. (1484), and are classified in books and titles. These two collections were included in the edition of Jean Chappuis in 1500; they passed into the later editions, and are considered as forming part of the *Corpus iuris canonici*. As such, and without receiving any complementary authority, they have been corrected and re-edited, like the others, by the *Correctores romani*. They are cited, like the decretals, with a further indication of the collection to which they belong: *Extrav. Jo. XXII.*, or *inter-comm-(unes)*.

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[1] *See* Laurin, *Introductio in corpus juris canonici*, c. vii. p. 73.

Thus was closed, as the canonists say, the *Corpus iuris canonici;* but this expression, which is familiar to us nowadays, is only a bibliographical term. Though we find in the 15th century, for example, at the council of Basel the expression *corpus iuris*, obviously suggested by the *Corpus iuris civilis*, not even the official edition of Gregory XIII. has as its title the words *Corpus iuris canonici*, and we do not meet with this title till the Lyons edition of 1671.

Though the collections of canon law were to receive no more additions, the source of the laws was not dried up; decisions of councils and popes continued to appear; but there was no attempt made to collect them. Canonists obtained the recent texts as they could. Moreover, it was an epoch of trouble: the great Schism of the West, the profound divisions which were its result, the abuses which were to issue in the Reformation, were conditions little favourable for a reorganization of the ecclesiastical laws. Thus we are brought to the third period.

After the Council of Trent.—The numerous important decrees made by the council of Trent, in the second part of its sessions, called *de reformatione*, are the starting-point of the canon law in its latest stage, *jus novissimum;* it is this which is still in force in the Roman Church. It has in no way undermined the official status of the *Corpus iuris;* but it has completed the legislation of the latter in many important respects, and in some cases reformed it. During this period, the legislative power becomes strongly centralized in the hands of the pope; since the reforming decrees of the council of Trent it is the pontifical constitutions alone which have made the common law; the ecumenical council has not become obsolete but no such council was held until that of the Vatican (1870), and this latter was unable to occupy itself with matters of discipline. This centralization, in its turn, has greatly increased the tendency towards unity and uniformity, which have reached in the present practice of the Roman Church a degree never known before, and considered by some to be excessive.

If we now consider the laws in themselves, we shall find that the dispersed condition of the legislative documents has not been modified since the closure of the *Corpus iuris;* on the contrary, the enormous number of pontifical constitutions, and of decrees emanating from the Roman Congregations, has greatly aggravated the situation; moreover, the attempts which have been made to resume the interrupted process of codification have entirely failed. As regards the texts, the canon law of to-day is in a very similar position to that of English law, which gave rise to J. S. Mill's saying: "All ages of English history have given one another rendezvous in English law; their several products may be seen all together, not interfused, but heaped one upon another, as many different ages of the earth may be read in some perpendicular section of its surface[1]." Nothing has been abrogated, except in so far as this has been implicitly demanded by subsequent laws. From this result insoluble controversies and serious uncertainties, both in the study and practice of the law; and, finally, it has become impossible for most people to have a first-hand knowledge of the actual laws. For this third period, the most important and most considerable of the canonical texts is the body of disciplinary decrees of the council of Trent (1545–63). In consequence of the prohibition issued by Pius IV., they have not been published separately from the dogmatic texts and other acts, and have not been glossed[2]; but their official interpretation has been reserved by the popes to the "Congregation of the cardinal interpreters of the Council of Trent," whose decisions form a vast collection of jurisprudence. Next in importance come the pontifical constitutions, which are collected together in the *Bullarium;* but this is a collection of private authority, if we except the *Bullarium* of Benedict XIV., officially published by him in 1747; further, the *Bullarium* is a compilation arranged in chronological order, and its dimensions make it rather unwieldy. In the third place come the decrees of the Roman Congregations, which have the force of law. Several of these organs of the papal authority have published official collections, in which more place is devoted to jurisprudence than to laws; several others have only private compilations, or even none at all, among others the most important, viz. the Holy Office (*see* CURIA ROMANA). The resulting confusion and uncertainty may be imagined.

The Future Codification.—Neither Clement VIII. nor, at a later date, Benedict XIV., could have dreamt of the radical reform at present in course of execution. Instead of accumulating the texts of the laws in successive collections, it is proposed entirely to recast the system of editing them. This codification in a series of short articles was suggested by the example of the French codes, the history of which during the 19th century is well known. From all quarters the Catholic episcopate had submitted to the Vatican council petitions in this sense.

> "It is absolutely clear," said some French bishops, "and has for a long time past been universally acknowledged and asserted, that a revision and reform of the canon law is necessary and most urgent. As matters now stand, in consequence of the many and grave changes in human affairs and in society, many laws have become useless others difficult or impossible to obey. With regard to a great number of canons, it is a matter of dispute whether they are still in force or are abrogated. Finally, in the course of so many centuries, the number of ecclesiastical laws has increased to such an extent, and these laws have accumulated in such immense collections, that in a certain sense we can well say: We are crushed beneath the laws, *obruimur legibus*. Hence arise infinite and inextricable difficulties which obstruct the study of canon law; an immense field for controversy and litigation, a thousand perplexities of conscience; and finally for the laws[1]."

We know how the Vatican council had to separate without approaching the question of canonical reform; but this general desire for a recasting of the ecclesiastical code was taken up again on the initiative of Rome. On March 19, 1904, Pius X. published a *Motu proprio, de ecclesiae legibus in unum redigendis*. After briefly reviewing the present condition of the canonical texts and collections, he pointed out their inconvenience, referred to the many requests from the episcopate, and decreed the preparation of a general code of canon law. This immense undertaking involved the codification of the entire canon law, its tabulation in a clear short and precise form, and the introduction of any expedient modifications and reforms. For this purpose the pope appointed a commission of cardinals, of which he himself became president; also a commission of "consultors" resident at Rome, which asked for a certain amount of assistance from canonists at various universities and seminaries. As a result of these labours, a *Codex* of Canon Law was promulgated by Benedict XV. under the Bull *Providentissima Mater* in 1917.

The common law of the Roman Church cannot by itself uniformly regulate all the churches of the different nations; each of them has its own local law, which we must briefly mention here. In theory, this law has as its author the local ecclesiastical authorities, councils or bishops; but this is true only for laws and regulations which are in harmony with the common law, merely completing or defining it. But if it is a question of derogating from the common law, the authority of the Holy See must intervene to legalize these derogations. This intervention takes the form either of "indults," *i.e.* graceful concessions granted at the request of the episcopate, or of special approbation of conciliary solutions.

Canon Law in England and in the Anglican Communion.—The historical position of the general canon law of the Catholic Church in the English provinces has since the separation from Rome, been the subject of much consideration by English lawyers and ecclesiastics. The view taken by the king's courts and acquiesced in by the ecclesiastical courts, since Henry VIII, is *that the Church of England was always an independent national* church, subject indeed to the general principles of the *Ius commune ecclesiasticum* (Whitlock J. in *Ever* v. *Owen*, Godbolt's Reports, 432), but unbound by any particular constitutions of council or pope; unless those constitutions had been "received" *here by English councils, or so recognized by English courts* (secular or spiritual) as to become part *of the* ecclesiastical custom of the realm. The sources of English ecclesiastical law (purely ecclesiastical) were therefore (1) the principles of the *Ius commune ecclesiasticum;* (2) foreign particular constitutions received here, as just explained; (3) *the constitutions* and canons of English synods *(see* Phillimore, *Ecclesiastical Law*, part i, ch. iv, and authorities there cited).

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[1] Quoted by Hogan, *Clerical Studies*, p. 235.

[2] There are innumerable editions of the council of Trent. That which is favoured by canonists is Richter's edition (Leipzig, 1863), in which each chapter *de reformatione* is followed by a selection of decisions of the S.C. of the council.

[1] *Omnium concilii Vaticani . . . documentorum collectio*, per Conradum Martin (Paderborn, 1873), p. 152.

An important departure in the grant of legislative autonomy to the Established Church was effected by the Church of England Assembly (Powers) Act of 1919 (often referred to as the "Enabling act"), which was the result of the report of a special committee appointed by the archbishops of Canterbury and York, and of what was known as the "Life and Liberty movement" in the Church of England. The act gives power to the newly constituted Church assembly, consisting of bishops, clergy and laity (men and women), to pass measures "relating to any matter concerning the Church of England"; such measures to have the effect of an act of parliament after the passing of resolutions in both houses, and the granting of the royal assembly (*see* ENGLAND, CHURCH OF).

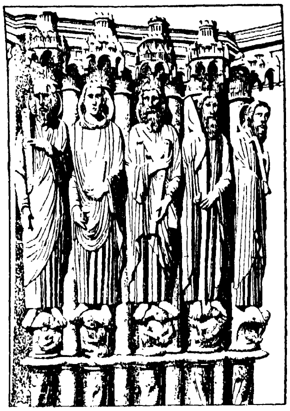
The Church assembly is free to discuss any proposal concerning the Church of England, and to make provision in respect of such matters, but where this includes parliamentary sanction for any alteration contemplated, this authority is to be sought in the manner prescribed by the Enabling act. It is specially provided that any innovation touching doctrinal formulae, or the services or ceremonies of the Church, or the administration of the Sacraments or sacred rites thereof, must be debated and voted upon by each of the three houses sitting separately, and must then be either accepted or rejected by the assembly in the terms in which it is finally proposed by the house of bishops. It is further laid down that the assembly or any of the three houses may debate and formulate its judgment by resolution upon any matter concerning the Church, or otherwise of religious or public interest, but the assembly may not issue any statement purporting to define the doctrine of the Church on any question of theology. None of the powers belonging to the convocations of Canterbury and York is to be diminished or derogated by the assembly, which is also prohibited from exercising any power or performing any function distinctively belonging to the bishops by right of their episcopal office.

Ireland.—In the case of Ireland, the canon law of the Protestant Episcopal Church becomes important after 1869, when the Irish Church act (32 and 33 Vict. c. 42) "disestablished" the Irish Church, and in sect. 19 repealed any act of parliament, law or custom whereby the bishops, clergy or laity of the said church were prohibited from holding synods or electing representatives thereto for the purpose of making rules for the well-being and ordering of the said church. The Church of Ireland, so set free, created for herself new legislative authorities, unknown to the old canon law, viz., mixed synods of clergy and laity, and a system of representation by election, unknown to primitive or mediaeval times. Under the provisions of this statute, the "archbishops and bishops of the ancient Apostolic and Catholic Church of Ireland," together with representatives of the clergy and laity, assembled in 1870, in "General Convention," to "provide for the regulation" of that church. This convention declared that a general synod of the archbishops and bishops, with representatives of the clergy and laity, should have chief legislative power in the Irish Church with such administrative power as might be necessary and consistent with the church's episcopal constitution. This general synod was to consist of two houses—the house of bishops and the house of lay and clerical representatives. No question was to be carried unless there were in its favour a majority of the clerical and lay representatives, voting either conjointly or by orders, and also a majority of the bishops, should they desire to vote. This general synod was given full power to alter or amend canons, or to repeal them, or to enact new ones. For any alteration or amendment of "articles, doctrines, rites or rubrics," a two-thirds majority of each order of the representative house was required and a year's delay for consultation of the diocesan synods. Provisions were made as to lay representation in the diocesan synods. The convention also enacted some canons and a statute in regard to ecclesiastical tribunals *(see* ECCLESIASTICAL JURISDICTION). It expressly provided that its own legislation might be repealed or amended by future general synods.

Scotland.—The post-Reformation history of canon law in the Anglican communion in Scotland differed from the story of that law after the 16th century in Ireland. After the legislation under William and Mary, disestablishing episcopacy in Scotland and subjecting its professors to civil penalties, little attention was given to canon law for many years. The canon law in Scotland before the 16th century was generally that of the continent of Europe. The usages of the church were similar to those in France, and had not the insular character of those in England and Ireland. The canon law regulating marriage, legitimacy and succession was taken over by the Scottish secular courts (*see* ECCLESIASTICAL JURISDICTION) and survived as part of the common law of the land almost unimpaired. Thus, the courts recognize marriages by *verba de praesenti* or by *verba de futuro cum copula*—in this last matter following a decree of Gregory IX—and also legitimation *per subsequens matrimonium.* But though it is one of the *fontes iuris Scotiae*, canon law never was of itself authoritative in Scotland. In the canons of her national provincial councils (at whose yearly meetings representatives attended on behalf of the king) she possessed a canon law of her own, which was recognized by the parliament and the popes, and enforced in the courts of law. Much of it, no doubt, was borrowed from the *Corpus iuris canonici* and the English provincial canons But the portions so adopted derived their authority from the Scottish Church. The general canon law, unless where it has been acknowledged by act of parliament, or a decision of the courts, or sanctioned by the canons of a provincial council, is only received in Scotland according to equity and expediency.

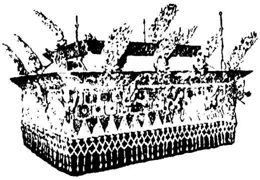
The United States.—The "Protestant Episcopal Church in the United States" is the successor of the Anglican communion in the American colonies before the Revolution This communion was subject to "all the laws of the Church of England applicable to its situation" (Murray Hoffman, *A Treatise on the Law of the Protestant Episcopal Church*, New York, 1850, p. 17). This body of law the Protestant Episcopal Church of the United States took over (*op. cit*. p. 41 et seq.; F. Vinton, *A Manual Commentary on the General Canon Law and the Constitution of the Protestant Episcopal Church*, New York, 1870, p. 16 et seq.). Much, however, of the English post-Reformation canonical legislation was not applicable to the United States, owing to different circumstances. In 1789, a general convention, consisting of clerical and lay deputies as well as of bishops, assumed for itself and provided for its successors supreme legislative power. The concurrence of both "orders," clerical and lay, was required for the validity of any vote. After 1853 a lay deputy to the convention was required to be a communicant (*ib.* p. 102). Upon the American bishops numbering more than three, they became a separate "House" from the "Convention." The house of bishops was given a right to propose measures to the "house of deputies," and to negative acts of the house of deputies, provided they complied with certain forms. Similar "constitutions" providing for representation of the laity were adopted by the different dioceses (Hoffman, *op. cit.* p. 184 et seq.). A great body of legislation was put forth by these bodies.

South Africa.—After 1870, at least, the "Church of the Province of South Africa" secured autonomy while yet remaining a part of the Anglican communion. By its constitution of that year the English Church in South Africa adopted the laws and usages of the Church of England, as far as they were applicable to an unestablished church, accepted the three creeds, the Thirty-Nine Articles, the Book of Common Prayer, the decisions of the undis-

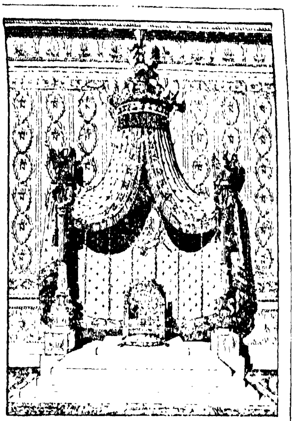


French Gothic Canopies 13th Century
(South Doors, Chartres Cathedral)

Louis 16th Bed Canopy
(Metropolitan Museum, New York)



Painted Wood Japanese Shrine Canopy
Early 7th Century
(Kondo, Horyuji)



Napoleon's Throne in the Tuileries
Paris Early 19th Century

JAPANESE CANOPY FROM WARNER, "JAPANESE SCULPTURE OF THE SUIKO PERIOD"

passed general councils, the Authorized English Version of the Scriptures, and disclaimed the right of altering any of these standards of faith and doctrine, except in agreement with such alterations as might be adopted by a general synod of the Anglican Communion. But in interpreting these standards of faith and doctrine, the Church of the Province of South Africa was not bound by decisions other than those of its own Church courts (*see* Wirgman, *The English Church and People in South Africa*).

Bibliography.—The literature of the subject in all its branches is very elaborate. The articles "Law (Christian), Western," "Law (Christian), Eastern," by A. Fortescue, and "Law (Christian), Anglican," by A. J. Maclean, in Hastings, *Encyclopaedia of Religion and Ethics*, give concise statements of information with references for further study. For fuller accounts, *see* articles on Canon Law in Herzog-Hauck, *Realencyklopadie für Protestantische Theologie;* in the *Catholic Encyclopaedia;* and in Vacant-Mangenot, *Dictionnaire de Théologie Catholique*. Among the classical authorities, the following may be mentioned: P. and J. Ballerini, *De Antiquis Collectionibus Canonum xxx;* in Migne, *Patrologia Latina*, vol. 56 (to Gratian), Schulte, *Geschichte der Quellen u. Literatur des kanonischen Rechts von Gratian bis auf die Gegenwart* (1875). For information as to the sources *see:* Schneider, *Die Lehre von den Kirchenrechtsquellen* (1892); A. van Hove, *Commentarium Lovan. in Cod. Iuris Can.*, vol. 1, tom. 1, *Prologemena* (Malines–Rome, 1928); Naz, *Dict. de Droit Canonique* (Paris, 1935–   ).

CANONSBURG, a borough of Washington county, Pennsylvania, U.S.A., 17 mi. S.W. of Pittsburgh; on Federal highway 19, and served by the Pennsylvania railroad. The population in 1930 was 12,558, and it was 12,599 in 1940. It is in a rich farming district, with coal mines and gas wells near by. The borough has important manufactures (steel, tin plate, tin cans, pottery and novelties) with an output in 1939 valued at $23,664,761.

The town, which dates from about 1773, was named after Colonel John Canon, a member of the Pennsylvania assembly, who planned its construction. Canonsburg is the site of the oldest school building west of the Alleghenies, built in 1780. Jefferson college was founded there in 1794 and remained in Canonsburg until 1865, when it merged with Washington college at Washington, Pa., 7 mi. S. of Canonsburg, to become Washington and Jefferson college.

CANOPUS or **CANOBUS,** ancient coast town of lower Egypt, 15 mi. E. of Alexandria, was the principal port in Egypt for Greek trade before the foundation of Alexandria. The Canopic (westernmost) branch of the Nile, which entered the Mediterranean at the western end of the Bay of Aboukir, is entirely silted up, but on the shore about 2 mi from Aboukir there are extensive traces of the city with its quays, etc.

Excavation has disclosed granite monuments with the name of Rameses II, but they may have been brought at a late period for the adornment of the place. In the 9th year of Ptolemy Euergetes (239 B.C.) a great assembly of priests at Canopus passed an honorific degree, *inter alia*, conferring the title **Εὐεργέτης,** "Benefactor," on the king. Two examples of this decree are known, inscribed in hieroglyphic, demotic and Greek. A temple of Osiris was built by Euergetes, but very near to Canopus was an older shrine, a temple of Heracles mentioned by Herodotus as an asylum for fugitive slaves. The decree shows that Heracles here stands for Ammon. Osiris was worshipped at Canopus under a peculiar form, a vase with a human head and was identified with Canopus the pilot of Menelaus, who was said to have been buried there. The name canopic has been applied, through an old misunderstanding, to the vases with human and animal heads in which the internal organs were placed by the Egyptians after embalming.

In the Roman epoch the town was notorious for its dissoluteness. In 1801 the final English victory over the French in Egypt took place on the site of Canopus.

CANOPUS, the second brightest star in the sky situated in the constellation Carina. It is in S. Dec. 53° and therefore invisible from latitudes above 37° N.

Canopus is a yellow supergiant of magnitude −0.9. Its distance from the sun is about 130 light years this value being given with some uncertainty.

CANOPY, a hood or cover, supported or suspended above an object; a tester. The canopy over an altar, when disconnected from the wall and supported on columns, is known as a baldachino (*q.v.*), one suspended from the ceiling or bracketed from the eastern wall is usually termed a tester.

The word also designates any projecting hood, such as that over choir stalls or niches; also, the embroidered hangings supported on poles, carried over the officiating priest in religious processions. By extension, the projecting arch or gable mouldings over doors or windows are sometimes known as canopies even when the projection is slight.

During the Gothic period canopies received lavish decoration, usually by means of small architectural features such as buttresses, tracery, pinnacles, gables, etc., and the under side frequently took the form of a miniature vault

The canopies over thrones sometimes received rich architectural treatment such as that for the throne of Napoleon in the Luxembourg palace in Paris, where caryatides of great delicacy are used as supports.

A canopy porch, usually small, is one whose primary purpose is to furnish a hood over a door. In modern usage the term is synonymous with awning.

CANOSA DI PUGLIA, a town of Apulia, Italy (anc. *Canusium*), in the province of Bari, on the right bank of the Ofanto (anc. *Aufidus*), 505 ft. above sea-level, 15 mi. S.W. of Barletta by rail. Pop. (1936) 28,163 (town); 28,377 (commune). The Normans rebuilt it after the Saracens destroyed it in the 9th century. The former cathedral of S. Sabino (the bishopric passed in 1818 to Andria), in the southern Romanesque style, was consecrated in 1101; it has five low domes and eighteen ancient columns. The archiepiscopal throne and pulpit are also fine. Sabinus, the patron saint of Canosa and of Bari, was bishop of Canosa from 514 to 566, and erected a baptistery which is still in existence (carefully described by Nachod in *Römische Mitteilungen*, 1915, 116 *seq*). On the south side of the cathedral is the detached mausoleum of Bohemund, son of Robert Guiscard, who died in 1111, constructed partly in Byzantine, partly in the local style. It has fine bronze doors with long inscriptions; the exterior is entirely faced with *cipollino* (Carystian) marble. A mediaeval castle crowns the hill on the side of which the city stands. (*See* CANUSIUM.)

CANOSSA, a ruined castle, 1,890ft. above sea-level, in Emilia, Italy, 12m. S.W. of Reggio Emilia, commanding a fine view of the Apennines. It belonged to the countess Matilda of Tuscany (d. 1115) and is famous as the scene of the penance performed by the emperor Henry IV. before Pope Gregory VII. in 1077. The castle was destroyed by the inhabitants of Reggio in 1255.

See E. N. Campanini, *Guida Storica di Canossa* (Reggio, 1915).

CANOVA, ANTONIO (1757–1822), marquis of Ischia, Italian sculptor, was born at Possagno, a little village near Treviso, on Nov. 1, 1757, of a family of stonemasons. He worked in his grandfather's shop until he was 12, when one of the Falieri family in Venice noted his talent and sent him to study under Bernardo (generally known as Torretto), and then under a nephew of Torretto's at Venice. According to tradition, the boy's genius was discovered through a lion he had modelled in butter. In Venice he occupied a monk's cell, which served as workshop, and worked at sculpture, languages and the study of antiquities. There he executed several groups, among them one of Daedalus and Icarus, and at 23 he went with a pension from the Venetian Senate, to Rome, where he found many patrons, among them Pope Clement XIV. He opened a studio in the Via del Babuino, and there spent two years on a monument to the Pope in the church of the Holy Apostles, completed in 1787. Then followed the cenotaph of Clement XIII. in St. Peter's, on which he was engaged for five years. In 1708 he visited Vienna and Berlin; in 1802 he went to Paris, to make studies for a statue of Napoleon, and he visited London in 1815. He received from the Pope the titles of marquis of Ischia, and "prefect of the fine arts." From time to time he returned to his native village in the hills, and there he was buried, in a temple designed by himself. He died in Venice on Oct. 13, 1822. The most distinguished funeral honours were paid to his remains, which were deposited in the temple at Passagno.

Amoing Canova's more celebrated works, in addition to those mentioned above, may be mentioned "Amor and Psyche" (Louvre, Paris); "Perseus with the head of Medusa" (Vatican); "Napoleon I." (Brera Palace, Milan); the cenotaph of Alfieri (Santa Croce, Florence); "Venus," modelled from the princess Pauline Borghese (Villa Borghese, Rome); "The Three Graces" (Hermitage Gallery, Leningrad); and others. Canova's work marks the reaction towards classicism from the school of Bernini; it was placed by his contemporaries on a footing with the great works of antiquity on which, in externals, it was modelled. His reputation since that date has declined. For a general appreciation of his work (*see* SCULPTURE).

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CANOVAS DEL CASTILLO, ANTONIO (1828–1897), Spanish statesman and author, was born at Malaga on Feb. 8, 1828. He studied law at the University of Madrid, earning his living meanwhile by literature and journalism. He entered the *cortes* in 1854, and held various offices in Liberal cabinets between 1860 and 1868. After the abdication of King Amadeus and the proclamation of the federal republic Canovas advocated the return of the Bourbons, and it was he who drew up the manifesto issued in 1874 by Alphonso XII., then a cadet at Sandhurst. But he opposed the method of the pronunciamiento. On the proclamation of Alphonso as king he formed a ministry, and held office, with two brief interruptions, for six years. He had to reconstruct a Conservative party out of the least reactionary parties of the days of Queen Isabella and out of the more moderate elements of the revolution. With such followers he made the constitution of 1876 and all the laws of the monarchy, putting a limited franchise in the place of universal suffrage, curtailing liberty of conscience, rights of association and of meeting, liberty of the press, checking democracy, obliging the military to abstain from politics, conciliating the Carlists and Catholics by his advances to the Vatican, the Church and the religious orders, adopting a protectionist tariff policy, and courting abroad the friendship of Germany and Austria after contributing to the marriage of his king to an Austrian princess. Canovas crowned his policy by countenancing the formation of a Liberal party under Sagasta, flanked by Marshal Serrano and other Liberal generals, which took office in 1881. Henceforth Sagasta and he alternated as prime ministers. He became prime minister for the fourth time in March 1895 immediately after the outbreak of the Cuban insurrection, and prepared to send 200,000 men to the West Indies to carry out his policy of no surrender, no concessions and no reforms. He was making up his mind for another effort to enable Gen. Weyler to enforce the reforms that had been wrung from the Madrid government, more by American diplomacy than from a sense of the inevitable, when the bullet of an anarchist, in Aug. 1807, at the baths of Santa Agueda, cut short his career. Canovas was the author of numerous historical and other works, among which may be mentioned: *Estudios literarios* (1808); *Historia del dominio austriaco en España* (1809); and *Estudios del reinado de Felipe IV.* (1888–90).

See Casado Sanchez de Castilla, *Canovas, apuntes biograficos* (1887).

CANROBERT, FRANÇOIS CERTAIN (1809–1895), marshal of France, was born at St. Céré, Lot, on June 27, 1809, and educated at St. Cyr He received a commission as sub-lieutenant in 1828, and in 1835 went to Algeria, serving with distinction in various campaigns against the Arabs. In 1839 he was employed in organizing a battalion of the Foreign Legion for the Carlist Wars. In 1841 he was again serving in Africa, and later commanded the 3rd regiment, afterwards transferring to the Zouaves. For his campaigns against the Arabs and Kabyles he was promoted in 1849 to the rank of general of brigade and received the commandership of the Legion of Honour. Summoned to Paris in 1850 he was made aide-de-camp to Louis Napoleon, and took part in the *coup d'état* of Dec. 2, 1851. In the Crimean War he commanded a division at the Alma, where he was twice wounded. He held a dormant commission entitling him to command in case of St. Arnaud's death, and he thus succeeded to the chief command of the French army a few days after the battle. Disagreements with the English commander-in-chief and, in general, the disappointments due to the prolongation of the siege of Sevastopol led to his resignation of the command, but he did not return to France, preferring to serve as chief of his old division almost up to the fall of Sevastopol. After his return to France he was sent on diplomatic missions to Denmark and Sweden, and made a marshal and senator of France, receiving the grand cross Legion of Honour and honorary G.C B. He commanded the III. Army Corps in Lombardy in 1859, distinguishing himself at Magenta and Solferino. In the Franco-German War he commanded the VI. Army Corps, which won the greatest distinction in the battle of Gravelotte, where Canrobert commanded on the St. Privat position. The VI. Corps was amongst those shut up in Metz and included in the surrender of that fortress. After the war Canrobert was appointed a member of the superior council of war, and was also active in political life, being elected senator for Lot in 1876 and for Charente in 1879 and again in 1885. He died in Paris on Jan. 28, 1895.

See L. Bapst, *Le Maréchal Canrobert* (1898–1904).

CANT, ANDREW (1590?–1663), a leader of the Scottish Covenanters. About 1623 the people of Edinburgh called him to be their minister, but he was rejected by James I. Ten years later he was minister of Pitsligo in Aberdeenshire, a charge which he left in 1638 for that of Newbattle in Mid-Lothian. In July of that year he went with other commissioners to Aberdeen in the vain attempt to induce the university and the presbytery of that city to subscribe to the National Covenant, and in the following November sat in the general assembly at Glasgow which abolished episcopacy in Scotland. In 1640 he was chaplain to the Scottish army and then settled as minister at Aberdeen. He resigned his charge in 1660. Though a staunch Covenanter, he was a zealous Royalist, and advocated the restoration of the monarchy in the time of the Commonwealth. His son Andrew was principal of Edinburgh university (1675–85).

CANT. (1) A term used in architecture where the corner of a square is cut off, octagonally or otherwise (possibly from Lat. *cantos*, corner). Thus a bay window, the sides of which are not parallel, or at right angles to the spectator, is canted. (2) A word appearing in English in the 16th century for the whining speech of beggars (Lat. *cantare*, to sing); hence it is applied to thieves' or gipsies' jargon, to the peculiar language of any class or sect, and particularly to the hypocritical use of pious phraseology.

CANTABILE (It.), a musical direction meaning "in a singing style" and employed in instrumental pieces to signify that the passage so marked is to be played in a song-like manner.

CANTABRI, an ancient tribe which inhabited the north coast of Spain near Santander and Bilbao and the mountains behind—a district hence known as Cantabria. Savage and untameable mountaineers, they long defied the Roman arms and made themselves a name for wild freedom. (*Cf.* Horace, *Odes*, ii. 6. 2. *Cantabrum indoctum juga ferre nostra.*) They were first attacked by the Romans about 150 B.C. and were not subdued till Agrippa and Augustus had carried out a series of campaigns (29–19 B.C.) which ended in their partial annihilation. Thenceforward their land was part of the province Hispania Tarraconensis, with some measure of local self-government.

CANTABRIAN MOUNTAINS, a mountain chain which extends 300 mi. across northern Spain, from the Pyrenees to the borders of Galicia, and near the coast of the Bay of Biscay. East of the pass of Leitariegos they are nearly parallel to the coast but to the west they trend southward between Leon and Galicia. Their western boundary is marked by the valley of the river Miño, by the lower Sil and by the Cabrera. Some geographers regard the mountains of Galicia beyond the Miño as a part of the same system; others confine the name to the eastern half of the highlands between Galicia and the Pyrenees, and call the western half the Asturian mountains. There are many local names for the subsidiary ranges within the chain. Intricate ramifications characterize the chain, but almost everywhere, especially in the east, it is possible to distinguish two principal ranges, from which the lesser ridges radiate. One series of ranges closely follows the coast; and short swift streams flow down it into the Bay of Biscay; the other series is loftier and there is a gradual descent to the high plateaux of Leon and Castile. Several large rivers, notably the Ebro, rise here and flow to the south or west. The breadth of the chain increases from about 60 mi. in the east to about 115 mi. in the west. Many peaks are above 6,000 ft. high, the highest, Peña Vieja (8,743 ft.), Prieta (8,304 ft.) and Espinguete (7,988 ft.), and an unnamed summit in the Peñas de Europa (8,045 ft.), all being in the central ridges, while farther west are the peaks of Manipodre (6,837 ft.), Ubiña (7,552 ft.), Rubia (6,331 ft.) and Cuiña (6,575 ft.). A conspicuous feature of the whole region is the number of its isolated plateaux (*parameras*). From the pass of Leitariegos the Sierra de Jistredo and Montañas de Leon curve towards the east and southwest while the Sierra de Picos, Sierra del Caurel and other ranges curve towards the west and southeast, and the two arms enclose El Vierzo, an old lake basin now an alluvial plain drained by the upper Sil. The Cantabrians are rich in coal and iron; an account of their geological structure is given under Spain. They are crossed at many points by good roads and in their eastern and central parts by several railways.

CANTACUZINO or **CANTACUZENE,** the name of a family which traces its origin to the Byzantine emperors and writers of the same name (*see* under JOHN V., Cantacuzene). The founder of the family, Andronik, migrated to Rumania in 1633, and from his two sons Constantine and Gheorge sprang the two principal lines which afterwards branched into numerous families of nobles and high dignitaries.

(1) SHERBAN CANTACUZINO (1640–1688), appointed hospodar of Walachia in 1679, served under the Turks in the siege of Vienna, and after their defeat is said to have planned a march on Constantinople to drive the Turks out of Europe. In the midst of his preparations he died suddenly, poisoned, it is said, by the boyars who were afraid of his vast plans. He introduced the maize plant into Rumania; maize is now one of the staple foods of the country. He founded the first Rumanian school in Bucharest; and under his auspices the famous Rumanian Bible appeared in Bucharest in 1688. Through his influence also the Rumanian was substituted for the Slavonic language in the liturgy. (2) STEFAN CANTACUZINO, son of Constantine, was prince of Walachia, 1714–1716. (3) DEMETRIUS CANTACUZINO, was prince of Moldavia, 1674–1676.

Descendants of Demetrius and Sherban emigrated to Russia, and held high positions there as governors of Bessarabia and in other responsible posts. (4) Of the Moldavian Cantacuzinos, THEODORE is well known as a chronicler of his times (*c.* 1740). (5) GHEORGE CANTACUZINO (1837–1913), son of GREGORI (1800–1849), was appointed in 1870 minister of public instruction in Rumania; in 1889, president of the chamber; in 1892, president of the senate; from 1899 he was head of the Conservative party, and from 1905 to 1907 prime minister (*see* also RUMANIA: *History*).

CANTAGALO, an inland town of the State of Rio de Janeiro, Brazil, about 100 mi. by rail N.E. of the port of Rio de Janeiro, with which it is connected by the Cantagalo railway. The population of the municipality was (1940) 28,789, of whom less than one-fourth live in the town. Cantagalo is situated in the fertile Paraíba valley and is the commercial centre of a rich coffee-producing district. There are exhausted gold placer mines in its vicinity, but they were not rich enough to cause any considerable development in mining. Coffee production is the principal industry, but sugar-cane is grown to a limited extent, and some attention is given to the raising of cattle and swine. The district is an excellent fruit region.

CANTAL, a department of central France, formed from Haute-Auvergne, the southern portion of the old province of Auvergne. It is bounded north by the department of Puy-de-Dôme, east by Haute-Loire, south-east by Lozère, south by Aveyron and Lozère, and west by Corrèze and Lot. Area, 2,231 sq.mi. Pop. (1936) 190,888. It extends eastwards into the heart of the Plateau Central and consists largely of crystalline schists, granites and recent volcanic rocks. The Monts du Cantal, a volcanic group, occupy its central region, and are continued towards the north and east by spurs of lower altitude. The Plomb du Cantal attains a height of 6,096 ft.; and its neighbours, the Puy Mary and the Puy Chavaroche, attain a height of 5,863 and 5,722 ft. respectively. Immediately to the east of this central mass lies the fertile plateau of Planèze, which merges into the Monts de la Margeride on the eastern border. The valley of the Truyère skirts the Planèze on the south and divides it from the Monts d'Aubrac, at the foot of which lies Chaudesaigues, noted for its thermal springs. Northwards the Monts du Cantal are connected with the Monts Dore by the volcanic range of Cézallier and the plateaux of Artense. The central ridge notched by steep narrow valleys, is the principal watershed. The chief rivers are the Alagnon, a tributary of the Allier; the Celé and Truyere, tributaries of the Lot; and the Cère and Rhue tributaries of the Dordogne.

The cold, damp climate of the plateaux restricts the cultivation of wheat, but rye and buckwheat are grown in considerable quantities. Cattle are reared, especially around Salers and in the Monts d'Aubrac, and butter and Roquefort cheese are made. Large flocks of sheep pasture in the Monts d'Aubrac, and elsewhere in the department goats also are kept. The principal articles of food are rye, buckwheat and chestnuts. This poor fare has seriously affected the physique of the people and many migrate to Paris and other parts of France. The internal resources of the department are considerable; but the difficulty of land-transport prevents their being sufficiently developed. Game and fish are plentiful. Cantal produces aromatic and medicinal plants; and its mineral products include coal, antimony and lime. The department has no prominent manufactures. Live-stock, cheese, butter and coal are the principal exports; coal, wine, cereals, flour and earthenware are imported. The department is served by the Orléans and Southern railways.

It is divided into three arrondissements—Aurillac, Mauriac and St. Flour—23 cantons and 267 communes. It belongs to the region of the XIII. Army Corps and to the académie (educational division) of Clermont-Ferrand. Its bishopric is at St. Flour and depends on the archbishopric of Bourges. Its court of appeal is at Riom. The capital is Aurillac (*q.v.*).

CANTALOUP: *see* MUSKMELON.

CANTARINI, SIMONE (1612–1648), called SIMONE DA PESARO, painter and etcher, was born at Oropezza near Pesaro in 1612. He was a disciple of Guido Reni and a fellow-student of Domenichino and Albano. His pictures, though masterly and spirited, are deficient in originality, and some of his works have been mistaken for examples of Guido Reni. Among his principal paintings are "St. Anthony," at Cagli; the "Magdalene," at Pesaro; the "Transfiguration," in the Brera gallery, Milan; the "Portrait of Guido," in the Bologna gallery; and "St. Romuald," in the Casa Paolucci. His most celebrated etching is "Jupiter, Neptune and Pluto honouring the arms of Cardinal Borghese." He died at Verona in 1648.

CANTATA (Italian for a song or story set to music), a vocal composition accompanied by instruments and generally containing more than one movement. In the 16th century, when all serious music was vocal, the term had no reason to exist, but with the rise of instrumental music in the 17th century cantatas began to exist under that name as soon as the instrumental art was definite enough to be embodied in sonatas. From the middle of the 17th till late in the 18th century a favourite form of Italian chamber music was the cantata for one or two solo voices, with accompaniment of harpsichord and perhaps a few other solo instruments. It consisted at first of a declamatory narrative or scene in recitative, held together by a primitive aria repeated at intervals. Fine examples may be found in the church music of Carissimi; and the English vocal solos of Purcell (such as "Mad Tom" and "Mad Bess") show the utmost that can be made of this archaic form. With the rise of the da capo aria the cantata became a group of two or three arias joined by recitative. Handel's numerous Italian duets and trios are examples on a rather large scale. His Latin motet *Silete Venti*, for soprano solo, shows the use of this form in church music.

The Italian solo cantata soon became indistinguishable from a scene in an opera. In the same way the church cantata, solo or choral, is indistinguishable from a small oratorio. This is equally evident in the 200 church cantatas of Bach or in the Chandos anthems of Handel. Many of Bach's larger cantatas are actually called oratorios; and the *Christmas Oratorio* is a collection of [illegible] church [illegible]ntata [illegible] [illegible]ded fo[illegible] pe[illegible] different days, though together forming as complete an artistic whole as any classical oratorio

Bach's church cantatas formed part of a church service, well-organized for a coherent musical scheme. Many of Bach's greatest cantatas begin with an elaborate chorus followed by a couple of arias and recitatives, and end with a plain chorale. Such a scheme is pointless in the concert-room, but it is magnificently appropriate to the Lutheran Church service. The text was based upon the gospel or lessons for the day; unless the cantata was short, the sermon probably took place after the first chorus or one of the arias, and the congregation joined in the finale chorale. Thus the unity of the service was the unity of the music; and, in the cases where all the movements of the cantata were founded on one and the same chorale tune, this unity has never been equalled, except by those 16th century masses and motets which are founded upon the Gregorian tones of the festival for which they are written. In modern times the term cantata is applied almost exclusively to choral, as distinguished from solo vocal music. It is also used as equivalent to "secular oratorio."

It is possible to recognize as a distinct artistic type that kind of early 19th century cantata in which the chorus is the vehicle for music more lyric and song-like than the oratorio style, though at the same time not excluding the possibility of a brilliant climax in the shape of a light order of fugue. Beethoven's *Glorreiche Augenblick* is a brilliant "pot-boiler" in this style; Weber's *Jubel Cantata* is a typical specimen, and Mendelssohn's *Walpurgisnacht* is the *locus classicus*. Mendelssohn's "symphony cantata," the *Lobgesang* (Hymn of Praise), is a hybrid work, partly in the oratorio style. It is preceded by three symphonic movements, a device avowedly suggested by Beethoven's ninth symphony; but the analogy is not accurate, as Beethoven's work is a symphony of which the fourth movement is a choral finale of essentially single design, whereas Mendelssohn's "symphony cantata" is a cantata with a triple symphonic prelude.

The full lyric possibilities of a string of choral songs were realized at last by Brahms in his *Rinaldo*, set to a text which Goethe wrote at the same time as he wrote that of the *Walpurgisnacht*. The point of Brahms's only experiment in this *genre* [illegible] bee[illegible]ed by [illegible] who [illegible]xpe[illegible]ed [illegible] olu[illegible] to be on more elaborate lines. But it represents a definite art form. The remaining types of cantata (beginning with Beethoven's *Meeresstille*, and including most of Brahms's and many notable English small choral works) are merely so many different ways of setting to choral music a poem which is just too long to be comprised in one movement. (D. F. T.)

CANTEEN, (1) a receptacle issued the soldier for carrying his individual supply of drinking water; (2) a chest containing the tableware of a commissioned officer on active service; (3) a soldier's club room or recreation hall where reading matter, cards, writing facilities, etc., are normally available and light refreshments may be purchased; (4) a sales centre where officers and men may buy certain foodstuffs, items of personal equipment and various oddments dear to the military heart.

The canteen as a water container dates from remotest antiquity, having first been fashioned from the skins of animals, later of wood, then pewter or tin, and more recently of aluminium Holding an average of a quart, its contents are sometimes partly insulated against heat or cold by jacketing its surface in a removable cover of some relatively non-conducting material. The second definition (chest of tableware) appears to be limited to the British service.

Definition three (club room or recreation hall) applies particularly within the French military establishment, but is not unknown elsewhere, as witness the Red Cross and other similar "canteens" maintained for the benefit of the American and British forces during the World War of 1914–18.

The fourth definition (sales centre) is of long standing in both British and American services, though in the latter it has been officially supplanted, since shortly after 1900, by the term "Post Exchange." This establishment fulfils an interesting and useful function in the daily life of all permanent military posts of the United States Army Presided over by the Post Exchange Council of which the Post Commander is ex-officio chairman and the senior officers of all organizations there stationed, voting members, [illegible] of a Post Exchange Officer appointed by the Commandant. In small posts he serves in the dual capacity of general manager and purchasing agent; in the larger a separate purchasing officer is designated. The shelves of the exchange are stocked with foodstuffs, soft drinks, articles of clothing—and the usual run of items to be found in a store catering to masculine needs. The wares offered are commonly secured in open market, though in rare instances excess stocks of commodities on hand in Quartermaster warehouses may be released for sale through post exchange channels.

Profits are allocated to the different military organizations comprising the personnel of the post, in the ratio of shares in the post exchange held by these—which are commonly proportionate to the total strength of each. Such profits pass into the company funds of the several commands participating, thence to be distributed as dividends to the individual soldier in the form of extra tidbits added to his regular ration, or recreational equipment to be used by his unit during hours of relaxation. In certain instances a portion of the gains may be appropriated directly for the purchase of such recreational material (magazines, athletic supplies, etc.) as may be enjoyed jointly by the entire personnel of the post. But in event of a deficit, each command must help to make this good—again in shares proportionate to the interest held by each in the stock of the post exchange. These interests pass in due and regular form from units ordered elsewhere to those relieving them at the particular posts involved. (C. Gd.)

CANTEMIR, the name of a celebrated family of Tatar origin which came from the Crimea in the 17th century and settled in Moldavia.

Constantine Cantemir became a prince of Moldavia, 1685–1693. He was succeeded on the throne by his son Antioch, who ruled twice, 1696–1700 and 1705–1707.

His youngest brother, Demetrius or Demeter Cantemir (b. October 26, 1673), was made prince of Moldavia in 1710; he ruled only one year, 1710–1711, when he joined Peter the Great in his campaign against the Turks and placed Moldavia under Russian suzerainty. Beaten by the Turks, Cantemir emigrated to Russia, where he and his family finally settled. He died at Kharkov in 1723. He was one of the greatest linguists of his time, speaking and writing eleven languages. The best known of his works is his *History of the Growth and Decay of the Ottoman Empire*. He also wrote a history of oriental music (no longer extant) the first critical history of Moldo-Wallachia; the first geographical, ethnographical and economic description of Moldavia, *Descriptio Moldaviae*, under the name of *Historia Hieroglyphica*, to which he furnished a key, and in which the principal persons are represented by animals; also the history of the two ruling houses of Brancovan and Cantacuzino; and a philosophical treatise on the old theme of the disputation between soul and body, written in Greek and Rumanian under the title *Divanul Lumii*.

His son, Antioch Cantemir (1708–1744), became in 1731 Russian minister in Great Britain, and in 1736 minister plenipotentiary in Paris. He brought to London the Latin MS. whence the English translation of his father's history of the Turkish empire was made by N. Tindal (London, 1756), to which he added an exhaustive biography and bibliography of the author (pp. 455–460). He was a Russian poet and almost the first author of satires in modern Russian literature.

Bibliography.—*Operele Principelui D. Cantemir*, ed. Academia Românâ (1872 foll.); A. Philippide, *Introducere in istoria limbei si literat. romane* (Iasi, 1888), pp. 192–202; O. G. Lecca, *Familiile boeresti romane* (Bukarest, 1898), pp. 144–148; M. Gaster, *Chrestom. româna*, i. 322, 359 (in Cyrillic).

CANTERBURY, CHARLES MANNERS-SUTTON, 1st Viscount (1780–1845), speaker of the House of Commons, was the elder son of Charles Manners-Sutton (*q.v*), afterwards archbishop of Canterbury, and was born on Jan. 29, 1780. Educated at Eton and Trinity college, Cambridge, he was returned (1806) to parliament in the Tory interest as member for Scarborough, and in 1809 became judge-advocate-general in the ministry of Spencer Perceval. In June 1817 he was elected speaker in succession to Charles Abbot, created Baron Colchester, refusing to exchange this office in 1827 for that of home secretary. In 1833 he was elected speaker for the seventh time. Some feeling had been shown against him on this occasion owing to his Tory proclivities, and the Whigs frequently complained that outside the House he was a decided partisan. When a new parliament met in Feb. 1835 a sharp contest ensued for the speakership, and Manners-Sutton was defeated by James Abercromby, afterwards Lord Dunfermline. In March 1835 he was raised to the peerage. He died in London on July 21, 1845.

CANTERBURY, a city and county borough and the metropolis of an archdiocese of the Church of England, in the Canterbury parliamentary division of Kent, England, 62 mi. E.S.E. of London by the S.R. Pop. (1938) 25,950. Area 7.35 sq.mi. It lies on the river Stour, which here debouches from a beautiful narrow valley of the North Downs, the elevations of which command fine views of the city from the west and south, while the river presently enters upon the flat belt of land which separates the elevated Isle of Thanet from the rest of Kent. This belt represents the existence, in early historic times, of a sea-strait, and Fordwich, little more than 2 mi. N.E. of Canterbury, was once accessible for shipping. Along the North Downs ran the prehistoric track which was to become the Pilgrims' Way, ending at the focus which marked the site of Canterbury. Hither came routes from the numerous ports clustering round the south-eastern angle of Great Britain, and here continental influences found a common expression. The various forms of artistic inspiration seen in the numerous ecclesiastical buildings are only one aspect of the rich culture produced by the intermingling of thoughts at this famous entry. In detail this ancient human site is seen to be related also to a ford over the river Stour where navigation received a check and where the east-west ridgeway along the open chalk had to face the crossing of a marshy valley. The Romans utilized the Canterbury ford, and the Romano-British *Durovernum* was a flourishing town on the road from the Kentish ports to London. The city, known by the Saxons as *Cantwaraburh*, the town of the men of Kent, became the metropolis of the kingdom of Aethelbert, the fourth Saxon king of Kent. It was here that Augustine and his fellow-missionaries came from Rome, and their settlement in the capital in 597 originated its position, maintained ever since, as the metropolis of the Church in England. Aethelbert, whose queen, Bertha, was already a Christian, gave the missionaries a church whose mythical founder was King Lucius. Augustine was a Benedictine and established the monastery of that order attached to the cathedral; this foundation was set upon a firm basis after the Norman Conquest by Archbishop Lanfranc, who placed its charge (as distinct from that of the diocese) in the hands of a prior. At the time of the Domesday survey Canterbury formed part of the royal demesne. In the 13th and 14th centuries, two bailiffs presided over the burghmote, assisted by a larger and smaller council. Henry II., by an undated charter, confirmed former privileges. In 1256 Henry III. granted the city to the citizens at an annual fee farm of £60, and the right of electing their bailiffs. Additional liberties were granted by later sovereigns, and Henry VI. incorporated Canterbury, which he called "one of our most ancient cities," under the style of the mayor and commonalty, the mayor to be elected by the burgesses. James I confirmed these privileges in 1607, giving the burgesses the right to be called a body corporate and to elect twelve aldermen and a common council of twenty-four. Canterbury was first represented in parliament in 1283, and it returned two members until 1885, when the number was reduced to one. It was disfranchised in 1918. A fair was granted by Henry VI to the citizens to be held in the city or suburbs on the 4th of August and the two days following; other fairs were in the hands of the monasteries; the corn and cattle markets and a general market have been held by prescription from time immemorial. Canterbury was a great centre of silk-weaving in the 17th century, large numbers of Walloons, driven by persecution to England, having settled there in the reign of Elizabeth. In 1676 Charles II granted a charter of incorporation to the Walloon congregation under style of the master, wardens and fellowship of weavers in the city of Canterbury. The market for the sale of corn and hops was regulated by a local act in 1801.

THE CATHEDRAL

History of the Building.—The old city surrounds the precincts of the cathedral. The Romano-British church of basilica form, occupied by St. Augustine, was largely rebuilt by Archbishop Odo, *c.* 950; after other hazards it was destroyed by fire in 1067. Archbishop Lanfranc, taking up his office in 1070, undertook the building of an entirely new church, but under Anselm (*c.* 1100) Prior Ernulf rebuilt the eastern part, and his successor Conrad carried on the work. A fire destroyed much of this part of the building in 1174, and from that year the architect, William of Sens, took up the work of rebuilding until 1178, when another

William, commonly distinguished as the Englishman, carried on the work and completed it in 1184. In 1376 Archbishop Sudbury entered upon the construction of a new nave, and Prior Chillenden continued this under Archbishop Courtenay. The building of the central tower was undertaken *c.* 1495 by Prior Goldstone.

Exterior.—This Perpendicular tower is the most notable feature of the exterior. It rises in two storeys to a height of 235 ft. from the ground, and is known variously as Bell Harry tower or as the Angel steeple from the gilded figure of an angel which formerly adorned the summit. The Perpendicular nave is flanked at the west front by towers, whose massive buttresses, rising in tiers, enhance by contrast the beautiful effect of the straight lines of Bell Harry tower. The south-western tower is an original Perpendicular structure by Prior Goldstone, while the north-western was copied from it in 1834–40, replacing a Norman tower which had carried a spire until 1705 and had become unsafe. The south-east transept exhibits Norman work; the projecting chapel east of this is known as Anselm's tower. It contains a Decorated window (1336), a style not common in the cathedral. The cathedral terminates eastward in a graceful apsidal form, with the final addition of the circular eastern chapel built by William the Englishman, and known as the Corona or Becket's Crown. St. Andrew's tower or chapel on the north side, corresponding to Anselm's on the south, is the work of Ernulf. From this point westward the various monastic buildings adjoin the cathedral on the north side.

Interior.—An unusual feature of the interior is its separation into two parts which represent the two main periods of building. In most English Cathedrals the choir is separated from the nave by a screen; at Canterbury the separation is further marked by a broad flight of steps leading up to the screen, the choir floor (but not its roof) being much higher than that of the nave. Chillenden, in rebuilding the nave, retained only the lower parts of some of the early Norman walls of Lanfranc and the piers of the central tower arches. These piers were encased or altered on Perpendicular lines. In the choir, the late 12th-century work of the two Williams, the notable features are its great length, the fine ornamentation and the use of arches both round and pointed, a remarkable illustration of the transition between the Norman and Early English styles; the prolific use of dark marble in the shafts and mouldings strongly contrasting with the prevailing light stone; and, finally, the graceful incurve of the main arcades and walls at the eastern end of the choir where it joins the chapel of the Trinity. From the altar eastward the floor of the church is raised again above that of the choir. The choir screen was built by Prior de Estria, *c.* 1300. There are several tombs of archbishops in the choir. The south-east transept serves as the chapel of the King's school and exhibits the work of William of Sens in alteration of that of Ernulf.

Becket's Shrine. Pilgrimages.—Behind the altar is Trinity Chapel, in the centre of which stood the celebrated shrine of St. Thomas of Canterbury. The priory owed its chief fame to the murder of Archbishop Becket (1170) in the church, his canonization as St. Thomas of Canterbury, and the pilgrimages of the Christian world to his shrine. Miracles were almost immediately said to be worked at his grave in the crypt and at the well in which his garments had been washed; and from the time when Henry II. did his penance for the murder in the church, and the battle of Alnwick was gained over the Scots a few days afterwards—it was supposed as a result—the fame of the martyr's power and the popularity of his worship became established in England. On the rebuilding of the cathedral after the fire in 1174, a magnificent shrine was erected for him in Trinity Chapel, which was built for the purpose, and became thronged for three centuries by pilgrims and worshippers of all classes. Henceforward the interests of the city became bound up in those of the cathedral, and were shown in the large number of hostels for the accommodation of pilgrims, and of shops; for trade has ever been associated with pilgrimages. The poet Chaucer, writing in the 14th century, gives an admirable picture of the pilgrimages, with the manners of a party of pilgrims, leisurely enjoying the journey and telling stories on the road. The English language preserved two words originating in these customs—"a canterbury," or a "canterbury tale," a phrase used for a fiction, and a "canter," short for a "canterbury gallop," an allusion to the easy pace at which these pilgrimages were performed. The shrine with its vast collected wealth was destroyed, and every reminiscence connected with it as far as possible effaced, by King Henry VIII.'s commissioners in 1538. But some of the beautiful old windows of stained glass, illustrating the miracles wrought in connection with the saint, are preserved.

Close to the site of the shrine is the fine tomb of Edward the Black Prince, with a remarkable portrait effigy, and above it his helmet and shield. In this chapel is the tomb of Henry IV. The Corona, at the extreme east of the church, contains the marble chair in which the archbishops are enthroned. Though called St. Augustine's, it dates probably from *c.* 1200. The western part of the crypt, beneath the choir, is the work of Ernulf, and perhaps incorporates some of Lanfranc's work. The chapel of St. John or St. Gabriel, beneath Anselm's tower, is still used for service, in which the French language is used; it was devoted to this purpose in 1561, on behalf of French Protestant refugees, who were also permitted to carry on their trade as weavers in the crypt. The eastern and loftier part of the crypt, with its apsidal termination, is the work of William the Englishman. Here for some time lay the body of Becket, and here the celebrated penance of Henry II. was performed.

Monastic Buildings.—The ornate Christchurch gateway, built by Prior Goldstone in 1517, gives entrance to the monastic buildings at the south-west. Their remains include the Norman ruins of the infirmary, the fine two-storeyed treasury and the lavatory tower, Norman in the lower part and Perpendicular in the upper. The cloisters, containing some rich Norman work, were very largely rebuilt by Prior Chillenden. The upper part of the chapter-house is also his work, but the lower is by Prior de Estria. The library is modern. The site of the New Hall of the monastery is covered by modern buildings of King's school, but the Norman entry-stair is preserved—a magnificent example of the style, with highly ornate arcading.

The principal dimensions of the cathedral are: length (outside) 522 ft., nave 178 ft., choir 180 ft. The nave is 71 ft. in breadth and 80 ft. in height.

Province and Diocese.—The archbishop of Canterbury is primate of all England; the ecclesiastical province of Canterbury covers England south of Cheshire and Yorkshire; and the diocese covers a great part of Kent with a small part of Sussex.

The following is a list of archbishops of Canterbury:

1. Augustine, 597 to 604.
2. Laurentius, 604 to 619.
3. Mellitus, 619 to 624.
4. Justus, 624 to 627.
5. Honorius, 627 to 653.
6. Deusdedit, 655 to 664.
7. Theodorus, 668 to 690.
8. Beorhtweald, 693 to 731.
9. Tatwine, 731 to 734.
10. Nothhelm, 735 to 739.
11. Cuthbeorht, 740 to 760.
12. Breguwine, 761 to 764.
13. Jaenbeorht, 765 to 792.
14. Aethelheard, 793 to 805.
15. Wulfred, 805 to 832.
16. Feologild, 832.
17. Ceolnoth, 833 to 870.
18. Aethelred, 870 to 889.
19. Plegmund, 890 to 914.
20. Aethelhelm, 914 to 923.
21. Wulfhelm, 923 to 942.
22. Oda, 942 to 958.

Aelfsige, 959.
Beorhthelm, 959.
Dunstan, 960 to 988.
Aethelgar, 988 to 990
Sigeric Serio, 990 to 994.
Aelfric, 995 to 1005.
Aelfheah, 1005 to 1012.
Lyfing, 1013 to 1020.
Aethelnoth, 1020 to 1038.
Eadsige, 1038 to 1050.
Robert (Champart) of Jumièges, 1051 to 1052.
Stigand, 1052 to 1070
Lanfranc, 1070 to 1089.
Anselm, 1093 to 1100.
Ralph d'Escures, 1114 to 1122.
William de Corbeil, 1123 to 1136.
Theobald, 1139 to 1161.
Thomas Becket, 1162 to 1170.
Richard (of Dover), 1174 to 1184.
Baldwin, 1185 to 1190.
Hubert Walter, 1193 to 1205.
Stephen Langton, 1207 to 1228
Richard le Grant (of Wetharshed), 1229 to 1231.
Edmund Rich, 1234 to 1240.
Boniface of Savoy, 1245 to 1270.
Robert Kilwardby, 1273 to 1278.
John Pecham (Peckham), 1279 to 1292.
Robert Winchelsey, 1294 to 1313.
Walter Reynolds, 1313 to 1327.
Simon Mepeham, 1328 to 1333.
John Stratford, 1333 to 1348.
Thomas Bradwardine, 1349.
Simon Islip, 1349 to 1366.

56. Simon Langham, 1366 to 1368.
57. William Whittlesey, 1368 to 1374.
58. Simon Sudbury, 1375 to 1381.
59. William Courtenay, 1381 to 1396.
60. Thomas Arundel, 1396 to 1397.
61. Roger Walden, 1398.
62. Thomas Arundel (restored), 1399 to 1414.
63. Henry Chichele, 1414 to 1443.
64. John Stafford, 1443 to 1452.
65. John Kemp, 1452 to 1454.
66. Thomas Bourchier, 1454 to 1486.
67. John Morton, 1486 to 1500.
68. Henry Dean, 1501 to 1503.
69. William Warham, 1503 to 1532.
70. Thomas Cranmer, 1533 to 1556.
71. Reginald Pole, 1556 to 1558.
72. Matthew Parker, 1559 to 1575.
73. Edmund Grindal, 1575 to 1583.
74. John Whitgift, 1583 to 1604.
75. Richard Bancroft, 1604 to 1610.
76. George Abbot, 1611 to 1633.
77. William Laud, 1633 to 1645.
78. William Juxon, 1660 to 1663.
79. Gilbert Sheldon, 1663 to 1677.
80. William Sancroft, 1678 to 1691.
81. John Tillotson, 1691 to 1694.
82. Thomas Tenison, 1695 to 1715.
83. William Wake, 1716 to 1737.
84. John Potter, 1737 to 1747.
85. Thomas Herring, 1747 to 1757.
86. Matthew Hutton, 1757 to 1758.
87. Thomas Secker, 1758 to 1768.
88. Frederick Cornwallis, 1768 to 1783.
89. John Moore, 1783 to 1805.
90. Charles Manners-Sutton, 1805 to 1828.
91. William Howley, 1828 to 1848.
92. John Bird Sumner, 1848 to 1862.
93. Charles Thomas Longley, 1862 to 1868.
94. Archibald Campbell Tait, 1868 to 1882.
95. Edward White Benson, 1883 to 1896.
96. Frederick Temple, 1896 to 1902.
97. Randall Thomas Davidson, 1903 to 1928.
98. Cosmo Gordon Lang, 1928 to 1942.
99. William Temple, 1942 to 1944.
100. Geoffrey Francis Fisher, 1945.

The archbishop has a seat at Lambeth palace, London. There are fragments in Palace street of the old archbishop's palace which have been incorporated with a modern palace.

Other Ecclesiastical Foundations.—The most important religious foundation, apart from the cathedral, was the Benedictine abbey of St. Augustine, named after its founder in spite of his dedicating it to St. Peter and St. Paul. This was erected on a site granted by King Aethelbert outside his capital, in a tract called Longport. The site is now occupied by St. Augustine's Missionary college, founded in 1844. Some remnants are preserved, the principal being the entrance gateway (1300), with the cemetery gate and the guest hall, now the refectory. The scanty ruins of St. Pancras' chapel, said to have been the first dedicated by St. Augustine, are of great interest, and embody Roman material.

There were lesser houses of many religious orders in Canterbury, but only two, those of the Dominicans and the Franciscans, both in St. Peter's street, have left notable remains. The Dominican refectory is used as a chapel. Among the many churches, St. Martin's, Longport, was the scene of the earliest work of Augustine in Canterbury, and had seen Christian service before his arrival. There are Norman, Early English and later portions; and the font may be in part pre-Norman, while there are traces of Roman masonry. St. Mildred's church exhibits Early English and Perpendicular work, and the use of Roman material is again visible here. St. Paul's is Early English; St. Dunstan's, St. Peter's and Holy Cross are mainly Decorated and Perpendicular. The village of Harbledown, on the hill west of Canterbury on the London road, has many associations with the ecclesiastical life of Canterbury, being mentioned by Chaucer in his pilgrimage under the name, appropriate to its site, of "Bob up and down." The almshouses, which occupy the site of Lanfranc's hospital for lepers, include an ancient hall and a chapel in which the west door and northern nave arcade are Norman.

City Buildings, etc.—The old city walls may be traced, and the public walk called the Dane John (derived probably from *donjon*) follows the summit of an artificial mound within the lines. Only the massive turreted west gate, of the late 14th century, remains out of the former six city gates. The site of the castle is not far from the Dane John, and enough remains of the Norman keep to show its strength and great size. The guildhall, in High street, is early 18th century. A modern statue of a muse commemorates the poet Christopher Marlowe (1564–1593) a native of the city. The King's school, adjacent to the cathedral, developed out of the early teaching furnished by the monastery. It was refounded in 1541 by Henry VIII, whence its name, and is still connected with the ecclesiastical foundation, the dean and chapter being its governors. Canterbury has considerable agricultural trade, tanneries and brickworks.

The city was seriously damaged in an air raid on June 1, 1942. The cathedral received only superficial hurt, though the modern library was demolished, the deanery (of Prior Goldstone's time) damaged, and the chapter house walls were fissured. The gateway to St. Augustine's college was badly scarred, also the buildings, while part of King's school was wrecked, though Norman columns remained intact. Many of the old city houses were wiped out.

See A. P. Stanley, *Historical Memorials of Canterbury* (London, 1855); J. Brent, *Canterbury in the Olden Time* (Canterbury, 1879); J. W. Legg and W. H. St. J. Hope, *Inventories of Christchurch, Canterbury* (London, 1902); *Victoria County History, Kent*; G. R. Stirling Taylor, *The Story of Canterbury* (Mediaeval Town Series, 1912).

CANTHARIDES, or SPANISH FLIES, the common blister-beetles (*Cantharis vesicatoria*) of European pharmacy, are bright, iridescent, golden-green or bluish-coloured beetles (*see* COLEOPTERA), from half-an-inch to an inch in length, found in the south of Europe.

Cantharides owe their value to the presence of a chemical principle (*cantharidin*). Cantharidin constitutes from ½ to 1% of cantharides. It has the formula $C_{10}H_{12}O_4$, and on hydrolysis is converted into cantharinic acid, $C_{10}H_{14}O_5$. It crystallizes in colourless plates and is readily soluble in alcohol, ether, etc., but not in water.

The external action of cantharides or cantharidin is characteristic. When it is applied to the skin there are no obvious consequences for some hours, then the part becomes warm and painful Soon afterwards there is an accumulation under the epidermis of a serum derived from the dilated blood-vessels. The numerous small blisters or vesicles thus derived coalesce, forming a large sac full of "blister-fluid."

Taken internally in any but minute doses the drug causes the most severe gastro-intestinal irritation, the vomited and evacuated matters containing blood, and the patient suffering agonizing pain and extreme depression. The further characteristic symptoms are displayed in the genito-urinary tract. The effect of large doses is to cause great pain in the renal region and urgent wish to micturate. The urine is nevertheless small in amount and contains albumen and blood owing to the local inflammation produced in the kidney by the passage of the poison through that organ. The drug often has a marked aphrodisiac action, producing priapism, or in the female sex the onset of the catamenia or abortion. Its criminal employment is usually intended to heighten sexual desire, and has frequently led to death.

A very large number of other insects belonging to the same family possess blistering properties owing to their containing cantharidin. Of these the most remarkable is the Telini "fly" of India (*Mylabris cichorii*), the range of which extends from Italy and Greece through Egypt and central Asia as far as China. It is very rich in cantharidin, yielding fully twice as much as ordinary cantharides. Several green beetles are, on account of their colour, used as adulterants to cantharides, but are easily detected by examination with the eye, or, when they have been powdered, under the microscope.

CANTICLES. This is another name (*cf.* the Vulgate *Canticum Canticorum*) for the Old Testament book called in the A.V. "The Song of Solomon," and in the R.V. "The Song of Songs." The latter title, taken from the opening words of the Hebrew, does not mean that the book is a collection of songs, but that it is the choicest of the songs which Solomon was traditionally supposed to have written (cf. I Ki. iv. [illegible]). By modern scholars, however, this traditional authorship is rejected, on linguistic and other grounds, while many of them do regard it as a collection of love lyrics, more or less connected with the marriage customs of the Hebrews.

In the Hebrew Bible the book stands in the third and latest part, known as the *Writings*, and in the special group known as the *Megilloth*, or "Rolls," which are read in the synagogue on certain days of commemoration. The Song of Songs is used on the first of these in the Jewish Year, namely Passover, and this use is dependent on the Jewish exegesis of the book, which makes it an allegory of the relation of Israel to Yahweh, with reference to the national history from the Exodus to the Messianic glory and final restoration. This interpretation is given in the *Targum* (the free Aramaic rendering of the Hebrew given in the synagogue when Hebrew was no longer understood). For this book the Targum is really a paraphrastic commentary; thus on i. 8 we read, "Let the congregation, which is compared with a beautiful girl, whom my soul loveth, walk in the ways of the righteous, and offer prayer according to the ordinance of her shepherds and the guides of her generations, and let her teach her sons, who are compared with kids of the goats, to go to the synagogue and schoolhouse." Except for some such spiritualizing interpretation, it would be impossible to explain the inclusion of a book of secular poetry in the sacred canon. The strong assertion of the holiness of the book by Rabbi Akiba in the 2nd century A.D. goes with other evidence to show that it was not so included without reluctance and opposition.

There is no reference to Canticles in the New Testament, but from at least the 3rd century the book claimed an important place in the thought and the language of the Christian Church. We may see this in the commentary of Origen in ten books (only part of which is extant) on the Septuagint translation of Canticles. He regards the book as historically a drama in which there are four speakers or speaking groups, viz., the bridegroom, the bride and the respective companions of both. In the higher (allegorical) meaning the bridegroom becomes Christ, with the angels, the prophets and patriarchs, the Church teachers, as His companions; the bride is either the Church or the soul of the individual believer, the latter view being more emphasized in the later work of Origen. The allegorical application to the Christian Church is represented in the chapter headings of our A.V., which, *e.g.*, make the little sister without breasts of viii. 8 into the Gentiles. The individual use of the allegory has greatly influenced the language of devotion, not always to its advantage.

The return to a more literal and historical interpretation is found already in Theodore of Mopsuestia (392–428), who was anathematized in 553 for his view that the book was Solomon's defence of the Egyptian princess whom he married, against the dislike of his people for her dark colour (Song i. 5). It is not, however, until the 18th century (Herder, 1778) that we meet with the modern view of the book as a collection of independent love lyrics, whilst throughout the 19th century the prevalent view of scholars was that the book is a drama. According to this view, of which the most notable exponent was Ewald (1826), whilst it was accepted by Robertson Smith when writing for this Encyclopaedia in 1876, the heroine of the book is a peasant maiden in Solomon's harem, who longs for her shepherd lover, and utters her feelings to the ladies of the court, who lead her on to describe her lover, and to tell how she came to be carried off by Solomon. Finally her constancy secures her release, and the curtain falls on the sentiment of the triumph of true affection in viii. 6, 7.

The attractiveness of this theory, when worked out in detail, cannot be denied; but it may be asked whether the attraction does not lie in the appeal to modern taste of a story which is largely the product of modern imagination. It supposes a freedom of intercourse between lovers inconceivable for the East. The initial situation of the maiden in the harem of Solomon is left as a problem for the reader to discover, until he comes to its supposed origin in vi. 11; the expedient might be granted in the case of one of Browning's *Men and Women*, but seems very improbable in the present case. The more elaborate dramatic theories can find no parallel in Semitic literature to the "drama" of Canticles, the book of Job being no exception to this statement; whilst even the simpler theories ask us to believe that the essential parts of the story—the rape of the Shulamite, the change in Solomon's disposition, her release from the harem—are to be supplied by the reader from obscure and disputable references. More serious still is the fact that any progress of action from first to last is so difficult to prove. In the first chapter we listen to a woman speaker desiring to be kissed by the man who has brought her into his chambers, and speaking of "our bed," in the last we leave her "leaning upon her beloved." The difficulties of detail are equally great. To suppose that all the male lovemaking, by hypothesis unsuccessful, belongs to Solomon, whilst the heroine addresses her passionate words to the continuously absent shepherd, is obviously unconvincing; yet, if this shepherd speaks in iv. 8–v. 1, how are we to explain his appearance in the royal harem? This and other difficulties were acknowledged by Robertson Smith, notably the presence of vii. 1–9, which he proposed to set aside as an interpolation, because of its sensuality and of the difficulty of working it into the dramatic scheme. The fact that this passage has subsequently become a central element in the new interpretation of the book is, perhaps, a warning against violent measures with difficulties.

Attention has already been drawn to Herder's proposal, accepted by some later writers, including Diestel and Reuss, to regard the book as a collection of detached songs. This received new and striking confirmation from the anthropological data supplied by J. G. Wetstein (1873), Prussian consul at Damascus. His observations of the wedding customs of Syrian peasants led him to believe that Canticles is substantially a collection of songs originally sung at such festivities. Wetstein's contribution was republished shortly afterwards by Delitzsch, in an appendix to his *Commentary;* but it received little attention. The first amongst Old Testament scholars to perceive its importance seems to have been Stade, who accepted Wetstein's view in a footnote to his *History of the Jewish People* (ii. p. 197) published in 1888; to Budde, however, belongs the distinction of the systematic and detailed use of Wetstein's suggestions, especially in his *Commentary* (1898). This interpretation of the book was accepted by Kautzsch (1896), Siegfried (1898), Cheyne (1899), and other eminent scholars, and is now generally adopted. The last-named stated the theory tersely as follows: "The book is an anthology of songs used at marriage festivals in or near Jerusalem, revised and loosely connected by an editor without regard to temporal sequence" (*Ency. Bibl.* 691). The character of the evidence which has contributed to the acceptance of this view may be indicated in Wetstein's own statements:—

"The finest time in the life of the Syrian peasant consists of the first seven days after his wedding, in which he and his young wife play the part of king (*melik*) and queen (*melika*), both being so treated and served by their village and the invited communities of the neighbourhood. The majority of the greater village weddings fall in the month of March, the finest of the Syrian year. . . . The winter rains being over, and the sun still refreshing, not oppressive as in the following months, the weddings are celebrated in the open air on the village threshing-floor, which at this time of the year is with few exceptions a flowery mead. . . . We pass over the wedding-day itself with its displays, the sword-dance of the bride, and the great feast. On the morrow, bridegroom and bride awake as king and queen. Already before sunrise they receive the leader of the bridesmen, as their vizier, and the bridesmen themselves; the latter thereupon fetch the threshing-board and bring it to the threshing-floor, singing a rousing song of battle or love, generally both. There it is erected as a throne, and after the royal couple have taken their seats and the necessary formalities are gone through, a great dance in honour of the young couple begins; the accompanying song is concerned only with themselves, its principal element being the inevitable *wasf, i.e.*, a description of the physical perfections of both and their ornaments. The eulogy of the queen is more moderate and praises her visible, rather than veiled, charms; this is due to the fact that she is to-day a married woman, and that the *wasf* sung on the previous day during her sword-dance has left nothing to desire. This *wasf* is the weak element in Syrian wedding-songs according to our taste; its comparisons are to us frequently too clumsy and reveal the stereotyped pattern. It is the same with the little collection of charming wedding-songs and fragments of them which has been received into the canon of the Old Testament under the name of Canticles; the *wasf* (iv.–

vii.) is considerably below the rest in poetical value. With this dance begin the sports, lasting seven days, begun in the morning on the first, shortly before midday on the other days, and continuing far into the night by the light of the fires that are kindled; on the last day alone all is over by sunset. During the whole week both royalties are in marriage attire, must do no work and have no cares; they have only to look down from the *merteba* (throne) on the sports carried on before them, in which they themselves take but a moderate part; the queen, however, occasionally gives a short dance to attract attention to her bridal attire." (Wetstein, *Zeitschrift f. Ethn.*, 1873, pp. 270–302; quoted and condensed by Budde as above in *Comm.* p. xvii.; for a fuller reproduction of Wetstein in English *see* Harper, *The Song of Songs*, pp. 74–76.)

For the general application of these and the related customs to the interpretation of the book reference should be made to Budde's *Commentary*, which recognizes four *wasfs*, viz., iv. 1–7 (describing the bride from head to breasts), v. 10–16 (the bridegroom), vi. 4–7 (similar to and partly repeating iv. 1–7) and vii. 1–9, belonging to the sword-dance of the bride, her physical charms being sung from feet to head (*cf.* vi. 13; "Why look ye on the Shulamite as [on] a dance of camps?" *i.e.*, a war-dance). This dance receives its name from the fact that she dances it with a sword in her hand in the firelight on the evening of her wedding-day, and amid a circle of men and women, whilst such a *wasf* as this is sung by the leader of the choir. The passage relating to the litter of Solomon (iii. 6–11)—an old difficulty with the dramatizers—relates to the erection of the throne on the threshing-floor. The terms "Solomon" and "the Shulamite" are explained as figurative references to the famous king, and to Abishag the Shulamite, "fairest among women," on the lines of the use of "king" and "queen" noted above. Other songs of Canticles are referred by Budde to the seven days of festivities. It need hardly be said that difficulties still remain in the analysis of this book of wedding-songs; whilst Budde detects 23 songs, besides fragments, Siegfried divides the book into 10. Such differences are to be expected in the case of a collection of songs, some admittedly in dialogue form, all concerned with the common theme of the love of man and woman, and without any external indication of the transition from one song to the next.

Further, we must ask whether the task has been complicated by any editorial rearrangement or interpolation; the collector of these songs has certainly not reproduced them in the order of their use at Syrian weddings. Can we trace any principle, or even any dominant thought in this arrangement? In this connection we touch the reason why some scholars were slow to accept the above interpretation, viz., the alleged marks of literary unity which the book contains (*e.g.*, Driver, *Introduction*). These are (1) general similarity of treatment, seen in the use of imagery (the bride as a garden, iv. 12; vi. 2, 3), the frequent references to nature and to particular places, and the recurrence of descriptions of male and female beauty; (2) references to "Solomon" or "the king," to "the Shulamite" and to "the daughters of Jerusalem" (from which, indeed, the dramatic theory has found its chief inspiration); (3) indications that the same person is speaking in different places (*cf.* the two dreams of a woman, and the vineyard references, i. 6; viii. 12); (4) repetitions of words and phrases especially of the refrains, "disturb not love" (ii. 7; iii. 5; viii. 4), and "until the day break" (ii. 17; iv. 6). But of these (1) is no more than should be expected, since the songs all relate to the same subject, and spring from a common world of life and thought of the same group of people; (2) finds at least a partial parallel and explanation in the use of "king" and "queen" noted above; whilst (3) and (4) alone seem to require something more than the work of a mere collector of the songs. It is, of course, true that, in recurrent ceremonies, the same thought inevitably tends to find expression in the same words. But this hardly meets the case of the refrains, whilst the reference to the vineyard at the beginning and end does suggest some literary connection. It is to be noted that the three refrains "disturb not love" severally follow passages relating to the consummation of the sexual relation, whilst the two refrains "until the day break" appear to form an invitation and an answer in the same connection, whilst the "Omnia vincit Amor" passage in the last chapter forms a natural climax (*cf.* Haupt's translation). So far, then, as this somewhat scanty evidence goes, it may point to some one hand which has given its semblance of unity to the book by underlining the joy of consummated love—to which the vineyard and garden figures throughout allude—and by so arranging the collection that the descriptions of this joy find their climax in viii. 6–7.

Whatever conclusion, however, may be reached as to the present *arrangement* of Canticles, the recognition of wedding-songs as forming its nucleus marks an important stage in the interpretation of the book; even Rothstein (1902), whilst attempting to resuscitate a dramatic theory, "recognizes . . . the possibility that older wedding-songs (as, for instance, the *wasfs*) are worked up in the Song of Songs" (Hastings' *D.B.* p. 594b).

Canticles thus describes, in a number of separate poems, not necessarily referring to marriage, the central passion of human life, and is wholly without didactic tendencies. Of its earliest history as a book we have no information. It is already included in the Hebrew canon (though its right to be there is disputed) when the first explicit mention of the book occurs. We have no evidence, therefore, of the theory of interpretation prevalent at the time of its incorporation with the other books of the canon It seems, however, fair to infer that it would hardly have found acceptance but for a theory of Solomonic authorship and a "religious" theory of meaning. The problem raised by its present place in the canon occurs in relation to mistaken Jewish theories about other books also; it suggests, at least, that divine inspiration may belong to the life of a people rather than to the letter of their literature. Of that life Canticles portrays a central element—the passion of love—in striking imagery and graceful language, however far its oriental standard of taste differs from that of the modern West. In recent times, beginning with Erbt in 1906, and culminating in the elaborate study of W. Wittekindt (1926; *Das Hohe Lied und seine Beziehungen zum Istarkult*), an attempt has been made to interpret the book as a cycle of cult-songs connected with the Tammuz-Ishtar festival as celebrated in the temple of Jerusalem in the time of Manasseh The Shulamite thus becomes a temple-prostitute, representing the goddess Ishtar, whilst the masculine figure is Tammuz or Adonis, with whom are mingled traits drawn from the Babylonian Marduk. The theory is ingeniously, and at some points plausibly, worked out by Wittekindt; but it is open to the same objection as the dramatic theory, in that too much has to be supplied from imagination, helped out by excessive emendation of the text. It seems, moreover, highly improbable that the ritual of a cult which justifiably aroused the passionate indignation of Israel's prophets should ever have been admitted into the sacred canon. The erotic interpretation of the imagery seems also to be carried to excess.

From the nature of the book, it is impossible to assign a precise date for its origin; the wedding-songs of which it chiefly consists must belong to the folklore of more than one century. The only evidence we possess as to date is drawn from the character of the Hebrew in which the book is written, which shows frequent points of contact with new Hebrew. On this ground, we may suppose the present form of the work to date from the Greek period, *i.e.*, after 332 B.C. This is the date accepted by most recent writers, *e.g.*, Kautzsch, Cheyne, Budde, Rothstein, Jacob Haupt, Buchanan Gray, Jordan, Sellin, Meinhold. This late date finds some confirmation in the fact that Canticles belongs to the third and latest part of the Old Testament canon, and that its canonicity was still in dispute at the end of the 1st century A.D.

BIBLIOGRAPHY.—Ginsburg, *The Song of Songs* (1857), gives much information as to the history of the exegesis of Canticles; Diestel's article, "Hohes Lied," in Schenkel's *Bibel Lexikon* (1871), reviews well the history of interpretation prior to Wetstein; *cf.* also Riedel, *Die Auslegung des Hohenliedes in der jüdischen Gemeinde und der griechischen Kirche* (1898). The most important commentary is that by Budde, in Marti's *Kurzer Hand-Commentar* (*Die fünf Megilloth*) (1898), where references to the literature of the 19th century are given. To his list add Siegfried, "Prediger und Hohe-lied," in Nowack's *Handkommentar* (1898); Cheyne's article "Canticles," in the *Encyclopaedia Biblica* (1899); Dalman, Palästinischer Diwan

(1901), parallels to the songs; Rothstein's article, "Song of Songs," in Hastings' *Dictionary of the Bible* (1902); G. Jacob, *Das Hohelied auf Grund arabischer und anderer Parallelen von neuem untersucht* (1902); A. Harper, *The Song of Songs* (1902); Haupt, "The Book of Canticles," in *The American Journal of Semitic Languages* (July 1902), and his *Biblische Liebeslieder* (1907); Scholz, *Kommentar über das Hohelied und Psalm 45* (1904) (written from the Roman Catholic dogmatic standpoint of allegorical interpretation, with a vigorous criticism of other positions); G. C. Martin in the *Century Bible* (1908); D. R. Scott, *Pessimism and Love* (1915); W. G. Jordan, in *Peake's Commentary* (1919). (H. W. R.)

CANTIGNY, a small village in northeast France, west of Montdidier and 18 mi. south of Amiens, was the scene of the first United States offensive in World War I. After the great German advance in March 1918, the 1st Div. of the American Expeditionary force, under Gen. Robert Bullard, relieved two French divisions in the Picardy section of the Allied front. The German line ran west of Montdidier and formed a small salient, of which Cantigny was the nucleus, immediately facing the American front. It was decided to reduce the salient, and for this task the 28th Regt. with 150 men of the 1st Engineers were detailed, supported by French tanks. On May 28, at 6:45 A.M., after an hour's artillery preparation, the United States infantry advanced on a front of 2,200 yd., and in 45 min. they had overcome the German defenses, capturing 250 prisoners. The Germans made fierce counterattacks, extending over three days, but failed to retake the position. The total casualties sustained by the American forces in this operation were 45 officers and 1,022 men. (*See* ST. QUENTIN, BATTLE OF, 1918). Pop. (1936) 102.

CANTILENA (It.), a musical term signifying literally a small song; hence a passage, either in vocal or instrumental music, of a melodious and song like character and, by further extension, the appropriate rendering of such passages.

CANTILEVER, a beam supported at one end and carrying a load at the free extremity, or distributed evenly all along the exposed portion. The upper half of the thickness of such a beam is subjected to tensile stress, tending to elongate the fibres; the lower half to compressive stress, tending to crush them. Cantilevers are employed extensively in building, steel constructional work, and machines. In the first specified any sort of wood or steel or masonry or concrete beam built into a wall and with free end projecting forms a cantilever; brackets of braced type are also used in small and large dimensions. The longer cantilevers have to be incorporated in a building when clear space is required below, the cantilevers carrying a gallery, roof, canopy, part of the building above or a runway for an overhead travelling crane.

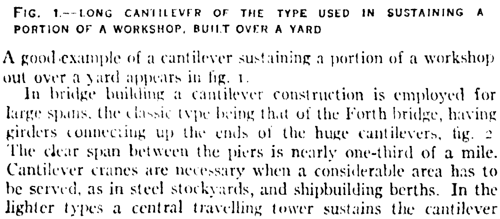

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FIG. 1.—LONG CANTILEVER OF THE TYPE USED IN SUSTAINING A PORTION OF A WORKSHOP, BUILT OVER A YARD

A good example of a cantilever sustaining a portion of a workshop out over a yard appears in fig. 1.

In bridge building a cantilever construction is employed for large spans, the classic type being that of the Forth bridge, having girders connecting up the ends of the huge cantilevers, fig. 2 The clear span between the piers is nearly one-third of a mile. Cantilever cranes are necessary when a considerable area has to be served, as in steel stockyards, and shipbuilding berths. In the lighter types a central travelling tower sustains the cantilever girders on either side: the big hammer-head cranes (made in capacities up to 300 tons) for fitting-out basins have a fixed tower and revolving pivot reaching down therein, to rotate the cantilever in a circle. These cranes are outlined in fig. 2. Block-setting Titan cranes have a very large reach of the cantilever, besides being mounted on a travelling carriage, to move out to sea as the block-setting proceeds.

In motor-car construction a cantilever spring was formerly much used for rear suspensions. Such a spring is anchored to the frame at the centre and at the forward end, the rear end being supported by the axle housing.

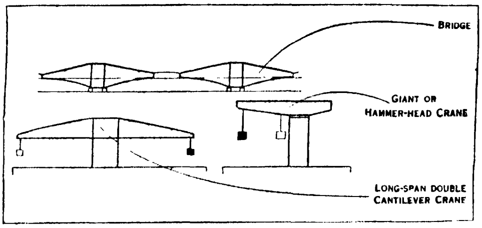


FIG. 2.—THE CANTILEVER IN BRIDGE BUILDING AND IN CRANES
The upper drawing shows the cantilever Forth Bridge, Scotland, in which the span between the piers is nearly one-third of a mile. The cantilever principle is also applied to the large cranes used in steel stock-yards and shipbuilding berths

CANTILUPE, THOMAS DE (*c.* 1218–1282), English saint and prelate, was a son of William de Cantilupe, the 2nd baron (d. 1251), one of King John's ministers, and a nephew of Walter de Cantilupe, bishop of Worcester. He was educated at Paris and Orleans, afterwards becoming a teacher of canon law at Oxford and chancellor of the university in 1262. During the Barons' War Thomas favoured Simon de Montfort and the baronial party. He represented the barons before St. Louis of France at Amiens in 1264; he was made chancellor of England in February 1265, but was deprived of this office after Montfort's death at Evesham, and lived out of England for some time. Returning to England, he was again chancellor of Oxford university. In 1274 he attended the second Council of Lyons, and in 1275 he was appointed bishop of Hereford. Cantilupe was now a trusted adviser of Edward I., and attended the royal councils. The archbishop of Canterbury, Robert Kilwardby, was also his friend; but after Kilwardby's death in 1279 a series of disputes arose between the bishop and the new archbishop, John Peckham, and this was probably the cause which drove Cantilupe to visit Italy. He died at Orvieto, on August 25, 1282, and he was canonized in 1330. In 1905 the Cantilupe Society was founded to publish the episcopal registers of Hereford, of which Cantilupe's is the first in existence.

See the *Acta Sanctorum, Boll.*, Oct. 1; and the *Register of Thomas de Cantilupe* with introduction by W. W. Capes (1906).

CANTILUPE, WALTER DE (d. 1265), bishop of Worcester, came of a family which had risen by devoted service to the crown. His father and his elder brother are named by Roger of Wendover among the "evil counsellors" of John, apparently for no better reason than that they were consistently loyal to an unpopular master. Walter took minor orders, and, in 1236, although not yet a deacon, received the see of Worcester. As bishop, he identified himself with the party of ecclesiastical reform, which was then led by Edmund Rich and Robert Grosseteste. At first a court favourite, the bishop came at length to the belief that the evils of the time arose from the alliance of crown and papacy. He raised his voice against papal demands for money, and after the death of Grosseteste (1253) was the chief spokesman of the nationalist clergy. At the parliament of Oxford (1258) he was elected by the popular party as a representative on the committee of 24 which undertook to reform the administration. In the war he sided with Montfort and, through his nephew Thomas, who was then chancellor of Oxford, brought over the university to the popular side. He was present at Lewes and blessed the Montfortians before they joined battle with the army of the king; he entertained Simon de Montfort on the night before the final rout of Evesham. During Simon's dictatorship, the bishop appeared only as a mediating influence; in the triumvirate of "Electors" who controlled the administration, the clergy were represented by the bishop of Chichester. Walter de Cantilupe died in the year after Evesham (1266).

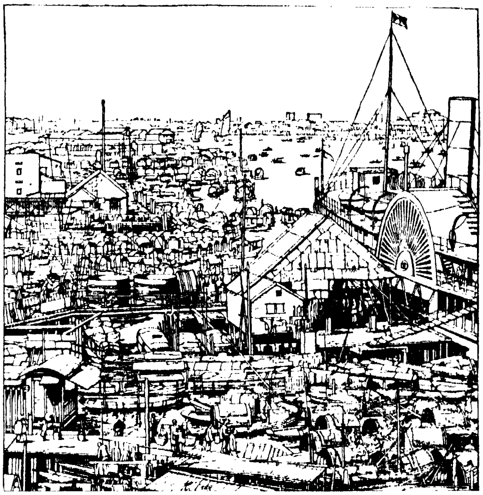
See the *Chronica Maiora* of Matthew Paris ("Rolls" series, ed. Luard); the *Chronicon de Bellis* (ed. Halliwell, Camden Society); and the *Annales Monastici* ("Rolls" series, ed. Luard); also T. F. Tout in the *Political History of England,* vol. iii. (1905).

CANTO, one of the divisions of a long poem, a term dating from the time when poetry was more usually sung by the minstrel to his own accompaniment than read (from Lat. *cantus,* a song). In music, *canto,* as a common Italian word, has many meanings, including music itself, song, singing (as in *bel canto,* beautiful singing), etc. More specifically it signifies the melody in a composition of many parts, usually given to the soprano nowadays, but in old music more frequently to the tenor. *Canto fermo* (or *cantus firmus*) is a melody of this kind which retains its shape unaltered throughout a contrapuntal work; such also in church music is the simple straightforward melody of the old chants as opposed to that of a more florid kind known as *canto figurato.*

CANTON, JOHN (1718–1772), English physicist, born at Stroud, Gloucestershire, on July 31, 1718, was a weaver's apprentice, and became a schoolmaster in Spital square, London. In 1749 he read a paper before the Royal Society on a method of making artificial magnets, which procured him election as a fellow of the society and the award of the Copley medal. He was the first in England to verify Benjamin Franklin's hypothesis of the phenomenon of lightning, and invented an electroscope and an electrometer. In 1762 and 1764 he published experiments in refutation of the decision of the Florentine academy, at that time generally accepted, that water is incompressible; and in 1768 he described the preparation, by calcining oyster-shell with sulphur, of the phosphorescent material known as Canton's phosphorus. He died in London on March 22, 1772.

CANTON, the great commercial metropolis of South China (23° 11′ N., 113° 14′ E.), is the regional capital and outlet of the Basin of the Sikiang or West River which is the focus of the life of South China, separated from the Yangtze Basin, the heart of Central China, by a broad highland zone across which the Hankow-Canton railway provides a through rail communication. The Sikiang is formed by the convergence of a large number of headwater streams rising in the highlands of Kweichow and Yunnan and affording west-east navigation for nearly 1,000 mi. Although wide bottom-lands occur in the valleys of the main river and its tributaries there is no focal basin in the middle or upper portions of the system at all comparable to the Central (Hupeh) or Red basin in the Yangtze system. This gives enhanced significance to the rich deltaic tract of Canton. The city is not on the main stream of the Sikiang, which keeps near the southern limit of the terminal lowlands, but on a northern tributary—the Canton or Pearl river, diverging at Samshui. Below Canton this tributary forms a complex delta intersected by canals. At Canton, the apex of this delta, the Pearl river is also joined by a branch or tributary of the Pei-kiang from the north, whose valley affords the easiest route through the Nan-ling by way of the Cheling pass to the Siang tributary of the Yangtze and so to the Central basin of Hankow. This has always been one of the two great routes linking south with central and north China and is the present course of the Peking-Hankow-Canton railway with its branch lines from Hengyang to Kweilin and into Kweichow province and from Chuchow via Nanchang to Hangchow and Shanghai. The alternative historic route to the north by the Mei-ling pass and the Kan tributary of the Yangtze is also approached by the valley of the Pei-ho, diverging from the first at Shiuchow. Finally a little below Canton the Pearl river is joined by the Tung-kiang, the chief outlet of the highland country of northeast Kwangtung, most of which is thus orientated to the delta. The space relations of Canton thus make it the outlet of the vast basin of the Sikiang, the inevitable terminus of the two great routes from north to south and the focal centre of the greater part of Kwangtung province. Moreover, lying at the head of the broadest deltaic channel, it has been at the limit of ocean navigation and the meeting point of river and sea trade. Large-scale harbour constructions to make the city's port suitable for ocean-going vessels were under way before Canton fell to the Japanese in 1938.

Owing to the relatively late advance of the Chinese to the South China sea the Canton delta was for long a kind of outpost in a barbarian region. It was incorporated in the Chinese Empire by the Chin Dynasty (249–206 B.C.), and from the time of the Han Dynasty (206 B.C.–A.D. 221) the city was known as Kwangchow, still the official name of Canton as capital of Kwangtung province, created by the Ming Dynasty (1368-1644). Owing to the great distance from the capital and the differences of social custom, speech and outlook Canton early and repeatedly exhibited a separatist tendency. It has been called "The Ulster of China" but a closer parallel is perhaps that of Catalonia in relation to Spain. The difference in its outlook from that of China as a whole is to be largely explained by the intimate contact with foreign traders established from a very early period. Canton has been identified with the port of the "Sinae" called Cattigara by the classical geographers and it was certainly very early drawn into the orbit of Indo-Malayan trade. After centuries of contact with Hindu, Parsee and later Arab merchants, who established a settlement near Canton, it was the first Chinese sea-port to be regularly visited by European traders, especially by the Portuguese who attempted to establish a monopoly which was strenuously resisted by the Spanish, Dutch and British. It was at this time the main outlet of the coveted Chinese products of tea, silk and rhubarb. In the 17th century the British made several abortive attempts to settle at Canton, but it was not until the Portuguese monopoly was broken that the East India Company secured a firm foothold in 1684. The French in 1725 and the Dutch in 1762 also established factories in Canton. From this period it became the pivot of the official Chinese policy towards foreign trade. This took the form of making Canton the sole port for foreign trade (Imperial decree of 1757) and of the establishment of the "Hong" system whereby the foreign traders, then mainly in the employ of the British East India Company, were confined to a special "factory" quarter and compelled to deal only with a small group of Chinese merchants who were directly responsible to the Imperial Government. The system led to increasing friction, especially when in the later eighteenth century the rapid rise in the imports of Indian opium began to alarm the Chinese authorities and by reversing the trade balance, hitherto favourable to China, to create a financial problem. The special Trade Missions sent out from Great Britain under Lord Macartney (1793) and Lord Amherst (1816) both


VIEW ALONG THE PEARL RIVER AT CANTON

started on their fruitless journeys to Peking from Canton, which after the lapse of the East India company's charter in 1834 became the headquarters of the official British "Superintendent of Trade in China." Under this new regime the friction with the Chinese authorities quickly came to a head and resulted in the so-called "Opium War" between Great Britain and China (1841–42). The treaty of Nanking (1842) which closed the war destroyed the "Hong" regime and substituted the Treaty Port system (for this and a discussion of the events leading up to the "Opium War" *see* CHINA). It also gave Great Britain possession of the island of Hongkong destined to be transformed into her greatest commercial base in the far east and distant only 80 mi. from Canton. Canton itself was one of the first five treaty ports established by the treaty and was declared open to foreign trade. But conditions remained unsatisfactory and it was friction in Canton which led to the second war between Great Britain and China known as the "Arrow War" of 1856. The city was then occupied by British and French troops. After its evacuation in 1861 foreign business houses and consulates were concentrated in a new concession area, a reclaimed sandbank in the Pearl river known as the "Shameen," divided from the city front by a narrow channel and well situated for purposes of trade.

The commercial importance of Canton in the modern period has naturally been affected by the steady rise of Hongkong as a deep-water port. Modern ocean vessels could not reach further than Whampoa on the southeast branch of the Pearl river, 12 mi. below Canton. Foreign goods for Canton were usually transhipped at Hongkong and sent up the river in small shallow-draft vessels. In 1922 Hongkong supplied no less than 94% of the imports and took 99.5% of the exports of Canton's foreign trade. Hongkong also dealt directly with treaty ports higher up the river, notably with Wuchow. But Canton was the chief link in Hongkong's, and therefore Britain's, trade with south China, and served as the main collecting and distributing centre for all the foreign trade of the interior not in immediate connection with Hongkong, especially that of non-treaty ports inaccessible to Hongkong in its official status of a "foreign country." The trade of the two ports was in this sense complementary but were Whampoa to be developed successfully as the outpost of Canton the situation would be materially altered.

Canton had become an important railway centre. Apart from the Hankow-Canton railway, the southern portion of which was occupied by the Japanese, there is an important railway between Canton and Kowloon, opposite Hongkong, of which 89½ mi. were Chinese and 22½ mi. British, and a local line to Samshui (32 mi.). Further lines are contemplated to Kweilin and Foochow. The completion of the projected railway system will greatly increase Canton's trade with the Yangtze valley and compete with coastal traffic. The Canton delta is devoted to the production of rice and silk. Rice production is however insufficient to feed the vast population and quantities up to 6,000,000 piculs were imported annually from the Wuhu basin along the Yangtze and from Siam and French Indo-China. The two most important silk-producing regions of China were the Yangtze and Canton deltas and in the amount though not in the quality of production the Canton delta was the greater. Silk was exported in the form of raw silk, which had simply passed through the filatures, rather than of silk yarn or of silk piece goods. Apart from electricity plants, steam filatures were the chief expression of western industrialism in the Canton delta and these only treated the silk preparatory to spinning. Steam filatures were more important just to the south of Canton than in Canton itself. For industrial requirements Canton, like Shanghai, was dependent on coal coming by sea from the Kaiping coalfield in north China and from the Kyushu fields in south Japan. Coal resources do exist in the hinterland of Canton, in Kwangsi and around Shiuchow on the upper Pei-kiang, but they are as yet undeveloped save for local consumption. It is often held that further industrial development in the Canton delta will have to await the utilization of these upstream coal resources.

In common with the other south China ports (*see* AMOY) and reflecting its southward aspect, Canton has long been a centre of overseas China emigration which sets especially towards the less densely populated lands of Indo-China and Malaya.

Canton's trade suffered with the Japanese occupation. Imports went down from $13,247,460 (U.S.) (1937) and $16,981,579 (U.S.) (1938) to $1,224,220 (U.S.) (1939) and exports from $37,013,432 (U.S.) (1937) and $60,726,769 (U.S.) (1938) to $2,753,164 (U.S.) (1939).

For many years Canton has played a conspicuous and constructive part in keeping with its traditions and illustrating the Chinese saying that "Everything new originates in Canton." Always restive under the Imperial regime and a source of anxiety to the great emperors of the early Manchu dynasty, Canton became the centre of the active revolutionary propaganda which produced the downfall of the dynasty in 1911. The principal parts were played by Cantonese, many of them, notably Dr. Sun Yat Sen, trained in the United States, with which Canton has long had intimate contact. In the subsequent Civil Wars Canton became the centre of opposition to the Northern Militarists and the seat of the southern government in opposition to that of Peking. It produced the *Kuomintang* or People's party which, under Dr. Sun's leadership, developed an ambitious program of reconstruction and became the rallying point of the nationalist cause. After many vicissitudes, it was from Canton that the nationalist armies, professing these principles, advanced northwards by the historic Cheling pass route, already described, to the conquest of Hankow and the lower Yangtze in 1926–27. The Nanking government was the direct outcome of the movements focussed in Canton and is based on the principles defined by Dr. Sun Yat Sen.

Canton has also been deeply involved both in the disturbances arising out of intense communist propaganda, which at times have threatened to break up the *Kuomintang*, and in the struggle against the treaty rights possessed by foreign powers. It took the lead in the organization of strong labour unions of a western type. Chiefly through their agency was organized in 1923 a remarkable boycott against Hongkong, by which the trade of this seaport was almost paralyzed for months.

Especially in the development of municipal government had Canton been conspicuously active. The local administration consisted of the mayor and a council appointed by the provincial government to represent various classes: merchants, scholars, the professions and labourers. It was generally admitted that, notwithstanding the political disturbances, real progress towards an efficient local government had been made. The outward appearance of the city had been largely transformed. Broad boulevards occupied the sites of the old city walls, destroyed in 1921, thousands of ancestral graves outside had been transferred to distant hills, and new suburbs, connected with the city by trackless trolley lines, had taken their place. Wide streets had been driven through congested areas, public parks created, and a new Bund, similar in character to that of Shanghai or Hankow, had come into existence on the water front. The program included a new system of docks, bridges over the Pearl river, deepening of water channels and, not least, active development of Whampoa as an outport with a dredged channel to the sea. But with the Japanese attack in 1938 the factories and other modern establishments were destroyed when the city was evacuated.

The abolishment of the treaty-port rights in 1943 has emphasized the importance of Chinese development after the war. Canton is the centre of the most important of the non-mandarin language zones of southeast China and the Cantonese "dialect" is spoken by some 15,000,000 to 20,000,000 people, but it is significant that at the National Educational conference of 1921 the Cantonese delegates, in common with those from the other coastal provinces, gave their adhesion to the principle that Mandarin should be taught in all primary schools and recognized as the *lingua franca* of China. The population of Canton was estimated at 1,122,600 in 1936. (P. M. R.; X.)

CANTON, a city of Fulton county, Illinois, U.S.A., near the Illinois river, about 150 mi. N. of St. Louis. It is served by the Burlington and the Toledo, Peoria and Western railways. The population was 11,718 in 1930, and was 11,577 in 1940 by the federal census. It is the trade centre of a rich agricultural and coal-mining district. The county mines over 2,000,000 tons of coal in a normal year. Ploughs were first made there in 1842, when William Parlin began using steel for their construction. The industry he founded became a plant of the International Harvester company. Other manufactures include pit-cars, spark-plugs, clothing, cigars, millwork, brick and tile. Canton was laid out in 1825, and was chartered as a city in 1854. Its name was suggested by that of Pekin, a city 20 mi. east.

CANTON, a town of Norfolk county, Massachusetts, U.S.A., 14 mi. S. of Boston, on the New York, New Haven and Hartford railroad. The population by 1940 federal census was 6,381. It has numerous and varied manufactures, including textiles, patent leather, fishlines and radio filterettes. Canton has been a manufacturing town since colonial days. It was the site of Paul Revere's brass and bell foundry. In the shade of Blue hill, John Eliot began his missionary work among the Indians. The town was separated from Stoughton and incorporated in 1797.

CANTON, a village of northern New York, U.S.A., on the Grasse river, 17 mi. S.E. of Ogdensburg; the county seat of St. Lawrence county. It is on federal highway 11, and is served by the New York Central railway. The population in 1940 was 3,018, federal census. The village is in a prosperous dairy-farming region. It has two large milk plants and several other manufacturing industries. For many years it was famous for its canoes, which went to all parts of the world. It is the seat of St. Lawrence university (chartered 1856), including the Brooklyn law school and the Clinton Liberal institute (founded at Clinton in 1832). The first settler, Daniel Harrington from Connecticut, came in 1800. The village was incorporated in 1845. From 1804 to 1807 it was called New Cairo.

CANTON, a city of northeastern Ohio, U.S.A., 60 mi. S. by E. of Cleveland, at an altitude of 1,065 ft.; the county seat of Stark county. It is on federal highway 30, and is served by the Baltimore and Ohio, the Pennsylvania and the Wheeling and Lake Erie railways. The area is 14 sq.mi. The population in 1920 was 87,091 (81·6% native white), and was 108,401 in 1940 by the federal census. Canton has some 300 factories, making 1,500 diversified products. Steel is manufactured from ore to billet and bar, and is the basic material for the majority of the other products, such as safes, vaults, structural steel, steel "lumber" and furniture, roller bearings, enamelware, diesel and gasoline engines, ornamental street-lighting standards, and so on. Brick and tile, in many varieties, constitute a second large group of industries. Factory output in and near the city in 1940 was valued at $370,000,000. Assessed valuation of property was $148,874,120; bank debits to individual accounts were $488,460,552.

From 1867 Canton was the home of President McKinley. He and Mrs McKinley are buried in a beautiful granite memorial, erected by the nation, in a park of 26 ac. on Monument hill. Canton was laid out in 1805, became the county seat in 1808 and was chartered as a city in 1854. In 1850 the population was 2,603; in 1880, 12,258; in 1900, 30,667. Between 1900 and 1910 it increased 63·7%; between 1910 and 1920, 73·4%. The city has 600 ac. of parks and playgrounds and a 40-ac. arboretum.

CANTON, a word used for certain divisions of some European countries. In France, the canton, a subdivision of the *arrondissement,* was a territorial rather than an administrative unit. The cantons were created by the law Dec. 22, 1789, but their administrative character was taken away by the Consular constitution of the year VIII. There were 3,028 in 1936, each comprising on an average about 12 communes. The canton, the seat of a justice of the peace, returned a member to the *conseil d'arrondissement (see* FRANCE). In Switzerland, canton is the name given to each of the 22 States comprising the Swiss confederation (*see* SWITZERLAND). In heraldry, a "canton" is a corner or square division on a shield, occupying the upper corner (usually the dexter). It is in area two-thirds of the quarter (*see* HERALDRY).

CANTON ISLAND, the largest and most northerly (lat. 2° 50′ S., long. 171° 43′ W.) of eight islands which constitute the Phoenix group. Pop. (1940) 40. These are 500 mi. N.E. of the Ellice islands. U.S. whalers frequented this area from the end of the 18th century. The island was surveyed by Commander R. W. Meade, of the U.S.S. "Narragansett," who named it after a New Bedford whaler, the "Canton," which was wrecked off the island in 1854. By an agreement concluded April 6, 1939 between the United States and British governments, Canton and the neighbouring Enderbury island were placed under joint U.S.-British administration for a period of 50 years. The U.S.S. "Bushnell" surveyed the island in 1939. A few U.S. and British colonists were permanently established on Canton, occupying small houses south of the lagoon entrance to the western side of the island. Canton is an island of the coral atoll formation which is familiar in the South Seas. It is triangular in shape and encloses a large lagoon studded with coral heads and crossed by numerous barrier reefs. It is a narrow strip of land, varying in width from 100 to 500 yd. and in height up to 20 ft. The western side of the island, lying in a north-south direction, is the shortest—about 4 mi. in length. The other sides trend in a southeasterly direction and meet at a point about nine miles from the northwestern extremity of the island. (W. H. CH.)

CANTONMENT. The disposition of troops in weatherproof shelters, such as private homes or in other buildings taken over for the purpose, is known as *cantoning,* and the aggregate of the structures so occupied, as a *cantonment.* (*See* also BIVOUAC.)

Until within relatively recent times, a European army in the conduct of active operations, but sufficiently removed from hostile concentrations to be safe from sudden attack, would, if tired by long campaigning, be given temporary relaxation by cantoning it among nearby villages, and this was the only type of cantonment then known. The sole permanent establishments of this character up to the mid-19th century were those occupied by British troops in India. These were usually in the vicinity of, but removed some distance from, substantial native settlements.

In World War I, the United States Army, during its period of training prior to embarkation for France, was housed largely in cantonments hurriedly built for the purpose and consisting of great numbers of two-story wooden buildings of uniform design. A conventional camp of this type sheltered some 50,000 officers and men and constituted in effect a small self-contained city with all of the requisite utilities, and enjoyed also the facilities of a base hospital of 2,500 beds. Construction of these cantonments during the winter of 1917–18 failed, unfortunately, to keep up with the influx of men reporting for duty under the Selective Service act, and considerable hardship was experienced, and illness developed, as a result. After the termination of the war, most of these camp sites were sold or abandoned; hence, when the draft army of 1940 commenced to assemble, an entirely new group of sites had to be acquired and construction operations rushed in a manner highly reminiscent of 1917. (C. GD.)

CANTOR, GEORG (1845–1918), German mathematician, was born at St. Petersburg (Leningrad) on March 3, 1845. He was educated at Zürich, Berlin and Göttingen. He was appointed tutor of mathematics in the University of Halle (Wittenberg), where in 1872 he became extraordinary professor and in 1879 ordinary professor of mathematics. Cantor's early work was on Fourier Series, and in extending the results obtained he developed a theory of irrational numbers which became classical. He developed an arithmetic of the infinite and a new branch of mathematics—the theory of sets of points. This theory underlies mathematical analysis. It has had a profound influence on modern work in the foundations of mathematics and in mathematical logic. In 1895–97 he published papers on *Begründung der transfiniten Mengenlehre* which formed the basis of his well-known work *Contributions to the founding of the theory of transfinite numbers* (1915). Cantor's last years were embittered by attacks of fellow mathematicians who could not appreciate the originality of his work. He died on Jan. 6, 1918, at Halle.

CANTOR, MORITZ (1829–1920), German mathematician, was born at Mannheim on Aug. 23, 1829. He studied at Heidelberg, Göttingen, Berlin. In 1853 he became a tutor and in 1863 professor of mathematics at Heidelberg. His first important book was *Mathematische Beiträge zum Kulturleben* (1863); this was followed by his well-known *Vorlesungen über die Geschichte der Mathematik,* the first volume of which was published in 1880, the second in 1892 and the third in successive parts between 1894 and 1898. By this time Cantor was too old to undertake the fourth volume; consequently the work was divided between nine men, each responsible for one section and under the editorship of Cantor. This work gives a clear, accurate account of the history of mathematics from earliest times up to 1799. A number of small inaccuracies which were in the *Vorlesungen* have since been corrected by Gustav Eneström, editor of the *Bibliotheca Mathematica.* Between 1856 and 1898 Cantor wrote a number of papers which were published chiefly in the *Zeitschrift für Mathematik und Physik*, among them being "Euclid und seiner Jahrhundert" (1867) and "Die Römischen Agrimensoren" (1875). Cantor's eyesight failed him towards the end of his life. He died on April 10, 1920, at Heidelberg.

CANTOR, in music, literally "singer"; and in church usage, the one (chanter, precentor, succentor) whose business it is to lead the singing or, if not actually to do this himself, to be responsible for its being properly done by others. In German usage the term, with Kapellmeister as its equivalent, includes the further meanings of choir-master and organist, as is recalled by the time-honoured description of Bach as the "Leipzig Cantor." In French, *maitre de chapelle* is the corresponding term.

CANTÙ, CESARE (1804–1895), Italian historian and novelist, was born at Brivio, Lombardy, on Dec. 5, 1804. On his father's death he was left in charge of his brothers and sisters, and supported them by the proceeds of teaching and writing. His early books include some of his best work, notably *La Lombardia nel secolo XVII.* (1832) and the novel *Margherita Pusterla* (Milan, 1838). This novel was written with a tooth-pick as pen and candle-smoke for ink in an Austrian prison, where he was confined for political reasons. In 1838 he began a universal history, *Storia Universale* (Turin, 35 vols., 10th ed., 1890), completed in 1846, and repeatedly revised, which brought a fortune to the publisher and a competence to its author. During the revolution of 1848 he fled from Turin to Milan to escape arrest, but after the Five Days he returned, and began to edit *La Guardia Nazionale.* He was one of the few liberals who responded to the pacific overtures of the archduke Maximilian, a fact that was often brought up against him in later days. After the establishment of the Italian monarchy he was a deputy to the chamber for a short time. He founded the Lombard historical society, and was appointed superintendent of the Lombard archives. He died in Milan on March 11, 1895. Among his numerous other works may be mentioned: *Gli Eretici in Italia* (Milan, 1873), and *L'abate Parini e la Lombardia nel secolo passato* (1854).

See his *Reminiscenze* (1883); and P. Manfredi, *Cesare Cantù* (1905).

CANUSIUM, an ancient city of Apulia (Gr. Κανύσιον, mod. *Canosa*), on the right bank of the Aufidus (Ofanto), about 12 m. from its mouth, and situated upon the Via Traiana, 85 m. E.N.E. of Beneventum. It was said to have been founded by Diomede, and even at the time of Horace (*Sat.* i. 10, 30) both Greek and Latin were spoken there. The legends on the coins are Greek, and a very large number of vases have been found in the necropolis, fine polychrome vases being actually made there (3rd. century B.C.). The town came voluntarily under Roman sovereignty in 318 B.C., afforded a refuge to the Roman fugitives after Cannae, and remained faithful for the rest of the war. It revolted in the Social War, in which it would appear to have suffered, inasmuch as Strabo (vi. 283) speaks of Canusium and Arpi as having shrunk considerably in his day. It had a trade in agricultural products and in Apulian wool (there dyed and cleaned); its position on the high-road was important. It was a *municipium* under the early empire, but was converted into a *colonia* under Antoninus Pius by Herodes Atticus, who provided it with a water-supply. In the 6th century it was still the most important city of Apulia. A few buildings are still preserved.

See T. Ashby and R. Gardner in *Papers of the British School at Rome*, viii., 154 *seq.* and reff.

CANUTE (CNUT), known as "the Great" (*c.* 995–1035), king of Norway, Denmark, and England, son of Sweyn Forkbeard, king of Denmark, was born *c.* 995. In 1013 he sailed, with his father, for England and shared in the conquest of Wessex. After Sweyn's death, in Feb. 1014, and the return of King Ethelred, who had fled to Normandy, Canute was driven out of the country, only to return again in 1015 with a strong Danish fleet. He landed at Sandwich, plundered Dorset, Wiltshire, and Somerset, and, advancing through Wessex, proceeded to subdue northern England as far as York. The fact that he met with so little resistance points to the probability of a general Danish supremacy already existing in England, north of the Thames. Wessex, however, put up a good fight against Canute's army, which was soon reinforced by Eadric and the East Anglians. At Ethelred's death, in April 1016, Canute persuaded the Witan at Southampton to elect him king; but London was obstinate in its support of Edmund Ironside, Ethelred's son. After the failure of several attempts to take London by siege, and a reverse at Sheppey, Canute at last defeated Edmund at Assandune in Essex. After this a conference was held at Olney, an island in the Severn, at which it was settled that Canute should rule over Mercia and the north, while Edmund retained East Anglia and Wessex, with London. A few months later, in Nov. 1016, Edmund died, and Canute was elected king of all England. Edmund's two young sons fell into his hands and were sent to the court of Sweden.

Canute experienced, naturally, the advantages as well as the disadvantages of his position as a foreign conqueror. For one thing he could always resort to the expedient of importing large bodies of Scandinavian troops in case of difficulties in England, and in the second place he was free from the tribal jealousies of the various English kingdoms, being a foreigner and equally king of all England. To counteract the disadvantages, too, he was careful to pursue an anti-Danish policy; after banishing his first wife, Aelfgifu, and her two sons Harold and Sweyn, he married Ethelred's widow, Emma; and he sent back all his Danish ships and soldiers with the exception of the crews of 40 ships, who were to form his bodyguard of "huscarles." Canute's firm alliance with the native clergy, his numerous benefactions, his consecration of the church at Assandune and restoration of that of St. Edmund at Bury were all part of the same policy. In 1026 he went on pilgrimage to Rome and was present at the coronation of Conrad III. as emperor (1027).

Canute's reign was a period of unusual order and security; he seems to have had more idea of central government than had any of the earlier Saxon kings, and the body of secretaries who travelled with him on his journeys represent the first trace of a permanent administrative staff, though their functions are uncertain; and though his division of the kingdom into four earldoms was feudal in tendency, Canute seems to have looked on his earls simply as royal officials, witness the summary dismissal of earl Thorkil, in 1021, and the appointment of the Saxon, Godwin, as earl of Wessex in his place. Canute is responsible for a code of laws, but these are no more than a recapitulation of the earlier Saxon laws of Ethelred and Eadgar and contain no innovations. In 1018 Canute's brother, Harold, king of Denmark, died without issue, and in 1019, Canute, who succeeded him, paid a visit to his Scandinavian dominions. His work of reform and reconciliation was interrupted in 1026 by the attempt of Olaf Haraldson, king of Norway, in conjunction with Anund Jakob, king of Sweden, to conquer Denmark. Canute defeated the Swedish fleet at Stangebjerg, and so seriously injured the combined squadrons at the mouth of the Helgeaa in East Scania, that in 1028 he was able to subdue the greater part of Norway "without hurling a dart or swinging a sword." But the conquest was not permanent, the Norwegians ultimately rising successfully against the tyranny of Alfifa, who misruled the country in the name of her infant son Sweyn. Canute also succeeded in establishing the dominion of Denmark over the southern shores of the Baltic, in Witland and Samland, then forming part of the coast of Prussia. Of the details of Canute's government in Denmark proper we know but little. His most remarkable institution was the *Tinglid*, a military brotherhood, originally 3,000 in number, composed of members of the richest and noblest families, who not only formed the royal bodyguard, but did garrison duty and defended the marches or borders. The story that he rebuked the flattery of his courtiers by showing that the advancing waves paid no heed to his command, is told by Henry of Huntington, about 1130. He was the first Danish king who coined money, with the assistance of Anglo-Saxon mint-masters. At some uncertain date Canute took an army into Scotland, after the Scots had defeated the Northumbrians at Carham in 1018, and ultimately Malcolm, the king of the Scots, is said to have acknowledged his overlordship.

Canute died at Shaftesbury on Nov. 12, 1035, in his 40th year, and was buried at Winchester.

See *Danmarks Riges Historie. Old Tiden og den aeldre Middelalder*, pp. 382–406 (1897–1905); E. A. Freeman, *Norman Conquest* (1870–75); Steenstrup, *Normannerne* (1876–82).

CANUTE VI. (Cnut) (1163–1202), king of Denmark, eldest son of Valdemar I., was crowned in his seventh year (1170) as his father's co-regent, and in 1182 succeeded to the throne. During his reign Denmark consolidated and extended her dominion over the North Baltic coast and adopted a more independent attitude towards Germany. The emperor Frederick I's claim of overlordship was rejected, and his attempt to stir up Duke Bogislav of Pomerania against Denmark's vassal, Jaromir of Rügen, was defeated by Archbishop Absalon, who destroyed 405 of Bogislav's 500 ships in a naval action off Strela (Stralsund) in 1184. In the following year Bogislav did homage to Canute, who, henceforth, styled himself king of the Danes and Wends. This victory led two years later to the voluntary submission of the two Abodrite princes, Niklot and Borwin, to the Danish crown, whereupon the bulk of the Abodrite dominions, which extended from the Trave to the Warnow, including modern Mecklenburg, were divided between them. In 1197 Otto, Margrave of Brandenburg, invaded Pomerania, while in the following year, in conjunction with Duke Adolf of Holstein, he wasted the dominions of the Danophil Abodrites. The war continued intermittently till 1201, when Duke Valdemar, Canute's younger brother, conquered the whole of Holstein and Duke Adolf was subsequently captured at Hamburg and sent in chains to Denmark. North Albingia, as the district between the Eider and the Elbe was then called, became Danish territory. Canute died on Nov. 12, 1202.

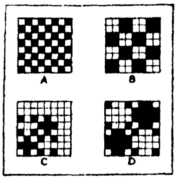
See *Danmarks Riges Historie. Oldtiden og den aeldre Middelalder*, pp. 721–735 (1897 1905).

CANVAS, a stout cloth which probably derives its name from *cannabis*, the Latin word for hemp. This would appear to indicate that canvas was originally made from yarns of the hemp fibre, and there is some ground for the assumption. This fibre and that of flax have certainly been used for ages for the production of cloth for furnishing sails, and for certain classes of cloth used for this purpose the terms "sailcloth" and "canvas" are synonymous. Warden, in his *Linen Trade*, states that the manufacture of sailcloth was established in England in 1590, as appears by the preamble of James I., cap. 23. But this, or a like cloth of the same name had been used for centuries before this time by the Egyptians and Phoenicians. Since the introduction of the power loom the cloth has undergone several modifications, and it is now made both from flax, hemp, tow, jute and cotton, or a mixture of these, but the quality of sailcloth for the British government is kept up to the original standard. All flax canvas is essentially of double warp, for it is invariably intended to withstand some pressure or rough usage.

In structure it is similar to jute tarpaulin; "bagging," "tarpaulin" and "canvas" form an ascending series of cloths so far as fineness is concerned, although the finest tarpaulins are finer than some of the lower canvases. The cloth may be natural colour, bleached or dyed, a very common colour being tan.

Amongst other articles made from it are: receptacles for photographic and other apparatus; bags for fishing, shooting, golf and other sporting implements; shoes for cricket and other games, and for yachting; travelling cases and hold-alls, letter-bags, school-bags, and nose-bags for horses. Large quantities of the various makes of flax and cotton canvases are tarred, and then used for covering goods on railways, wharves, docks, etc.

Sail canvas is, naturally, of a strong build, and is quite different from the canvas cloth used for embroidery purposes, often called "art canvas." The latter is similar in structure to cheese-cloths and strainers, the chief difference being that the yarns for art canvas are, in general, of a superior nature. All kinds of vegetable fibres are used in their production, chief among which are cotton, flax and jute. The yarns are almost invariably two or more ply an arrangement which tends to obtain a uniform thickness—a very desirable element in these open-built fabrics. The plain weave A in the figure is extensively used for these fabrics, but in many cases special weaves are used which leave the open spaces well defined. Thus weave B is often employed, while the "imitation gauze" weaves, C and D, are also largely utilized in the production of these embroidery cloths. Weave B is known as the hopsack, and probably owes its name to being originally used for the making of bags for hops. The cloth for this purpose is now called "hop pocketing," and is of a structure between bagging and tarpaulin. Another class of canvas, single warp termed "artists' canvas," is used, as its name implies, for painting in oils. It is also much lighter than sail canvas, but must, of necessity, be made of level yarns. The best qualities are made of cream or bleached flax line, although it is not unusual to find an admixture of tow, and even of cotton in the commoner kinds. When the cloth comes from the loom it undergoes treatment to prepare the surface for the paint.



CANVAS WEAVES

A. Plain weave. B. Hopsack weave. C and D. Imitation gauze weaves

CANVASBACK, a diving duck related to the pochard (*q.v.*), but larger. The canvasback (*Aythya valisineria*) is an American bird much esteemed for the table. It takes its name from the light colour of the back. The head is chestnut, the beak long and narrow. The canvasback is found in the whole of North America, and breeds from Great Slave lake south to eastern Oregon, northern New Mexico and central Minnesota; wintering from southern British Columbia and Chesapeake bay to the Gulf states and Mexico. Feeding on wild celery in winter was supposed to give its flesh a delectable flavour. (G. F. Ss.)

CANVASS, to sift through canvas, hence to examine carefully. To solicit subscriptions, interest, votes in a prospective election etc.

CANYNGES or **CANYNGE, WILLIAM** (*c.* 1399–1474), English merchant, was born at Bristol in 1399 or 1400, a member of a wealthy family of merchants and cloth-manufacturers in that city. Canynges was five times mayor of, and twice member of parliament for, Bristol. He owned a fleet of ten ships, the largest hitherto known in England, and employed, it is said, 800 seamen. By special licence from the king of Denmark he enjoyed for some time a monopoly of the fish trade between Iceland, Finland and England, and he also competed successfully with the Flemish merchants in the Baltic, obtaining a large share of their business. In 1456 he entertained Margaret of Anjou at Bristol, and in 1461 Edward IV. Canynges undertook at his own expense the great work of rebuilding the famous Bristol church of St. Mary, Redcliffe. In 1467 he himself took holy orders, and in 1469 was made dean of Westbury. He died in 1474. The statesman George Canning and the first viscount Stratford de Redcliffe were descendants of his family.

CANYON, an anglicized form of the Spanish word *cañon*, signifying a valley with high cliff-like sides, such as are found in the western parts of the United States and in Mexico. A few of the more notable examples in the United States are the Grand Canyon (*q.v.*) of the Colorado; the Canyon of the Yellowstone, in Yellowstone National park; and the Black Canyon of the Gunnison, in Colorado.

CANZONE, a form of verse which has reached us from Italian literature. The word is derived from the Provençal *cansò*, a song, but it was in Italian first that the form became a literary one, and was dedicated to the highest uses of poetry. The canzone-strophe consists of two parts, the opening one being distinguished by Dante as the *fronte*, the closing one as the *sirma*. These parts are connected by rhyme, it being usual to make the rhyme of the last line of the *fronte* identical with that of the first line of the *sirma*. In other respects the canzone has great liberty as regards number and length of lines, arrangement of rhymes and conduct of structure. An examination of the best Italian models, however, shows that the tendency of the canzone-strophe is to possess 9, 10, 11, 13, 14 or 16 verses, and that of these the strophe of 14 verses is so far the most frequent that it may almost be taken as the type. In this form it resembles an irregular sonnet. The *Vita Nuova* contains many examples of the canzone, and these are accompanied by so many explanations of their form as to lead us to believe that the canzone was originally invented or adopted by Dante.

The *Canzoniere* of Petrarch is of great authority as to the form of this species of verse. In England the canzone was introduced at the end of the 16th century by William Drummond, of Hawthornden, who has left some very beautiful examples. In German poetry it was cultivated by A. W. von Schlegel and other poets of the Romantic period. It is doubtful, however, whether it is in agreement with the genius of any language but Italian.

CAOINE (pron. *Keen*), an Irish term for the wailing lamentations uttered over the body of the deceased at wakes and funerals. These wailings, which are sometimes led by professional or semi-professional mourners, are more or less musical in character. The practice still lingers in remote parts of Ireland.

CAOUTCHOUC, the principal constituent of natural rubber (*see* RUBBER; BOTANY, CULTIVATION AND CHEMISTRY) and therefore sometimes called pure rubber. It occurs as a vegetable gum, mixed with from $\frac{1}{20}$ to 8 times its own weight of other substances. Caoutchouc is a white resilient solid; at 0–10° C. it is hard and opaque, but it becomes soft and translucent above 20° C. It contains carbon and hydrogen only, and belongs to the terpenes (*q.v.*). By polymerization (*q.v.*) isoprene can be converted to a product resembling caoutchouc but inferior to that synthesized by the plant. *Mineral caoutchoucs* is one of the names of elaterite (*q.v.*), or elastic bitumen.

CAPACITANCE, is the modern term for what was formerly called "capacity" in electrical circuits. It may relate to an isolated conductor when it is defined as the constant ratio of the charge Q on the conductor to the potential, V, to which that charge raises the conductor, *i.e.* $C = Q/V$. If the conductor is an isolated sphere in vacuo the potential $V = Q/r$ where r is the radius of the sphere. Hence the capacitance of an isolated sphere equals its radius.

Capacitance is often concentrated in electrical condensers (*q.v.*) and in many such cases may be simply calculated. On the other hand in many electrical circuits the capacitance is distributed throughout the circuit and more technical methods are required to find its value

The capacitance of conductors or electrical circuits in general depends on the presence of neighbouring charges or conductors, also on the medium between them. (*See* ELECTRICITY.)

(H. B. LM.)

CAPACITOR, in a radio set, is an instrument for storing electrical energy in electrostatic form (*see* ELECTRICITY). It ordinarily consists of two conducting surfaces, approximately parallel, separated by an insulator or dielectric material. It is also called a condenser (*see* CONDENSER [ELECTRICAL]).

CAPACITY, the ability to contain a definite quantity. Cubical capacity is measured in units of volume. Electrical capacity or *capacitance* (*q.v.*) is denoted by the charge Q (*see* ELECTRICITY) which a system will hold on the application of a given voltage V, and is given by the ratio $\frac{Q}{V}$. (*See* CONDENSER [ELECTRICAL], BROADCASTING: *Technical Aspects*; TELEGRAPH; WIRELESS TELEGRAPHY.) *Thermal capacity* measures the capability of a body for absorbing heat (*q.v.*), and numerically is the product of its specific heat and its density.

CAP-À-PIE, O.Fr., meaning from "head to foot," a mediaeval expression to indicate that a knight or man-at-arms was equipped with full body armour.

CAPE BRETON ISLAND, the northeast portion of Nova Scotia, Canada, separated from the mainland by a narrow strait, known as the Gut of Canso; length (north to south) 110 mi., greatest breadth about 87 mi., land area 3,975 sq.mi. Pop. (1941) 150,157. It juts out so far into the Atlantic that it has been called "the long wharf of Canada," the distance to the west coast of Ireland being less by 1,000 mi. than that from New York. A headland on the east coast is also known as Cape Breton, and is said by some to be the first land made by Cabot on his voyage in 1497–98. The large, irregularly shaped, salt water lakes of Bras d'Or communicate with the sea by two channels on the northeast; a short ship canal connects them with St. Peter's bay on the south, thus dividing the island into two parts. Except on the northwest, the coastline is indented with numerous bays, several of which form excellent harbours. The most important are Aspy, St. Ann's, Sydney, Mira, Louisburg, Gabarus, St. Peter's and Mabou; of these, Sydney harbour, on which are situated the cities of Sydney and North Sydney, is one of the finest in North America. There are numerous hill streams not navigable for any distance; the largest are the Denys, the Margaree, the Baddeck and the Mira. Lake Ainslie in the west is the most extensive of several fresh-water lakes. The surface of the island is hilly and the northern part is a tableland 1,000 ft. high, consisting of gneiss, and fringed by a narrow border of carboniferous rocks. South of this a Cambrian belt continues the same formation on the Atlantic coast of Nova Scotia. On the west and south sides of the island at Seacoal Bay and Little River (Richmond county), valuable seams of coal are worked. Still more important is the Sydney coal field on the east coast from Mira bay to St. Ann's. The outcrop is plainly visible at various points along the coast, and coal has been mined in the neighbourhood from a very early period. The coal is bituminous, of good quality and easily worked, most of the seams dipping at a low angle. Several have been mined for miles beneath the ocean. Slate, marble, gypsum and limestone are quarried, the latter being of great value as a flux in the blast furnaces of Sydney. Pop. (1941): Sydney 28,305; North Sydney 6,836; Sydney Mines 8,198.

The lumber, agricultural products and fisheries of Cape Breton are also important. Nearly covered with forest at the time of its discovery, it still exports pine, oak, beech, maple and ash. Oats, wheat, turnips and potatoes are cultivated, chiefly for home consumption; horses, cattle and sheep are reared in considerable [illegible] butt[illegible] [illegible]d che[illegible] [illegible]ed. The Bras d'Or lake and the neighbouring seas supply an abundance of cod, mackerel, herring and whitefish, and the fisheries employ over 7,000 men. Salmon and trout abound, attracting large numbers of tourists and sportsmen from the other provinces and from the United States. The Canadian National railway extends to Sydney and crosses the Gut of Canso on a powerful ferry. From the same strait a railway runs up the west coast, and several shorter lines are controlled by the mining companies. Of these the most important is that connecting Sydney and Louisburg. Numerous steamers, with Sydney as their headquarters, ply upon the Bras d'Or lakes. The Trans-Canada (National) air service connects Sydney with regular schedules to Moncton and St. John's, Nfd. The inhabitants are mainly of Highland Scottish descent, and Gaelic is largely spoken in the country districts. On the south and west coasts are found a number of descendants of the original French settlers and of the Acadian exiles (*see* NOVA SCOTIA), and in the mining towns numbers of Irish are employed. Several hundred Mic Mac Indians, for the most part of mixed blood, are principally employed in making baskets, fish-barrels and butter-firkins. Nearly the whole population is divided between the Roman and Presbyterian creeds.

HISTORY

There is some evidence in favour of early Norse and Icelandic voyages to Cape Breton, but they left no trace.

In 1629 Lord Ochiltree settled a small colony at Baleine, on the east side of the island; but he was soon after taken prisoner with all his party by Captain Daniell of the French company. By the peace of St. Germain, in 1632, Cape Breton was formally assigned to France; and when, by the treaty of Utrecht (1713), the French were deprived of Nova Scotia and Newfoundland (*qq.v.*) they were still left in possession of Cape Breton, and their right to erect fortifications for its defense was formally acknowledged. They accordingly transferred the inhabitants of Plaisance in Newfoundland to the settlement of Havre à l'Anglois, which soon after, under the name of

Louisburg, became the capital of Cape Breton (or Ile Royale, as it was then called), and an important military post.

Cod-fishing formed the staple industry, and a large contraband trade in French wines, brandy and sugar was carried on with the English colonies to the south. In 1745 it was captured by a force of volunteers from New England, aided by a British fleet. By the treaty of Aix-la-Chapelle the town was restored to France; but in 1758 was again captured by a British force. On the conclusion of hostilities the island was ceded to England; and on Oct. 7, 1763, it was united by royal proclamation to the government of Nova Scotia. In 1784 it was separated from Nova Scotia, and a new capital founded at the mouth of the Spanish river which received the name of Sydney in honour of Lord Sydney, then secretary of state for the colonies. In 1820, in spite of strong opposition, it was again annexed to Nova Scotia, since when, its history has been uneventful. Since its annexation to Nova Scotia, Cape Breton Island is not a unit of administration; it represents four counties of the province (Richmond, Cape Breton, Victoria and Inverness), four provincial assembly constituencies (N.S.E.W. and Centre Cape Breton), two federal constituencies (North Victoria and Cape Breton South) with incorporated municipalities including Sydney as above and Glace Bay (25,050).

CAPE COAST CASTLE, a castle (staple, formerly fortified) of central Gold Coast (5° 6′ N., 1° 13′ W.), and the adjacent settlement of 17,685 persons—100 Europeans—(1931). The name is corrupted from the Portuguese *Cabo Corso*—a low, rock promontory on which the castle stands. In its lee (to the east) is a landing place for surfboats. The site was disputed for half a century after 1610 by Portuguese, Dutch, Swedes, Danes, English and Africans. Since 1664 it has remained in English hands, despite attacks by Dutch, French and Africans. After 1667 the castle, supplemented by forts on hills rising 100–200 ft. behind, constituted the strongest English place on the coast, and until 1876 was the seat of administration for the British settlements. It still houses the local government. The first enduring Christian mission of the Colony started there in 1838. In 1894 the community was made a municipality, electing part of its council and one of the ten African members of the Colony council. It provides water and electricity. A rifle company of the African force and two church-supported secondary schools are located there. Prosperity has varied with volume of trade, *i.e.*, with facilities for transport. Tar-bound macadam roads follow the coast and reach inland. Surpassed in population and business by the two centres which have rail terminals and wharves, it remains the third coastal settlement in the Gold Coast.

See *The Gold Coast Handbook* (1937) for bibliography; W. W. Claridge, *A History of the Gold Coast*, vol. i, 166–9. (D. Wh.)

CAPE COD CANAL joins Cape Cod Bay, Mass., with the waters of Buzzards bay, an inlet of Long Island sound, and traverses the narrow isthmus of Cape Cod. It is 8 mi. long with a dredged approach channel 5 mi. long. The width varies between 100 to 300 ft. and the depth at low water is 25 feet. The canal was first projected in early American colonial times and was subsequently a national project. It was finally put into operation in 1914 by private capital after five years of construction work. The canal has cut the distance, for water-borne traffic, between New York and Boston, via the East river, Long Island sound and the canal, by more than 75 miles. The Cape Cod canal was purchased by the U.S. government in 1928 and is operated toll free for both commercial and naval vessels. The traffic is in excess of 800,000 cargo tons annually.

CAPE COLONY: *see* Cape Province; South Africa, Union of.

CAPEFIGUE, JEAN-BAPTISTE HONORÉ RAYMOND (1801–1872), French historian and biographer, was born at Marseilles. The general catalogue of printed books for the Bibliothèque Nationale contains no fewer than 77 works (145 volumes) published by him during 40 years. Of these the most important are the *Histoire de Philippe-Auguste* (4 vols. 1829), and the *Histoire de la réforme, de la ligue et du règne de Henri IV* (8 vols. 1834–35).

CAPE GIRARDEAU, a city of Cape Girardeau county, Missouri, U.S.A., on the bluffs of the Mississippi river, 131 mi. S.S.E. of St. Louis. It is on Federal highway 61, and is served by the Frisco railway, river steamboats and barges and a ferry to Thebes, Illinois. In 1900 the population was 4,815; in 1920, 10,252 (90% native white); and in 1940 was 19,426 by the federal census. There are extensive hardwood forests in the neighbourhood, and deposits of marble, lime, sandstone, iron, silica and pure white clay. The leading manufactures are shoes, cement and lumber products.

The Southeast Missouri State Teachers' college, established as a normal school in the year 1873, occupies massive buildings of native limestone in a picturesque setting high above the river. It has a fine collection of local Indian relics, assembled and presented by Thomas Beckwith (d. 1913) of Charleston, Missouri. Cape Girardeau was founded in 1793 by Louis Lorimier, a French Canadian, and was named after another early trader. Under Spanish dominion it was an important military and trading post, and it was the site of a fort in the Civil War. The city was incorporated in 1843. It has a commission form of government.

CAPEK (chä′pĕk), **KAREL** (1890–1938), Czech dramatist and novelist, born at Malé Svatonovice, in Bohemia, is famous for the plays *R.U.R.* (1920; Eng. trans. 1923), in which he satirizes the mechanical tendencies of modern civilization, and *The Insect Play* (1921; Eng. trans. 1923), written in collaboration with his brother Josef, and satirizing various phases of modern society. Other plays included the *Makropulos Affair* (1922), dealing with longevity; *Power and Glory* (1937); and *The Mother* (1938). Of his fiction the best known are *Painful Tales*, short stories which deserve comparison with Maupassant, and his novels, *The Manufacture of the Absolute* (1923), *Krakatit* (1924, Eng trans. 1925), and *War with the Newts* (1937). He wrote a brilliant series of feuilletons, *Letters from England* (1924; Eng trans. 1925), *Letters from Italy* and *Concerning the Nearest Things* (1926), *Letters from Spain* (1932), and *Letters from Holland* (1933).

CAPEL (of Hadham), **ARTHUR CAPEL,** Baron (*fl.* 1640–1649), English royalist, son of Sir Henry Capel of Rayne Hall, Essex, was elected a member of the Short and Long Parliaments in 1640 for Hertfordshire. He at first supported the opposition, but went over to the king's party and was raised to the peerage on Aug. 6, 1641. On the outbreak of the civil war, he was appointed lieutenant-general of Shropshire, Cheshire and North Wales, and was a commissioner at the negotiations at Uxbridge in 1645. He attended the queen in her flight to France in 1646, but disapproved of the prince's journey thither and retired to Jersey, subsequently aiding in the king's escape to the Isle of Wight. He was one of the chief leaders in the second Civil War. On Aug. 27, together with Lord Norwich, he surrendered to Fairfax at Colchester on promise of quarter for life, an assurance which the civil authorities declared not to be binding on themselves. He succeeded in escaping from the Tower, but was again captured, was condemned to death by the new "high court of justice" on March 8, 1649, and was beheaded, together with the duke of Hamilton and Lord Holland, the next day.

Lord Capel's *Daily Observations or Meditations: Divine, Morall*, published with some of his letters in 1654, was reprinted, with a short life of the author, under the title *Excellent Contemplations*, in 1683.

CAPEL CURIG (kăp′ĕl kü′rig or kü′rēch), a small tourist centre in Caernarvonshire, North Wales. Pop. of civil parish (1931) 492. It lies 6 mi. W. of Bettws-y-Coed near the confluence of the Gwryd and the Llugwy, in some the wildest mountain scenery of North Wales, and forms a convenient centre for ascending Snowdon, the Glydyrs and the Carnedds. Moel Siabod rises immediately to the south.

CAPELL, EDWARD (1713–1781), English Shakespearian critic, was born at Troston Hall in Suffolk, and became deputy-inspector of plays in 1737. In 1760 appeared his *Prolusions, or Select Pieces of Ancient Poetry*, a collection which included *Edward III*, placed by Capell among the doubtful plays of Shakespeare. Shocked at the inaccuracies which had crept into Sir Thomas Hanmer's edition of Shakespeare, he projected an entirely new edition to be carefully collated with the original copies. After spending three years in collecting and comparing scarce folio and quarto editions, he published his own edition in 10 vols. 8vo. (1768), with an introduction written in a style of extraordinary quaintness, which was afterward appended to Johnson's and Steevens's editions. Capell published the first part of his commentary, which included notes on nine plays with a glossary, in 1774. This he afterward recalled, and the publication of the complete work, *Notes and Various Readings of Shakespeare* (1779–83), the third volume of which bears the title of *The School of Shakespeare*, was completed in 1783, two years after the author's death. Besides the works already specified, he published an edition of *Antony and Cleopatra*, adapted for the stage with the help of David Garrick in 1758.

CAPELLA, MARTIANUS MINNEUS FELIX, Latin writer, according to Cassiodorus a *native* of Madaura, in Africa, flourished during the 5th century, certainly before the year 439. He appears to have practised as a lawyer at Carthage. His curious work, entitled *Satyricon*, or *De Nuptiis Philologiae et Mercurii et de septem Artibus liberalibus libri novem*, is an allegory written in a mixture of prose and verse. The style is involved, loaded with metaphor and verbose The first two books contain the allegory proper—the marriage of Mercury to a nymph named Philologia. The remaining seven contain expositions of the seven liberal arts, represented as courtiers of Mercury and Philologia. The work was an encyclopaedia of the culture of the time, and was in high repute during the middle ages. The author's chief sources were Varro, Pliny, Solinus, Aquila Romanus, and Aristides Quintilianus. His prose resembles that of Apuleius, but is even more difficult. The verse portions are in imitation of Varro and are less tiresome. A passage in book viii contains a clear statement of the heliocentric system of astronomy. It has been supposed that Copernicus, who quotes Capella, may have received from this work some hints toward his own new system.

Editio princeps, by F Vitalis Bodianus (1499); the best modern edition is that of F. Eyssenhardt (1866); for the relation of Martianus Capella to Aristides Quintilianus *see* H. Deiters, *Studien zu den griechischen Musikern* (1881).

CAPELLA, the fifth or sixth brightest star in the sky, and the brightest star in the constellation Auriga (*q.v.*) hence its alternative name α Aurigae. It was found to be a spectroscopic binary by Newall and Campbell (*see* STAR), and the separation of its two components was first directly measured in 1919 with Michelson's interferometer (*q.v.*) in conjunction with the 100-in. telescope on Mt. Wilson. Its approximate distance from the sun is 45 light years. The spectrum (*see* SPECTROSCOPY) of Capella closely resembles that of the sun.

CAPELLO, LUIGI (1859–), Italian soldier, was born on April 14, 1859. His career until he became a general officer was passed in the infantry. During World War I he conducted in Aug. 1916 the attack which led to the capture of Gorizia. As commander of the Gorizia zone II (VIII, VI and II Corps) he conducted the first phase of the Italian offensive in May 1917. In June he was given command of the II Army and in August he directed the attack on the Bainsizza plateau, but his desire to continue the attack led to differences with Cadorna, his commander-in-chief, who favoured a defensive disposition. It is probable that Capello's faith in his own method of meeting the enemy counter-attack prevented his wholehearted co-operation with Cadorna. After his retirement in July 1918 he took some part in politics and for a brief period supported fascism but later joined the opposition and, in Nov. 1925, was arrested on a charge of complicity with Zaniboni in a plot against the life of Mussolini. He was tried and condemned to 30 years' penal servitude.

CAPE MAY, a city of Cape May county, New Jersey, U.S.A., a popular summer resort on the Atlantic coast, 2 mi. E.N.E. of the southern tip of the state. It is served by the Pennsylvania-Reading Seashore railway. The permanent population in 1940 was 2,583. The principal part of the city occupies a peninsula between the ocean and Cape May inlet, which has been dredged and protected to make a harbour 25 ft. deep. On the sea side, along a hard sand beach five miles long, is the esplanade, bordered by hotels and cottages. The lighthouse on the cape, built in 1800 and rebuilt in 1859, is 145 ft. high. There is a landing field for both hydroplanes and aeroplanes at the naval air station on the inlet. The commerce of the harbour in 1940 amounted to 150,000 tons, largely fish, coal and ice. The city has sand plants, two stocking factories, two boat-building plants and a paint factory. The fish, clam and oyster industry is important.

The cape was named after Cornelius Jacobus Mey, director of the Prince Hendrick (Delaware) river for the West India Company of Holland, who took possession of the river in 1623, and planted a short-lived colony (Ft. Nassau) 4 mi. below Philadelphia. The first permanent settlement here was made about 1699. It was an important whaling port early in the 18th century, and became prominent as a summer resort before 1800. Under the name of Cape Island it was incorporated as a borough in 1848 and chartered as a city in 1851.

The name was changed in 1869. In 1937 a commission form of government was adopted.

CAPENA, an ancient city of southern Etruria, frequently mentioned with Veii and Falerii. According to Cato it was a colony of the former, and in the wars between Veii and Rome it appears as dependent upon Veii, after the fall of which town, however, it became subject to Rome. Out of its territory the *tribus Stellatina* was formed in 367 B.C. It stood on the lonely hill known as Civitucola, about 4 mi. N.E. of the post station of *ad Vicesimum* on the ancient Via Flaminia, on the north side of a dried-up lake, once a volcanic crater.

Remains of buildings of the Roman period exist, while many tombs, especially of the 8th to 7th centuries B.C., have been found in the neighbouring hills.

See T. Ashby, *Memorie dell Accademia Pontificia*, ser. 3, vol. i, part ii, p. 153 *sqq.* (1924), for a full account of the site, with reff.

CAPE OF GOOD HOPE, the full name of the southernmost province of the Union of South Africa, formerly Cape Colony, now Cape Province; also the cape of the same name, forming the peninsula between Table bay and False bay, which eventually gave its name to the whole territory. *See* CAPE PROVINCE.

CAPE PROVINCE, or, officially, "The Province of the Cape of Good Hope," consists of the southernmost part of Africa, and is one of four provinces of the Union of South Africa. Area 277,169 sq.mi., *i.e.*, 59% of the total area of the Union. It is bounded by the Atlantic and Indian oceans, and by Natal, Basutoland, the Orange Free State, the Transvaal, the Bechuanaland Protectorate, and South-West Africa, the boundary following, for the greater part of its length, the course of rivers and escarpments.

Structure and Topography.—Topographically, Cape Province can be divided into two main regions. The first of these consists of part of the inner plateau of South Africa, the altitude of which averages, in the province, about 3,000 feet. About the Orange river the western portion of the plateau descends to about 2,000 ft.; toward the east it rises over 4,000 feet. The limits of the plateau are, as a rule, clearly defined by a great escarpment which runs more or less parallel with the coast, and which is known by several local names, such as the Drakensberg, Stormberg, Sneeuwberg, Nieuwveld, Komsberg, Roggeveld, Bokkeveld and Kamiesberg. Here the greatest heights in the province are attained. Near the Basutoland border Ben Macdhui reaches about 10,000 feet. In the Sneeuwberg range the Kompas Berg is said to be 8,500 feet. The high plateau forms undulating country, broken by ranges of hills and isolated kopjes. The general aspect varies greatly from east to west, according to the rainfall. In the west the rusty brown rocks, practically unrelieved by any running water, stretch away to the horizon. In day time, with the heat of a fierce sun being reflected from bare surfaces, one is made to think of the dry skeleton of a country; but round about sunset the scene is painted over as by magic with soft and yet brilliant colours—blues, amethysts, silver grays. The extraordinary charm of the veld at night can only be experienced. The greater part of this region consists of scarcely disturbed strata of the Karroo system, with older and more disturbed formations outcropping to the north-west of a Prieska-Kimberley line. (*See* SOUTH AFRICA, UNION OF.)

The second main region, lying between the great escarpment and the sea, is more diversified, and can be divided into several sub-regions. The first of these is the Great Karroo, an arid, almost desert, area bounded on the north by the escarpment, and on the south by the Folded Belt (*see* below). Its elevation varies from 1,000 to about 4,000 feet. It is floored mainly by sandstones and shales of the lower part of the Karroo system, reinforced in the northern part by dolerites. Owing to the gentle dip of the strata, the topography consists of a number of minor plateaux or terraces, which are due to the more resistant sandstones, the softer shales being more easily eroded. In the southern part of the Karroo the beds have been steeply tilted, and the topography has acquired a definite east to west grain, owing to differential erosion along the outcrops of hard and soft strata.

The boundary between the Great Karroo and the second subregion is indefinite and largely a matter of climatic gradation. This second area, the south-eastern region, includes the country to the north-east of Graaff Reinet, which lies between the Sneeuwberg, Stormberg, Drakensberg and the Coastal Belt. It is built very largely of Karroo rocks, and consists of a series of great terraces, due to the greater resistance of outcrops of sandstones and dolerites. In East Griqualand, large masses of intrusive, basic rocks, having a considerable petrological range, give rise to the Ingeli mountains (more than 7,000 ft.), Mt. Currie and Insizwa. At Port St. Johns a horst of Table mountain sandstone is cut across by the Umzimvubu river, which forms a deep cañon.

The Folded Zone.—Late in the Karroo period a series of mountain ranges was folded along a number of axes. In the western part of the area these trend north-north-west to south-south-east, but about Karroo Poort, in the Ceres district, the direction changes, and the axes have a more or less east to west trend. Each axis is somewhat curved and has its concave side toward the coast. At the northern end the folding dies away about Van Rhyn's Dorp. When traced eastward the folded zone passes beneath the sea between Cape Agulhas and the Peddie district, owing to the north-easterly trend of the coast. The rocks involved in the folding belong to the Cape and the Karroo systems, and include tough, quartzitic sandstones (Table mountain sandstones, and Witteberg series) and softer shaly beds (Bokkeveld). The former still give rise to mountain ranges which coincide with the old anticlinal axes, while the shales outcrop chiefly in the synclinal valleys, where they are sometimes overlain uncomformably by cretaceous shales and conglomerates (the Uitenhage beds). These later formations do not occur to the west of Worcester, but they are well represented about Uitenhage, Oudtshoorn, Riversdale and Swellendam. Near the axes of some of the anticlines pre-Cape granites, slates or limestones reach the surface. The Cango caves near Oudtshoorn occur in an outcrop of dolomitic limestone. Toward the west these older rocks play a more important part. Along the Paarl granite is extensively quarried for building purposes. Among the folded ranges are the Cedarberg, Groote Zwarteberg, Zuurberg, Drakenstein, River Zonder Einde mountains, Langeberg, Outeniqua, etc. The highest point among these ranges is the Seven Weeks' Poort mountain in the Zwarteberg (7,627 ft.), but many peaks reach over 6,000 feet. The skylines of those mountains, which do not exceed 4,000 ft., are remarkably even, and apparently represent remains of an old plain. Toward the east the remains of this plain become more conspicuous, and are well-developed from about Oudtshoorn eastward into the Albany district. A remarkably fine plain runs from just north of Grahamstown, where it stands about 2,200 ft. above sea-level, away to the north, where it reaches the foot of the Great Winterberg at about 4,500 feet. Where the outcrops of the resistant Table mountain sandstone reach the sea, bold cliffs and headlands are formed between Cape St. Blaize and Cape Recife.

The Coast Belt varies considerably in width, and consists of a terrace, which may reach an elevation of 700 to 1,000 feet. It slopes gently seaward, and may end in cliffs 400 ft. or 500 ft. high, as at Knysna and Mossel bay, or dip gently to a line of sand dunes. The Coast Belt can be traced northward to beyond the Orange river, where it merges into the Namib. South of the Olifants river, between the great escarpment and the sea, there occur mountain groups, formed of Table mountain sandstone, resting comparatively undisturbed on the worn down edges of the older rocks, *e.g.*, Piquetberg, Cape peninsula, etc. Along the western side of the latter, granites and Malmesburg slates and grits (Transvaal system) are well exposed. The same sandstone, still but little disturbed, forms part of the coastal lands between False bay and Cape Infanta. East of Knysna the coastal terrace, which is well developed about George, where it is clearly a plain of marine denudation, becomes very narrow. North-eastward from Algoa bay the coast lands are formed of Karroo rocks, except for the horst of Table mountain sandstone at St. Johns. (For coast line, *see* SOUTH AFRICA, UNION OF.)

Drainage.—The great escarpment is a major water parting. The interior plateau is drained by the Orange and its tributaries (*see* ORANGE [river]). In the escarpment rises a number of streams, which flow across the Karroo and the Folded Belt to the sea. Most of these receive insufficient alimentation during the dry season to maintain their flow, and become a series of pools along channels, lined with accumulations of sand, mud or gravel. Between the Albany district and the Ceres Karroo are the remains of a post-Cretaceous plain, with an elevation of about 2,500 ft. This has been much eroded. The rivers of the folded area flow for long stretches in wide valleys, parallel with the strike of the beds, and then, in short sections, escape across the ranges, by means of "poorts," or steep, narrow and rugged valleys, such as the poorts of the Gamka, Gouritz, etc. In the south-eastern region the rivers alternate with long, gently graded sections, with many meanders and cut-offs, and shorter, tumultuous reaches, where they drop to a lower terrace over the outcrops of dolerites and sandstones. Their volume is more constant than that of the Karroo rivers, though it is liable to much diminution in the winters.

Owing to the low rainfall, and the high evaporation, which, from a free water surface is 97 in. per annum at Kimberley, there are no lakes. The nearest approach is a number of "vleis," or shallow pools, the areas of which vary considerably with the seasons, and "pans," or shallow hollows, which contain water after rain, but soon dry up, often leaving an incrustation of salt.

Climate.—The amount of rainfall varies greatly, according to the distance from the sea, situation with regard to mountain ranges, etc. Thus the Royal Observatory at Capetown records an average of 25.6 in., while Bishopscourt, 3 mi. away registers 55.2 inches. Again, while George has 34.36 in., Ezeljagt 12 mi. away, but on the landward side of the Outeniqua mountains, receives only 14.08 inches. Between the mountain ranges the rainfall is much less than near the coast. The Little Karroo, lying between the River Zonder Einde mountains, the Langebergen and the Outeniquas on the south, and the Zwartebergen on the north, has an almost desert climate. The annual rainfall at Oudtshoorn is 10.4 in., and at Ladismith 14.5. The same may be said of the Great Karroo, between the Zwartebergen and the Great Escarpment, where Beaufort West has 9.7 in. of rain, and Prince Alfred 11.4. As one proceeds northward along the coast from Capetown the rainfall also diminishes. The annual precipitation at Port Nolloth is 2.17 inches. The Eastern province enjoys a higher rainfall, much of it falling in short heavy showers, often accompanied by thunder. Port Elizabeth has 22.23 in., East London 33.39, Port St. Johns 48.56, Cathcart 26.17, Aliwal North 24.36. There is also an important seasonal difference in the incidence of rainfall. Winter rains, April to September, predominate in a comparatively narrow strip of territory near the southwest coasts. A line drawn through places having 50% of their rain in the winter, would run from the west coast, just south of Walvis bay to near Swellendam, and then, turning eastward, would pass somewhere near Oudtshoorn, and reach the coast a little to the northeast of Port Elizabeth. Within the region is a district, between George and Humansdorp, which receives a fairly plentiful rainfall about 40 in., well distributed through the year. This is the only important forest area of Cape Province.

Near the coast frosts are almost unknown and the temperature ranges are comparatively small. Inland they are much greater, owing to the altitude, and to the clearness and dryness of the air. Snow is seen on Table mountain about once in six or seven years, but on the mountains in the north-east of the province, it is of yearly occurrence.

Vegetation.—Cape Province can be divided into several botanical regions. The first of these may be called the *Cape*, or *Southwestern Region*. It includes the area of the Fold mountains and the Coast Belt between the Olifants and Sunday rivers, and on the seaward side of the Cedarberg, Hex river, Zwarteberg, Baviaan's Kloof, and Elandsberg mountains. In this region vegetation has to withstand long summer droughts and bright sunshine. The plants, therefore, show many devices for checking the transpiration of water. Most of them are evergreen, though dark or grayish green tints predominate. The leaves tend to be small and tough. The general appearance is that of the Macchia of Corsica, and is due to the dominance of low bushes and shrubs, from 2 to 8 ft. high. Among the principal families represented are the Proteaceae, with 262 species, including the sugar bush (*Protea mellifera*) and the silver tree (*Leucodendron argenteum*); and the Ericaceae, which is particularly common, one genus alone, *Erica,* being represented by 456 species. These are characteristic of the coastal districts and of the mountain slopes. In spring, about September, when they are in bloom, the whole countryside is splashed with colour. In the inland valleys the rhenoster bush (*Elytropappus rhinocerotis*), and a great number of plants belonging to the Restiaceae, give to the vegetation a prevailing grayish tint. Below the bushes and shrubs grow large numbers of bulbous and tuberous plants belonging to the Iridaceae, Liliaceae, etc. Along the rivers and by the vleis the typical plants are the palmiet (*Prionium palmita*) and the pig lily (*Zantedeschia aethiopica*).

Within the south-western region are the evergreen forests between George and Humansdorp, on the seaward slopes of the Outeniqua, Langkloof and Zitzikamma ranges. Among the more important timber trees are the yellowwoods (*Podocarpus elongatus* and *P. thunbergii*), the former growing to a height of 130 ft., stinkwood (*Ocotea bullata*) and black ironwood (*Olea laurifolia*). Climbing plants are abundant. In addition to the indigenous trees, oaks, pines, gums and wattles have been introduced into the province. They are grown in plantations, though oak is chiefly used for lining the streets of such towns as Stellenbosch, George, etc. Owing to its rapid growth, its wood is much softer than European oak.

Along the west coast, north of the Olifants river, the climate becomes increasingly dry. There is no continuous covering of vegetation, and only xerophyllous types can exist. Desert grasses and succulents are found, and low acacia bushes grow along the dry river beds.

Except just after rains, the *Karroo,* and the adjacent western portion of the inner plateau, appear almost desert. Trees grow only near the river beds, and are represented by species of small acacia, etc. Almost everywhere succulent forms—aloes, euphorbias, mesembryanthemums are dominant. In places, small bushes, 1 to 3 ft. high, manage to maintain themselves. On the upper Karroo the various shrublets of the family Compositae become important.

After the rains tuberous and bulbous plants and annuals come into bloom, but in a few weeks the Karroo relapses to its arid condition. In some areas the prickly pear, introduced by man, has covered the hillside.

In the South African *Steppe and Forest Area* are included the high country in the north-east of the province, and the coastlands beyond Algoa bay. This is largely a grassland area. The higher lands are pure steppe, in which *Themeda triandra* is dominant. Other common grasses are *Andropogon amplectens, A. schirensis, Heteropogon contortus,* etc. Between the great escarpment and the Coast Belt, *i.e.*, approximately between 6,000 and 1,000 ft., Savannah is the characteristic association. The grasses include *Themeda triandra, Eragrostis plana, Sporobolus indicus, Andropogon amplectens* and *A. schoenanthus.* The trees consist chiefly of acacias—*A. caffra, A. karroo, A. benthami* and *Zizyphus mucronata, Ehretia hottentotica,* etc. On the drier slopes succulents become dominant, and include *Aloe ferox, A. bainsii, Euphorbia grandidens, E. ingens,* etc. On mountain slopes, facing between south-east and south-west, patches of forest occur up to about 6,000 feet. Among the more important trees are the yellowwoods (*Podocarpus elongatus, P. latifolia*), ironwood (*Olea laurifolia*), lemonwood (*Xymalos monospora*), *Celtis kraussiana,* etc. Along the Coast Belt, *i.e.*, below 1,000 ft., where frost is rare or absent, the country was originally covered, from about East London to Natal, with bush or forest, which has tropical affinities. It consisted of low trees 20–30 ft. high. Here are to be found *Rhus longifolia, Mimusops caffra* (red milkwood), *Albizzia fastigiata* (flat crown), *Millettia caffra* (umzimbiti). Very characteristic are the palm, *Hyphaene crinita,* and *Strelitzia augusta* (wild banana). In these woods are many climbing plants, such as *Rhoicissus capensis* (wild grape), *Cassine natalensis* (Natal cherry), etc.

Fauna.—The fauna is varied, but some of the wild animals common in the early days of the colony have been exterminated (*e.g.*, quagga and blaauwbok), and others (*e.g.*, the lion, rhinoceros, giraffe) driven beyond the confines of the Cape. Other game have been so reduced in numbers as to require special protection. This class includes the elephant (now found only in the Knysna and neighbouring forest regions), buffalo and zebra (strictly preserved, and confined to much the same regions as the elephant), eland, oribi, koodoo, hartebeest and other kinds of antelope and gnu. The leopard is not protected, but lingers in the mountainous districts. Cheetahs are also found, including a rare woolly variety peculiar to the Karroo. Both the leopards and cheetahs are commonly spoken of in South Africa as tigers. Other Carnivora more or less common to the colony are the spotted hyena, aardwolf (*Proteles*), silver jackal, Cape hunting dog (*Octocyon*) and various kinds of wild cats. Of ungulates, besides a few hundred of rare varieties, there are the springbuck, of which great herds still wander on the open veld, the steinbok, a small and beautiful animal which is sometimes coursed like a hare, the klipspringer or "chamois of South Africa," common in the mountains, the wart-hog and the dassie or rock rabbit. There are two or three varieties of hares, and a species of jerboa and several genera of mongooses. The English rabbit has been introduced into Robben Island, but is excluded from the mainland. The ant bear or aardvark, with very long snout, tongue and ears, is found on the Karroo, where it makes inroads on the ant-heaps which dot the plain. There are also various species of pangolins, of arboreal habit, which live on ants. Baboons are found in the mountains and forests, otters in the rivers. Of reptiles there are the crocodile, confined to the Transkei rivers, several kinds of snakes, including the cobra di capello and puff adder, numerous lizards and various tortoises, including the leopard tortoise, the largest of the continental land forms. Of birds the ostrich may still be found wild in some regions. The great kori bustard is sometimes as much as 5 ft. high. Other game birds include the francolin, quail, guinea fowl, sand grouse, snipe, wild duck, wild goose, widgeon, teal, plover and rail. Birds of prey include the bearded vulture, aasvogel and several varieties of eagles, hawks, falcons and owls. Cranes, storks, flamingoes and pelicans are found in large variety.

Parrots are rarely seen. The greater number of birds belong to the order Passeres; starlings, weavers and larks are very common, the Cape canary, long-tailed sugar bird, pipits and wagtails are fairly numerous. The English starling is stated to be the only European bird to have thoroughly established itself in the province. The Cape sparrow has completely acclimatized itself to town life and prevented the English sparrow obtaining a footing.

Large toads and frogs are common, as are scorpions, tarantula spiders, butterflies, hornets and stinging ants. The most interesting of the endemic insectivora is the "golden mole" (*Chrysochloris*), so called from the brilliant yellow lustre of its fur. There are not many varieties of freshwater fish, the commonest being the baba or catfish and the yellow fish. Both are of large size, the baba weighing as much as 70 lb. The smallest variety is the culper or burrowing perch. In some of the *vleis* and streams in which the water is intermittent the fish preserve life by burrowing into the ooze. Trout have been introduced into several rivers and have become acclimatized. Of sea fish there are more than 40 edible varieties. The snock, the steenbrass and geelbeck are common in the estuaries and bays. Seals and sharks are also common in the waters of the Cape. Whales visit the coast for the purpose of calving.

Of the domestic animals, sheep, cattle and dogs were possessed by the natives when the country was discovered by Europeans.

The various farm animals introduced by the whites have thriven well.

Population.—In 1936 the total population of the province was 3,529,900. The number of "European" inhabitants was 791,574. Under this term are included settlers of Dutch origin, to whom the term "Boer" (farmer) is often, though obviously not always justifiably, applied. They are also known as Afrikaners. Among them will be found many French names, which are due to Huguenot immigrants, who were soon absorbed by the Dutch colonists. Most important, numerically, after the Dutch is the British element. In 1936 the "home language" of 461,356 Europeans was reported as Afrikaans, and that of 297,077 as English. An additional 19,698 Europeans used both languages in their homes. Formerly, colonists of British stock were concentrated in the towns, while the land was held by the Dutch. However, many Dutch have moved into the towns, and much land has been bought by British settlers. On the whole the British element is more strongly represented in the eastern part of the province, while the western part is mainly Dutch. Early in the 19th century considerable numbers of German immigrants arrived in South Africa. Many of their descendants are still to be found among the farmers in the country between East London and King William's Town, and also in the Cape peninsula. Six thousand of them retain their own language. An appreciable number of Scandinavians are engaged in the whaling industry, and in the timber industry about Knysna. The Jewish population (most of which is in Capetown and vicinity) was 28,163 in 1936.

The native Bantu population (1936) was 2,045,570, most of which was rural. The Bantu, in their spread to the southwest, were arrested by Europeans along the Great Fish river, which may still be regarded as the limit of any important native population. The Transkei territories, between the Kei river and Natal, contain a native population of 1,153,975. Large numbers of natives have been attracted, perhaps beyond their natural climatic limit, to the area about Capetown, by the freer social atmosphere than exists in the other provinces of South Africa. The number of natives living in Capetown in 1936 was 14,160. Many natives are also employed in Port Elizabeth and East London.

The Asiatics, amounting to 10,508, include Mohammedan Indian traders, Parsees and Syrians. Grouped by the census under the heading "Mixed or Coloured" are Bushmen, Hottentots, Griquas, Korannas, Namaques, Cape Malays and Cape Coloureds. Together they amount to 682,248. The pure Bushmen and Hottentots probably total no more than a few thousand. The Griquas are a Dutch-Hottentot cross. Many of them settled about Kokstad in Griqualand East. The Cape Malays were originally introduced as slaves by the Dutch. There are still considerable numbers in Capetown, where they play an important part in the fishing industry. The greater part of this mixed group is formed by Cape Coloureds, who represent mixtures in varying proportions of Dutch, Hottentot, Malay, Negro and Bantu blood. The distribution of the coloured people is complementary to that of the natives. They occur in greatest numbers in and about Capetown, and through the Folded and Coastal Belts to Port Elizabeth. They are found, however, throughout the province, and provide most of the unskilled and semiskilled labour in town and country, though they have been experiencing considerable native competition in the labour markets.

Owing to the arid and mountainous nature of the interior, the population of Cape Province is largely concentrated near the coast, though the diamond mines of Kimberley have given rise to a distinct centre of density. Inland the population is denser in the better watered eastern districts. In 1936 the density of rural population for the province as a whole was Europeans 2.86, non-Europeans 9.88 per square mile.

Towns.—The chief towns are placed on the coast. Capetown in 1936 had 173,412 Europeans and 170,811 non-Europeans; Mossel Bay, which lost with the decline of the ostrich feather trade, had 3,260 Europeans and 3,967 non-Europeans; Port Elizabeth had 53,461 and 56,380; East London 31,311 and 29,252. There are also a few minor ports, such as Port Nolloth; Simonstown, the naval station; Knysna; Port Alfred and Port St. Johns. The largest inland centre is Kimberley (15,741 Europeans and 24,490 non-Europeans). The other towns are small, and are largely market centres, railway junctions, such as Mafeking and De Aar; pleasure or health resorts, such as Coledon and Aliwal North, or administrative or educational centres, like Grahamstown. Their names and position will be best obtained from a map (*see* also separate articles). They are practically all laid out on a rectangular plan. Near the centre is a large marketplace or square about which are to be found a church and many of the public buildings. In some cases rivulets are led in channels along the streets, which may be lined with trees.

Occupations.—Much of the country is unsuitable for agriculture, because of its aridity. In the Karroo and in the valleys among the Fold mountains, cultivation depends on irrigation. The eastern districts are better favoured and produce a certain amount of maize, wheat, oats and fruit. The southwest is the great fruit-growing area.

Most of the wheat produced in South Africa is grown in Cape Province, chiefly about Queenstown, in the Eastern Province, and in the southwest, especially about Malmesbury. The yield per acre is low. Flour milling is an important industry in the Cape district and in Port Elizabeth. Oats and barley are grown fairly generally for green forage, as well as for grain but nowhere on a large scale. Viticulture flourishes in the southwestern area of winter rainfall. The districts especially concerned are the Paarl Worcester and Stellenbosch, while large quantities of vines are cultivated also in the Malmesbury, Cape, Robertson, Tulbagh, Montagu and Caledon districts. Altogether there are 100,000 ac under vines. The wines are mostly of the sweet and heavy types but efforts are being made to produce lighter wines. The quality has been improved in recent years. Brandy is also made in considerable quantities. Grapes are grown for table purposes, and many are converted into raisins, of which there is a growing export, which increased from 1,830,531 lb. in 1903–04 to 17,312,901 lb. in 1938. The same area produces large quantities of peaches apricots, pears, plums, etc. Some of these are marketed fresh and others are dried. The growth of citrus fruit is increasing and is more widely spread through the southern districts and about Port Elizabeth and East London. There is a considerable production of pineapples in Albany district. At Port Elizabeth Capetown and about Paarl and Worcester, factories have been established for canning fruit. Olive cultivation has probably passed the experimental stage, but the production is insignificant.

The cultivation of tobacco is increasing. The country about Oudtshoorn, George, Swellendam and the Piquetberg grows a medium to heavy type of Virginian tobacco. Turkish tobaccos for cigarettes are grown about Stellenbosch, the Paarl, Wellington and Tulbagh

Much of Cape Province is devoted to the pastoral industry According to the 1936 census the number of cattle in the country was 3,846,418. Many of these are of the old Afrikaner breed which was especially valued for transport purposes Since the Boer War much progress has been made, and the province possesses good herds of pedigree and crossbred stock—the most popular imported breeds appear to be Frieslands and Shorthorns though most of the well known British breeds are represented The cattle are concentrated very largely in the eastern area There is a distinct falling off of numbers to the west of Port Elizabeth though dairying is being developed in connection with the irrigated lands further west, and in the wheat area, north of Capetown. There are very few cattle in the Karroo districts, such as Beaufort West, Fraserburg, etc. The ox is still used very largely for transport purposes, where the country is not too dry to support him.

The flock of woolled sheep numbered 19,465,135, and consisted mostly of merinos and crossbreeds. In addition there were more than 4,000,000 of the original hairy, fat-tailed breed Practically all the wool clip is sent overseas Most of the clip is sent to brokers at the principal ports, who undertake its sale. Annual wool sales, however, are held at some inland towns, such as Caledon, Swellendam, Riversdale.

The official returns show 676,591 Angora goats and 3,346,109 other goats. The yield of mohair was 3,474,000 lb., most of which is sold to the Bradford market. Goats are bred principally in the dry Karroo and in the native areas, while the main sheep area lies somewhat further east, where grass is more plentiful.

Horses do well where sheep thrive, though horse sickness may take a heavy toll at irregular intervals. The horse is used almost entirely for riding and driving. The Cape Province horse has some of the characteristics of the thoroughbred. He usually has a fine head and good shoulders, but is light in the hind quarters. Owing to insufficient feeding in the winter months, and in time of drought, he is generally undersized. A heavier type of horse has been used to some extent for farm work in the growing areas. In 1936 Cape Province possessed 333,156 horses. In the drier areas the horse is often replaced by the donkey. The chief area for donkey breeding is Bechuanaland and the adjoining regions; Vryburg is the largest market for them. The donkey is also used in the Karroo and the southern districts, where a span of 16 to 20 is often seen harnessed to the large four-wheeled wagon, which they pull along at about 1½ mi. per hour. The number of donkeys in 1936 was 353,288. Mules, of which there were 91,750, are of a good type. They are more resistant than horses to horse sickness, though they are not immune from it.

Ostrich farming, which was so profitable up to 1913, has fallen on evil days. In that year over 1,000,000 lb. of feathers were exported, but in 1925 the export was only 269,528 lb. The number of birds fell from 756,923 in 1913 to 204,388 in 1924, and to 39,082 in 1937. The breeding of ostriches was associated with the growing of lucerne under irrigation. The birds were most numerous about Oudtshoorn, Ladismith, Robertson and Montagu. The lucerne fields are being used for intensive dairy work, or are being replaced by tobacco and fruit cultivation.

Parts of the great stretches of heather lands in the southwestern region offer opportunities for beekeeping. In 1937 the province produced 720,211 lb. of honey. The prospects of any place for development in this direction depend largely on the species of heaths found in the locality. Those about Albertinia appear to be quite suitable.

Cape Province, like South Africa as a whole, is deficient in timber. The Knysna forests are exploited and yield yellowwoods for building purposes and furniture making, and, after being impregnated with creosote, for railway sleepers. Other woods obtained from the same area are stinkwood, a rare heavy wood, much in demand for furniture making, and ironwood and white pear (*Apodytes dimidiata*) for wagonmaking. The patches of forest, which occur on the hill slopes in the east of the country, have been mostly denuded of their valuable timber. The trees are of the same species as about Knysna, except that stinkwood rarely occurs, but sneezewood (*Ptaeroxylon utile*) is fairly common, and is very useful for making fence posts. In the Transkei territories considerable patches of forest remain, owing largely to their inaccessibility. A considerable amount of tree planting is being done by the government and by private individuals. Even so, large quantities of timber have to be imported from overseas.

The fishing industry is still in the early stages of development. The coast is deficient in small harbours, which might serve as bases for fishing smacks. At present most of the fishing is done from rowing boats, or from a few large trawlers. There are considerable possibilities for improvement in the methods of catching, curing and distributing fish. There is no lack of good fishing grounds, where stationary species, such as the silverfish, red stumpnose, etc., and migratory types, such as the geelbek, kabeljauw, mackerel, etc., may be caught. Soles occur very abundantly on the Agulhas banks. In the colder waters along the west coast a species of crawfish is plentiful, and has given rise to an important industry.

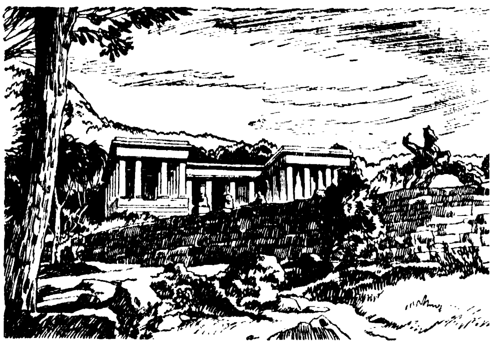
In 1938 there were 22 canning companies at work, and 20,000,000 lb. of crawfish were caught. The crawfish catch is exported almost wholly to France.

A whaling industry is also based in Capetown, but is declining. In 1922 over 1,000 whales were captured, and whale oil, valued at £447,833 was exported. In 1939, the export value of whale oil had dropped to £141,000. (*See* CETACEA.)

Mining.—The chief mineral wealth of Cape Province consists of diamonds which occur in "pipes," filled in with "blue ground," or kimberlite, a basic, eruptive material. Such are the occurrences at Kimberley. Diamonds, of a better quality, are found also in alluvial gravels, which are worked in the Barkly West district. The production of diamonds has been liable to much fluctuation. It is now controlled by an agreement, which fixes the quota to be marketed by each of the members of the Diamond Producers association.

Copper was formerly mined in Namaqualand with much profit, but in 1919 the two principal companies had to close down. The future of this industry depends on the exploitation of low grade ore. Smelting was recommenced in 1922. Tin has been worked at Kuils river, 16 mi. from Capetown. It occurred in lodes traversing the granite, and in alluvial deposits. Near Prieska are inexhaustible supplies of crocidolite, or blue asbestos, which occurs in a belt, from 4 to 20 mi. wide, running from 30 mi. S. of the Orange river to the Bechuanaland border, a distance of 250 miles. The fibre is short, and rarely exceeds 2 inches. The production of coal in the Molteno and Indwe areas has practically ceased.

Manufactures and Trade.—In 1938–39, 3,854 privately owned factories were recorded. The chief industries represented were: creameries, breweries, jam making, fruit canning, textiles, boots and clothing (as for instance the large boot factories at Port Elizabeth). In nearly every town there is at least one wagonmaking establishment, while the lighter two or four wheeled "buggy" or "spider" is also of local provenance. Metals and engineering, building and contracting, including brick, tile and cementmaking, enterprises are also numerous.



DRAWING FROM A PHOTO BY DE COU FROM EWING GALLOWAY

RHODES MEMORIAL IN CAPETOWN

These industries employed 39,857 Europeans who received £7,139,000 in wages in 1938–39, and 50,877 non-Europeans who received £3,619,000 in wages.

The exports of the province (*see* SOUTH AFRICA, UNION OF) consist largely of diamonds, wool, mohair, hides and skins, fruit and wines. The chief imports are textiles, foods, whiskey, hardware and machinery, timber and coal. Much of trade, done in the country, is connected with the transit of goods to and from the inland provinces of the Union.

Education.—Education, other than higher, that is, university education, is subject to the provincial administrator, directed by the Provincial Education department, at the head of which is the superintendent general. Most schools for white children are controlled by school boards, and those for non-European children by religious organizations. The department fixes salaries, lays down syllabuses, grants loans for building and inspects the schools. It will also grant bursaries to meet the travelling and hostel expenses of suitable rural scholars to enable them to attend secondary schools, and so to equalize opportunity, as far as possible, between urban and rural children. Two-thirds of the members of the school board are elected by ratepayers, and one-third are nominated by the government, or by the municipal or divisional council.

Boards have powers to establish and maintain schools, to control their finances, and to enforce attendance by children between the ages of 7 and 16. Each school is usually managed by a committee, elected by the parents or nominated by the board. The committee's duty is to supervise the school and select the teachers.

The cost of teachers' salaries, buildings and equipment is defrayed almost entirely by provincial revenue funds. Up to and including Standard VI, education is free for Europeans and non-Europeans, with the exception of some special high schools intended for the more advanced scholars.

Cape Province has the following schools:—83 farm schools, which give primary education at centres where it is not possible to obtain an average attendance of ten pupils; 1,540 primary schools; 158 high schools; and 79 secondary schools. Above these are 9 training schools and colleges, in which 1,242 students are being trained for the teaching profession. There are also special schools for the blind and for deaf mutes; and for the teaching of art, music, domestic science.

The educational needs of the natives have been met by the establishment of 4 high, 15 secondary, 22 industrial, 14 normal and 1,835 denominational primary schools, and those of coloured children by 4 high, 6 secondary, 7 farm, 8 normal, 42 public primary and 873 denominational primary schools.

Religion.—Among the Christian denominations, the Dutch churches have the greatest number of white adherents (408,106). Next comes the Church of the Province of South Africa (Anglican Communion). Then follow the Methodist Churches, Church of Rome, Presbyterian Church. The Hebrew congregation is numbered at 28,163. Of the non-European peoples, about 1,000,000 are returned as heathens. Approximately 1,000,000 more are adherents of the various Christian denominations which have carried on missionary enterprise in South Africa. South Africa forms a province of the Anglican Communion, the seat of the archbishop being at Capetown. Cape Province is divided into the following dioceses: Capetown, George, Grahamstown, St. Johns, Kimberley and Kuruman.

The Dutch churches in Cape Province are ruled by a Synod, which has the highest legislative, judicial and administrative authority. The Synod divides the country into church circles for purposes of administration.

Press.—About 150 newspapers, in English or Afrikaans, are published in the province. The chief English papers are the *Cape Times* and *Cape Argus* (Capetown); the *Diamond Fields Advertiser* (Kimberley); and the *Eastern Province Herald* (Port Elizabeth). *Ons Land, Die Suiderstem* and *Die Burger* are Afrikaans publications. There are also ten native newspapers.

See SOUTH AFRICA, UNION OF, for geology, communications, posts and telegraphs, trade, law and justice, revenue, standard time, weights and measures, etc.

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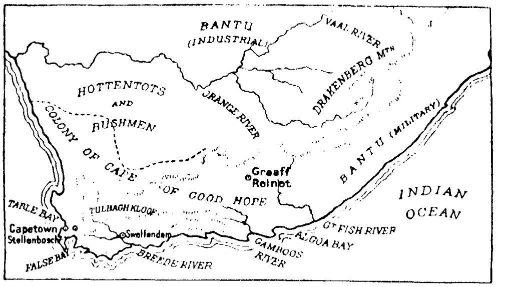
HISTORY

The South African Dutch.—In 1652 the Dutch East India company (*q.v.*) formed a naval station at Table Bay; and this was converted subsequently into a colony. Although the soil and climate of the Cape were proved quite early to be suitable for European colonization, it was not easy for the company to find

ent out parties of orphan girls in their outward-bound ships, as opportunity offered; and they obtained at least 150 excellent settlers from among the French protestants driven from France by the revocation of the Edict of Nantes (*q.v.*), 1685. Concurrently the company sent out an equal number of Dutch emigrants; and all necessary measures were taken to secure the rapid absorption of the Huguenots by the Dutch. As no special effort to secure fresh emigrants was made after 1688, the population of the settlement in 1691 may be regarded as the parent stock of the colony. It was composed of (1) soldiers, sailors, and other discharged servants of the company; (2) Dutch families or individuals, the majority of whom were sent out concurrently with the Huguenots; (3) Dutch orphan girls; and (4) the Huguenots. The number of permanent settlers of both sexes and all ages, according to the census, was approximately 1,000, of whom two-thirds were Dutch, one-sixth French, a small fraction Swedish, Danish, or Belgian and one-seventh Low German and almost identical in racial characteristics with the Dutch. At the same time there was a non-European imported population of 50 free Asiatics and Central Africans, with their wives and some 60 or 70 children, and 386 slaves, men, women and children. Apart from the predominance of the Dutch element, this parent stock is noticeable as being composed largely of settlers who had emigrated in circumstances tending to weaken the natural ties of kinship and pride of race that bind the average emigrant to his mother country. The illiterateness of the Dutch population whom the company left in Cape Colony at the close of the 18th century, and their abandonment of the language of Holland for the *Taal*, a meagre *patois* limited to a few hundred words, may be attributed to the illiberal and inefficient system of administration under which they lived; but the intense devotion to the country of their adoption, and the deep distrust of European civilization, which they afterward manifested in so marked a degree, must be connected with the character and circumstances of the parent stock. In 1795 Cape Colony was drawn suddenly within the orbit of the 100 years' contest between France and England for maritime and commercial supremacy, which had been renewed in 1793 by the republic's declaration of war against England and Holland.



CAPE COLONY IN 1795 UNDER THE DUTCH AND HUGUENOT COLONISTS
The boundary of the settlement is indicated by a dotted line

British Temporary Occupation.—With the arrival of Admiral Elphinstone's ships at False bay, the southern inlet of the Cape peninsula, the history of the colony is merged for a time in the main current of world-events. It will suffice, therefore, to recall the dates which bridge the interval between 1795 and 1806, when the period of British rule began. From 1795 to 1803 Great Britain held the Cape in the name of the prince of Orange, who, after the seizure of Holland by the French and the subsequent constitution of the Batavian republic, had taken refuge in England. During this temporary British occupation the company's restrictions upon trade were removed. Under the Treaty of Amiens, 1802, the colony was restored to Holland; and, while it was under the direct administration of the Dutch government (1803–06), many necessary reforms were effected. The peace of Amiens lasted barely a year; and on the resumption of hostilities the command of the sea passed to England by the destruction of the combined fleets of France and Spain at Trafalgar (Oct. 21, 1805). Three months later (Jan. 19, 1806) a British force, under Sir David Baird, took possession of Cape Colony—Holland being then a dependency of France—in the name of the King of England. The possession of the colony thus gained by conquest was ratified, on the downfall of Napoleon in 1814, by international agreement and by Holland's formal cession of the territory to Great Britain.

Under British Rule.—In 1806, when British rule began, the colony had a total population of [illegible], composed of [illegible] Europeans, 17,657 Hottentots and 29,256 persons returned as slaves. In Capetown there were some 17,000 people, of whom 6,000 were European. The rest of the inhabitants were scattered over a belt of coastlands extending for some 500 mi. from the Cape to the Fish river, and similar in its relationship to the plains and high plateaux of the interior, and in its general physical features, to the Tell of northwest Africa. The annual value of the goods imported was rather more than £100,000, and that of the produce exported rather less than £60,000. While the resistance of the indigenous Hottentots and Bushmen of the colony had been overcome, outside its boundaries the Bantu peoples had increased in numbers and drawn nearer to the zone of European occupation. The military tribes, who had established themselves in the fertile littoral east of the great mountain ranges, confronted the European colonists on the further bank of the Fish river. The industrial tribes, to whom, as being weaker in arms, the inhospitable deserts and steppes to the west of the ranges had fallen, were less advanced in their southward progress. The former, whose Central African blood had been mingled with that of the Asiatic settlers on the east coast of the continent, were destined to dispute the possession of South Africa with the Europeans in the long series of wars which have given a sinister familiarity to the words Kaffir, Zulu, Basuto and Matabele. They were then a mass of cruel and untamed humanity, ready whenever opportunity offered to break over the eastern frontier of the colony and engulf its lonely homesteads in fire and rapine. A century later the area of European occupation, or control, under the British Crown extended from the Cape to the Belgian Congo; the European population numbered over a million, and their external trade, of the annual value of £75,000,000, was larger per head of (European) population than that of any other British state overseas. And within this area the non-European peoples, five or six times as numerous as the European, had been brought under European administration. Up to 1835 Cape Colony contained the whole, and from that date up to the foundation of Johannesburg in 1886, approximately two-thirds, of the European population of South Africa. The governors of the colony from 1847 (Sir Henry Pottinger) to 1901 (Lord Milner) were also high commissioners in South Africa, and as such concerned with the sub-continent as a whole. The history of Cape Colony in the 19th century, therefore, is often hardly distinguishable from that of South Africa as a whole; and it is related in this sense under the title SOUTH AFRICA, UNION OF. The account following is limited accordingly to what may be called its internal, or domestic, development.

Before British Colonization.—During the 20 years between the beginning of the permanent occupation and the report of the royal commissioners (1806–25), the colony was administered, broadly speaking, as a Dutch colony in British possession. The institutions and personnel of the former government were maintained, few new measures were introduced, and economic progress was confined to agriculture and stock-raising. The Hottentots were removed from the authority of their chiefs and placed under special regulations identical in principle with those subsequently adopted under British administrations in Natal and the Transvaal for the control of African unskilled labourers in European employment. In the original enactment (1809) the practice of retaining the children of Hottentot servants as apprentices was made illegal; but this provision was subsequently rescinded (1812) in deference to the wishes of the colonists. Circuit courts were instituted in order that no one should be prevented by distance from seeking redress in the high court. The insecurity of land tenure was remedied by the conversion of the occupation licenses revokable at will, issued by the Dutch company, into perpetual quit-rent tenures (1812); and the (Dutch) farmers thus obtained a virtual freehold of their farms, which ranged from 6,000 to 20,000 ac in area. Government schools were established in outlying districts; the production of fine wool, soon to become the staple industry of the colony, was promoted by the importation of merinos from England and the provision of breeding-farms; and a beginning of efficient road-communication was made by piercing the Drakenstein range at French Hoek (1824). Twice, in 1811–12 and 1817–18, the colony was cleared of Bantu invaders by force of arms; and definite progress was made in the protection of the districts on the eastern frontier against these Kaffir inroads. A post of British regulars was placed (1812) where afterwards Grahamstown (so called from the name of its commander) grew up; and after the expulsion of the Amakosa clans in 1818, the colonial boundary was made more secure by the exaction of an undertaking from their chiefs to withdraw eastward to the line of the Keiskamma river, thus leaving an unoccupied zone between the Bantu and the Europeans on the west side of the Fish river. The military advantage thus gained was supplemented by the settlement of 4,000 British emigrants (1820) on the west side of the Fish river, in the country between it and the (more western) Bushman river, subsequently known as the Albany district. The measure was proposed by the governor, Lord Charles Somerset, and approved by the British government. Out of 90,000 applicants, 4,000 persons of varying social conditions were selected and established at State expense. This event, second only in historical significance to the foundation of the colony by the Dutch East India Company in 1652, as marking the first appearance of an appreciable British population in South Africa, brought this early period to a natural close. Before the Albany settlement the European population of the colony, almost entirely of Dutch descent, had risen from 26,000 to 42,000; and had not the "rebellion" of Slachter's Nek revealed the complete estrangement of the rural Dutch from the European civilization of the 19th century, the period would have seemed one of slow, but assured, material progress.

Administrative Changes.—The Albany settlers and their descendants not only founded Grahamstown and Port Elizabeth and made the population of these districts predominantly British, but they bore a large part of the burden of defending the eastern frontier, and contributed materially to the industrial development of the colony. The introduction of these settlers must rank as the most conspicuous of the services which Lord Charles Somerset, the last of the early British governors, rendered to the colony, but it was none the less the immediate cause of his resignation. At the time in question much English labour, hitherto locked up in the war with Napoleon, had been set free; and during the 20 years following the battle of Waterloo (1815) large numbers of emigrants left the British Isles to find homes in Canada and Australia. Coming, as they did, from a country where the government was so firmly established that complete freedom could be allowed to all its subjects, they keenly resented the restrictions of speech and action which dangers unknown in the homeland made necessary in the colonies. Although the Albany settlers were mainly drawn from the ranks of the manual labourers, there were men of education among them, and some of these latter, in search of more congenial employment, came to Capetown. In 1824 the first South African newspaper, edited by Pringle and Fairbairn, was published. And here at the Cape, as in Canada and Australia, the new English settlers, coming into conflict with the colonial government, became a cause of political disturbances, which led subsequently to the establishment of more liberal systems of administration. In response to complaints against the arbitrary methods of the governor, and on other grounds, the British government sent out commissioners in 1823 to enquire into the general administration of the colony, and the condition of the Hottentots and the Albany settlers. Their report was presented in 1826, and in the meantime Lord Charles, to avoid the necessity of defending his action, had resigned. As there was now an English population, although it was only one-eighth of the European population of the colony, it was thought that some, at least, of the Dutch institutions might be replaced by English; and on the recommendation of this commission changes tending to assimilate the Cape system of administration to that of other British colonies, were introduced. The arbitrary powers of the governor had been limited before by the constitution of an (official) executive council in 1825; but now his salary and those of all officials were reduced and, while the cost of the administration was lessened, its efficiency was increased. Ordinances were issued, and the proceedings of the law courts conducted, in English. The Dutch system of local government was replaced by an English system in which the heemraden (courts of principal inhabitants) disappeared, and the judicial and administrative duties of the landdrost were assigned respectively in each district to a resident magistrate and a civil commissioner. Further, in view of the evidence recorded by the royal commissioners on the condition of the Hottentots, and the powerful pleading of the missionaries, the new governor, General Bourke, under instructions from the British government, issued in 1828 an ordinance which removed the free non-European population from the operation of the special laws hitherto applicable to them, and placed them on an equality in point of law with the Dutch and English colonists. These changes were of doubtful expediency. The virtual introduction of English as the official language was premature in view of the large preponderance of Dutch colonists; although it must be remembered that the more enlightened Dutch were perfectly conversant with it, while to the backward and Taal-speaking majority the Dutch of Holland had become strange.

The Hottentot ordinance was felt to be an unjustifiable interference on the part of the British government. For, while the abstract justice of the principle of racial equality was not disputed, the colonists knew—what the people of England at that time did not know—that before the principle could be applied successfully, the non-European must have acquired an elementary knowledge of the laws of civilized life; and that without this knowledge his freedom was as harmful to himself as it was dangerous to his European neighbours. This enactment reveals the greatest of the special difficulties which together made the administration of Cape Colony a more complex and arduous task than any similar undertaking of the British nation. They were: (1) the long separation of the preponderant European population from intercourse with Europe; (2) the division of the colonists into two nationalities; (3) the fact that the possession of the subcontinent was disputed by the Bantu, who, greatly outnumbering the colonists, so far from weakening by contact with civilization, increased both in numbers and military capacity; (4) the accentuation of the differences in the Dutch and British attitudes towards the African natives by missionary enterprise, as the exponent of the humanitarian sentiment of the early 19th century. As these difficulties were imperfectly understood in England, "divergences of opinion" between the governor and the secretary of state were of frequent occurrence.

The Emancipation Act (1833).—The inherent justice of the measure which, in Lord Brougham's words, dissipated throughout the British dominions "the wild and guilty fantasy that man can hold property in man," was recognized in Cape Colony; but, while there was no such complete destruction of industry as in the West Indies, a very severe strain was put upon the resources of the small community of some 60,000 colonists. The immediate monetary loss of approximately £2,000,000 was not confined to the actual slave-owners, but fell also upon investors in this form of property, who in some cases were reduced to absolute penury. For some time agriculture and stock-raising, almost the sole industries, were dislocated; since it was found difficult to replace the slaves by free labour within the period provided by the Act, which in the case of Cape Colony ran from Dec. 1, 1833 to Dec. 1, 1838. When the colonists had just begun to adapt their concerns to the economic situation thus created, they were overtaken by a more violent catastrophe. On the last day of 1834, news, which had taken five days to come hot-haste, reached the new governor, Sir Benjamin D'Urban, at a party which he was giving on New Year's Eve. On Christmas Day the Kaffirs had swept across the frontier, murdering the farmers, plundering and burning their farmsteads and driving off their cattle. When, after more than six months' hard fighting, the British regulars, aided by all the able-bodied colonists, Dutch and English, had driven back the Bantu invaders, Sir Benjamin made a new and more secure disposition of the eastern frontier. By treaty with the chiefs (Sept. 1835) the Kaffirs were to withdraw eastward to the line of the Kei river. The country between the Fish and Keiskamma rivers was to be given to those settlers whose losses had been most severe, but subject to their personal occupation of their holdings. Eastward of this belt, between the Keiskamma and the Kei, a belt of friendly Kaffirs, with military posts, was to be placed. The responsibility of the colonial government for the losses thus incurred—the official returns showed that 456 farmsteads had been completely, and 350 partially, destroyed—was aggravated in the eyes of the colonists by the circumstances that normal defensive measures had been postponed in deference to the emphatic assurances of the peaceful intentions of the Kaffir chiefs, given by Dr. Phillip, the very influential general superintendent of the London Missionary Society's missions in South Africa. In any case, however, Sir Benjamin recognized that the frontier farmers were entitled to compensation. These proposals were forwarded to London for the approval of the home government. The reply, which came in a despatch written on Dec. 26, 1835, by Charles Grant (afterwards Lord Glenelg), was of a very unexpected nature. In it, the opinion was expressed that the long continued encroachments of the colonists amply justified the warlike action of the Kaffirs; and in accordance with this opinion Sir Benjamin was instructed to reinstate the Kaffirs in the territory which they had given up. So far from giving compensation to the colonists, all grants of land east of the Fish river made since 1817 were to be cancelled. The despatch seemed incredible, and Sir Benjamin protested. He was recalled and superseded by Sir George Napier (1837). The position of the frontier settlers seemed intolerable.

The Boer Secession (1835–38).—The longstanding grievances of the Dutch colonists, arising from the inherent difference between the Dutch and British attitudes towards the natives, were brought to a head by this despatch. In the year following (1836) there began the withdrawal from the colony of the Dutch farmers, or Boers (to give them the name which they subsequently made famous), known as the Great Trek. The motives which led them to divest themselves of their allegiance to the British government, and seek new homes in the regions beyond the Orange river, were stated at length in a document signed by their leader, Piet Retief, and published in the *Grahamstown Journal* of Feb. 2, 1837. But the less lengthy account contributed by Retief's niece (Mrs. Steenekamp) to the *Cape Monthly Magazine* of Sept. 1876, is probably not less authentic.

"The reasons for which we abandoned our lands and homesteads, our country and kindred, were the following.—

"1. The continual depredations and robberies of the Kaffirs, and their arrogance and overbearing conduct, and the fact that, in spite of the fine promises made to us by our government, we, nevertheless, received no compensation for the property of which we were despoiled.

"2. The shameful and unjust proceedings with reference to the freedom of our slaves; and yet it is not so much their freedom that drove us to such lengths, as their being placed on an equal footing with Christians, contrary to the laws of God and the natural distinction of race and religion, so that it was intolerable for any decent Christian to bow down beneath such a yoke; wherefore we rather withdrew in order thus to preserve our doctrines in purity."

The population thus withdrawn numbered from 7,000 to 10 000 persons. The epic of the *Voortrekkers* is to be found under the title SOUTH AFRICA, UNION OF. It will suffice to add that the communities to which they gave birth, the Transvaal and Orange Free State, were recognized by the British government as (internally) independent republics respectively under the Sand River (1852) and Bloemfontein (1854) conventions. Natal was occupied also by the Boers; but there, on account of its maritime situation and earlier occupation by Englishmen, British authority, established in 1843, was maintained; and during the years 1845-48 it was administered as a part of Cape Colony

The Defense of the Frontier.—The penetration of the Bantu area by the Boers, together with the insecurity in which the eastern frontier of the colony had been left by the reversal of D'Urban's plans for its defense, made the 20 years 1834–54 a period of recurrent and onerous native wars In the course of them, large numbers of British soldiers lost their lives, and the heavy military expenditure incurred was borne almost entirely by British tax-payers. At the same time, the progress of Cape Colony, as compared with that of other British colonies, was regarded as most inadequate. In these circumstances the British government determined to reduce their financial responsibilities to the lowest point compatible with the discharge of the political obligations from which they could not well escape. The measures by which it was sought to give effect to this "non-intervention" policy were these: The independence of the Boer republics was recognized; a native territory, named British Kaffraria, was formed to act as a "buffer state" between the colony and the military Bantu; and, outside these territories and Natal, the Boers, the missionaries, and the natives were told that they must settle their differences in their own way. As a complementary measure, a more liberal constitution was to be granted to the colony, and it was hoped that with the privileges of self-government the colonists would assume its responsibilities, notably the protection of their eastern frontier. Although a legislative council, with (nominated) unofficial members, had been added to the executive council in 1834, the system of representative government thus set up, gave the people of the colony for the first time in its two centuries of existence an appreciable part in the management of its affairs. The executive officials were still appointed by the governor, as representing the Crown, instead of being chosen by the electors, and they were, therefore, responsible to him for their conduct of affairs, and not to the people of the colony. But while the executive power was thus retained, the legislative power was vested, subject to the customary reservations in favour of the Crown, in a parliament of which both chambers, the legislative council and the house of assembly, were elected by all British subjects, irrespective of nationality or race, possessed of certain minimum qualifications of property or income. This parliament met for the first time on June 30, 1854. In spite of war and drought, arbitrary governors and ill-informed secretaries of state, from the beginning of British rule onward, the internal administration had been honest, impartial, and efficient, and the colony had at length begun to prosper. The Dutch colonists lost by the great trek had been replaced by some 5,000 new British settlers of whom the great majority were brought out under a state-aided scheme of the colonial government in 1840–48. The population had risen to 350,000, of whom 140,000 were European and 210,000 non-European. The revenue approached £400,000, and the annual value of the external trade £3,000,000. Of the exports, £800,000 in annual value, two-thirds were wool. In 1844 the system of roads, which Sir Harry Smith (Gov. 1847–52) declared "would do honour to a great nation instead of a mere dependency of the Crown," was projected by the colonial secretary John Montagu, and executed by Col. Mitchell and Andrew Bain; and in this and other respects the colony was being equipped with national plant. In 1852 the first-fruits of the hidden mineral wealth of the subcontinent were reaped in the copper mines of Ookiep. At the same time, changes were made in England. Under the colonial policy of Lord Grey the largest practicable measure of self-government was granted to the rapidly developing Pacific colonies, and on the outbreak of the Crimean War the colonial department was transferred from the war office in 1854, and, reorganized as the colonial office, was placed under a separate secretary of state.

Under Representative Government.—With the grant of representative institutions the long tradition of military governors was broken by the appointment of Sir George Grey (1854–61) (*q.v.*). After four years in the colony, Grey realized that the non-intervention policy, being based upon imperfect information, was calculated not to remove but to aggravate the inherent difficulties of South African administration. His conclusions, accompanied by remedial proposals, were communicated to the colonial secretary in a luminous despatch (Nov. 19, 1858); but his advice was rejected and he himself recalled and subsequently reinstated on condition of his strict observance of the policy which had been laid down. Though thwarted and censured, he did good service to England and to the colony. The wheels of the new constitution ran smoothly under his guidance. That was to be expected. A greater and more original service was the institution of the humane and efficient methods of treating the Bantu, which were to make the native policy of the mother colony a model and inspiration for the newer states of South and South-Central Africa. Grey's plans went beyond the mere military defense of the frontier. He realized that sooner or later European supervision must be established over the whole of the Bantu population; and he feared that if this necessary task was postponed too long, the Bantu peoples might unite in a common, and much more serious, effort to challenge the European occupation of South Africa. His wider proposals for averting this danger—the union of the Boer republics with the British colonies by a federal tie, and the placing of British residents among the Zulus—were rejected, but he could, and did, act in this sense within the sphere of his governorship. Before his arrival a British officer had exercised control in British Kaffraria through the chiefs. Grey broke down the power of the chiefs by purchasing from them by monthly stipends the right to inflict fines and punishments, and then introduced European magistrates to administer justice. To raise the natives in the scale of civilization, he established schools and encouraged the substitution of individual ownership for the tribal tenure of land. And by introducing a knowledge of medicine through the hospitals he set up he caused the witch-doctors, who were the instruments of the chiefs' cruelty and cupidity, to become discredited. To the depreciatory estimate of the country formed in England he replied: "Her Majesty's possessions in South Africa are of great and increasing value." His assurance was quickly justified. In 1870, little more than ten years later, in the desert plains beyond the northern boundary of the colony were found the craters and pipes of the extinct volcanoes which hold the diamonds of Kimberley.

Responsible Government.—The establishment of the diamond industry materially altered the attitude of England toward South Africa. The nonintervention policy was abandoned. In 1871 British authority, in disregard of the conventions with the Boers, was proclaimed over the diamond fields; and the new territory, Griqualand West, was subsequently (1880) incorporated into Cape Colony. In the meantime the sudden creation of an energetic and wealthy community at Kimberley had quickened the industrial and political progress of the colony. Within five years the revenue was more than doubled. By the time Cecil Rhodes (who had twice rescued the diamond industry from overwhelming disaster) was prime minister of the Cape (1890), the annual value of the exports of the colony had risen to £7,000,000, and of this total the diamond export provided more than half. The change from representative to responsible government was effected in 1869–72; and on the strength of the increasing revenue the first premier, John (afterward Sir John) Molteno, was able to begin an extensive program of railway construction by which the two chief towns, Capetown and Port Elizabeth, were connected, and the inland districts brought into direct railway communication with the ports. The change in the constitution was not advocated by the Dutch, but by the more progressive of the British colonists. None the less, the Dutch majority in Cape Colony, when once conscious of their power, became a factor of increasing influence in the policies and events by which the subsequent history not merely of the colony itself, but of South Africa as a whole, was determined.

European Supremacy.—In 1876, Grey's anticipation of a common effort by the Bantu to contest possession of the country with the Europeans was realized. There were then in South Africa some 320,000 Europeans (of whom 220,000 were in Cape Colony) scattered over an area larger than France and Germany combined, with 1,200,000 natives within, and 2,000,000 without, the two Boer republics and the British territories. A rapid succession of events showed (in words used by a deputation of Cape merchants to Lord Carnarvon, the colonial secretary, on Oct. 26) "how very slender was the plank between the colonists and the great deep of savagery and barbarism in South Africa." To meet this danger, Lord Carnarvon sought to apply Grey's rejected remedy of 20 years before, the reunion of the Europeans by confederation. His first proposals (1875) were received coldly by the Molteno ministry, but in the autumn of 1876 he decided to annex the Transvaal, and to appoint an administrator of the highest capacity to the governorship of the Cape, Sir Bartle Frere (*q.v.*). Frere (1877–80) established the supremacy of the Europeans by the subjugation of the Zulus, the flower of the military Bantu, in 1879, but he failed to carry through confederation. The causes of his failure are significant. Frere, like D'Urban, was censured and (partially) superseded (1879); and, as happened to D'Urban, the man by whom he was superseded—Lord Wolseley (*q.v.*)—subsequently gave generous testimony to the correctness of his policy in South Africa.[1] The displeasure of the home government materially increased the difficulty of Frere's task, but the immediate cause of his failure was the action of the Dutch majority in Cape Colony. The necessary first step toward confederation was a conference of the South African governments concerned. Frere had been so far successful in promoting Lord Carnarvon's policy, that in the Cape general election of 1878 a ministry pledged to support confederation was placed in office; and in the following year the ministry framed definite proposals for holding the conference, to be laid before parliament at its next session. When the Cape parliament assembled in 1880, in England, Mr. Gladstone's government had succeeded that of Lord Beaconsfield; but contrary to the expectation of the Boers it had decided on May 12 that the Transvaal was to remain under British rule. On the announcement of this decision, Paul (afterward President) Kruger secured a pledge from all, or nearly all, of the Dutch supporters of Gordon (afterward Sir Gordon) Sprigg in the house of representatives to vote against the conference proposals on the ground that confederation ought to be postponed until the republic was restored. The ministry, to avoid certain defeat, withdrew their proposals; and directly their action was known (officially) in London, Frere was recalled (July 20). As Grey had foreseen, the isolation of the Boer states had not prevented the Dutch subjects of the Crown from "acting in unison . . . in a great national question" with their republican kinsmen.

The Retrocession of the Transvaal.—On Dec. 16, 1880, the Transvaal Boers rose in arms. The British were heavily defeated at Majuba Hill (Feb. 26, 1881), and on March 26 peace was made on the assurance that the republic, under British suzerainty would be restored within six months. President Brand had informed the Cabinet that he could no longer hold back the Free State burghers from joining the Transvaal insurgents, and the Dutch in Cape Colony had declared openly their sympathy with their kinsmen. The retrocession was in direct conflict with the advice which Frere had given to the British government up to June 1879, when the Transvaal was removed from his jurisdiction and placed under Lord Wolseley, and subsequently in connection with affairs in Cape Colony. Frere held, and advised the colonial secretary, that although the expediency of the annexation was questionable, British authority, once established, must be maintained. Apart from the obligations incurred to the natives, and to the non-Boer European population which had settled in the country since the annexation *because* British rule had been established, and in the belief that it would continue, the problem of the Transvaal was part of the larger problem of South Africa. Reliance on mere force, he wrote, would be useless; the Boers must be won by a prompt and generous measure of self-government, such as he had proposed when visiting the Transvaal (March 15–May 6, 1879). Either reliance on mere force, or the withdrawal of British authority, would strain to the breaking point the loyalty of the Dutch in Cape Colony.

The Afrikaner Bond.—The period of 18 years between the retrocession and the South African War (Oct. 11, 1899–May 31, 1902) was marked by the occupation by Germany of Southwest Africa; by the establishment of direct British authority (exercised through the high commission) over the Bantu peoples outside the European states; by the acquisition and settlement of large territories in South-central Africa by the chartered company founded by Rhodes in 1889; by the expansion of Cape Colony eastward to Natal and northward to the Bechuanaland protectorate; by the establishment of the gold industry in the Transvaal, and the foundation of Johannesburg in 1886; and by the rapid development of the industries, railways, and material equipment of the subcontinent, under the stimulus of gold discovery, accompanied by an appreciable increase of the mainly urban British population. In the political events of this period the soundness of the advice tendered by Frere in respect of the Transvaal, and on other South African questions, was amply demonstrated. On April 7, barely a fortnight after Gen Joubert had accepted the British promise to restore the republic, Carl Borckenhagen, a German republican and editor of *The Bloemfontein Express*, published in that paper the manifesto of a political organization, styled the "Bond" and originally founded in Cape Colony in 1879. The first paragraph ran:

"The Afrikaner Bond has as final object what is summed up in its motto, 'Africa voor de Afrikaners.' The whole of South Africa belongs by just right to the Afrikaner nation. It is the privilege and duty of every Afrikaner to contribute all in his power towards the expulsion of the English usurper. The states of South Africa to be federated in one independent republic. The Afrikaner Bond prepares for this consummation."

Then followed the "argument in justification." While the creed of the Dutch nationalists was advocated in this form in the republics, in Cape Colony the program was modified in 1883, under the guidance of J. H. Hofmeyr, by the omission of all expressions inconsistent with allegiance to the British crown from the official constitution. In 1884 the Bond secured the return of 25 members of the Cape parliament. From that date onward to the outbreak of the South African War in 1899, Hofmeyr although he refrained from putting a Bond ministry in office, by making it impossible for any ministry to be formed without Bond support exercised a general control over the policy of the colonial executives. In 1886 the Bond met for the first (and only) time as an inter-state organization at Bloemfontein; and, as the result of disagreements then manifested between the respective representatives of the Transvaal, the Free State and the Cape from 1887 onward the Afrikaner Bond was developed in Cape Colony as a colonial rather than an inter state organization

There was a side of the Bond which appealed to Rhodes, who born of a land-owning and farming stock, in all his large industrial and financial enterprises never neglected the interests of the country population. In 1883 the Farmers' Protection Association had been amalgamated to the Bond, for Hofmeyr, who was also interested in the development of the country districts, sought the co-operation of the more progressive British farmers in his plans for the improvement of the agriculture of the colony. Apart from this, Rhodes and Hofmeyr found common ground in the desire that South African ideas should prevail in the administration of South Africa. Rhodes never wavered in his loyalty to the British connection; but he recognized the faultiness of a system under which the cardinal questions of South African administration were left to be decided by the House of Commons a body unfamiliar with the country and its peoples, whose judgment was often warped by irrelevant considerations of English party politics. In this sense he advocated "the elimination of the Imperial factor." Hofmeyr probably never ceased to desire Afrikaner supremacy in South Africa, whether under the British or a republican flag. But there was much useful work which each desired to accomplish, that could be accomplished in common, and yet leave each of them free to choose the path—republican or imperial—by which the final goal of South African unity was to be attained. In 1890 Rhodes, with Bond support, became prime minister of the colony; and the Rhodes-Hofmeyr alliance, tending materially to draw together the Dutch and British colonists, worked well until Rhodes's complicity in the Jameson raid (Dec. 29, 1895–Jan. 2, 1896) brought about its violent disruption in 1896. At the time Joseph Chamberlain (*q.v.*), who a few months before had become colonial secretary, was preparing to press President Kruger to grant the franchise to the British population whom the gold industry had brought into the Transvaal. The reaction in Cape Colony against Rhodes, and in favour of Kruger, which followed the raid, materially increased the difficulty of his task. In spite of the prompt and full reparation made by the British

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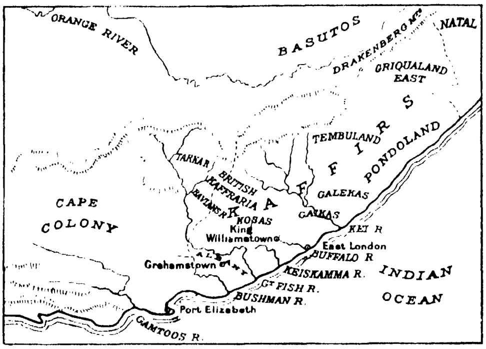
[1] In a letter of June, 1902, to Sir George Arthur. "Life of Lord Wolseley," by Gen. Sir F. Maurice and Sir George Arthur, p. 131.

Government to the Transvaal, the Bond went back to the policy of 1881; and in view of the increasing seriousness of the situation a man of exceptional ability, Alfred (afterwards Lord) Milner (*q.v.*), was appointed governor of the Cape and high commissioner in 1897. In the year following, the Sprigg ministry, which in 1896 had succeeded the Rhodes ministry, came into conflict with the Bond. It was replaced (Oct. 17) by a ministry, pledged at the hustings to prevent British intervention in the Transvaal, in which Philip Schreiner was prime minister.

The Boer War and After.—As high commissioner, Milner was the agent and adviser of the British Government. As governor of the colony, he acted only by, and with, the advice of his ministers. The aim of the Schreiner ministry, with whom rested the disposal of the colonial forces, was to oppose British intervention in the Transvaal, and in the event of war to keep the colony "neutral." As high commissioner, Milner advised the British Government (May 4, 1899) that "the case for intervention was overwhelming." As governor of the colony, he was unable (Aug. 5) to call out the volunteers and take other measures for the protection of the northeastern frontier; while a consignment of 500 Mauser rifles and 1,000,000 cartridges passed without his knowledge (July 15) through the colony to the Free State. In these circumstances it needed not only a clear intellect and high resolution but a sympathetic imagination to maintain tolerable relations between himself and the ministry during the four months of abortive negotiations which preceded the war. As it was, on the outbreak of hostilities (Oct. 11) between the Boer republic and Great Britain, five districts in the northwest of the colony went over to the Free State, and nine-tenths of the Afrikaner farmers in Bechuanaland joined the Transvaal. Four months later Milner wrote to the secretary of state (Jan. 16, 1900): "Not less than 10,000 of those now fighting against us in South Africa, and probably somewhat more, either are, or till quite recently were, subjects of the Queen." (For the history of this contest, *see* SOUTH AFRICAN WAR, 1899–1902, and SOUTH AFRICA, UNION OF.)



FROM W. B. WORSFOLD, "HISTORY OF SOUTH AFRICA"

MAP SHOWING THE EXTENSION OF THE EASTERN BORDER OF CAPE COLONY

The Great Fish river formed the eastern border at the outset of British colonization, 1806, but successive conflicts with the Bantu peoples extended it first to Keiskamma river and then to the Kei river. In 1871, after the discovery of the Kimberley diamond fields, it was extended to Natal

In the course of the war the members of the Schreiner cabinet were divided on the question of the treatment of the Cape rebels; and on Schreiner's resignation, a new ministry, under Sir G. Sprigg, took office (June 10, 1900). On Feb. 28, 1901, Lord Milner left Capetown to take up his appointment as governor of the Transvaal and Orange River colonies. He was succeeded by Sir W. Hely-Hutchinson as governor of Cape Colony, but retained the high commission, which was thus separated for the first time from the governorship of the Cape. In the same year a new party, styled the "Progressive," was formed in the colony, of which, on the death of Rhodes (March 26, 1902), Dr (afterwards Sir) Starr Jameson, became leader. After the war was ended (May 31, 1902) a Progressive ministry, with Jameson as prime minister, was placed in power by the general election of Feb. 1904; and this ministry was succeeded, on the defeat of the Progressives at the polls by the South African party, by the ministry of J. X. Merriman in 1908. In the meantime, the four colonies, which had barely emerged from a ruinous conflict in arms, were confronted by the prospect of an economic war scarcely less injurious. In 1906 the Customs Union, instituted in 1903, failed to adjust the financial and industrial interests of the four separate governments, and it seemed that a disastrous competition in tariffs and railway rates for the trade of the Rand could be averted only by a common administration. The first step toward this long-sought goal of South African statesmanship was taken by Jameson, as prime minister of Cape Colony, when on Nov. 28, 1906, he formally requested Lord Selborne (by whom Lord Milner had been succeeded in 1905) to "review the situation." The response was the federation memorandum of 1907, in which the high commissioner, availing himself of the work of Mr. Lionel Curtis and other advocates of "closer union," trenchantly demonstrated the impossibility of settling the outstanding disputes on fiscal and railway questions by any other method than the administrative union of the four colonies concerned in them. The Merriman ministry was equally in favour of closer union, and in 1908 the national convention met at Durban. On Sept. 20, 1909, the South Africa Act, of which the draft had been completed at Bloemfontein on May 11, received the royal assent; and on May 31, 1910, Cape Colony became Cape Province in the Union of South Africa. At that date the colony had a population of 2,563,024, of whom 583,177 were European and 1,545,308 non-European; and it thus contributed nearly one-half of both the European (1,278,025), and the total (4,061,082) population of the union. (*See* SOUTH AFRICA, UNION OF; AFRICA; and RHODESIA.)

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(W. B. W.; Ho. F.)

CAPER, FLAVIUS, Latin grammarian, flourished during the 2nd century. He devoted special attention to the early Latin writers, and is highly spoken of by Priscian. Caper wrote *De Lingua Latina* and *De Dubiis Generibus*, now lost; but two short treatises, *De Orthographia* and *De Verbis Dubiis*, have come down to us under his name, probably excerpts from the original works, with later additions by an unknown writer.

See F. Osann, *De Flavio Capro* (1849), and review by W. Christ in *Philologus*, xviii. 165–170 (1862), where several editions of other important grammarians are noticed; C. Keil, "De Flavio Grammatico," in *Dissertationes Halenses*, x. (1889); text in H. Keil's *Grammatici Latini*, vii.

CAPERCAILLIE (Capercailzie or Capercally), a bird's name derived from the Gaelic. The bird (*Tetrao urogallus*) became extinct in the British Isles about 1750, but was re-introduced in Scotland at the beginning of the 19th century and is now tolerably abundant. The species is widely, though intermittently, distributed on the continent of Europe, from Lapland to the northern parts of Spain to Turkestan, but is always restricted to pine forests, which alone afford it food in winter. Its bones were found in the kitchen middens of Denmark and the caves of Aquitaine. It is the largest European grouse, 34 in. long, reaching 12 lb. or more in weight, the female much smaller. The Siberian capercaillie (*T. parvirostris*), a darker, blacker species with a longer, more graduated tail, lives in northeast Asia.

The male, known as the mountain cock or cock of the woods, is remarkable for his large size and dark plumage, with the breast metallic green. He is polygamous, and in spring mounts to the topmost bough of a tall tree, and challenges all comers by extraordinary sounds and gestures; while the hens, which are much smaller and mottled in colour, abide below the result of the duels. The hen nests on the ground, and lays from seven to nine or even more eggs. The young are able to fly soon after they are hatched, and towards the end of summer, from feeding on the fruit and leaves of the bilberries and other plants, get into excellent condition and become good eating. With the first heavy falls of snow they betake themselves to the trees, and then, feeding on the pine leaves, their flesh speedily acquires a distasteful flavour of turpentine. Hybrids are frequently produced between capercaillie and black grouse (*Lyrurus tetrix*). (G. F. Ss.)

CAPERN, EDWARD (1819–1894), English poet, was born at Tiverton, Devonshire, on Jan. 21, 1819, and died on June 5, 1894. From an early age he worked in a lace factory, and then became "the Rural Postman of Bideford," by which name he is usually known. He published *Poems, by Edward Capern*, (1856); *Ballads and Songs* (1858); *The Devonshire Melodist* (a collection of the author's songs, some of them to his own music) and *Wayside Warbles* (1865). He received a civil list pension from Lord Palmerston.

CAPERNAUM, on the northern shore of the sea of Galilee, Jesus' second home, a garrison town (Matt. viii. 5), a centre of administration (John iv 46), and a customs station (Matt. ix. 9). Out of it Jesus called Peter, Andrew and Matthew (or Levi). It was the witness of many of his miracles and in its synagogue he delivered many of his discourses It is of special interest that its name disappeared and its very site became a matter of debate (*cf.* Matt. xi. 23). Two possible identifications have long divided the interest and allegiance of investigators—*Tell Hūm* about 2½ m. W. of the Jordan's entry into the lake and *Khirbet el-Minyeh*, 2 m. W. of *Tell Hūm*. Excavations began at *Tell Hūm* in 1905 and conducted by the Franciscans have cleared the site of debris and made its identification with Capernaum certain.

The Centurion's Synagogue.—The remains of a synagogue have been disclosed and its plan established. It was a rectangular building (75 ft.×57 ft.) and was apparently oriented north at the first. It was entered by three doors from a platform on its south side. Built of coarse marble, its walls were ornamented externally with pilasters. An open court with covered porticoes on three sides and extending the entire length of the east side, had been added at a later date (prob. 4th century A.D.). In the interior a stylobate, a yard broad, raised 2½ in. from the floor and based on the south wall ran parallel to the walls and divided the synagogue into a nave, two aisles and a transept. It supported seven columns (Corinthian capitals) on each of its long sides with two additional between nave and transept, 16 in all. Above the aisles and transept was added at a later date (2nd or 3rd century A.D.) a gallery with Doric columns. Above each set of columns was a richly ornamented entablature. The lintels of the doors had been surmounted by a frieze from which the figures forming part of the design had been obliterated—probably through Pharisaic zeal about 66 A.D. The *Tebah* (chest) in which were kept the Books of the Law, was erected originally at the north end of the nave but later, to meet the injunction to congregations to pray facing Jerusalem (2nd century A.D.) it was removed to the other end, close to the main door and across it. The platform fronting the façade was approached on its western side by three, and on its eastern by fourteen, steps. Their discovery has proved vital for identification. In the year 385 A.D., when Capernaum still bore its name, it was visited by Sylvia of Aquitania who mentions as a matter of interest that its synagogue is reached by many steps (*per gradus multos ascenditur cf.* Migne, *Patrol. Lat.* 173 p. 1,128). As this is the only synagogue discovered in Galilee of which that could be said, the existence of the steps proves indisputably that the synagogue of *Tell Hūm* was indeed that built by the Roman centurion who loved the Jewish nation (Luke vii. 5). As the synagogue was evidently destroyed by an earthquake and the stones lie mostly where they fell, its re-erection, which is purposed, should not be difficult.

The Church of St. Peter.—Sylvia and Antoninus Martyr (570) amongst others make mention of a church built on the site of Peter's house at Capernaum. Between the synagogue and the lake the ruins of an octagonal building covering a tesselated pavement have been exposed. By some this has been taken to be a forecourt of the synagogue, but it is much more likely that we have here the church built by Joseph of Tiberias in 330 A.D. (Epiphanius, Adv. Haeres. xxx. 4).

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CAPERS, the unexpanded flower-buds of *Capparis spinosa*, (family Capparidaceae) prepared with vinegar for use as a pickle. The caper plant is a trailing shrub, belonging to the Mediterranean region, resembling in habit the common bramble, and having handsome flowers of a pinkish white, with four petals, and numerous long tassel-like stamens. The leaves are simple and ovate, with spiny stipules. The plant is cultivated in Sicily and the south of France; and in commerce capers are valued according to the period at which the buds are gathered and preserved. The finest are the young tender buds called "nonpareil." Other species of *Capparis* are similarly employed in various localities

CAPET, the name of a family to which, for nearly nine centuries, the kings of France, and many of the rulers of the most powerful fiefs in that country, belonged. The first of the family to whom the name was applied was Hugh, who was elected king of the Franks in 987. The real founder of the house, however, was Robert the Strong (*q.v.*), who received from Charles the Bald, king of the Franks, the countships of Anjou and Blois, and who is sometimes called duke, as he exercised some military authority in the district between the Seine and the Loire. According to Aimoin of Saint-Germain-des-Prés, and the chronicler, Richer, he was a Saxon, but historians question this statement. Robert's two sons, Odo or Eudes, and Robert II., succeeded their father successively as dukes, and, in 887, some of the Franks chose Odo as their king. A similar step was taken, in 922, in the case of Robert II., this, too, marking the increasing irritation felt at the weakness of the Carolingian kings. When Robert died in 923, he was succeeded by his brother-in-law, Rudolph, duke of Burgundy, and not by his son Hugh, who is known in history as Hugh the Great, duke of France and Burgundy, and whose domain extended from the Loire to the frontiers of Picardy. When Louis V., king of the Franks, died in 987, the Franks, setting aside the Carolingians, passed over his brother Charles, and elected Hugh Capet, son of Hugh the Great, as their king, and crowned him at Reims. Avoiding the pretensions which had been made by the Carolingian kings, the Capetian kings were content, for a time, with a more modest position, and the story of the growth of their power belongs to the history of France. They had to combat the feudal nobility, and later, the younger branches of the royal house established in the great duchies. The direct line ruled in France from 987 to 1328, when, at the death of King Charles IV., it was succeeded by the younger, or Valois, branch of the family. Philip VI, the first of the Valois kings, was a son of Charles I, count of Valois and grandson of King Philip III. The Capetian-Valois dynasty lasted until 1498, when Louis, duke of Orleans, became king as Louis XII, on the death of King Charles VIII. Louis XII dying without male heir, the house of Valois-Angoulême followed from Francis I to the death of Henry III in 1589, when the last great Capetian family, the Bourbons, mounted the throne.

Scarcely second to the royal house is the branch to which belonged the dukes of Burgundy. In the 10th century the duchy of Burgundy fell into the hands of Hugh the Great, father of Hugh Capet, on whose death in 956 it passed to his son Otto, and in 965, to his son Henry. In 1032 Robert, the second son of Robert the Pious, king of the Franks, and grandson of Hugh Capet, founded the first ducal house, which ruled until 1361. For two years the duchy was in the hands of the crown, but in 1363, the second ducal house, also Capetian, was founded by Philip the Bold, son of John II, king of France. This branch of the Capetians became connected with the Habsburgs through the marriage of Mary, daughter of Charles the Bold, duke of Burgundy, with Maximilian, afterwards the emperor Maximilian I. Of great importance also was the house of the counts of Anjou, which was founded in 1246, by Charles, son of the French king Louis VIII, and which in 1360 was raised to the dignity of a dukedom. (*See* ANJOU.) Members of this family sat upon the thrones of two kingdoms. The counts and dukes of Anjou were kings of Naples from 1265 to 1442. In 1308 Charles Robert of Anjou was elected king of Hungary, his claim being based on the marriage of his grandfather Charles II, king of Naples and count of Anjou, with Maria, daughter of Stephen V, king of Hungary. A third branch formed the house of the counts of Artois, which was founded in 1238 by Robert, son of King Louis VIII. This house merged in that of Valois in 1383 by the marriage of Margaret, daughter of Louis, count of Artois, with Philip the Bold, duke of Burgundy. The throne of Navarre was also filled by the Capetians. In 1284 Jeanne, daughter and heiress of Henry I, king of Navarre, married Philip IV, king of France, and the two kingdoms were united until Philip of Valois became king of France as Philip VI in 1328, when Jeanne, daughter of King Louis X, and heiress of Navarre, married Philip, count of Evreux.

In the 13th century the throne of Constantinople was occupied by a branch of the Capetians. Peter, grandson of King Louis VI, obtained that dignity in 1217 as brother-in-law of the two previous emperors, Baldwin, count of Flanders, and his brother Henry. Peter was succeeded successively by his two sons, Robert and Baldwin, from whom in 1261 the empire was recovered by the Greeks.

The counts of Dreux, for two centuries and a half (1132–1377), and the counts of Evreux, from 1307 to 1425, also belonged to the family of the Capets—other members of which worthy of mention are the Dunois and the Longuevilles, illegitimate branches of the house of Valois.

CAPETOWN, the oldest town of South Africa, 33° 56′ S., 18° 25′ E. Capetown was built on a strip of low ground on the southwestern shores of Table bay. To the south, immediately behind the town, rises Table mountain in a precipitous wall, 2 mi. long, and over 3,500 ft. high at its highest point. Its eastern corner, Devil's peak, is 3,300 ft. high. (*See* TABLE MOUNTAIN.) An outlying arm of this barrier extends round on the northwest side of the city in Lion's head, over 2,000 ft., and Lion's rump (or Signal hill). Between Lion's head and Table mountain is a *col*, known as the Kloof, through which pass a road and a tramway, connecting Capetown with the suburb of Camps Bay. From its original nucleus, the city has spread for about 3 mi. in a more or less continuous line around the lower slopes of Signal hill to Sea point, with an outlying cluster of houses and hotels at Camps Bay (5 miles). Up the lower slopes of Table mountain it has climbed as far as the gradients will allow. A series of suburbs and independent municipalities also developed, especially after 1910, to the east of Capetown, and then, turning the flank of Devil's peak, became aligned in a north to south direction along the fall line between the Cape Peninsula hills, and the Cape flats, which connect the former with the mainland. Included in this series are Woodstock, Mowbray, Rosebank, Rondebosch, Newlands, Claremont, Kenilworth and Wynberg, with Muizenberg, 15½ mi. from Capetown, and Kalk Bay on the shores of False bay. All these centres are now united to Capetown, which includes an area of 67 sq.mi.

Several very distinct ethnic elements go to make up the population (*see* SOUTH AFRICA, UNION OF). In 1936 Capetown and its suburbs included 173,412 Europeans, 152,911 "coloured," 14,160 natives and 3,740 Asiatics.

Streets and Parks.—Capetown is laid out in rectangular plan. The main street is Adderley street, running inland from the shore. Seaward it is continued by a promenade pier, which, with its approach and circus, is 600 yd. long. At the other end Adderley street is continued by Government avenue, about five-eighths of a mile long, and lined on both sides by oak trees. Just to the west of Adderley street is Greenmarket square, the original centre of the old Dutch town, and still further is Riebeek square, on the site of the old slave market. From the pier the sea front, for about 1,000 yd. to the southeast, has been laid out as an esplanade, and planted with palms and shrubs. Behind this is the castle, which was completed about 1680, much of its brick having been brought out from Holland. About ¾ mi. from the pier, in a northwesterly direction, are the docks. To the west of the castle is a large, rectangular space, known as the parade ground, which is occupied on Wednesdays and Saturdays by numerous stalls and auctioneers.

Among the chief open spaces are the Greenpoint common, lying to the northwest of the city, and including the golf links and the athletic ground, Trafalgar park to the southeast, and the Botanical gardens, which are situated along the western side of Government avenue, and cover an extent of 14 acres. On the eastern slopes of Table mountain, at Kirstenbosch, and covering about 400 ac., are the National Botanical gardens, originally part of the Groote Schuur estate. Much of this area is a reserve for the indigenous botanical associations.

Public Buildings.—Most of the public buildings and monuments are to be found along Adderley street and Government avenue. Near the entrance to the pier is a bronze statue of Van Riebeek, presented to the city by Cecil Rhodes. A short distance away is the war memorial, unveiled in 1924. Then, along the main street, are the custom house, the railway station, the Standard bank, the general post office, and the Dutch Reformed church, which is the oldest church in South Africa. It was begun in 1699, but of the original building only the bell tower remains. In the church eight of the old Dutch governors of the Cape are buried. On the eastern side of Government avenue are the houses of parliament, and Government house, the residence of the governor-general. On the opposite side is the Anglican cathedral, which promises, when completed, to be a fine example of modern architecture. The public library, near by, contains about 270,000 volumes, including first and second editions of Shakespeare's plays. It greatly benefited by a generous gift by Sir George Grey, who was governor of the Cape from 1854 to 1861, and whose statue stands in front of the library. The South African museum occupies a site at the top of the Botanical gardens, and contains much that is of interest to the anthropologist, archaeologist, etc. The opera house in Darling street is capable of seating a thousand people. In front of it is a memorial by Sir Goscombe John to the Cape volunteers who died in the war of 1899–1902.

The new municipal buildings are also in Darling street; the city hall has seating accommodation for 2,000 persons. Opposite to its main entrance is a statue, also by Sir Goscombe John, of King Edward VII. The Michaelis collection of old Flemish and Dutch paintings is housed in the "Old Town house" in Greenmarket square, a fine example of 18th-century colonial Dutch architecture. The Koopman-de Wet house in Strand street contains old Dutch furniture, and illustrates the life of the early Dutch settlers. Outside of Capetown, about half a mile from Rondebosch station, is Groote Schuur, which was left by Rhodes as the official residence in Capetown of the premier of the Union of South Africa. It is built in the Dutch colonial style, and contains some fine specimens of old Dutch furniture. Some distance away is the Rhodes memorial. In the grounds of Groote Schuur are the new buildings of the University of Capetown.

Harbour.—The harbour of Capetown consists of the Victoria basin, a rectangular area of 67 ac. enclosed within walls. The northwestern wall is prolonged and slightly curved to form a breakwater. An inner area, the Alfred basin, covers 8½ acres. Additional wharfage for fishing boats, etc., is provided along the shore to the southeast of the main harbour. The depth of water at the entrance to the harbour is 38 ft. at L.W.O.S.T., and vessels of any draught can anchor in the roadstead under the shelter of the breakwater. In the Victoria basin the average depth at L.W.O.S.T. ranges from 10 to 35 ft. The harbour is well equipped with electric cranes and transporters. Trains of the South African railway system can run alongside the main wharves. There are considerable facilities for fruit cooling and storing. A grain elevator, capable of holding 30,000 tons of grain, has been completed. There is also a graving dock, 500 ft. long, on the keel blocks, with a maximum width of 56½ ft., and a depth at H.W.O.S.T. of 26 ft. An extensive harbour development scheme to cost £6,000,000 was begun in 1937, and continued during the war. Provision was made for a new huge graving dock.

Trade.—Capetown is the principal passenger and mail port of South Africa, and deals with over 50% of the combined passenger traffic of the four chief ports of the Union. It is 5,978 mi. from Southampton, a distance travelled by the mail boats in 17 days. Passengers may disembark, and find trains waiting alongside, which will take them to Johannesburg (956 mi.), Rhodesia, or Durban (1,253 miles). Capetown is also an important port of call for vessels trading between Europe and Australia or the east. There is also a certain amount of traffic with South American ports. For goods traffic, Capetown is less favourably situated than its rival, Durban.

The handicaps of a large, arid hinterland, and the distance from the centres of population and industry on the Witwatersrand, are only partially compensated by preferential railway rates. It is, however, the chief port of exit for South African gold and diamonds.

Capetown has had an increasing export of fresh and dried fruits, flowers and wines, which are being produced in the neighbouring districts. There is also a considerable trade in wool, mohair, skins and maize. Local industries are largely concerned with the preparation of foods.

Owing to the distance from the coalfields, and the scarcity of water, power is apt to be expensive, but coloured labour for unskilled and semi-skilled work is comparatively cheap.

As a pleasure resort, Capetown attracts many visitors from South Africa, and from other countries. Many people from the inland provinces, on retiring, take up permanent residence here. The city owes much to its picturesque situation at the foot of Table mountain and its satellite hills, the slopes of which are in many places covered by plantations of coniferous and other trees, or by the indigenous macchia of heaths, proteas and bulbous plants, which make a wonderful blaze of colour in the spring months.

The houses of the suburbs are embowered among trees and gardens. Every Wednesday and Saturday morning, in the season, Adderley street is enlivened by masses of flowers, which are offered for sale by the coloured people. The country in the neighbourhood offers a wide choice of walks and drives, including the justly famed 96 mi. drive around the peninsula, passing by Camps Bay, Hout bay, Chapman's peak, the Cape of Good Hope, Simonstown, Muizenberg and Rondebosch. This, for its blending of mountain and sea, heathlands and woodlands, is probably unsurpassed in the world.

Table mountain offers climbing to suit the most adventurous spirits. The most popular bathing place is Muizenberg, 15½ mi. from Capetown. Here, in the warm waters of False bay, surfing is much practised. The shore shelves very gradually, and sharks do not molest the bathers. At Capetown, and along the western coast of the peninsula, the cold waters of the Benguela current offer less encouragement to bathing.

Climate, Health.—The average amount of sunshine throughout the year is 7.5 hours a day, ranging from 4.8 hours in June to more than 10 in December. Most of the rains fall between April and October. The health of Capetown is satisfactory. The city is equipped with a good sewage scheme. It also has a good water supply, obtained partly from Table mountain, and partly from a reservoir about 40 mi. away, in the Caledon district

The city is lighted by electricity, and there is an efficient tram service. At the Union of South Africa in 1910 Capetown was made the legislative capital, with Pretoria as the administrative capital. It is also the seat of an archbishop of the English Church, and of a bishop of the Roman Catholic Church. (R. U. S.; X.)

University of Capetown.—The university foundation dates from April 2, 1918, when the council, created by act 14 of 1916, received a bequest from Sir Julius Wernher of £250,000 and a donation of £250,000 from Otto Beit, who added £50,000 to a lapsed bequest by Alfred Beit. By 1921 a special appeal for funds had raised about £280,000, inclusive of £50,000 for the Jameson Memorial hall.

The main seat of the university is on the Groote Schuur estate at Rondebosch where new buildings, begun in 1925, have been erected to accommodate it. The university, in 1925, created chairs in commerce, fine art and accounting, while the faculty of law was strengthened by a third professorship. In 1928 the first part of the new buildings at Groote Schuur was opened to students.

CAPE VERDE ISLANDS *(Ilhas do Cabo Verde)*, an archipelago belonging to Portugal; off the West African coast, between 17° 13′ and 14° 47′ N. and 22° 40′ and 25° 22′ W. Area, 1,557 sq mi.; pop. (1940) 174,403, of whom 7,017 were white. There are 14 islands in the group, including Santo Antão, São Vicente, Santa Luzia, São Nicolao, Sal, Boa Vista, Maio, São Thiago (St. Jago), Fogo and Brava. The archipelago is volcanic in origin. The islands derive their name, frequently incorrectly written "Cape Verd" or "Cape de Verd," from the cape on the African mainland called Cape Verde or the Green cape. The principal ports are São Vicente (St. Vincent), also known as Mindello or Porto Grande, and Praia, the capital.

Climate.—The atmosphere is generally hazy, especially in the direction of Africa. With occasional exceptions during summer and autumn, the northeast trade is the prevailing wind, blowing most strongly from Nov. to May.

The rainy season is during Aug., Sept. and Oct. The Harmattan, a very dry east wind from the African continent, occasionally makes itself felt. The heat of summer is high, the thermometer ranging from 80° to 90° F. near the sea.

The unhealthful season is during and following the rains.

Flora.—The flora is markedly tropical in character; and although some 70 wild flowers, grasses, ferns, etc., are peculiar to the archipelago, the majority of plants are those found on the neighbouring African littoral. The Portuguese have introduced a few trees, such as the baobab, eucalyptus and dragon-tree, besides many plants of economic value. Coffee-growing, an industry dating from 1790, is the chief resource of the people of Santo Antão, Fogo and São Thiago; maize, millet, sugar-cane, manioc, excellent oranges, pumpkins, sweet potatoes, and, to a less extent, tobacco and cotton are produced. On most of the islands coconuts, dates, tamarinds and bananas are to be found; orchil is gathered; and indigo and castor oil are produced. Of considerable importance is the physic-nut *(Jatropha curcas)*, which is exported.

Fauna.—Quails are found in all the islands; rabbits in Boa Vista, São Thiago and Fogo; wild boars in São Thiago. Both black and gray rats are common. Goats, horses and asses are reared, and goatskins are exported. The neighbouring sea abounds with fish, and coral fisheries are carried on by a colony of Neapolitans in São Thiago. Turtles come from the African coast to lay their eggs on the sandy shores. The Ilheu Branco, or White Islet, between São Nicolao and Santa Luzia, is remarkable as containing a variety of puffin unknown elsewhere, and a species of large lizard *(Macroscinctus coctei)* which feeds on plants.

Inhabitants.—The first settlers on the islands imported Negro slaves from the African coast. Slavery continued in full force until 1854, when the Portuguese government freed the public slaves, and ameliorated the conditions of private ownership. In 1857 arrangements were made for the gradual abolition of slavery, and by 1876 the last slave had been liberated. The blacks and mulattoes far outnumber the white inhabitants. They are, as a rule, taller than the Portuguese, and are of fine physique, with regular features but woolly hair. Their language is a bastard Portuguese, known as the *lingua creoula*.

Industries.—The principal industries, apart from agriculture, are the manufacture of sugar, spirits, salt, cottons and straw hats and fish-curing. The most important of the exports are coffee, physic-nuts, millet, sugar, spirits, salt, live animals, skins and fish. The imports consist principally of coal, textiles, food-stuffs, wine, metals, tobacco, machinery, pottery and vegetables. Over 3,000 vessels, with a total tonnage exceeding 3,500,000 annually enter the ports of the archipelago in normal times; the majority call at Mindello, on São Vicente, for coal, and do not receive or discharge any large quantities of cargo.

Santo Antão (pop. 25,000) at the extreme N.W. of the archipelago, has an area of 265 sq.m. Its surface is very rugged and mountainous, abounding in volcanic craters, of which the chief is the Topoda Coroa (7,300ft.), also known as the Sugar-loaf. Mineral springs exist in many places. Santo Antão produces large quantities of excellent coffee, besides sugar and fruit. It has several small ports, of which the chief are the sheltered and spacious Tarrafal Bay, on the S.W. coast, and the more frequented Ponta do Sol, on the N.E., 8m. from the capital, Ribeira Grande, a town of 4,500 inhabitants. Cinchona is cultivated in the neighbourhood.

São Vicente (pop. 8,000), lies near Santo Antão, on the S.E., and has an area of 75 sq.m. Its highest point is Monte Verde (2,400ft.). An English speculator founded a coaling station here in 1851, and the town of Mindello, also known as Porto Grande or St. Vincent, grew up rapidly, and became the commercial centre of the archipelago. São Vicente has a station for the submarine cable from Lisbon to Pernambuco in Brazil.

Santa Luzia, about 5m. S.E., has an area of 18 sq.m. Its highest point is 885ft. above sea-level. On the S.W. it has a good harbour, visited by whaling and fishing boats.

São Nicolao or **Nicolau** (pop. 12,000), a long, narrow, crescent-shaped island with an area of 126 sq.m., lies farther E. Maize, kidney-beans, manioc, sugar-cane and vines are cultivated. The interior is mountainous, and culminates in two peaks one of which, Monte Gordo, has a height of 4,280 feet. The island was one of the first colonized; in 1774 its inhabitants numbered 13,500, but famine subsequently caused a great decrease.

Sal (pop. 750), in the N.E. of the archipelago, has an area of 75 square miles. Towards the close of the 17th century it was inhabited only by a few shepherds, and by slaves employed in the salt-works. In 1705 it was entirely abandoned, owing to drought and consequent famine; and only in 1808 was the manufacture of salt resumed. A railway, the first built in Portuguese territory, was opened in 1835.

Boa Vista (pop. 2,600), the most easterly island of the archipelago, has an area of 235 square miles. It was named São Christovão by its discoverers in the 15th century. A chain of heights, flanked by inferior ranges, traverses the middle of the island, culminating in Monte Gallego (1,250ft.), towards the E.

Maio (pop. 1,000) has an area of 70 sq.m., and resembles Sal and Boa Vista in climate and configuration. Its best harbour is Nossa Senhora da Luz, on the S.W. coast, and is commonly known as Porto Inglez or English Road, from the fact that it was occupied until the end of the 18th century by the British.

São Thiago (pop. 63,000) is the most populous and the largest of the Cape Verde Islands, having an area of 350 square miles. It is also one of the most unhealthy, except among the mountains over 2,000ft. high. The interior is a mass of volcanic heights, formed of basalt covered with chalk and clay, and culminating in the central Pico da Antonia (4,500ft.), a sharply pointed cone. There are numerous ravines, furrowed by perennial streams, and in these ravines are grown large quantities of coffee, oranges, sugar-cane and physic-nuts, besides a variety of tropical fruits and cereals.

Fogo (pop. 17,600) is a mass of volcanic rock, almost circular and measuring about 190 square miles. In the centre a still active volcano, the Pico do Cano, rises to a height of about 10,000 feet. Its crater, which stands within an older crater, measures 3m. in circumference and is visible at sea for nearly 100 miles. It emits smoke and ashes at intervals; and in 1680, 1785, 1799, 1816, 1846, 1852 and 1857 it was in eruption. After the first mentioned and most serious outbreak, the island, which had previously been called São Felipe, was renamed Fogo, *i.e.*, "Fire."

Brava (pop. 9,013), the most southerly of the islands, has an area of 23 square miles. Though mountainous, and in some parts sterile, it is very closely cultivated, and, unlike the other islands, is divided into a multitude of small holdings. The women, who are locally celebrated for their beauty, far outnumber the men, who emigrate at an early age to America.

History.—The earliest known discovery of the islands was made in 1456 by the Venetian captain Cadamosto (*q.v.*), who had entered the service of Prince Henry the Navigator. The archipelago was granted by Alphonso V. of Portugal to his brother, Prince Ferdinand, whose agents completed the work of discovery. On his death in 1470 his privileges reverted to the crown, and were bestowed by John II. on Prince Emanuel, by whose accession to the throne in 1495 the archipelago finally became part of the royal dominions. Its population and importance rapidly increased; its first bishop was consecrated in 1532, its first governor-general appointed about the end of the century.

Bibliography.—The best general account of the islands is given in vols. xxiii. and xxvii. of the *Boletim* of the Lisbon Geographical Society (1905, 1908), and in *Madeira, Cabo Verde, e Guiné*, by J. A. Martins (Lisbon, 1891).

See also *Über die Capverden* (Leipzig, 1884) and *Die Vulcane der Capverden* (Graz, 1882), both by C. Dölter. A useful map, entitled *Ocean Atlantico Norte, Archipelago do Cabo Verde*, was issued in 1900 by the *Commissão de Cartographia*, Lisbon.

CAPGRAVE, JOHN (1393–1464), English chronicler and hagiologist, was born at Lynn, in Norfolk, on April 21 1393. He became a priest, took the degree of D.D. at Oxford, where he lectured on theology, and subsequently joined the order of Augustinian Hermits. Most of his life he spent in the house of the order at Lynn, of which he probably became prior; he was certainly provincial of his order in England, which involved visits to other friaries, and he made at least one journey to Rome. He died on Aug. 12, 1464.

Capgrave was an indefatigable student, and was reputed one of the most learned men of his age. The bulk of his works are theological: sermons, commentaries and lives of saints. His reputation as a hagiologist rests on his *Nova legenda Angliae*, or *Catalogus* of the English saints, but this was no more than a recension of the *Sanctilogium* which the chronicler John of Tinmouth, a monk of St. Albans, had completed in 1366, which in its turn was largely borrowed from the *Sanctilogium* of Guido, abbot of St. Denis. The *Nova legenda* was printed by Wynkyn de Worde in 1516 and again in 1527. Capgrave's historical works are *The Chronicle of England* (from the Creation to 1417), written in English and unfinished at his death, and the *Liber de illustribus Henricis*, completed between 1446 and 1453. The latter is a collection of lives of German emperors (918–1198), English kings (1100–1446) and other famous Henries in various parts of the world (1031–1406). The portion devoted to Henry VI of England is a contemporary record, but consists mainly of ejaculations in praise of the pious king. The accounts of the other English Henries are transferred from various well-known chroniclers.

The *Chronicle* was edited for the "Rolls" Series by Francis Charles Hingeston (London, 1858); the *Liber de illustribus Henricis* was edited (London, 1858) for the same series by F. C. Hingeston, who published an English translation the same year. *See* Potthast, *Bibliotheka Med. Aev.;* and U. Chevalier, *Répertoire des sources hist. Bio-bibliographie, s.v.*

CAP HAÏTIEN, a seaport of Haiti, West Indies. Pop. about 15,000. It is situated on the north coast 90 mi. north of Port-au-Prince, in 19° 46′ N. and 72° 14′ W. Its original Indian name was Guarico, and it has been known, at various times, as Cabo

Santo, Cap Français and Cap Henri, while throughout Haiti it is always called Le Cap. It is the most picturesque town in the republic, and the second in importance. On three sides it is hemmed in by lofty mountains, while on the fourth it overlooks a safe and commodious harbour. Under the French rule it was the capital of the colony, and its splendour, wealth and luxury earned for it the title of the "Paris of Haiti." It was then the see of an archbishop and possessed a large and flourishing university. The last remains of its former glory were destroyed by the earthquake of 1842 and the British bombardment of 1865. It is the centre of a thriving district and does a large export trade. It was founded by the Spaniards about the middle of the 17th century, and in 1687 received a large French colony. In 1695 it was taken and burned by the British, and in 1791 it suffered the same fate at the hands of Toussaint L'Ouverture. It then became the capital of King Henri Christophe's dominions, but since his fall has suffered severely in numerous revolutions.

CAPILLARY ACTION: *see* Surface Tension.

CAPILLARY TUBE, a tube of small dimensions in which the effects of surface tension (*q.v.*) in liquids become conspicuous and may be approximately measured. When a small-bore glass tube is inserted in a vessel of water which wets the glass, the surface tension of the water film adhering to the glass on the inside of the tube draws the water up in the tube above the level of the surrounding liquid outside. If the liquid be mercury, which does not wet but tends to draw away from a glass surface, the mercury is depressed within the tube a very definite distance below the level at which it stands in the outside vessel. Various solids in the form of small-bore tubes in various liquids show these phenomena in varying degrees. (H. B. Lm.)

CAPILLARY WAVES, small waves (*see* Waves of the Sea) in a liquid, in which, owing to their short wave length, the force due to surface tension (*q.v.*) has more effect in controlling their velocity than has that due to gravity.

CAPISTRANO, SAINT JOHN OF (*1386–1456*), Italian theologian and inquisitor, was born in Capistrano in the Abruzzi. He became a magistrate, but on the death of his wife (1416), joined the Franciscans where, under the direction of Bernardino of Sienna, he defended the ideal of strict observance. He was charged with various missions by Eugenius IV and Nicholas V; as legate or inquisitor, he persecuted the last Fraticelli of Ferrara, the Jesuati of Venice, the Jews of Sicily, Moldavia and Poland, and, above all, the Hussites of Germany, Hungary and Bohemia; his aim in the last case was to prohibit conferences between the representatives of Rome and the Bohemians, for every attempt at conciliation seemed to him to be conniving at heresy. After the taking of Constantinople, he gathered troops for a crusade against the Turks (1455), which at least helped to raise the siege of Belgrade, then blockaded by Mohammed II. He died on Oct. 23, 1456, and was canonized in 1690.

CAPITAL, in architecture, the top number of a column, pier or pilaster, usually larger on the upper surface than the diameter of the shaft supporting it, thus not only furnishing a better bearing for the superstructure, but also forming a decorative accent to cap the vertical line of the shaft. The capital had three parts: the abacus (*q.v.*) at the top, a block acting as the supporting surface; a bell, or echinus (*q.v.*) carrying the abacus and furnishing the richest portion of the decoration; and some feature to mark the transition between shaft and capital. Bracketed capitals are also found, in which projecting brackets at the top of the column furnish a long support for beams or arches.

Primitive capitals, as shown in rock cut tombs of the 12th dynasty, at Beni Hassan, Egypt, consisted merely of a thin, square abacus block supported directly on the shaft. Other types were developed in Egypt, probably first in wood, as early as the 4th dynasty; they appeared in highly organized forms from *c.* 2000 B.C. on. These are: First, the lotus bud type; second, the campaniform or bell type, painted with papyrus; third, palm leaf forms, in which the bell is ornamented with lobes and palm leaves. From *c.* 500 B.C. on, convex types based upon the open lotus flower, complicated lobed types, decorated with water plants, and a square form, whose four sides carry the face of the goddess Hathor, are found. (*See* Egyptian Architecture.) Ancient capitals in western Asia are principally of the bracketed type. Contemporary reliefs show that Mesopotamian buildings had small columns with voluted capitals resembling the later Ionic. The capitals used by the Persians in the 5th and 6th centuries B.C. consist of a long, narrow block, either directly above the shaft, or supported by a scrolled and bell-shaped member. This block is carved with a bull or horse at each end, carrying the main beams; a hollow between them gave space for a cross beam.

The Aegean civilization used a capital having a square abacus, with a heavy, simple convex echinus below. Examples are found in the palace at Cnossus, *c.* 1500 B.C., and the so-called treasury of Atreus in Mycenae, *c.* 1200 B.C. in which the echinus is richly carved. The later Hellenic Greeks developed capitals that have been an inspiration to all subsequent Western art. The Aegean type grew into the Doric order, where the echinus curve was studied with great refinement. The scrolled, bracketed type, taken from earlier builders of western Asia, became the Ionic order, and the effort to decorate appropriately a simple bell produced the Corinthian order, with its scrolls and acanthus leaves. These types were developed by the Romans and the Renaissance architects in various ways. (*See* Order.)

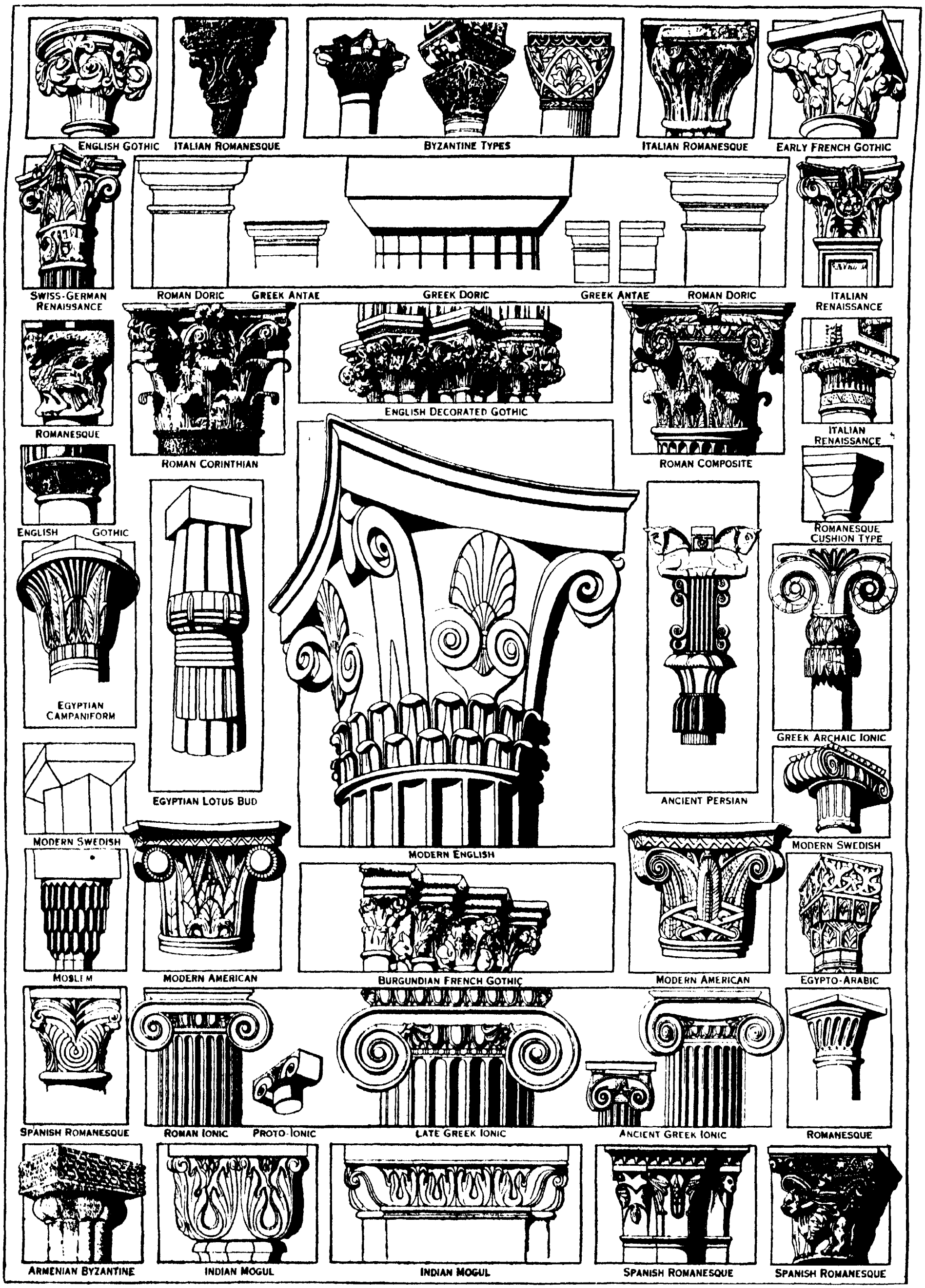
Three trends distinguish the evolution of the capital in Europe during the middle ages. One is of Byzantine origin. The capital surface is ornamented with small scale, deeply cut leafage. In early examples, classic forms persist, but a tendency toward simplification led to the type called the basket capital. The second family results from the effort to make a simple geometrical transition from round shaft to square abacus, and is known as the cushion capital. It is common in Lombard, German and Norman Romanesque. The third kind is a mediaeval development of the Roman Corinthian. In addition, from the Romanesque period, many grotesque capitals are found, decorated with birds, beasts and human figures, especially in Spain and France. Growing naturalism, and the use of the bud form known as the crocket (*q.v.*), produced the varied Gothic capitals. In France, early conventional treatment gave place to vivid naturalism and a loss of structural significance in the late 13th century, but in the 15th a new period of extreme conventionalism occurred. In England, moulded capitals, in which strong projections and deep hollows give the effect, were popular throughout the 13th century. Foliated capitals are more free than French examples. Frequently they display naturalism of an extremely vital and pictorial perfection. In late English Gothic, as in French, the capital is comparatively unimportant.

Renaissance capitals usually follow classic prototypes, although many exceptions are found in the early Renaissance and the Baroque. In "modernistic" work, on account of the theory that the capital is decoratively false, because often structurally unnecessary, it has largely disappeared. Occasional forms, with classic influence, occur in Germany and Scandinavia.

The earliest Mohammedan capitals are based on Roman types, but the general objection of the Moslems to the representation of any objects soon led to the development of abstract forms. These consist either of a succession of geometrical faces or else of the little bracketed niches called stalactite ornament. In China and Japan, where beams usually run through columns, instead of being supported upon them, there is no real capital, although occasionally the projecting beam ends give a similar decorative effect. Indian capitals, on the other hand, are varied and complex. At times they seem almost classic, at times, in their elaborately intersecting planes, they resemble Mohammedan types, and at times they consist merely of an intricate set of small mouldings.

See Byzantine and Romanesque Architecture; Chinese Architecture; Japanese Architecture; Egyptian Architecture; Gothic Architecture; Greek Architecture; Indian Architecture; Mohammedan Architecture; Order; Renaissance Architecture; Roman Architecture. (T. F. H.)

CAPITAL, EXPORT OF. A shift of funds from one country to another constitutes an export of capital. These funds may be either long- or short-term and the long-term movement might be in the form of a direct or portfolio investment. Direct investments include all holdings in those foreign corporations or



BY COURTESY OF (MODERN AMER.) C. H. WHITAKER (ROM. CORINTHIAN, ROM. COMPOSITE, ANC. GR. IONIC) D'ESPOUY, "FRAGMENTS D'ARCHITECTURE ANTIQUE" (CH. MASSON ET CIE) (ROM. DORIC, GR. ANTAE, GR. DORIC, ROM. IONIC, LATE GR. IONIC, ANC. GR. IONIC) BUHLMAN, "CLASSIC AND RENAISSANCE ARCH." (NEFF AND HELBURN) (ENG. GOTHIC) HAMLIN, "HISTORY OF ORNAMENT" (THE CENTURY COMPANY) (SWISS GER. REN., EGYPTO-ARABIC) SIR BANISTER FLETCHER, "HISTORY OF ARCHITECTURE ON THE COMPARATIVE METHOD" 8TH EDITION 1928 (BATSFORD) (ENG. GOTHIC) GARDNER, "A GUIDE TO ENGLISH GOTHIC ARCHITECTURE" (CAMBRIDGE UNIV. PRESS) (MOD. SWEDISH) AHLBERG, "SWEDISH ARCH. OF THE 20TH CENT." (ERNEST BENN, LTD.) (MOSLEM ROMANESQUE, ROMANESQUE) BENOIT, "ARCHITECTURE DE L'ORIENT, MÉDIÉVALE ET MODERNE" (LIBRAIRIE RENOUARD) enterprises which are controlled by a person, or closely identified group of persons (corporate or natural) domiciled in the lending country, or in the management of which such person or group has an important voice. Equity and other security holdings (bonds, stocks, etc.) in foreign-controlled corporations and in the issues of foreign governments are classed as portfolio investments.

The existence of an investing public able and willing to acquire and hold foreign securities is of prime importance in the creation of an international financial market. While the banks might be in a position to grant short-term credits to their foreign customers, and to place privately a certain amount of long-term securities, of themselves, they are unable to provide long-term loans on a substantial scale without the assistance of the general public. The creation of an adequate banking system for dealing with international business is a lengthy process, but it takes even more time to develop an investing public willing to acquire and hold foreign securities. One or more unfavourable investment experiences may quickly destroy the work of decades, and may make it almost impossible ever to restore confidence.

A stable currency on a gold basis is also of considerable importance to the development of an international money market. It is essential that the currency should be stabilized both *de jure* and *de facto*, and that the system adopted should be the gold bullion standard. Although the gold exchange standard might be sufficient to maintain stability, a country with heavy foreign investment cannot afford to base the stability of its currency on the stability of other currencies. On the other hand, there appears to be no need to introduce the full gold standard with coins in circulation, and it is equally superfluous to amass a huge gold reserve. Undoubtedly, it is desirable to have a safety margin, so as to be able to resist temporary adverse influences; but the hoarding of a spectacular gold stock is as unnecessary as the issue of gold coins. The amount of gold and foreign assets required for the purpose of securing the stability of a currency depends, to a great extent, upon the elasticity of the currency system involved, and upon the confidence of the public in the stability of that currency. The latter factor again is largely determined by the past record of the country concerned. (*See* MONEY.)

What Constitutes Foreign Investments.—Investment has been defined as the lending of money at interest, or its exchange for property rights from which a profit is expected. It has been truly stated that there is no such thing as an absolutely safe investment. Few investments have the same degree of safety and the amount of interest received comprises two component parts, the net or true interest, and a premium for the risk assumed. Risk may be in marketability as well as in security. Added value is given any investment which may be readily sold without sacrifice. Marketability is a desirable quality, and the lack of it is just as truly an investment risk to the average investor as lack of security The premium for risk, therefore, comprises marketability as well as security. But all investments do not have the same degree of risk. The bonds of the United States government obviously are more secure than those of a weaker nation such as Greece, and those of Canada more marketable than those of Mexico.

When the basic principles of investment are applied, there appear to be three main considerations to be taken into account which motivate an investment abroad rather than in the domestic market. They are political, monetary and social. In the past, international politics played a very important part in influencing the directional movement of international capital. Recent history also records cases where a private investment, such as the building of a railroad in a weak country by nationals of a strong country, often leads to spheres of influence and later to extraterritorial privileges for the strong country. This may soon lead to political control as regards foreign relations and then to control in domestic affairs which brings the aggrandizing nation into complete control of the weaker and once independent country.

Monetary considerations require special study. Domestic investments are payable in the local standard of value, and foreign securities are generally payable in foreign currencies which are not readily converted into local currencies and are often subject to wide fluctuations. Such fluctuations can be of monetary advantage or disadvantage to the investor. For instance, the income from a foreign investment, received in a foreign currency, would be increased when exchanged into local currency if the gold value of the foreign money is above normal. On the other hand, the income will be decreased if the gold value is low. A speculative risk of considerable proportion is therefore connected with the purchase of foreign stocks in countries which have no gold standard, entirely apart from their merits otherwise. It is only when the attractiveness of large immediate or future returns becomes great enough to surmount these barriers in addition to overcoming the natural conservatism of capitalists that capital moves out of the homeland for permanent investment abroad.

The social and economic effects of foreign investment should be examined from the standpoint of both the borrower and the lender. In the case of countries in the earlier stages of development where resources are but partially exploited and the machinery of production is still lacking or inadequate, the advantages of foreign capital to the borrowing country are many. It secures needed machinery and equipment and the country is thereby enabled to produce additional wealth. The influx of foreign capital stimulates the demand for labour; it also stimulates general industrial activity and growth. The benefit to the lending or investing country is obvious. The income from the capital invested abroad enables it to increase its standard of living beyond what it would be if its population depended solely upon its own earning capacity.

An International Investment Market.—In addition to having a large pool of liquid funds, an educated investing public, a stable currency, etc., it is extremely important that a capital exporting country be well supplied with a highly-trained technical organization. The stock and produce markets must be well organized and functioning smoothly, the communication system must be completely modern, a good money market is also important, and most of all, an experienced and trusted investment banking organization is necessary in order to facilitate the placement of the foreign issues. In simple cases, one financial house or bank might arrange for the underwriting and distribution of a loan Larger loans are often underwritten by a group of banking houses Before the sale of any loan is undertaken, a staff of trained technicians—economists, engineers, actuaries, bankers etc.—should have made a very thorough investigation of the soundness of the particular loan. This practice has not, however, always been followed, with the result that many of the loans made in the 1920s, the heyday of foreign investments, went into default and the investing public, in the U.S. in particular, became somewhat skeptical of foreign loans.

Does Trade Follow the Dollar?—The close relationship of foreign investment to foreign trade is indicated by the often quoted expression "trade follows the investment." If one nation sells goods to another nation and accepts in return a promise to pay at a future date, the transaction takes the nature of a foreign investment. The terms of sale constitute, with price, perhaps two of the most cogent factors in foreign trade. Nations generally trade with those countries which grant the most favourable credit terms. The early British interests in U.S. railroads began when the British manufacturers accepted securities of the road in payment for rails and materials U.S. manufacturers of railroad equipment now find it difficult to sell to South American roads because the roads are English owned.

Apart from the great direct effect which foreign investment has in trade channels through ownership influence, another indirect but nonetheless vital factor is involved in the interest payments When capital is invested abroad, it generally earns a somewhat higher interest than when invested in the home market. This interest may be paid by the shipment of money or gold, but it is more likely to be paid in the form of merchandise The debtor nation must pay its interest, and to the extent of this interest, it has no choice in the determination of its foreign trade unless it is able to secure the necessary funds from services rendered In any case, the interest must be paid by the exportation to the creditor country of an equivalent amount of merchandise or money. Prior to World War II, the foreign investments of Great Britain were largely responsible for Britain's importance in the field of foreign trade. In payment of an annual interest charge of approximately $1,000,000,000, a constant flow of merchandise from every part of the world was shipped to the British Isles. Great Britain's foreign investments also influenced the exportation of the valuable British manufactured products for foreign countries.

Early History of Foreign Investments.—The origin of modern foreign investment can be traced back to the middle ages and the operations of the Jews, the Lombards and the Florentines. Thus in 1403, Henry V of England borrowed 1,000 marks from the merchants of Genoa, allowing them to retain the duties on goods to be imported and on certain other goods to be exported by them from certain ports. The loan was renewed in the following year on the same terms, and certain other Florentine merchants lent 500 marks in return for similar benefits. By the beginning of the 17th century, foreign investment had become of some importance. By this time, mediaeval restrictions had largely broken down, and the extension of foreign trade brought much money into the hands of merchants. Investment, however, was mainly in the carrying trade and in trading stations in suitable places. It is clear that the great bulk of the capital required for the trade with the east was what would now be called mercantile capital. It was invested in ships and goods, and only to a very small extent in fixed establishments abroad. The chief opening for permanent foreign investment in these early times was the plantations in the West Indies and on the North American mainland.

In the 17th and 18th centuries, Holland occupied the most prominent position in the field of international finance. Unable to live on the produce of the land, the Dutch had taken to the sea. The profits of an immense carrying trade and the position of Amsterdam as the leading trading centre in Europe brought surpluses to Holland which its merchants did not hesitate to lend. By 1672, the Dutch were familiar with negotiable public securities, and they had a market in which such instruments were actively bought and sold. England, Austria, France, and the continental congress all turned to Amsterdam to obtain funds. By about 1700, the Dutch held some £20,000,000 in consols as well as shares in the Bank of England and the East India company.

England has been protected from complete dependence on the Dutch carrying trade by the Navigation acts. Although still somewhat dependent upon the Dutch for capital in the early part of the 18th century, the accumulation of British capital had already commenced. There was an accumulation of wealth arising from certain foreign ventures, notably the West Indian sugar trade, the traffic in African slaves and the spoliation of India.

British Investments Abroad.—At the outbreak of the revolutionary wars in 1792, Holland was still the chief financial centre, but was soon to be displaced by London, whose resources, though temporarily drained by the Seven Years' War, and the War of American Independence, had been constantly increasing through the rapid growth of trade and industry. The field of foreign investment was, however, still very limited, but there had been a marked advance over the 17th century. Foreign investors were less exclusively merchants, and securities were now bought and sold by the nonmercantile class, with the volume and area as well as the purpose for which capital was applied broadened and extended. The close of the 18th century saw the final destruction of Amsterdam as the predominant financial market of Europe. The overthrow of the Dutch republic by Napoleon, coupled with the exaction of a heavy indemnity, and the failure of the Bank of Amsterdam and the Dutch East India company, left London supreme.

Although not the inventor of the joint-stock company, England was one of the first countries to use this form of corporate organization which has played such an important part in the financing of foreign enterprises. This form of business organization became well-known by the end of the 18th century. The 19th century saw a rapid increase in the number of companies despite legal difficulties, but laws were gradually accommodated to requirements and the introduction of limited liability made possible a great advance.

Even during the war period, some extension of British foreign investments took place. It was estimated that in 1807, $80,000,000 of the U.S. national debt was held by British subjects. The main movement of capital was, however, still into and not away from Great Britain; continental investors sent their capital there for safekeeping, and probably invested in a considerable range of securities. For instance, the property tax statistics for 1806 show that £18,500,000 of the British national debt was exempted from tax, on the ground that it was owned by foreigners. In 1813, claims were made for the exemption of more than £20,000,000 on the same ground, but by 1815 this figure had fallen by £3,000,000, indicating that capital had probably been withdrawn by continental investors.

Within the next generation, Great Britain was able not only to put vast amounts of capital into its own internal development, but also to supply a considerable amount of funds to other countries. Western Europe and the United States were the most important fields for this investment, and these funds were used to purchase state and government bonds, to assist in the building of canals, railroads and other public undertakings, as well as to finance all types of private enterprises in these areas.

With the exception of only a few periods of short duration British export of capital was practically continuous from the end of the Napoleonic wars to the outbreak of World War I. British investments in colonial and foreign securities in 1881 were estimated by R. L. Nash to equal at least £1,250,000,000. By 1907 it was estimated that the yearly outflow of capital from Britain had reached the enormous total of £140,000,000. Sir George Paish estimated that at the end of 1913, the amount of capital publicly invested by British citizens in the colonies and foreign countries amounted to more than £3,700,000,000, to which should be added a large amount invested privately, bringing the total to about £4,000,000,000.

World War I brought enormous changes in the sphere of international indebtedness. The initial shock to the credit system at the outbreak of war caused an immediate stoppage in the normal flow of capital from lending to borrowing countries and gave rise to demands on the part of the former for the repayment of maturing obligations. Great Britain bore a large part of the burden of financing the external purchases of the Allies prior to the entry of the United States into the war. So far as purchases could not be paid for out of ordinary credit items in the trade account they were met out of money obtained (a) by selling abroad holdings of foreign securities, (b) by borrowing abroad on the market, or (c) by borrowing from foreign or dominion governments. Each method was adopted so far as practicable, the last becoming more common as more countries joined the Allies.

In view of the magnitude of British foreign investments, it might have appeared that vast sums could be raised abroad by the sale of securities rather than borrowing. However, only in exceptional cases did it prove possible to sell any of the sterling securities, which represented the bulk of British holdings, and sales were for the most part limited to securities expressed in (or convertible into) foreign currencies—particularly U.S. dollar securities. In the course of its operations, the so-called American Dollar Securities committee purchased U.S. and Canadian dollar securities to the value of £184,266,540, and obtained the deposit on loan of others valued at £100,290,052. More important in amount than the sale of U.S. and other securities was the direct borrowing through the floating of loans abroad and by arrangements with foreign bankers and governments. The aggregate external debt of the British government on March 31, 1919, amounted to £1,364,850,000 at par of exchange. Of this, £840,822,000 was owed to the United States government, £91,808,000 to the Canadian government and £113,500,000 represented loans from certain Allied governments.

At the same time British holdings of dollar securities were being sold abroad and money was being borrowed, advances were being made by the British to European Allies and to certain of the dominions. Although it appears rather clear that the creditor position of Great Britain at the end of the war was considerably impaired, its extensive prewar foreign holdings, coupled with the wartime extension of foreign credits, certainly must have left Great Britain still a net creditor on a substantial scale.

Shortly after the close of World War I, Great Britain was able to resume the export of capital, though on a reduced scale. The external debt, incurred during the war, was reduced by more than £200,000,000 between March 1919 and March 1921. Estimates of the export of capital, based upon an analysis of its balance of payments studies, indicate that in 1922 it approached £200,000,000 and in 1923 was about £170,000,000. It fell to £86,000,000 in 1924 and to £54,000,000 in 1925. In 1926, when the trade of the country was disorganized by a prolonged coal stoppage, it is estimated by the same authority that there was a net import of capital amounting to approximately £7,000,000.

The most careful estimates of British foreign investments are those prepared by Sir Robert Kindersley and published in the *Quarterly Journal of the Royal Economic Society*. This series covers a ten-year period. Detailed analysis of the figures has been confined to securities quoted officially or unofficially or otherwise known to the London market (shown in Table I below under "Quoted securities"). These, of course, constitute the main block of Britain's overseas investments. There are, however, other important miscellaneous investments abroad (shown in Table I below under "Private and unquoted investments"), less readily susceptible to accurate or even approximate measurement. For example, in addition to the considerable amount of unquoted securities, there are numerous subsidiaries, branches and establishments abroad of one kind or another, of companies whose main assets are situated in England. There are also a large number of small private companies or partnerships engaged in manufacturing or trading abroad as well as numerous estates and other properties owned by British subjects.

TABLE I.—*British Long-term Overseas Investments, 1929 to 1938*
(In millions of pounds sterling)

End of Year	Total	Private and unquoted investments	Quoted securities			
			Total	Overseas governments and municipalities	British companies abroad	Foreign and dominion companies
1929	3,738	300	3,438	1,412	1,187	839
1930	3,725	300	3,425	1,437	1,205	783
1931	3,700	290	3,410	1,441	1,210	759
1932	3,640	285	3,355	1,432	1,204	710
1933	3,666	280	3,386	1,480	1,211	695
1934	3,714	300	3,414	1,499	1,228	687
1935	3,787	350	3,437	1,503	1,236	698
1936	3,764	400	3,364	1,441	1,220	703
1937	3,753	400	3,353	1,425	1,210	718
1938	3,692	400	3,292	1,398	1,209	685

No adequate estimate is available regarding the amount of short-term balances deposited for British account in foreign banking institutions. It is known, however, that on Aug. 31, 1939, British short-term claims on U.S. banking institutions amounted to about £150,000,000 and Britain's gold reserves were approximately £500,000,000. Britain's importance as a trading nation leads to the conclusion that British short-term balances in other countries at this time must have been substantial. It appears likely, therefore, that at the outbreak of World War II, British gold holdings, long-term investments abroad and short-term balances were in excess of £4,500,000,000.

The main burden of financing the war, particularly after the collapse of the French and prior to U.S. lend-lease, was borne by the British. By the end of August 1941, the British had used more than £450,000,000 of their gold reserves, their dollar balances had declined by about £80,000,000, and by the end of 1943 Britain had lost or pledged £985,000,000 of its long-term foreign investments as follows in millions of pounds sterling: India, 332; Canada, 186; South Africa, 125; Argentina, 25; Egypt, 12; Australia, 5; and the United States, 300, of which 175 were sold and 125 pledged. Undoubtedly additional countries reduced their sterling debt through regular authorization payments, and numerous private transfers probably also occurred, so that the total of British overseas investments sold and pledged must have been well over £1,000,000,000 by the end of 1943.

With a loss of approximately £1,000,000,000 of overseas investments, the question is immediately raised as to just how much remained of these investments. British foreign investments at the end of World War II are estimated at £2,395,000,000 by Donald F. Heatherington, British empire unit, U.S. department of commerce and are distributed as follows in millions of pounds sterling: Latin America, 700; Australia, 475; Canada, 250; India, 250; other British Africa, 225; United States, 210; New Zealand, 145; Union of South Africa, 100; and other British areas, 40. Far east and European investments are excluded and some estimates may be an overstatement while others are an understatement. On the basis of prewar estimates, however, the final total is roughly comparable and indicative of the position of Britain when adjustments are made for known or suspected liquidations and repatriations. In addition to the long-term foreign investments, British short-term balances abroad at the end of 1944 were estimated roughly not to exceed £250,000,000 to £300,000,000 or probably not more than the amount necessary to take care of ordinary commercial and financial transactions in normal times.

On the other side of the ledger, little was known regarding size or distribution of foreign long-term investments in Great Britain. With the exception of the United States, however, they were thought to be small. By the end of March 31, 1944, British direct borrowing, to assist in the financing of World War II, was much smaller than for World War I, amounting to only £253,000,000. One of the major reasons for this was the altered position of the United States, which, under terms of the Johnson act, was unable to make loans. Another reason was the development of lend-lease and mutual aid, together with the technique of foreign-exchange accumulation in the form of sterling balances which obviated the necessity for direction flotations of sterling securities in foreign markets. The accumulation of sterling balances in London from the beginning of World War II was large and has been continuous. These balances do not of themselves represent direct debt obligations of the British government, but they do represent claims against the United Kingdom which must be resolved. Only part of wartime balances should be considered "abnormal," since before the war many countries kept London balances amounting in all to between £250,000,000 and £300,000,000. These balances were expected to reach a total of £2,000,000,000 by the end of 1944. On the basis of the best information available, it appears therefore that British long- and short-term investments abroad at the end of 1944 were roughly large enough to cover sterling balances and direct loans outstanding, or slightly more than £2,500,000,000 each.

Other European Countries.—Several other European countries emerged as exporters of capital during the 19th century. Apart from Holland, which had established its position earlier as an investing country, these included France, Germany, Belgium and Switzerland.

The amount of French capital invested externally was estimated in 1912 at some 40,000,000,000 to 45,000,000,000 fr. French investors tended to concentrate their investments in Europe, Egypt and the French African colonies and showed a marked preference for government bonds, including Russian government issues which were held very extensively. They also had considerable investments in South America, Mexico and the Transvaal. The effects of World War I upon the creditor position of France were even more disastrous than upon England because of the loss of France's investment in Russia and other countries affected by the war. In addition to incurring considerable debts abroad to private interests, the French government borrowed heavily from the British and United States governments. Payments on these accounts were terminated long before the beginning of World War II. For the entire period between the two wars, France ceased to provide capital for export to other parts of the world and on the whole the flow was into rather than away from France. The resources of France were fully taken up with the restoration of devastated areas, and during the 1920s substantial sums were borrowed in the United States. At the outbreak of World War II, however, France was on the verge of again becoming a capital exporting country.

The amount of German foreign investments was variously estimated at 22,000,000,000 to 25,000,000,000 r.m. before World War I. A large part was represented by Russian government bonds, railway and industrial securities; and German investors had large interests in Austria-Hungary, Turkey and the Balkans with smaller interests in France, Great Britain, Spain and Portugal. They also had substantial interests farther afield, in the United States and Canada, Latin America, Africa and Asia. Like France, Germany lost its investments in Russia after the war, and also suffered from the sequestration of German property and enterprises in the territory of hostile countries, though to some extent this was set off against property of those countries in Germany sequestered by the German government. Like the Allies, Germany incurred heavy debts in certain foreign countries, notably Holland, Sweden and Switzerland, and mobilized salable foreign securities with the view to effecting payments abroad. On the other hand, Germany had advanced large sums to its allies, but had to forego its claims to repayment as one of the conditions of peace. Germany's defeat in World War I resulted in the loss of its position as a capital exporting country and in the period between the wars it borrowed heavily for reparation payments, reconstruction and rearmament. At the end of July 1931, however, it is estimated that Germany still had about 8,500,000,000 r.m. of foreign investments and holdings of foreigners in Germany were estimated at 23,000,000,000 r.m.

Neutrals of World War I.—The urgent demands of the European belligerents provided neutral countries an exceptional opportunity to extend credit and advance funds to both sides. This applied to a considerable extent to some of the European countries, especially Holland, Sweden and Switzerland; their capacity to furnish supplies on loan or otherwise, however, was restricted by economic difficulties resulting from their position in the war area. It was estimated nevertheless that by the end of 1918, Switzerland had lent the Allies 400,000,000 fr. and the Central Powers 200,000,000 fr. and at the same time had repurchased securities in French, German, English and Austrian hands to the value of at least 800,000,000 fr. The experience of Holland and Sweden was not dissimilar. In the period between the two wars, these countries continued to export capital on balance, and until the German occupation of Holland all were sources of financial assistance to debtor countries. The Dutch suffered heavy capital losses during World War II both at home and abroad and the loss in value of their foreign investments was certainly very large. Sweden probably accumulated some foreign assets during the war period. The Swiss continued to send capital abroad, particularly on short-term to the United States.

The United States as a Creditor Country.—For some years prior to World War I, the United States had been investing capital abroad, although on balance it was a capital importing country. Its financial strength was increasing, however, and it was only the great demand for capital for internal development which kept it from becoming a capital exporting country. The export of capital from the United States had already commenced on a substantial scale by 1900 and by 1914 had gained considerable headway. By the end of 1909, U.S. foreign investments are estimated by H. E. Fisk to have reached $2,000,000,000 and by Dec. 31, 1913, he estimated that these investments had increased to $2,605,000,000.

World War I greatly hastened the progress of the United States as a capital exporting country. It was able to repurchase with ease large amounts of U.S. securities from Europe, the aggregate being estimated at $2,000,000,000 up to the end of 1918, which practically wiped out foreign holdings in the United States. It is estimated, however, that an additional $500,000,000 was repurchased in 1919 and 1920. In addition to these repurchases, foreign loans floated in the United States from Aug. 1, 1914, to Nov. 11, 1918, amounted to $3,300,000,000, of which $3,200,000,000 represented direct or indirect loans to the Allied countries and their nationals, while most of the remaining $100 000,000 represented loans to Latin American countries. Meanwhile the government of the United States advanced $7,077,114,750 to the Allied governments prior to the Armistice. Agreements were subsequently reached for settlement of these debts with nearly all

TABLE II *Export of Capital from the United States, 1920–1940*
(In millions of dollars. Minus sign indicates net movement to U.S.)

Year	Net inflow or outflow	American capital: Total	Foreign securities: New issues	Foreign securities: Other	Amortizations	Direct investments†	Change in short term funds‡	Foreign capital: Total	Net sale or purchase (−) of U.S. securities	Amortizations	Short term funds: Officials§	Short term funds: Other¶	Foreign sale or purchase (−) of U.S. currency
1920	[illegible]	554	500	481	−581	154	*	278	258	20	*	*	*
1921	[illegible]	588	[illegible]	10[illegible]	[illegible]	111	*	4	16	20	*	*	*
1922	815	822	666	137	131	153	*	7	−[illegible]	20	*	*	*
1923	78	405	317		−8[illegible]	148	52	−387	−358	20	14	−2	−61
1924	531	904	853		1[illegible]	182	150	413	205	20	−38	202	12
1925	676	917	821		−221	268	46	−241	321	20	−17	61	16
1926	[illegible]	[illegible]	921	15[illegible]	−206	351	36	−550	11[illegible]	20	−47	419	−9
1927	15[illegible]	1,330	1,114	103	28[illegible]	351	340	−884	[illegible]	20	−128	821	18
1928	1,105	1,541	1,010	04	301	558	251	−340	−455	20	97	205	9
1929	[illegible]	850	11[illegible]	105	720	602	200	−551	558	20	−223	31	−6
Total	5,210	8,010	7,100	1[illegible]4	−2,041	2,858	1,[illegible]	3,100	−1,01[illegible]	200	−510	1,118	21
1930	[illegible]	555	77[illegible]	405	300	294	101	222	86	20	100	184	5
1931	115	256	100	285	[illegible]	[illegible]	[illegible]	1,190	56	[illegible]	11	1,1[illegible]	−7
1932	[illegible]	−178	31	−116	17[illegible]	16	[illegible]	606	6	[illegible]	[illegible]	3[illegible]	78
1933	* 1[illegible]	13	83	120	1[illegible]	32	35	280	−186	15	82	331	21
Total	1,783	666	1,000	−714	832	500	990	2,400	316	75	516	1,007	137
1934	* 1[illegible]	281	17	135	114	17	−96	111		15	−1[illegible]	1[illegible]9	25
1935	1,[illegible]08	840	53	80	−155	31	−173	968	3[illegible]3	15	−10	−630	1
1936	1,[illegible]8	[illegible]	1[illegible]	[illegible]	151	[illegible]	[illegible]	976	[illegible]	1[illegible]	−71	286	−25
1937	8[illegible]	421	13	64	−100	35	1[illegible]	536	60	15	−163	−151	3
1938	111	67	53	10	8[illegible]	10	7	−374	[illegible]	15	5	−307	15
1939	1,1[illegible]	371	[illegible]	6[illegible]	93	0	−311	−1,175	71	15	−301	821	−131
1940	** 1,503	206		−25	80	23	150	** −1,237	231	10	−658	−56	−35
Total	**−7,156	−2,051	136	−253	−900	−88	−1,017	** −5,395	−986	100	−1,213	−2,396	−177

*Figures not available

†Includes public offerings of U.S. and semi-U.S. corporations for foreign purposes (excluding discounts and refunding)

‡Includes changes in banking and brokerage balances and some additional short term funds

§Through Sept. 21, 1938, figures represent official funds at the New York Federal Reserve bank only; thereafter they also include funds held with commercial banks in New York city

‖Foreign and domestic security transactions not shown separately for these years are therefore included with "Net sale or purchase of U.S. securities"

¶Includes a $10,000,000 outflow in 1933 and a $30,000,000 inflow in 1934 to cover security arbitrage operations which could not be divided between foreign and domestic security transactions for these years.

**Includes capital assistance and advance payments by the British government amounting to $720,000,000 in connection with procuring war supplies in the U.S. before the advent of lend lease.

Source: Data derived from *The United States in the World Economy*, department of commerce, 1943, and condition statements of federal reserve banks of the foreign governments, but in 1931 President Hoover and congress found it necessary to grant a year's moratorium, after which no nation except Finland resumed full payments.

At the end of World War I, the United States was no longer a debtor country on balance. During the following years it rapidly established its position as a great creditor. The period of greatest U.S. investments in foreign countries took place during the 1920s. During this decade, U.S. capital flowed abroad in the form of security purchases, direct business investments, and short-term funds. In the ten-year period (1920–1929), the net export of capital from the United States was estimated at more than $5,800,000,000. In the second half of 1928, however, Americans began to lose their interest in foreign bonds as the domestic bond market tightened and the stock market drove ahead toward its climax in 1929. The movement of U.S. capital into securities and business investments abroad dwindled away to almost nothing, and heavy withdrawals of short-term funds from foreign countries began. Until the devaluation of the dollar in Jan. 1934, however, the return flow of U.S. funds was more than offset by the withdrawal of foreign short-term funds from the U.S. market and the net outflow of capital was about $1,800,000,000. After devaluation, the movement of foreign money turned heavily toward the United States and added its effects to those of the return flow of U.S. funds. From 1934 through 1940, the inward movement of U.S. capital from abroad was slightly more than $2,000,000,000; and that of foreign capital about $5,400,000,000.

As stated previously, the United States emerged from World War I a creditor country on balance and the net export of capital in the intervening period increased U.S. investments abroad. On the basis of a United States treasury census, U.S.-owned foreign property (long- and short-term) in foreign countries as of May 31, 1943, was estimated at $13,350,000,000 and was distributed as follows in millions of dollars: Europe, 4,635; Canada and Newfoundland, 4,400; West Indies, 920; Central America and Mexico, 805; South America, 1,605; Asia, 675; Africa, 145; Oceania, 160; and unspecified, 5. The treasury department also took a census covering the other side of the picture and on the basis of reports submitted to them, foreign-owned U.S. property as of the middle of June 1941 amounted to $10,685,000,000. This investment covered $4,080,000,000 of deposits and other banking assets, $3,130,000,000 of U.S. securities, $1,950,000,000 of so-called direct investments, and $1,525,000,000 other investments. On the basis of the two census figures, it appears that on capital account the United States was a creditor country by at least $2,665,000,000.

Lend-Lease and Other Developments.—The introduction of lend-lease early in 1941 opened up a completely new phase of international finance. The rapidly mounting volume of war exports was handled by simple bookkeeping operations. Services such as ship-repair were supplied on the same basis as were certain construction operations. From the beginning of the program through June 1944, more than $28,000,000,000 of lend-lease assistance had been granted countries associated with the United States in fighting World War II.

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CAPITAL, NATIONAL: *see* Wealth, National.

CAPITAL AND INTEREST.—The concept of capital is peculiarly difficult to explain briefly, because of its intimate relationships with other types of wealth and sources of income, and because of the changes in meaning which all the main concepts used in economic analysis have undergone in the history of the science. Particularly in the generation or so preceding World War II, this development made scientific usage quite divergent from that of everyday life.

Historical Background.—In the main tradition of "classical" economics, not to go farther back, capital has generally been described as produced wealth used for further production. (The classical and neo-classical schools include the bulk of treatises written in English since Adam Smith's *Wealth of Nations* in 1776 (*see* the article Economics). This definition distinguished capital on the one hand from land or natural resources, supposedly unproduced, and on the other from "consumption goods." It was also taken for granted that "wealth" should not include human beings, though, in contrast with the later social viewpoint, the earlier writers inclined to treat the working population as a means to political ends or power. Analysis soon came to be built explicitly around the notion of three "factors of production"—labour, land and capital—supposed to correspond with the three recognized forms of income—wages, rent and "profit." The progress of investigation has tended to make the conception of capital less definite and more inclusive.

The change most sweeping in its implications has been the redefinition of production and consumption, which blurs the distinction between capital and consumers' goods. Adam Smith and his followers for about a century were much under the influence of the immediately preceding French school, the *Économistes* or "Physiocrats" of the third quarter of the 18th century. Both groups viewed production as the creation of a "surplus" of tangible wealth, primarily consumption goods, available for such "unproductive" uses as the support of government and the cultural life, or net growth in the population and wealth of a country. The writers shared the popular belief that agriculture is the only activity which is really productive. At that time, particularly in France, industry was undeveloped and agriculture was in fact the main source of income in excess of the "maintenance" of the employed population. Both schools also accepted the popular notion that all wealth is produced by labour with land and capital in a merely assisting or supporting role. Capital was viewed as a particular way of using consumption goods, through "advancing" means of subsistence, and raw materials and tools to support "productive" labourers who reproduced the advances and something more. This excess was the return on capital, designated as "profit." The typical capitalist, and at the same time the "entrepreneur" (as he later came to be called), was the "farmer" in the British sense, who rented land and hired labourers received the product at the end of the year, and turned over to the other two claimants their respective shares The farmers of the poorest land worth using at all paid no rent; others paid the landlord an amount which measured the superiority of their land over that at the margin of cultivation. From the remainder after payment of rent (if any) the capitalist farmer recouped the wages paid the previous year and set aside a more or less arbitrary amount to be advanced to productive labourers the next year. The final remainder he consumed, either directly or in the support of "unproductive" labourers—or paid it as taxes to the state, whose political functionaries were also classed as unproductive labour The level of wages was determined by subsistence requirements, and all increase in population and wealth (and even maintenance) depended upon the "thrift" of the capitalist, possibly supplemented by saving by landlords and labourers. These conceptions were carried over into nonagricultural production, with recognition of compound interest on investment in capital which lasted for a term of years; but the role of machinery and durable capital was not effectively incorporated into the distributive analysis The theory was somewhat systematized by David Ricardo (*Principles of Political Economy and Taxation*, 1817) and his work was largely accepted in England through most of the 19th century. Adam Smith's doctrine was developed along somewhat different lines in France by J. B. Say (*Traité d'économique politique*, 1803) who exerted much influence in the U.S.A. The Americans (notably H. C. Carey in the 1830s and 1840s) were particularly critical of the theory of rent the central feature of Ricardo's system. In capital theory N. W. Senior (*Political Economy*, 1836) introduced the notion of "abstinence" as a subjective or sacrifice cost involved in saving, parallel with the irksomeness of labour, and justifying the receipt of profit or interest. The radical transformation of the classical system may be dated from the promulgation of the "utility" or "subjective" theory of value by a number of writers in the early 1870s (W. S. Jevons, C. Menger and L. Walras—somewhat later, but perhaps independently, by the American, J. B. Clark). The new theory was gradually popularized by Menger and his followers as the "Austrian" economics. It inverted the causal relation between cost and price, making the former the effect of the latter, and changed its meaning from "real" cost in labour or sacrifice, to the money value of the productive services, paid for their use by the "entrepreneur," the active producer, distinguished from the capitalist. Even more important for economic theory in the long run, this revolution changed the meaning of production and consumption and led to a new theory of distribution as the valuation of productive services of all kinds, derived from product value by "imputation." The subjective-value theorists held various ideas about capital. Most important historically in this connection is E. von Boehm-Bawerk (*see* BOEHM VON BAWERK, EUGEN) (main works in late 1880s) who elaborated the "abstinence" theory (in more or less changed form) and also developed (without reconciling the two) a theory of interest based on a particular conception of the "productivity of capital." This second theory was a development of the Smith-Ricardo view of capital, as consumption goods advanced to labourers to support further production. It treated land and labour as primary factors and added the notion that larger advances not merely support more labour (and possibly bring in more land) but increase production by making it more efficient through increasing the length or "roundaboutness" of the production process. Boehm-Bawerk's work led to a generation of controversy between "productivity" and "psychological" schools of interest theory, and the combination of the two in an "eclectic" theory by Alfred Marshall (*Principles of Economics*, 1st ed., 1890). The issues will be discussed later.

Modern Views.—Contemporary economic thought with respect to capital and its return is still controversial, but the view which seems to be gaining predominance may be sketched out. First of all, production is defined in relation to economic equilibrium, a conception due primarily to J. B. Clark, in the form of a stationary economy. This is a hypothetical society in which capital is maintained without increase or decrease, while population and wants and the "state of the arts" are also unchanging, and all economic adjustments have been worked out to a position of stability. Under these conditions, production consists in using "productive agents" of all kinds in a relationship of symmetrical co-operation, to provide an unvarying stream of consumable services or satisfactions as the ultimate product. The production of the services consumed in any period of time includes the maintenance of all productive agents and materials used in the economy, including in turn the replacement of any which are worn out or used up. Thus under equilibrium conditions production and consumption are simultaneous. And where investment or disinvestment intervenes, there is no determinate relation in time between the two. In a progressive economy (in the sense of increased production without change in wants or productive methods), production further includes a net addition to the productive equipment through saving and investment, and exceeds consumption by this amount. In a retrogressive economy (in the same sense) consumption would exceed production, the difference representing a decrease in the total productive equipment, through "dissaving" and disinvestment. Thus the fundamental meaning of "real" capital is simply productive equipment viewed as subject to quantitative increase or decrease. The theory as a whole pictures distribution of the product among different types of productive agents through imputing to each unit of each type, the value of the "increment" of total product which is finally dependent upon the co-operation of any one small unit of that type of agent, or "factor." This is the "marginal productivity" theory of distribution. The theory describes the position of equilibrium for the economy as a whole, which can also be pictured as moving with change in the given conditions. (*See* ECONOMICS; WEALTH AND INCOME, DISTRIBUTION OF.)

In this new setting, the problem of the classification of productive agents appears in a different light. The traditional "tripartite" division into three factors, labour, land and capital, loses much of its significance, as does the distinction between producers' and consumers' goods or wealth. As already indicated (and as Irving Fisher in particular has emphasized) the major analytical distinction is that between "income" consumed or saved, and "sources" of (or agents which yield) the services which compose income. All sources are properly productive agents, and are also "capital goods" in the most inclusive meaning. In practice, it is often useful to restrict the notion of capital goods in various directions, and the definition will depend on the problem considered in any particular piece of exposition. Some four or five main lines of restriction may be significant. First, human beings (in "free" society) are not capital in the same sense as property which is regularly bought and sold. Second, "intangibles," including many types of claims upon sources or their earnings, are in a different case from physical sources themselves. Within the class of tangible goods (third) some are used directly for consumption, others indirectly to make other goods. Further (fourth) some are immediately destroyed in use (food, fuel, chemicals, etc.) while others last and render their services over periods of time of almost any length. Finally, among goods of substantial durability, some are used by those who own them while others are used by a second party, under various contractual arrangements between owner and user. In all these cases there are grounds for restricting the appellation of "capital" to one or the other member of the comparison, and many subclasses or differences in degree may be recognized.

With respect to the organization of production, and hence for the purpose of general theory, the durability of sources (the fourth distinction) is particularly important, because it largely determines the length of time that will be required to convert an agent of one type into one of another type, suitable for a different mode of use, in response to a change in the demand or in technology. The speed of such transfers also depends on the time required to produce the new form of source. Again, as already indicated, only goods of a minimum durability can be used by parties other than their owners, or their services be bought and sold apart from the sources themselves.

As already observed, the general and fundamental meaning of real capital includes all sources or objects which have productive capacity, the quality of rendering valuable (and scarce) services of any sort. For the purpose of theoretical analysis, the essential matter is the distinction between such objects, or "capital goods," and "capital," *i.e.*, productive capacity, viewed in abstract quantitative terms, as subject to increase or decrease, hence transferable from one use to another through decrease of one kind and increase of another. Thus the problem is one of measurement or quantification of productive capacity. This, in turn, is a matter of valuation, since value is the only common denominator between different economic forms. The market enables an individual to change his investment position through changing places with another, and the prices guide the process of real investment and transfer of investment in the economy. Where there is no market for an agent, as the case of free human beings, or where the price is indeterminate because of imperfect competition, the data which enter into market price may enable computation of a value or a more accurate one, as the case may be. The economic importance of capital does not depend on exchange, and still less on the borrowing and lending of money, but on the fact that changes in production are effected chiefly through disinvestment and reinvestment. Only to a limited extent can productive agents be moved from one use to another without being changed in form in this way, though in a progressive economy proportional changes are largely effected through directing new investment into fields where relative expansion is called for.

Reflection upon the process by which production in any line is extended through investment, or contracted through disinvestment, will make clear the reason for the "passing" of the three-factor classification of productive agents. There is no general difference between any two of the three traditional classes—labourers, natural agents and capital goods—with respect to the possibility either of transfer from one use to another "as they stand" or of increase or decrease. We find all degrees of freedom of investment and disinvestment, hence replacement of any kind by any other, and also all degrees of substitutability of one physical kind for others in the production of the same (or an equivalent) consumable service.

Capital-goods and Natural Agents. Exploration and Invention.—Business usage hardly makes a distinction between investment in "natural" and in "artificial" instruments, or materials. This is partly because of their exchangeability in the market, but there are deeper reasons for regarding the business view as sound from the standpoint of general theory. On the historical side, all "natural resources" have at some time been discovered and "developed," at a cost, hence through saving and investment. More important are considerations which look to the future. Most of the resources also require maintenance at a cost, as in the case of agricultural land, or outright replacement, as in that of minerals, etc., which are subject to depletion. And both improvements and increase in supply are constantly being effected through investment in exploration and development, with the expectation of a return. Such operations are not essentially different economically from other production. As long as they are carried out in open competition with other uses of the resources employed, it is to be expected that on the average the outlays will tend to yield the same return that they would yield in more repetitive or routine activities; in other words, the value of the results will tend toward equality with the costs incurred. There may, indeed, be differences. Natural resources may on the whole exceed such things as factory equipment in durability and specialization, making the commitment of investment in the former more permanent, less responsive to changes. And again, the uncertainty which affects explorative activity in any particular case may produce a bias either for or against such investment, depending on the prevalent social attitude toward adventure and risk. Such differences will at most be a matter of degree and will vary enormously from one example or sub-type to another within both general fields; hence they hardly justify a general distinction.

The explorative character of investing in new natural resources brings to mind that improvement in technology is also a field of investment, giving rise to a form of intangible capital recognized in business usage. Scientific research and its technical application are carried on at a cost and with the expectation of a return in some form. These activities are also affected with a high degree of uncertainty; but a successful innovation may yield a large income, and there must be a tendency for gains and losses to average out, leaving about the same relation between yield and cost as in fields where the result is predictable in the individual case. However, investment in technology presents one important peculiarity. New knowledge, or a valuable new idea, can usually be copied and diffused at little cost, so that the return would soon fall to zero, in the absence of some artificial restriction upon the extension of its use. Such restrictions bring the value under the theoretical head of monopoly. Such monopolies are good or bad, depending upon whether they are limited in degree and duration to what is reasonably required as an incentive to commit resources to experimentation, and for its rational direction. Any monopoly power is clearly capital to its individual owner, but whether it should be treated as a part of the capital of a society or the world depends on complex social conditions

The Relation Between Interest and Rent.—Only historical accident or "psychology" can explain the fact that "interest" and "rent" have been viewed as coming from different sources, specifically natural agents and capital goods. The difference is clearly one of contractual form, or even of arbitrary "point of view." If one person, A, hires from another, B, the use of any piece of property whatever, the payment will be called a rent. It is quite immaterial whether the property itself is land or anything else, whether it is natural or artificial, tangible or intangible or is used for production or consumption. Houses, furniture, and even some articles of clothing are regularly leased for a rental, as well as farms or building sites; and the same is true of patents, though under certain forms of contract the payment is called a "royalty." The lessee in such an agreement always has the alternative of borrowing money and buying the object, and in so far as competitive conditions prevail, the two arrangements will be exactly equivalent for both parties. The user may borrow the money from the previous owner, as regularly occurs in the case of real estate; and if the use is wanted for a limited time, the object can be sold and the loan paid off. Thus every lease could be replaced by a sale, and vice versa.

The difference between a lease and a sale mediated by a loan lies in the incidence of changes in value, or rather the "risk" of such changes. If A leases a farm from B, any increase or decrease in its value will accrue to B, while if the transfer is effected by a sale it will accrue to A. If changes are predictable in advance, or if both parties have the same expectations of change (and the same psychological attitude toward risk) the competitive terms of lease or sale will again make the two contracts equivalent—or, a sale might be accompanied with a contract for resale at any future date. Even highly perishable goods might be furnished under the form of a lease, the borrower agreeing to return articles identical or equivalent to those received and used up. Further, the owner of any piece of property may arbitrarily view its return as either a rent on the property itself or interest on the investment in it, whether the return is service to himself or a rental paid by some other user. Finally, both lease and sale can be replaced by still other arrangements; in fact, either transaction is equivalent to a partnership agreement, with appropriate provision for dividing the income yield—and any future capital gain or loss—between the two parties. Thus, even in an entrepreneurial economy using money, the relation between capital and its yield, or between rent and interest, has no essential connection with the borrowing and lending of money.

Capital-goods and Labourers.—Similar considerations apply in substance to the labourer and his wages as to land and rent Though, for "human" reasons, labourers are not usually referred to as "means of production," they are economically similar to other productive agents. The difference is "institutional" and in a slave economy labourers of all classes would be merely species of capital goods. This of course was once largely the case in parts of the U.S.A. There usually are, indeed, important differences; sentiment and social usage, including religion, cause human slaves to be treated in a somewhat different way from work animals, or machines. Important economic differences arise in the control of reproduction and the rearing of children. However all these things are matters of detail and of degree, and similar distinctions exist between many categories of capital goods. The procurement of slaves, through raids, or purchase from people who themselves recognize slavery, has commonly been hardly more influenced by sentiment (or law) than other investment operations.

Even in a free society, human beings are productive agents and are produced at a cost, and this is obviously true of the qualities which give their services economic value Birth rates, as well as training, are influenced by the expectation of earning power, much as in the case of any investment which looks beyond the maker's own lifetime. In extreme cases, as when a youth borrows money to secure a technical education, the difference is reduced to a minimum. However, the accepted principle of the sanctity of freedom, embodied in modern law, has the important consequence that an individual cannot be very effectively pledged to secure a debt, since he cannot be sold, or "seized" to enforce payment—since corporal punishment and imprisonment for debt have been abolished. But on the other hand, the law also gives debtors a property exemption and the privilege of bankruptcy. Instead of thinking of a slave economy we may reflect on the converse method of making human beings and property alike, *i.e.*, legal prohibition of purchase and sale of other property Since every sale could be replaced by an equivalent lease or other arrangement, even the modern complex organization of production could be carried on without much change if all property were "entailed" as landed estates typically were in the middle ages. At that time, too, the prohibition of lending at interest was regularly and easily evaded by recourse to other contractual forms, and was finally dropped because it became ineffective. In short, the meaning of capital and its yield is essentially unconnected with the general organization of the social economy. It would be essentially the same in a Crusoe economy; or, to be more realistic, one may think of an individual or business unit in our own society, which saves and invests directly for its own use. If the role of capital in a situation without exchange or lending is understood, the explanation of the market value of sources, and of their yield as an annual rate percent of their value, will present no difficulty.

Present-day Theory of Capital and Its Return.—The essential phenomena of capital centre in the necessity for maintenance and replacement of productive agents and the possibility of disinvestment and of further investment in practically any form, old or new. Every economically active person must constantly apportion productive capacity under his control between use to yield a larger current stream of want-satisfying services and the maintenance, improvement or creation of productive agents with a view to a larger flow of such services in the future, or to still further investment. There is little difference among physical classes of resources with respect to this choice. And further, roughly speaking, all kinds co-operate in making every kind, including human beings endowed with all varieties of earning power. Accordingly, modern thought is abandoning the distinction between primary and secondary, produced and unproduced, or reproducible and non-reproducible agents. The distinction between human beings and property and that between personal and real property are important in law and human relations, but no fundamental economic differences correspond to them. The original fallacy was probably rooted in the "moral prejudices" that only labour is really productive, and that land is a gift of nature. Realistic economic analysis must avoid any general classifications of productive agents and make distinctions on the basis of the facts that are significant for the problem in hand. For general analysis, it would be desirable to drop also the traditional classification of income forms, and to speak of the yield and "hire" of productive agents, irrespective of kind.

Accurately speaking, investing or disinvesting involves a comparison between consuming income in the immediate and the more remote future, rather than in the "present" versus the future. To avoid technicalities which can only be dealt with by the mathematics of "continuously compounded" interest, we may think of an investment made and completed within an interval short enough to be treated as a moment of time, and which immediately begins to yield a return. The yield itself may of course be either consumed or wholly or partly invested; the latter use corresponds to the facts in a progressive economy or economic unit of any kind, but the same form of choice is involved in deciding between maintenance of the stationary condition and retrogression.

For both simplicity and realism, it is best to approach the rate of return on any income source by considering that the possibility of investment and disinvestment makes any future income, however distributed in time, equivalent to some perpetual and uniform annual flow. What any source actually produces in any interval of time is its gross imputed yield for that interval, reduced by whatever amount may be necessary to provide for maintaining the source itself intact, including routine maintenance and eventual replacement, thus converting the yield into a perpetuity. (This allowance must be made in identifying the "rent" or "hire" of any productive agent with the "interest" on the investment in it, since rent contracts more commonly make maintenance and replacement the responsibility of the owner and include these costs in the rent paid; in legal language, the property is to be returned in its original condition except for "ordinary wear and tear and unavoidable accident.") The annual rate of yield is the ratio between the annual value of the perpetuity and the investment in the source. Under conditions of perfect competition, or in an economic system in the position of theoretical equilibrium (stationary or moving), all sources would yield a uniform rate of return on their cost of production, which would be equal both to their cost of reproduction and to their market value. The essential principle is that under ideal conditions—which include perfect knowledge and foresight—existing resources will be so apportioned between the use to yield current satisfactions and the investment use, and among all forms of both, as to make this rate uniform, for the whole economy, at the highest level which can be obtained under existing technical and other circumstances. Under real conditions, this rate "tends" to be approximated at the margin of new investment (or disinvestment), with allowance for the uncertainties and errors of prediction. But existing sources will be valued by "capitalizing" their expected income yield (or the equivalent perpetuity) at the rate fixed at the margin of growth (or of disinvestment, in a retrograde society). In other words, their value will be the market estimation of the minimum cost of producing any source which will yield the same income in perpetuity. The expected yield of any source during its life may itself be affected by its durability or by the time required to carry out investment in new forms expected to yield an equal income at lower cost.

The Rate of Interest.—It must be evident that if borrowing and lending of money occurs in a situation where opportunity for productive investment is open, the rate of interest on loans will tend to be equal to the theoretical rate of yield on real investment. An intelligent man will not make a loan at a rate lower than he could secure by investing his capital himself—with allowance for uncertainty and for trouble and expense in the two cases; and the borrower for productive purposes will naturally not pay a higher rate than his investment is expected to yield. The lender in this case becomes in effect the owner of the new assets in the amount required to produce the income which he receives as interest, together with additional security. Finally, if loans are made for purposes other than productive investment, *i.e.*, for consumption, competition will tend to fix the same rate on these. If the concepts are carefully defined, loans for consumption purposes are not very different from loans for productive investment, since they involve a lien upon assets—if the borrower gives security, as he must if the transaction is really a loan. And the case is not essentially changed if the transaction is a means to disinvestment more rapid than the owner could effect through undermaintenance. In a progressive society, particular cases of disinvestment, however carried out, are best viewed as a small deduction from the net growth of capital in the economy as a whole.

The Psychological Factor.—The argument of the preceding section seems to make the marginal productivity of capital the causal determinant of the rate of yield, and so of the interest rate. This conclusion is essentially correct, but its establishment depends on further argument; what has been said shows merely the necessity of equality, leaving the question open as to which determines the other or whether both are determined by some other cause. We referred earlier to the controversy between productivity theorists and others who have explained the rate of return in "psychological" terms, meaning an alleged general human preference of present over future satisfactions of like kind and amount (Both groups follow Boehm-Bawerk who also suggested a third "ground" of interest, but it cannot be explained briefly, and discussion would show it to be unimportant if not unreal) "Time-preference" or discount of the future as an independent explanation has been advocated especially by F. A. Fetter in the U.S.A. and L. von Mises in Vienna. Essentially, the theory is the "abstinence" doctrine of N. W. Senior and J. S. Mill; but the writers of the British classical school never attempted to use the degree or intensity of abstinence to explain the actual rate of yield or of interest. The neo-classical economists (following Marshall) usually combine productivity and time-preference in an eclectic or equilibrium theory, using the one to yield a demand curve and the other a supply curve. The most elaborate and careful development of this view is found in the work of Irving Fisher.

The issue in interest theory is parallel to that involved in the controversy between "cost of production" and "utility" theories of general price determination, which was also set in motion by the Austrians and other writers of the subjective-value school. It was finally recognized that neither marginal cost nor marginal utility directly determines price. At equilibrium, any two prices must be in the same ratio as both of the other pairs of magnitudes, because the economic behaviour of producers and consumers will make all three ratios equal. The process of adjustment must be considered in two steps. First, every consumer buys products, at prices which he finds given, in such proportions as to equalize the marginal satisfaction secured from equal increments of expenditure; and market competition sets the prices that will "clear the market" of the existing or momentarily forthcoming supplies. Second, entrepreneurs and owners of productive agents adjust production, at given prices of both products and productive services, so as to equalize costs and selling prices, and competition fixes the prices of productive services at the levels which will clear the market of the existing or forthcoming supplies of these. Equalization in both fields—prices proportional to utilities and equal to costs—defines the condition of general equilibrium, remembering that the prices of productive services are at the same time the incomes of consumers, one factor in the effective demand for products. In a still longer view account must be taken of changes in the supply of productive agents and in technology and consumers' tastes, in a theory of historical economic change or progress (Marshall's "secular changes").

Whether we shall say that either relative marginal utility or relative marginal cost predominates over the other in the determination of any price must depend on the relative amounts of change undergone by the two ratios in establishing the equality. As Marshall in particular pointed out, the general rule is that productive adjustments are comparatively slower than those of consumers, but finally much more extensive. In the short run, demand is elastic and supply approximately fixed, hence utility is the determining factor; but in the long run, or "normal price" view, the situation is largely reversed. To the extent that all resources are ultimately transferable between uses, the investment in them being recoverable, costs will be "constant" (relative to output) in the long run, or supply perfectly elastic. Cost will then determine price, in the sense that equilibrium price will be equal to cost, which is not affected by changes in the shape or position of the demand curve. To the extent that any resources are permanently immobile, because specialized and durable, long-run marginal cost will increase with output, and the "eclectic" theory of mutual determination or equilibrium between demand and supply (utility and cost) will be applicable. During the period of adjustment following any important change, when supply is out of line with demand, the productive resources which are relatively immobile will tend to command a premium above interest on their cost in the expanding industry, and a price below the theoretical value in that which is contracting. (These payments are called "quasi-rents" by Marshall.) To the extent that the hire paid by producers themselves lags, the difference will appear as a "profit" (or loss) to the enterprisers concerned. (If there are permanent and unproducible specialized resources, without producible substitutes, they will command a hire which is one-sidedly dependent on the price of the particular product, since it is not affected by the competition of alternative uses; this case fits the classical theory of rent.) (*See* ECONOMICS; PROFIT; RENT; WEALTH AND INCOME, DISTRIBUTION OF.)

The percentage rate of return on capital is a matter of the price of sources of future income, relative to their (perpetual) annual yield (the reciprocal of the rate itself). The general principles of price fixing apply in this case, but the factual conditions are radically different from those affecting particular consumption services or short-lived and freely reproducible goods. As pointed out earlier, there is little or no permanent specialization of productive agents between the consumption and the investment use, so that the alternative-cost curve for capital goods in terms of sacrificed consumption is practically horizontal—*i.e.*, constant cost—allowing time for adjustment to changes. But in spite of this fact, the total situation is the opposite of constant cost; it is one of fixed supply. The field of investment includes not merely all salable wealth, but the productive capacity of human beings and in any society at any moment it is the total accumulation made through all past time. Further, under "normal" conditions (apart from disastrous war or depression) the stock of capital must be expected to go on increasing through new saving and investment. It follows that the price theory applicable to the case corresponds to that of short-run or market price in an isolated market where there is a given stock to be disposed of, and not that of equilibrium price, for a consumption good. Typical consumption goods are in fact consumed about as fast as they are produced; and the price in which producers and society are most interested is not that which happens to prevail at the moment (when production may be out of line with demand); it is that which would make the rate of production equal to the rate of consumption and so can be expected to prevail on the average over a substantial period of time. In the case of capital, the normal case is a growing total stock; but this is so large that the net production in a short period of time will not make an appreciable difference in the demand price. ("Historical" changes will be considered presently.)

It is true that a sudden and unexpected change in saving "might" temporarily be so much in excess (or so much short, as the case may be) of what the construction industries are prepared to absorb as to cause a considerable fall or rise in the demand price while construction plans are being changed. But in practice, the important short-run changes are of the opposite sort; high rates of saving go with high interest rates, and conversely. The important short-run changes are connected with the business cycle, and this problem must be considered separately.

Thus the general theory of the yield of capital, to which the rate of interest tends to conform, must conclude that the normal price of capital goods is fixed by the demand for an existing supply. The demand-price will be the cost of a new investment of equal yield. Savers find a certain rate of return obtainable, fixed by the marginal productivity of new investment in the economy, and they save enough of their income to make their "marginal time preference" equal to this rate. This rate will not be appreciably affected by ordinary changes in the amount saved per unit of time. This equilibrium rate will, however, respond "permanently" to changes on the side of demand, such as result from an important technological advance opening up a large new field to investment.

Changes Over Long "Historical" Periods.—The equilibrium just described clearly is not, like the normal price of a reproducible good, a position of permanent stability, defined with reference to given conditions of demand and supply. In fact "stationary conditions" of saving and of investment are logically impossible. The facts of history and of human psychology show that capital tends to go on accumulating indefinitely, if general social conditions are stable. We can "imagine" a stationary or retrogressive society, but it is idle to build theory on the assumption that either the supply of capital or investment opportunity tends to become and to remain stationary. Accumulation obviously changes the supply of capital, and this must change the conditions which determine both the rate of saving and the demand price, the real rate of return.

With respect to the demand price for the use of capital if all other things were to remain equal—particularly if progressive accumulation could occur without causing any advance in technology—it would undoubtedly tend gradually to lower the rate of return. This is because while investment may increase the supply of most kinds of productive services, and those of any large general class, there are factors in the investment situation, given by nature and economically unalterable, which prevent completely free and uniform growth in all fields. Consequently, increasing total investment is doubtless subject to "diminishing returns," as a result of the increasing proportion of equipment of types in which investment is more readily expansible, to others where it is less so. But the decline in the rate would be slow, in historical terms.

On the supply side, at the same time, the growth of total income through further accumulation must make saving easier. It is impossible to say on general grounds what would be the net effect of all the inevitable consequences of saving upon the rate of accumulation, or the rate of return. The notion of stationary equilibrium with a zero rate of return is a disputed point among theorists. It rests on the questionable assumption that accumulation could proceed without opening up new demand by occasioning invention and discovery, and in any case is reasonably supposable only as a vague limit at the end of an indefinitely long course of development. During this process any prediction of given conditions tends to become fanciful. The reasonable prediction is that over long periods changes tending to raise the rate of return will more or less predominate during some intervals, and changes of the opposite kind in other intervals. This has been true in the past, as far as we have tolerably reliable statistical records. Frank W. Taussig fittingly characterized the long-run trend of the interest rate as a race between accumulation and invention.

Irrational or "Institutional" Factors.—The behaviour both of savers and of entrepreneur investors is much influenced by social-psychological or "institutional" factors, and by whim and caprice, which resist analysis in terms of rational comparison between present and future enjoyment. Viewing society as a going—and an on-going—entity, the maintenance and accumulation of capital must depend on motives which look beyond the life of the individual. Even within the individual life, analysis which cannot be given here in detail makes it seriously doubtful whether the typical person in such a civilization as ours systematically prefers present to future enjoyments of like kind and amount, *i.e.*, would do so in the absence of opportunity to invest. Further, the attitude toward activity, adventure and risk seems to be a more important influence on saving than the comparison between enjoyment at different dates. If net saving is ever to cease and the supply of capital and the rate of return to become approximately stationary, it will doubtless occur through a balancing of risk and various "costs" against the expected return; and risk may operate on the whole as a stimulus or incentive to action rather than a deterrent or subjective cost. Even if men on the average were to save all that they could save, without an "impossible" reduction of their standard of living, and if other things were to remain equal, the consequence would be only a more or less rapid decline in the rate through diminishing return. The course of change would depend on potential investment opportunities, which, like social psychology, are a matter of prophecy rather than predictive knowledge.

Analysis of capital in terms of economically rational behaviour and theoretical equilibrium seems unrealistic, and its explanatory and predictive value are rather limited. In the making of investments, including the lending and borrowing of money—"representing" liquid capital—the consequences of ignorance, error, psychological and institutional factors, and innumerable "prejudices" appear in the enormous variation among actual rates of return. The "book yield" of a real investment may be anything from total loss almost immediately (or worse, since the result may be a "dead horse") to an increase at an "astronomical" annual percentage rate. One may think, for example, of such speculative ventures as prospecting for gold and inventing. Loans may also be made without interest, for accommodation (with varying prospect of loss) or at a rate as high as 25% or more per week. Under special conditions, short-term government obligations have been sold for more than their face value at maturity; and a substantial amount of saving is regularly done at a cost, in various ways.

Computation of Capital Values.—As already observed, where the market for any capital good is highly imperfect, or there is no market at all (as in the case of free human beings), the same data may be found, or estimated, and used to determine a value, or one supposedly more accurate than that of the market, as the case may be. There are clearly two approaches to the problem, which would yield the same result under "theoretical conditions," and are more or less closely related in reality. The true present value of any future income is found by discounting the calculated expectation as a perpetuity at the "correct" future rate of return. Allowance must be made for any foreseeable change in this rate itself, as well as in the value or purchasing power of money. All capitalization is inherently a matter of forecasting, not to say prophecy, rather than of calculation from current or past objective data. The other approach is historical, in terms of cost of production and depreciation. The second is familiar in business and accounting practice, yielding a "book value" of assets. Depreciation is usually computed by some more or less arbitrary rule, in order to give the value definite meaning. Where there is enough divergence between this result and the current replacement cost of a physically similar or an "equivalent" item and the latter can be definitely ascertained, the stated book value may be modified accordingly in either direction. But it is more usual in corporate statements to add an explanatory note covering this and other sources of error than it is to depart from established rules. In the extreme case, where some unforeseen change or miscalculation makes an asset certainly and permanently worthless, it is likely to be written off. The needs of accounting call primarily for objective definiteness and conservatism—and in fact the rules affecting depreciation and other reserves are largely defined by the income-tax administration. (*See* also DEPRECIATION.)

Computation of a capital value for a human being is much affected by the vagueness of all the factors—prospective life and earnings, historical cost, depreciation, and cost of replacement with allowance for risk. Production of human beings and their useful qualities is governed by a complex mixture of economic and non-economic considerations. With respect to free individuals, no clear or workable distinction can be made between maintenance cost and consumption as an ultimate end. The distinction is valid theoretically, and was stressed by the classical writers, notably J. S. Mill, but modern usage generally treats all the consumption of a labourer as an end. This difficulty is perhaps the strongest objective reason for ignoring the capital aspect of labourers and classifying them apart from (other) capital goods.

Cyclical and Monetary Phenomena.—The most important concrete causes of error in anticipation, and hence of divergence between expected and realized rates of return on real investment and on obligations (securities, notes, etc.) centre in the business or trade cycle. The great depression of the 1930s focused the attention of economists on these phenomena and produced a new literature on the theory of capital and interest, under the leadership of J. M. (later Lord) Keynes. A school of thought has arisen which proposes to reverse the previous attitude toward money. General economic theory had been based on the assumption that money is "neutral," *i.e.*, that its purchasing power is either unvarying or changes uniformly in all uses, so that money has no effect on relative prices. The central idea was formulated in J. B. Say's "law of markets" (*loi des débouchées*) which asserts that the demand for any good or service is the supply of other things offered in exchange. The intention was to counteract the older "mercantilist" confusion between money and wealth, and particularly to show that there cannot be a "general glut" as commonly believed by the public. (The Keynes position rehabilitates much of the mercantilist point of view.) The neglect of monetary and cycle theory in the main economic tradition (including Marshall) was, indeed, gradually being corrected by a separate literature beginning in the later 19th century. Much of this work was of questionable merit, but the subject also received increasing attention by conservative writers, especially in the popular college textbooks.

The new doctrine (his followers often go far beyond Keynes himself) involves a revolution in general economic theory as well as that of interest and money. It treats money as an independent entity in all supply and demand relations, regarding the value of money itself as determined by the disposition to hold idle cash ("liquidity preference") rather than by its use to purchase other things. Proceeding from the premise that cash could always be used for investment in some form, notably for the purchase of "securities," the theory makes the interest rate a payment for parting with money instead of holding it. The issue raised is the relation between the two general grounds of the desirability of money, its purchasing power over goods and services, and "hoarding"—more especially the motives for holding wealth, or assets, in the form of money rather than real things which yield an income in some form, or securities or other claims to money in the future. The theoretical problem may be viewed as that of defining the conditions under which certain assumptions are legitimate. The first is that changes in the value of money, assumed to reflect changes in the disposition to hoard, are immediately expressed through hoarding or dishoarding. Second, the prices of products are assumed to respond (fall or rise) while those that make up costs (particularly wages) do not. Hence (third) the result is a change in profit margins, followed by contraction or expansion of production (and employment), specifically the production of goods for inventory, and more durable forms of capital. The issues and the facts are too complex for discussion in the present connection. (*See* MONEY.)

Opponents will admit that "liquidity preference" is the main cause of the extremely high short-run interest rate (the bank rate) at the moment of a crisis and the abnormally low rates of deep depression. And it is not questioned that monetary expansion and contraction—whether in consequence of governmental policy or the activities of banks or the public—may bring about a substantial deviation, for a considerable period, in the apparent market loan rate and in general prices, or in the prices of securities or particular classes of goods, in contrast with others or with wages or other services, depending on the nature of the primary change. If any condition creates an anticipation of a rise or fall of general prices, uniformly for all goods and services, loan contracts over long periods (and the price of outstanding long-term securities) will naturally involve an allowance for the expected difference between the purchasing power of the money to be received in the future and that parted with in making the loan or purchase. This is a purely nominal matter, reflecting a change in the unit of measurement and not a difference in the real rate of yield of the loan. What is really most important is the effect of prospective price changes (general or in particular fields) on the disposition to make real investment, creating productive equipment. Rising prices must stimulate, and falling prices inhibit, investment; this is entirely apart from loan rates on money or even the occurrence of money lending in the society in question. As between boom and depression, loan rates seem to vary inversely with liquidity preference, not directly as the theory requires, and the price level for goods also varies with interest rates instead of inversely. It is also to be noted that where the classical equilibrium theory calls for opposite changes in investment and consumption, cyclical variations "swamp" this tendency, and the statistics show a positive correlation, though the production of capital goods fluctuates far more violently. In fact there is heavy net disinvestment in a severe depression such as that of the early 1930s in the U.S.A.

Money and Capital.—The question whether money should be treated as capital is one of the most difficult aspects of the general problem. It also involves the meaning and role of money, and the forces which determine its value. Money is clearly capital to the individual owner, though its value to him, on any theory (except the psychology of the miser) depends on its future purchasing power. Its value may bear nearly any relation to that of the money material (or metallic "reserve"), its cost of production or its utility in nonmonetary uses. In the case of a metallic currency, with free and unlimited coinage, these values are equal; but the bulk of a nation's medium of exchange, or even all of it, may consist of paper or bank credit of little cost or intrinsic worth. Money is also capital from the standpoint of the exchange economy as a whole, in the sense that it is one of the vital instrumentalities of organized economic life—virtually a necessity. But the amount of money, or of wealth in that form, that is "required," depends on the conventionally established timing of payments, as well as the price level and the volume of economic activity. Hence the amount of money which should be included in an estimate of the aggregate wealth of a society is a question which admits of no definite answer.

The Ethics of Interest-taking.—The scientific treatment of capital and its return (earlier referred to as profit, now usually as interest) has been much influenced—and confused—by ethical controversy over the "justice" of the receipt of interest by individuals. The early classical economics naturally raised the question of the right of the capitalist and landlord to their shares in the product, which gave rise to the doctrines of socialism and (later) of "single-tax."

As to interest on loans, the argument given above shows that ethical condemnation rests for the most part on fallacy. The loan at interest could always be replaced by an equivalent agreement of various other forms; its practical significance is a certain redistribution of risk, and the conditions of risk assumption are the only ethical problem which is properly involved—a serious one, to be sure. A general condemnation of interest would be valid only if extended to require the replacement of all sales by gifts. This may well be the intention in the one place in the New Testament (LUKE 6:34–35) where interest-taking seems to be explicitly condemned. The prohibition probably applied only between the religious brethren, as in the Old Testament; and rent and equivalent partnership arrangements might also have been condemned if these practices had been familiar—but not too familiar!—to the early Christian and mediaeval writers. Any custom which is thoroughly established, hoary with age, and accepted as an integral part of the established system of social order is unlikely to be questioned by religious moralists. What is condemned is a threatened innovation, and particularly one which seems to replace an ethic of personal and functional-status relationships with "impersonally rational" norms.

The argument also shows that the sharp distinction, common to popular and reformist thinking, between the ethical claims of property and personal services involves a similar fallacy. The possession of productive capacity in external things and in internal abilities stands in much the same position, particularly with respect to inheritance *versus* effort, foresight and initiative, which seem to be the basis of ethical rights in distribution, according to modern conceptions. Beyond these formal rights lies the moral duty of the strong (or fortunate) to relieve accidental distress and to assist the weak (or unfortunate) through private charity or political action. In such a country as Britain, or the U.S.A., personal capacity makes up from three-fifths to three-fourths of all individual earning power. The facts of institutional inheritance, which give individuals vastly different initial advantages in "capacity"—both for production and for appreciation—impose serious limitations on the social-ethical principle of freedom of contract, which modern thought has accepted rather uncritically. The over-emphasis may be more or less explained by reaction against the traditionalism and authoritarianism of the preceding historical epochs. The issue affects all types of economic rights and claims but the borrower-lender relationship is a "mechanical detail" of minor importance. (*See* INHERITANCE: ECONOMIC ASPECTS; LAWS RELATING TO REAL PROPERTY AND CONVEYANCING; SOCIALISM, SINGLE TAX.)

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(F. H. K.)

CAPITALISM. A society is called capitalist if it entrusts its economic process to the guidance of the private businessman. This may be said to imply, first, private ownership of nonpersonal means of production, such as land, mines, industrial plant and equipment; and, second, production for private account, *i.e.*, production by private initiative for private profit. But, third, the institution of bank credit is so essential to the functioning of the capitalist system that, though not strictly implied in the definition, it should be added to the two other criteria. Common parlance applies the adjective "capitalist" to almost all the phenomena of modern society, particularly when envisaged with reference to the socialist alternative. This article first presents an outline of historical developments (sections 1-4); then a summary of the economics and the sociology of capitalism (sections 5 and 6); followed by a brief survey of some of the principal topics usually discussed in connection with capitalism (sections 7 and 8); and by comments on the problem of the future of the capitalist order (section 9).

1. **Early Capitalism.**—Most of the features that define the capitalist order may be found in the ancient world, and particularly in its Graeco-Roman sector. There were factories producing for markets; there were bankers; and merchants that traded internationally. The upheavals and devastations that accompanied the fall of the western Roman empire never destroyed this capitalist trade and manufacture entirely. The warrior society and warrior civilization that rose from those ruins (feudalism) greatly differed, of course, from the businessman society and businessman civilization of the 19th century. But the former also contained elements of, and partly subsisted on, economic activities that differed from those of capitalist times only in technique and importance. Surveying the course of economic history, we find no sharp break anywhere, but only slow and continuous transformation. Need for protection largely accounts for the growth of fortified towns and for the concentration in them of industrial production and trade. The craft guilds—corporations of the arts and trades—that had no facilities for trade at a distance, found their complement in the early trading companies—also primarily the

products of the need for protection—and both developed together. The individual of supernormal energy who was irked by the strict regulations of the craft guilds moved out of the towns controlled by them, and either set up a workshop in his home where, with the assistance of apprentices and journeymen he was able to produce with more freedom and on a somewhat larger scale, or confined himself to furnishing raw materials to such "masters" and specialized in the commercial and financial task (domestic industry).

Interlocal and international trade was, however, by far the most important line of early capitalist endeavour. It was often associated with the business of providing for the financial needs of spiritual and temporal princes—*the* earliest form of international finance—and with the exploitation of the privileges or "concessions"—exclusive rights to mine, to trade, or to produce—that were sometimes granted in return. Fighting its way through the resisting framework of feudal society, this process of economic change slowly evolved greater freedom of property and lending and also the institutions of typically capitalist hue, such as the joint-stock company, the salable share, the bank and the bank deposit, the negotiable paper the stock exchange. All these institutions and practices, including speculation, were well developed, at least in a number of business centres, by the middle of the 16th century, but none of them were then entirely new. Moreover, the public mind then reacted to the phenomena of capitalism in much the same way as it does in our time. it cried out against usury, speculation, commercial and industrial monopolies, cornering of commodities and other abuses, and the arguments used were, both in their common-sense content and in their one-sidedness, neither much worse nor much better than are the popular arguments of the 20th century. Governments reacted in sympathy. They dealt with the practical problems that presented themselves by means of regulations, the technical and administrative shortcomings of which must not be allowed to obliterate a fundamental similarity of intention with those of more recent times. This applies also to the extensive labour legislation of that epoch such as the Elizabethan Statute of Apprentices and Poor Law (*q.v.*) which, on the one hand, continued an old tradition and, on the other hand, embodied ideas so "modern" as index wages and arbitration.

Some economists, among whom it must suffice to mention Max Weber (*q.v.*), have felt the need of explaining the rise of capitalism by means of a special theory. But the problem such theories have been framed to solve is wholly imaginary and owes its existence to the habit of painting unrealistic pictures of a purely feudal and a purely capitalist society, which then raises the question what it was that *turned the tradition-bound individual* of the one into the alert profit hunter of the other. According to Weber, it was the religious revolution that, changing humanity's attitude toward life produced a new spirit congenial to capitalist activity. We cannot go into the historical objections that may be raised against this theory. It is more important that the reader should realize that there is no problem. Nothing but proper attention to the details of the social and economic structure of the middle ages and of the economic history from the 8th to the 16th century is necessary in order to understand that transformation. Far from being stationary or tradition-bound or hostile to economic activity, the mediaeval world offered plenty of opportunity for rudimentary entrepreneurial venture. Success and failure taught their lessons. And each lesson produced an increment of capitalist practice and capitalist spirit alike. Thus, merely by functioning, the world of Charlemagne developed into the world of Luther and Calvin, of the Chigis (*see* CHIGI-ALBANI) and Fuggers (*q.v.*), of Charles V and Elizabeth. It still remains necessary, of course, to take into account all the particular events and circumstances that accelerated, retarded and shaped the process

2. **Mercantilist Capitalism.**—Of particular interest are those events and circumstances which are extraneous to the logic of the capitalist process and must, from the standpoint of the latter, be considered as accidental. Such an accident was, for instance, the inflow of American silver and gold that superimposed silver and gold inflation on pre-existing inflationary tendencies and accelerated capitalist developments in one very obvious way and retarded them in another less obvious way. Much more important, however, was the circumstance, purely fortuitous though it was, that these capitalist developments impinged upon a social structure of extraordinary vitality whose ruling stratum, the feudal aristocracy headed by the families of sovereign positions, was able to harness the new wealth into the service of its own interests, traditions and political goals. This symbiosis of two different social worlds was the dominant factor in European history from the 16th to the end of the 18th century and an important factor even during the 19th. In particular, it accounts for the well-known economic policies of the so-called age of mercantilism (*see* MERCANTILE SYSTEM) which, roughly speaking, lasted until the end of the 18th century

We behold the struggle of the rising national states. They all fostered domestic industry and supported it in its conquest of foreign markets; they mostly—though not so generally as has been often asserted—sided with employers against the workmen; those of them that were in a position to do so embarked upon careers of rival colonial enterprise and vied with one another in trying to secure the biggest possible share in the slave trade; and all this was geared to the one pivotal purpose of asserting and expanding national power by military force. These traits were indeed blurred and mitigated by many other issues, but on the whole the picture may be summed up in the phrase "doing business sword in hand." The finishing touch is supplied by our impression though it is not uniformly borne out by such fragments of statistical information as we possess, that, while the wealth of the business class fairly rapidly increased, at least in western Europe, extreme poverty was widespread among the masses.

This pattern lends itself to the interpretation that has in fact been put upon it, viz., that the rising business class or, to use the Marxist term, the *bourgeoisie*, acting on the spur of its economic interest, was the propelling force behind mercantilist policy and, in particular, mercantilist aggressiveness. But the presence, in a position of supremacy, of a nonbourgeois stratum suggests another interpretation; the wars were often, and the incident taxation was always, contrary to the bourgeoisie's interest; the mercantilist state regulated industry and trade with a heavy hand; the rule of a growing bureaucracy was not congenial to the businessman's mind. The bourgeoisie indeed accepted that supremacy. It no doubt endeavoured to use to the full the profit possibilities offered by mercantilist policy and itself acquired in doing so something of the prevailing spirit of aggression. But its role is perhaps more truly described as that of a servant than as that of a master. The importance of this question of interpretation is obvious: it makes all the difference in our view of the capitalist process whether we attribute observed tendencies toward economic nationalism and political aggression to its very nature or to a distortion of this nature by extra-capitalist factors. The history of the subsequent epoch when the business class really enjoyed ascendancy supports the latter view.

3. **Intact Capitalism.**—Accelerated change in technology and organization that revolutionized first agriculture and then industry (*see* THE INDUSTRIAL REVOLUTION; last quarter of the 18th, first quarter of the 19th centuries) produced a significantly different social pattern which may be termed Intact Capitalism and prevailed substantially from the Napoleonic wars to the end of the 19th century. The familiar features of its political complement, liberalism, were laissez-faire (*q.v.*), in particular free trade (*q.v.*), and "sound money" (meaning unrestricted gold currency), or at least tendencies toward these goals; a pacific, though far from pacifist, attitude toward foreign nations and, though with many relapses, toward colonies; unprecedented respect for personal freedom not only in economic but in all matters; increasing "democratization," meaning extension of the suffrage and the secret ballot. For a time, the state and its bureaucracy were in full retreat. But nothing is more characteristic of the spirit of that age than its fiscal policy of which William E. Gladstone (*q.v.*) was the most representative as well as the most brilliant exponent. The principle of leaving individuals to themselves and of trusting their free interaction to produce socially desirable results cannot be better expressed than it was by the three rules which sum up that

policy: that public expenditure should be limited to the minimum required for the essential services ("retrenchment"); that budgets should not only balance but display a surplus to be applied to the reduction of the national debt; and that taxation should serve no other purpose than that of raising the necessary revenue, and exert as little effect as possible on the distribution of income and on the channels of trade, from which it followed that it must be light. The income tax was an essential part of this program; but it was not less essential that it should be so low as to constitute a minor item in the taxpayer's total expenditure. We cannot enter into the question whether the social legislation of the period—protection to women and children, hours acts, factory acts, social insurance, the recognition of trade unions and of collective bargaining, etc.—was in accord with these policies or spelled deviation from them. We merely note that it was not absent.

This system, though well-defined and logically coherent, must of course be understood as a system of tendencies only. The heritage of the past and other obstructions prevented the full realization of its principles except in relatively few cases, of which English free trade is the most important instance. The adverse judgment passed upon these principles by conservative and socialist critics alike must be considered in the light of this fact and, let us add at once, in the light of the further fact that the economic history of that epoch, owing to its brevity, is unduly loaded with records of its childhood diseases, most of which were rapidly passing within its span. Such as they were, however, both tendencies and realizations bear the unmistakable stamp of the businessman's interests and still more of the businessman's type of mind. Moreover, it was not only policy, but the philosophy of national and individual life, the scheme of cultural values, that bore that stamp. Its materialistic utilitarianism (*q.v.*), its naïve confidence in progress of a certain type, its actual achievements in the fields of pure and applied science, the temper of its artistic creations, may all be traced to the spirit of rationalism that emanates from the businessman's office. For much of the time and in many countries the bourgeoisie did not rule politically. But even noncapitalist rulers espoused its interests and adopted its views. They were what they had not been before, its agents.

More definitely than in any other historical case these developments can be explained by purely economic causes. It was the success of capitalist enterprise that raised the bourgeoisie to its position of temporary ascendancy. Economic success produced political power, political power produced policies congenial to the capitalist process, and the latter in turn responded to these policies by further success. Thus the English bourgeoisie obtained free trade, and free trade in turn was a major factor in a spell of unprecedented economic expansion. The same example serves to show that the bourgeoisie was not the only or even the principal beneficiary of these developments. The much-derided "free breakfast table," more accurately, the untaxed exchange of industrial products for the raw materials and foodstuffs of newly opened countries, meant more for labour than did many spectacular reforms of later times. And labour was quite aware of the fact: though many individuals and minority groups challenged the capitalist system, the large majority of the manual workers of all countries accepted it, and was content to improve its position within it, throughout the period. For the rest, it was the age of steam and steel, of another industrial and agrarian revolution that, following upon the preceding one, once more transformed the economic world and subsided into a period of readjustment, 1873–97, that is, misleadingly, known as the Great Depression. There is a note of admiration for the performance of the system even in Karl Marx's and Friedrich Engels' (*qq.v.*) *Communist Manifesto*. Looking back, however, we should be less impressed by the actual performance of that epoch than by the performance it rendered possible for the future.

4. **The Modern Phase (1898 and Later).**—Upon the Great Depression followed a period of intense prosperity, interspersed with short depressions, that was associated with the new electrical, chemical, automotive and rubber industries. It lasted until about 1913 and, indeed, amounted to yet another industrial revolution. Like the two preceding ones, this period issued into a period of predominantly depressive character interspersed with spells of prosperity, the longest and most intense of which occurred in the United States, 1923–29. In order to exclude at least those disturbances that were directly due to actual warfare, this period should be dated 1919–39. So far there was, except the *absolute* values of statistical figures, nothing new or unprecedented in the sequence of events. On the whole, the behaviour of industrial output, price levels, interest rates, profits, monetary and real wage rates, income and employment repeated the pattern made familiar by previous experience, and peculiar features are amply accounted for by war effects. It is important to note that, contrary to a widespread impression, this also applies to the world crisis, 1929–32: like every crisis, it was, of course, an historical individual, but its general features did not differ substantially from those of the comparable instances, 1826–30 and 1873–78.

Nevertheless, it is undeniable that this epoch witnessed a complete reversal of the public attitude toward capitalism and of almost all the tendencies of the liberal epoch. The best method of showing this is to visualize the expectations that an observer might have formed in 1870 and to contrast them with what actually happened. He might have expected steady progress toward universal free trade; more and more peaceful foreign relations; reduction of armaments; decreasing tax burdens; removal of such obstacles to free enterprise as still remained; internationally unrestricted gold currencies; gradual development of security and other labour legislation within the increasing means provided by growing wealth. Instead, we find revival of protectionism from the first; growing antagonism between nations; expansion of armaments; rising public expenditure and taxes; increasing regulation of economic activity; increasing strain in the system of international gold monometallism that eventually resulted in its abandonment in favour of strictly managed national currencies security and other labour legislations that did indeed develop according to expectation until 1914, but displayed a new spirit and acquired a new significance in Germany during the 1920s and in the United States during the 1930s. Again all this may be linked with corresponding changes in social structure, philosophies of life, schemes of values. The fundamental explanation, however, is much more complex and difficult than is generally realized, and cannot be attempted here. Instead, we shall briefly notice two important doctrines concerning the change that has come upon, or is supposed to have come upon, the economic process itself, the doctrine of the maturity of capitalism and the doctrine of imperialism.

The first, which may also be called the doctrine of vanishing investment opportunity, is not intended to explain the economic and political pattern of modern capitalist society as a whole. It limits itself to the propositions: (1) that the capitalist system has reached maturity in the sense of having substantially exhausted its possibilities of growth, particularly its opportunities for new investments on a large scale, both for technological reasons and because of the decreasing rate of increase of population; (2) that the whole scheme of capitalist society, particularly its saving habits, being geared to the task of exploiting such opportunities, the permanent depression of anaemia will result from their gradual disappearance; (3) that in this state of maturity or stagnation, the capitalist process can be kept going only by incessant injections of purchasing power by means of government deficit spending. This theory, mainly framed to account for the unsatisfactory conditions that prevailed in the United States (and in France) during the 1930s, is unsupported by any facts prior to 1932. Its wide appeal is, however, understandable: the public and the economic profession are equally apt to be more impressed by the real or supposed peculiarities of their own problems and troubles than by any analogies with conditions half a century ago.

The second doctrine is the orthodox socialist theory, according to which "imperialism" is the last phase of capitalism. It has been developed, on a Marxist basis, by O. Bauer, R. Hilferding, V. I. U. Lenin, L. D. Trotsky, F. Sternberg and others. Competition among capitalist firms tends to eliminate all of them except a small number of giant concerns; these find themselves unable to use the productive capacity they have built up owing to the falling, or inadequately increasing, purchasing power of the masses; they are therefore driven to invading foreign markets and to excluding foreign products from their own markets; this state of things produces aggressive colonial and foreign policies and "imperialist" wars, which the proletariat then turns into the civil war of socialist revolution. This doctrine, even if stripped of its most obviously ideological elements, is open to serious objections. Three points, however, must be recorded in its favour: first, it does attempt what no other theory has attempted, viz., to subject the whole of the economic, political and cultural pattern of the epoch that began in 1898 to comprehensive analysis by means of a clear-cut analytic schema; second, on the surface at least it is strikingly verified by some of the outstanding features of this pattern and some of the greatest events of this epoch; third, whatever may be wrong with its facts and interpretations, it certainly starts from a fact that is beyond challenge, the tendency toward industrial combination (*see* Combination in Industry) and the emergence of largest-scale concerns. Though both cartels (*q.v.*) and trusts (*q.v.*) antedate the epoch, the role of what is popularly called big business has so much increased in its course as to constitute one of its outstanding economic characteristics.

5. **The Economics of Capitalism.**—It must be borne in mind that capitalism cannot, any more than any other form of organization, be judged by economic results alone. Account must also be taken of the social and cultural achievements for which the capitalist process provided both the means and the psychological prerequisites. Moreover, as has been pointed out, any final appraisal really involves appraising an attitude toward life, a scheme of life's values, in short, a civilization. It is this fact which precludes agreement even among those who agree about the economic facts and their interpretation.

Not even the purely economic results of the capitalist process, however, are capable of exact measurement, still less of measurement by a single figure. The nearest approaches to such a figure, the various indices of total, agrarian and industrial output that are available for the leading countries, over varying periods and in varying degrees of perfection, tend to understate actual performance by giving too little weight to new industries, taking insufficient or even no account of improving quality, and are inadequate also for other reasons. However, the often-repeated estimate of a 3% average annual rate of increase of total output, 1850–1910, may serve to give at least a vague idea. For the output of the U.S. *manufacturing* industries alone, a careful investigation (*see* Fabricant, *Output of Manufacturing Industry*, National Bureau of Economic Research, 1940) yielded, for 1899–1937, in spite of the world crisis and its aftermath, an increase of 276% (3.5% in the annual average) which, after various corrections, corresponds roughly to a *per capita* increase of 100% in all finished processed goods produced by factories. While appraisal of such figures is not a simple matter, it is safe to assert that a repetition of this performance would eliminate anything that could reasonably be called poverty, *even if no part of capitalist incomes were, by means of taxation, diverted to purposes directly benefiting labour.* This conclusion presupposes, of course, that the relative share of labour in national incomes remains constant. But so far back as our statistical information carries us, this relative share, though fluctuating with cyclical phases, has in fact, contrary to Marxist prediction, displayed remarkable stability. On the absolute share and the course of real wages, *see* Wages.

Few observers are in fact inclined to find fault with capitalism considered as an engine of production. Criticism usually proceeds either from moral or cultural disapproval of certain features of the capitalist system (*see* below, section 7), or from the short-run vicissitudes with which long-run improvement is interspersed (*see* below, section 8). At the moment, however, we are concerned with the problem of how far the economic achievements of the capitalist *epoch* should be attributed to the capitalist *system.* For instance, it is often argued that observed developments were the fruits, *not* of capitalist enterprise *but* of the technological progress. It is true that the historical increase in output of commodities and services is not only or even primarily due to the increase of capital or of the working population, still less to increased skill or effort of the individual operative, but principally to improvements in technology and organization. But these are not independent of the capitalist system that, on the contrary, tends to call them forth by concentrating human energy upon economic tasks, by creating the rational attitude favourable to technological development, and by setting high prizes upon success in this field. For the rest, owing to the impossibility of experimental variation of conditions, we must look to economic theory in order to derive such answer as we can to the question whether observed results may reasonably be ascribed to the capitalist system.

The first thing to be noticed about the capitalist process is its evolutionary character. Stationary socialism would still be socialism, but stationary capitalism is impossible, is, in fact, a contradiction in terms. For the central figure on the capitalist stage, the entrepreneur (*q.v.*), is concerned not with the *administration* of existing industrial plant and equipment but with the incessant *creation* of new plant and equipment, embodying new technologies that revolutionize existing industrial structures. This is the source of his profits (*see* Profit), so far as they exceed interest on owned capital and the remuneration of routine management and salesmanship, as well as the typical source of private capitalist fortunes. The other sources, ownership of appreciating natural resources, especially urban land, speculation financial piracy, and saving from current income are of but secondary importance. The financing of this activity is the essential function of bank credit, which removes from the path of the industrial innovator the requirement of ownership of capital. All the typical phenomena of capitalism, all its achievements, problems and vicissitudes, including the trade cycle (*q.v.*), derive from this process. Nevertheless traditional theory is primarily a theory of the current management of resources. The points most relevant to our subject may be summed up as follows:

If in all markets of products and services sellers and buyers be so numerous that none of them is able to influence price perceptibly by his own individual action (hypothesis of perfect competition. [*See* Competition in Industry]) then it can be proved that there will be a tendency toward a determined state of the economic organism, the so-called equilibrium state, in which: (1) all firms will expand their production to the point at which the current price just covers the cost of producing an additional increment of product; (2) all resources including labour are fully employed; and (3) a competitive rate of interest and a competitive rate of earnings of management being counted as costs, all profits above costs vanish. These propositions do not establish, as many 19th-century economists believed, that competitive capitalism tends to produce ideal results. But they do serve to dispel certain gross errors, such as that an economic process which is not consciously planned by a central agency must necessarily be chaotic; or that action guided by the profit motive must, because of this fact alone, be less efficient in satisfying consumers' wants than would be action by an agency guided by their interest alone. The fact that a perfectly competitive capitalist system would tend, in the sense defined by proposition (1), to maximize total output, together with certain corollaries concerning distribution, has induced the best theorists among modern socialists not only to drop the Marxist objections but also to frame their own plan for the socialist form of society upon this model and to base their criticism of capitalism, so far as it is not directed against the effects of private thrift (*see* below, section 8), upon the deviations of capitalist practice from perfect competition. It is indeed obvious that none of those three propositions applies to monopoly (*q.v.*) or even to monopolistic competition, *i.e.*, to cases where firms are in a position to fix their prices at will within a certain range instead of being constrained to accept a current market price. In these cases which are, of course, much more frequent than are cases of perfect competition, outputs are not maximized, excess capacity (*see* below, section 8) and surplus profits appear even in equilibrium, and existing industrial positions are exploited and protected by quasi-monopolistic practices.

Criticism on these scores derives support from the public's impulsive aversion to anything to which the label monopoly can be affixed and has, mainly for this reason, met with considerable political success. But it has no general validity, as distinguished from validity in individual instances. The proposition that monopolists will sell smaller quantities of product at higher prices than will firms in conditions of perfect competition is true only under the proviso that other things—cost structures in particular—be strictly equal, and therefore has but little practical importance. Almost without exception, largest-scale concerns do alter the cost structure of their industry, by introducing new methods of production and in other ways that are beyond the reach of numerous competing concerns of medium size. Therefore it does not follow that their outputs are actually smaller and their prices actually higher than would be the outputs and prices with the methods within the reach of perfectly competitive business. In fact, the behaviour of indices of manufacturing output in the era of mergers and big concerns lends some support to the opposite view. Also it is clear that the potentialities of mass production can be fully realized only by concerns that are beyond the size compatible with perfect competition. Finally, the wages paid in the largest concerns are, more often than not, higher than the wages paid elsewhere for comparable work.

6. **The Class Structure of Capitalist Society.**—The classes of traditional economic theory, such as landowners, capitalists, workmen, are functional categories, not living and acting sociological entities. Classes in the latter sense, and the corresponding concepts of class consciousness, class action, class war, were introduced by Karl Marx. Choosing ownership of means of production for sole criterion, he recognized two classes only, capitalists and proletarians. But this scheme, though it served his purpose and though it had the further advantage of linking up with the popular distinction between haves and have-nots, rich and poor, is next to valueless for purposes of analysis. On the *one* hand, even if we disregard the presence of noncapitalist strata—the "symbiosis" emphasized above—and confine ourselves to the classes created by the capitalist process, it still spells distortion and not simplification to reduce them to two. In order to understand the economics and politics of the capitalist epoch, it is essential to see the co-operative and antagonistic interactions of, at least, the classes associated with the control of large, medium and small business; the farmers who differ so significantly from the other business classes that there is no point in including them with one of these; the *rentier* class ("capitalists" in a narrower but more useful sense); the professional class; the clerical ("white collar") class; the skilled workers; the unskilled workers. On the other hand, it is equally essential to realize that these classes, and still more such classes as rich and poor, by virtue of their very nature, do not admit of clearly defined border *lines*, but shade off into each other across broad border *zones*.

Class distinctions are perhaps inevitable in any social group of any size and complexity. They have already developed in soviet Russia. They produce, and are in turn buttressed by, what is usually referred to as "connection." But in capitalist society they are further buttressed by the presence or absence of inherited wealth and therefore present, to the casual observer, a misleading impression of stability: because there are always industrialists, bankers, farmers, labourers, etc., and because the corresponding economic and social positions are as a rule passed on from father to son, we are apt to think of these classes as if they consisted of a self-perpetuating set of families and as if rise into a "higher" class, and fall from it into a "lower," were exceptional occurrences. This opinion, though implied in widely accepted social ideologies, is the exact opposite of the truth. It is one of the outstanding characteristics of the social structure of capitalism that its "higher" strata incessantly lose members to, and incessantly recruit themselves from, its "lower" strata and that this incessant rise and fall in general proceeds relatively quickly: the slogan "three generations from overalls to overalls" expresses a great deal of truth.

While this is rarely denied explicitly, no agreement seems possible on another question that is not less important for our general picture of capitalism, viz., whether the kind of business success that spells ascent in capitalist society is causally related to the presence of personal qualities that the observer believes to be socially desirable or undesirable or, to put it differently, whether social ascent and descent through success or failure in business spells positive or negative social selection. Partisans of the capitalist system almost invariably attribute success in business, in the broad average, to superior moral stamina and ability, opponents not less regularly to either "luck" or absence of moral inhibitions. Although industrial and family history, as well as other sources, afford sufficient material for arriving at an answer, the question has not received from serious scholars all the attention it deserves. In the special case—which is not unimportant quantitatively—where ascent through successful enterprise starts from a working class environment, it is safe to assert that supernormal will power and intelligence constitute the most important of all ascertainable causal factors. Other cases, while frequently suggesting a similar inference, present greater difficulties of interpretation. Unrealistic ideas about the size and nature of what is commonly called the "leisure class" are another obstacle to arriving at a lifelike picture of capitalist society as it really is.

7. **Exploitation and Inequality.**—As we have seen above (section 5), to evaluate capitalism is to evaluate a civilization in all its aspects. The complexity of such a task is, however, not the only reason why agreement is not to be expected. Another is that moral and cultural *judgments* presuppose moral and cultural *standards* that are matters of individual preference and beyond the range of scientific proof or disproof. All that can be done about them from a scientific standpoint is (1) to establish the truth or falsity of such statements of fact as may enter into those judgments, and (2) to point out the economic and cultural consequences to be expected from giving effect to them. The two topics of this section illustrate this truth.

In itself, *the statement that capitalism* involves *exploitation* of man by man conveys nothing except ethical disapproval. Recognizing this, Marx tried to give it more definite content by means of his theory of exploitation: starting from the propositions that economic values of commodities tend to be proportional to the number of hours of labour that enter into their production (labour-theory of value, derived from David Ricardo [*q.v.*]) and that in capitalist society labour is a commodity, he went on to argue that the workmen will receive wages equal to the value of their labour, which is proportional to the number of hours of labour that enter into the production of their labour force (or of the commodities and services required in order to rear, train, feed, clothe, house . . . the workmen) and, further, that the product of their work will similarly sell at its value, which is proportional to the number of hours the workmen are constrained to work. Since workmen can work more hours than it takes to produce their labour force, there is a positive difference between the value of products and the value of the labour force, the surplus value, which goes to the capitalist employer. This is what constitutes exploitation. The argument is open to fatal objections and is no longer upheld by any economists except the Marxists of strictest observance. The other attempt at giving meaning to the term has been made by a group of English theorists. Whereas Marx's theory also applies to the case of perfect competition, there is, according to these theorists, no exploitation in this case, and whereas Marx's theory applies only to labour, any factor of production may suffer exploitation. This will happen whenever owing to deviations of practice from the competitive model, the share of a factor falls short of what it would receive if perfect competition prevailed. It should be observed that, even if it were possible to agree on what constitutes exploitation, this would not necessarily determine the judgment to be pronounced. For exploitation, even if admitted, might still be the means of providing for economic or cultural needs that we may not be prepared to sacrifice.

The general problem of social inequality cannot be considered in this article. We must confine ourselves to a single type of inequality, the inequality of income (for illustrative figures, *see* WEALTH AND INCOME, DISTRIBUTION OF). In capitalist society this inequality is due to the facts (1) that incomes are the result of pricing processes and reflect the market values of products and productive services (this, as is easy to see, also has an important *equalizing* effect), and (2) that, once acquired, wealth may be transmitted by inheritance. The first fact is essential in the sense that a society from which it were completely eliminated could no longer be called capitalist; the second is not inherent in the logic of the capitalist plan, but so deeply rooted in the structure of capitalist society as to be practically inseparable from it. Again, it should be borne in mind that, in itself, disapproval of this inequality from the standpoint of equalitarian ideals expresses nothing beyond the critic's personal feelings of fitness or justice. These differ widely The critic may disapprove, on religious or other grounds, of any inequality whatever; or he may reserve disapproval for particular kinds or aspects of inequality, such as "inequality of opportunity," inequalities of income due to inheritance, all inequalities not due to inequality of effort, etc. Errors of fact or reasoning may, however, enter into statements of particular reasons for ethical disapproval. One of the most common ones is the belief that the majority of people is poor *because* a minority is rich.

Appraisal of the purely economic effects of inequality depends mainly, though by no means wholly, upon our views (1) on the relation of inequality to economic motives, and (2) on private thrift. Looking back into the past, we can hardly fail to perceive the prime importance of the stimulating atmosphere of inequality. The lure of big prizes coupled with the threat of complete destitution no doubt produced a scheme of motivation of perhaps unique effectiveness. The importance of inequality *within* the highest income brackets should be particularly noticed. A single spectacular success may draw far more brains and means into industry than would be attracted to it by the same sum if more equally divided To this extent current views about unnecessarily or even absurdly high rewards and about the total cost to society of entrepreneurial performance should be modified. Under modern circumstances this argument has however lost some of its importance, and there is room for difference of opinion on the question what weight should be attached to it for the future. But in any case it should not be forgotten that, whatever its weight, this argument also covers the case of inequality through inheritance: the privileged position of the entrepreneur's family may be more important as a motive than any desire for personal position or enjoyment.

So long as economists were practically unanimous in considering thrift or saving as the principal requisite for the expansion of the physical apparatus of industry (capital formation), or even for all economic progress, the most important, and indeed a decisive, economic argument for inequality was that the bulk of saving is done by the higher incomes and that equalization by share-the wealth policies would hence paralyze the very process that operates to raise the standard of life of the masses. But that practical unanimity does no longer exist. The classical theory of the role of saving, much too absolutely stated by its sponsors, was bound to lose ground as it had repeatedly done before, in times of prevalent unemployment. During the 1930s an increasing number of economists adopted the opposite view, viz., that saving, withholding income elements from being expended on consumers' goods, has a depressing effect on the economic process and thus impedes, instead of fosters, the expansion of plant and equipment. It ought to have been admitted from the first that the persistence of saving habits during a depression may make things worse than they otherwise would be. Larger claims on behalf of the newer theory are of doubtful validity. The support it lends to prevalent political attitudes toward capitalism should, however, be noticed.

8. Unemployment and Waste.—Planning by a central agency, whatever else it may or may not be able to accomplish, can certainly be expected to mitigate the trade cycle. Therefore, so far as involuntary unemployment (*q.v.*) is an inevitable concomitant of cyclical depressions, it may with justice be placed to the debit of capitalism's account. This also covers technological unemployment, irrespective of whether or not we include it with cyclical unemployment, on the ground that the investment characteristic of prosperity in part finances labour-saving technologies; in either case, a central agency is in a position to plan technological advance in such a way as to minimize the unfavourable effects it may have on employment. However, in order to see this fact in the proper perspective, it must be borne in mind that in many important instances the introduction of new technologies has directly increased employment opportunities; that where it did not, the resulting unemployment has been but temporary, though often severe; and that, so far as we know, the unemployment *percentage* had not, until 1929, displayed any tendency to increase over time, that is to say, that the capitalist process has always absorbed, *at increasing real wage rates*, not only the unemployment it generated but also the increase in population. Interpretation of the persistent unemployment, 1933–39, that was particularly severe in the United States and France, is the subject of a controversy ("reform *vs.* recovery") greatly influenced by political preferences. No scientifically reliable conclusions can in any case be based on the experience of seven years.

The above argument in favour of a centrally planned economy may be extended, with varying degrees of confidence, to other types of involuntary unemployment as well as to the numerous cases that may be called voluntary or involuntary with equal justice. An example will illustrate the most conspicuous of these. If a trade union succeeds in keeping wage rates abnormally high within its jurisdiction, this will cause unemployment among its members but may nevertheless draw newcomers to its waiting list who will also be unemployed. Both members and newcomers are involuntarily unemployed from the standpoint of the individual workmen, but their unemployment is caused by the voluntary policy of their directing agency. It may be argued that such unemployment would possibly be nonexistent in a perfectly planned society. These cases, however, serve to bring out an aspect of planning which is more or less present in all. In part, unemployment is the price workmen and their organizations pay for the freedom they enjoy in capitalist society. In order to be fully effective in eliminating the one, the planning authority would have also to eliminate the other and to adopt the principle enunciated by Trotsky: who does not obey, *i.e.*, undertake the work assigned to him at the wages fixed by the authority, shall not eat.

In the past, criticism of unemployment primarily emphasized the sufferings of the unemployed. For the future this aspect has lost much of its importance, because the capitalist process may be expected to produce adequate means for supporting them. But there still remains the loss to society of the potential products of their services and also of the services of other factors of production that may be unemployed or underemployed along with labour. This loss, largely attributable to the trade cycle, is indeed the most important element in the indictment of capitalism on the score of waste ("poverty in [potential] plenty"). But there are others. Thus, excess capacity is not entirely avoidable in any form of economic organization, but certain types of it are peculiar to monopolistic competition (*see* above, section 5); even perfect competition does not exclude wasteful multiplication of service; much of the energy of some of a nation's best brains is absorbed by struggles—between concerns and against regulating bureaucracies—that do not serve, or serve only remotely, productive efficiency; in important instances natural resources have been used uneconomically and without regard to the more remote future. Facts may be adduced in support of all these and other headings. The obvious inference, however, should not be drawn without due attention to the following points: (1) against some of those types of waste must be set compensating advantages; for instance, multiplication of service may be the best guarantee of excellence of service; excess or reserve capacity may have its uses in national emergencies; (2) some of the wastes observed are not due to the logic of the capitalist process but to the prevailing hostility to it, which produces protective behaviour often harmful to efficiency; (3) *all* those sources of waste must be viewed in connection with the evolutionary character of capitalism; much that appears as unrelieved waste if considered as an incident of a stationary economy, ceases to do so when viewed as an incident of a rapidly progressive one; (4) no machine being 100% efficient, appraisals of efficiency are essentially relative to the quality of available substitutes; it is a serious as well as common mistake to overlook the sources of waste that may be inherent in alternative arrangements and, in particular, to compare the *reality* of capitalism with an *ideal* picture of bureaucratic socialism.

9. **The Future of Capitalism.**—This problem, naturally first raised by socialist writers, Karl Marx in particular and, partly under Marxist influence, by the economists of the German historical school, has become a standard topic of popular discussion. This fact greatly increases the difficulty of stating it with precision and of distinguishing the various issues involved. The following comments may, however, assist the reader in forming his opinion.

(a) In most writings on the subject, there is an obvious association between prognosis and preference; there cannot be any doubt but that, in this as in other matters, people are apt to foresee what they desire. This tends not only to vitiate argument and presentation of facts but also to confuse two issues that should be carefully kept distinct. It is one thing to believe that the survival of capitalist institutions is desirable or undesirable; and quite another thing to believe that they will or will not survive. The first is a matter of personal preference; only the second constitutes a problem that may be attacked by scientific methods.

(b) Karl Marx was the first to realize the importance of this distinction and to formulate correctly the fundamental scientific question involved, viz., whether or not there are observable tendencies, inherent in the capitalist process as we know it, which, if allowed to work themselves out fully, will destroy the capitalist and produce the socialist system. Scientific prognosis—medical or other—can never mean more than the assertion or denial of the presence of such tendencies, and it is in this sense only, not in the sense of a prophecy, that the term "inevitable" must be understood. In Marx's affirmative answer to that question, it is necessary to separate the arguments, drawn from his analysis of the capitalist process, by which he supported his answer and the answer itself. *All* his arguments, but in particular the one that asserts that labour will be goaded into revolution by steadily increasing misery, can be proved to be untenable. But this does not dispose of the answer itself, because it is possible to arrive at a correct result by faulty methods. The case for the affirmative answer is in fact strong. We observe that, as the capitalist epoch wears on, the individual leadership of the entrepreneur tends to lose in importance and to be increasingly replaced by the mechanized teamwork of specialized employees within large corporations; that the institutions and traditions that sheltered the structure of capitalism tend to wear away; that the capitalist process by its very success tends to raise the economic and political position of groups that are hostile to it; and that the capitalist stratum itself, mainly owing to the decay of the bonds of family life that in turn may be traced to the "rationalizing" influence of the capitalist process, tends to lose some of the grip and part of the scheme of motivation which it formerly had. Other arguments, such as the one from exhaustion of the objective possibilities of private enterprise (*see* above, section 4), may be unconvincing. But the ones just glanced at are quite sufficient. It should be noticed, however, that they establish no more than the presence of a tendency toward the shifting of economic activity from the private to the public sphere, or, as we may also put it, toward increasing *bureaucratization* of economic life, coupled with an increasing dominance of the labour interest. So far as the tendency in question is concerned, transitional states might be in prospect which, while greatly differing from the economic and cultural pattern of intact capitalism, would yet fail to attain full-fledged socialism for an indefinite time. In fact, they might equally well be called the one or the other, according to the requirements of political warfare. The only reason why Marx used to stress sudden transition by revolution was that, as was natural in his time, he greatly overrated the bourgeoisie's power and will to resist gradual changes that are contrary to its interest or uncongenial to its scheme of life.

(c) We have had occasion, however (*see* above, section 2), to emphasize the importance, for the interpretation of social processes, of circumstances that are extraneous to what may be termed the inherent logic of an economic system. Applying this principle to prognosis, we cannot fail to realize that World War I is an instance in point. Whether or not economically conditioned, it visibly accelerated, in Europe at least, existing tendencies unfavourable to the survival of capitalist institutions. On the one hand, it produced situations of stress that, though due to a chance combination of factors, caused permanent breakdown of social patterns which without such stresses might have persisted indefinitely; this is strikingly exemplified by the case of the U.S.S.R. On the other hand, it caused a permanent change in the distribution of political weights that produced policies which prevented the capitalist engine from working according to design and thus further undermined allegiance to the system; this is exemplified by the case of England. A similar argument applies, of course, to the war that broke out in 1939: in the 1920s some competent observers used to qualify a prognosis otherwise favourable to the survival of capitalism by the proviso "unless there be another world war."

(d) Much light may be shed (1945) on the *immediate* future by visualizing how far the process of transformation has advanced already. Government control of the capital and labour markets, of price policies and, by means of taxation, of income distribution is already established and needs only to be complemented systematically by government initiative in indicating the general lines of production (housing programs, foreign investment) in order to transform, even without extensive nationalization of industries, *regulated*, or *fettered*, capitalism into a *guided* capitalism that might, with almost equal justice, be called socialism. Thus, prediction of whether or not the capitalist order will survive is, in part, a matter of terminology. If it is to be more than that, it depends upon the likelihood of a reversal not only of existing tendencies, but also of an established state of things and therefore upon the answer to the question where the political forces are to come from that will be able and willing to effect such a reversal.

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CAPITAL LEVY. During the first year of World War I it was thought in Great Britain that a loan policy should take the first burden of its cost, but as soon as it became obvious that the war would be a long one, it was equally clear that the amount of the war debt would reach figures quite unprecedented in financial history. There was the apparent impossibility of meeting the cost from current resources, either by taxation or by loan, and also a strong desire to avoid the evils of currency inflation.

Early Suggestions for a Levy.—The first suggestions for a levy in Great Britain seem to have been made by W. Watson Rutherford (Nov. 19, 1914) in the house of commons. He proposed a 5% tax on capital, which would produce £500,000,000 and be taken in kind in the case of shares or real estate. He thought that the majority of persons would gladly pay if they understood that the levy was to take the place of a high income tax. It was put forward therefore as a sound business proposition. Sir Thomas P. Whittaker, M.P., in May 1915 proposed a 2½% levy to raise £250,000,000, which was described as an attractive proposal.

but very difficult to carry out. Professor A. C. Pigou, one of the earliest academic supporters of the scheme, incorporated a detailed proposal for the special taxation of earned income to balance the special levy on objective wealth.

Development of the Plan.—The theory of "commutation," or the "business deal," did not, however, long hold the field. A considerable degree of inflation was taking place, and many were preoccupied with the inevitable fall in prices expected after World War I. It was obvious that the repayment of £1,000,000,000 of debt at such a time involved far less real production and effort than the repayment of a similar amount when the price level would be lower in years to come. Moreover, what was a tolerable burden of interest at a high level of prices would become intolerable at some future period at a much lower level. It was said that "where we had borrowed one pair of boots we should really be repaying two," for, the debt being in sterling, sterling would in future have a much greater purchasing power with a lower price level. The proportion of the debt charge to the national income at that time was probably not more than one-eleventh or one-twelfth, whereas if the price level went back to its prewar position that same sterling debt charge might represent one-sixth or one-seventh of the same real national income. Everything else in the national income might go down with the price level, but the debt charge could not. It was urged, therefore, that the opportunity to make a very substantial reduction in the indebtedness by a special levy on individual fortunes should not be missed.

During the last two years of World War I the case for the levy became reinforced by two powerful semiethical considerations. In the first place enormous fortunes were being made, despite heavy taxation by income tax, supertax and excess profits duty, at a time when large numbers of people were impoverished through the war, and it was considered to be wholly unjust that people who were able to avoid the fighting line should in addition secure a much greater personal wealth than they had at the beginning of the war.

Approval of the principle of the levy was at first not confined to any particular political party. Mr. Bonar Law at one time showed a definite leaning towards the proposal, and a small group of economists were in favour of it on broad grounds. The chief battleground of controversy was the question of the practicability of carrying through so gigantic a financial operation without dislocating the delicate financial mechanism of the country, bringing about a wholesale slump in stock exchange prices, robbing industry of credit, and generally undermining the whole foundation of stable values upon which the idea of the levy rested.

PROPOSED LEVY ON WAR WEALTH

After World War I the discussion took a specific direction, viz., it proposed to confine the levy to "war fortunes." It was realized that a capital levy would tax two fortunes of £20,000 identically, although one might have been reduced from £50,000 owing to the war, while the other might have been built up from practically nothing. The capital levy, therefore, was seen to work considerable injustice, judged from purely ethical standpoints. The proposal for the moment thus became limited to the levying of a tax upon fortunes which by a common public sentiment were regarded as specially fit for such a burden. It was soon, however, agreed to be administratively impracticable to examine every individual circumstance and to decide in which particular cases the increase was actually due to the war, so that a new proposition was put forward that *anybody* who had had an increment in his fortune between 1914 and 1919 would probably be a suitable subject for such a tax.

Report of a Select Committee.—Early in 1920 postwar inflation and the great amount of the floating debt, with its continual renewal in cost and competition, created a difficult and dangerous situation. It was thought that a special levy would raise from £500,000,000 to £750,000,000 and, by reducing the floating indebtedness, would conduce to stability. A select committee of the house of commons considered the question early in 1920. Its report was not conclusive, but, in any case by May 1920, the financial situation had definitely turned, prices declined, and it was thought to be positively dangerous to adopt such a highly difficult expedient at such an unpropitious time.

Resumption of the Capital Levy Proposal.—Under those conditions the financial objections to a general capital levy became stronger and more pronounced on many sides. Apart from a few supporters in academic circles, the program became almost entirely identified with the Labour party, and the grounds upon which it was put forward were also gradually shifted. It was no longer specially urged as a composition by the taxpayer for his own future liabilities.

On coming into power the Labour party appointed a special committee to consider questions relating to national debt and taxation (the Colwyn committee). In their report (Nov. 1926) the majority concluded that "if there were a prospect of a capital levy being well received, the relief from debt which it offers would be insufficient to justify an experiment so large, difficult and full of hazard; this would hold good in any circumstances not differing widely from those of the present time. Further, unless a levy were accepted with more goodwill than it would be possible to anticipate under present conditions, it would be highly injurious to the social and industrial life of the community." The minority said the levy would still be the best method of dealing with the debt, "provided that it were generally approved and were assured fair treatment by the taxpayers. The nation may yet turn to the capital levy as a wise and practicable measure affording the best road out of its difficulties." The proposal disappeared from the Labour program altogether in 1927.

SUMMARY

The chief financial and economic contentions on the two sides for and against a levy may now be set out. The ethical considerations that once loomed so large became later less prominent. The chief objections may be classified as follows:—

1. *Repetition.*—A successful levy, although definitely aimed at relieving war debt, can give no guarantee against repetition for other purposes in the future, and possibly even in the near future. No ordinary assurance against this possibility is of any use because no government can bind its successor. Indeed, the more successful the levy, the greater may be the incentive to repeat it. The consequence of this would be that under a fear of repetition the accumulation of capital would be restricted and slow, and, as a consequence, all industrial progress must be retarded.

Against this view it has been contended that repetition is not a thing to be feared, because no one would think of imposing a special charge of this character except in a great emergency. In the event of a great emergency it would be a positive advantage to have the national accounts cleared of such indebtedness, and to be able to enter upon a war without a colossal debt. All war loans have conditions attached to them which are honourably observed by governments, and there is no reason to suppose that a similar assurance cannot be given to the taxpayer so that any economic effects through fear of repetition could be avoided.

2. *Effects on Prices.*—The second main contention is that the financial operation would be so huge that the attempts to carry it out on practical simultaneous lines must destroy its own basis by depressing prices. If the treasury were satisfied to take only cash this would involve putting large blocks of shares on the market for which there would be no ready sale, panic prices would ensue, and confidence would be destroyed. If, in order to avoid forced sales, the government were to take stocks and shares in payment, they would find themselves with large miscellaneous holdings in industry which they could not realize without disastrous consequences. The mere passive holding of securities is no relief to the budget.

It has been rejoined that the notion that a large quantity of securities must be put on the market and result in depressing it is quite mistaken. It is merely a matter of synchronizing the supply of securities with the demand, for whenever debt is redeemed an investor will be ready in the market to buy securities that are on sale, either by taxpayers or the government. It is true that the banks and finance houses could talk the market into a state of panic, but if they were determined to support the scheme with their good will, depression of prices would be quite unnecessary.

3. *Damage to Individual Businesses.*—The third contention is that the ordinary business in private hands could not pay a large levy without encompassing its own destruction. It could not divide its business, and would be forced to raise mortgages or debentures which, in view of the uncertain financial future, could only be obtained on onerous terms.

A counter contention to this takes the following form: If a business were really valued at a figure necessitating a payment to the government, it would also have sufficient credit to raise a mortgage and the charge or levy would be evidence of the fact. The money for this would be forthcoming in the market because of the funds set free by the redemption of debt. The utmost difficulty that could arise would be some slight redirection of capital. In all cases of hardship, or where a business was likely to be inconvenienced, the government would grant payment by instalments. Against this it has been replied that a levy honeycombed with instalments and special cases would be very similar to a special income tax, but levied on an insecure and unfair basis. Such a system, it is urged, would take 10 or 20 years to bring to a definite conclusion.

4. *Valuations Impracticable.*—The next contention is that so much of the wealth of the country is held in contingent titles, such as life interests and reversions, and that the valuation of these would make an insoluble problem. However actually correct the valuation may be at the time, the results would be belied by subsequent events, and wherever duty was being paid by instalments there would be overwhelming demands for adjustments. These would be sufficiently important to reduce the levy to chaos.

5. *Repayment of Part of the Debt Makes the Repayment of the Remainder more Difficult.*—The fifth argument relates to the deflationary effect of the levy itself. It is stated in some financial circles that the sudden cancellation of £3,000,000,000 of debt according to the program of the Labour party would remove from businesses a very large amount of collateral security. This would cause credit to be withdrawn and restricted. In other cases credit would be withheld, and prices would fluctuate with disastrous effects on business enterprise and employment.

Against this it is contended that the argument is a gross exaggeration. Only a small proportion of the war loan is used as the actual basis of credit operations, and many people who so use it have other securities which can be used instead. Again, credit is much more largely personal, and does not depend upon collateral of this kind. Moreover, others contend that deflation can only be brought about by operations through the Bank of England, and the inability of an individual borrower to be granted a loan means that, in practice, a loan is given to someone else because the banks have this credit available. The total amount of effective credit, it is said, cannot be affected by the demands of the particular borrowers.

6. *Future Saving Impaired.*—The sixth contention relates to the effects of redistribution of wealth upon future saving. The idea that the wealth-accumulating classes would have not only to give up a part of their existing fortune, but also to suffer rates of tax in future as high, or higher, would, it is said, strike at the root of all thrift and lead to national wastefulness, because the other classes of the community would not themselves save an equivalent sum.

Against this it is stated, however, that the outlook is too serious for any ordinary arguments about the redistribution of wealth to avail. Money must be taken where it is to be found. Whatever the immediate disadvantageous effects of the levy, the dynamic effects in future are by far the more important. Greater good to the community would come about by relieving the worker and the middle classes of some of the burden of taxation or by expending state funds on proper social purposes.

This would lead to greater productivity, to lower rates of taxation and to greater general average prosperity.

7. *The Price Level Argument.*—In the next place, the price level contention is disputed. The idea that it will be an advantage to repay a debt before the price level falls must be qualified by the fact that the operation of the levy itself would bring about lower prices and thus make the remaining £4,000,000,000 sterling of the debt charge a much more onerous charge than would otherwise be. In view, however, of the denial that the price level will be necessarily lower in the long run, this contention is not accepted. But in so far as it might prove to be true, it is said that it would be so much to the advantage of the workers to have higher real value in their earnings that the whole country would gain. It is said that there are more factors making for a rise in prices than for a fall in the long run, and therefore future repayment may be easier than present repayment.

8. *The Net Annual Relief.*—In the last place the opponents of the levy say that the whole basis of the program is fallacious, because it has been assumed that the effect would be to set free the whole of the interest on £3,000,000,000 of debt, say £150,000,000 a year, and allow of expenditure program to this amount, or of a reduction of taxation *pro tanto.*

It is stated that this view ignores the progressive features in the existing income tax, supertax and death duty schemes. Taking large sums away from individual fortunes would reduce their taxpaying power in future, and the revenue side of the budget would also be seriously affected, so that all that could be reckoned upon would be a certain *net* saving. One authority has estimated that, in the long run, out of a saving of expenditure of £140,000,000, something between £90,000,000 and £98,000,000 per annum would have to be set aside to make good the effects of the levy on future revenue, so that the net advantage to the budget would have to be reduced to some £42,000,000 or £50,000,000 a year.

No effective counter statistics have been so far put forward to alter this result.

THE LEVY IN OTHER COUNTRIES

In 1920 in Czechoslovakia a levy was introduced which was to bring in £63,000,000 or about £5 per head of the population, with a low limit of exemption, *i.e.,* 10,000 crowns free, 1% on the first 25,000 crowns, and then on a progressive scale up to 30% on amounts over 10,000,000 crowns. The actual yield was £17,-000,000 in the first two years, and the instalment system which was allowed gave it, as a matter of fact, the character of a heavy income tax. The results have been regarded as disappointing, and the consequent arrears in income tax are heavy. (J. S.)

The best-known practical experiment in capital levy was carried out in Germany soon after World War I. It was a complete failure owing to the unsettled conditions prevailing there. Lack of experience on the part of the administrative machinery, the demoralizing effect of political upheavals and inflation, and the absence of adequate exchange control contributed towards the unsatisfactory results of the levy.

On the other hand the Italian capital levy to cover the costs of the Abyssinian war was fairly successful. It was adopted in 1936, at a rate of 5%, in the form of a forced loan or a levy at the taxpayer's option. The proceeds were up to expectations. In 1937 a 10% tax was levied on the capital of all joint stock companies. This levy was not so successful. Subsequently there was also a 7½% levy on the capital of private firms. In Hungary, too, a levy on capital was adopted in 1938 to cover rearmament expenditure. The rate was from 5% to 20%.

SUGGESTED CAPITAL APPRECIATION TAX

During World War II there was no revival in Great Britain of the agitation in favour of a capital levy. The reason for this was that direct taxation was raised to such an unprecedented level that an additional capital levy came to be considered both unnecessary and impracticable. With income tax at 10s. in the £ and excess profits tax at 100%, most of the taxable resources became materially reduced. Wealthy people were forced to live on their capital, so that in practice the high taxation of incomes produced a result similar to a capital levy. For this reason the Labour party did not press its proposal for a capital levy. Proposals were put forward from various sides during World War II in favour of a tax on capital appreciation. After the liberation of Belgium the finance minister, M. Gutt, intended to adopt a 100% tax on wealth created after the German invasion in 1940, whether through trading with Germany or profiteering. His scheme met with strong opposition and was abandoned. It was sought to be replaced partly by a capital levy. The idea was also revived in other liberated countries, as a means of absorbing part of the note circulation inflated during the German occupation. Alternative schemes of confiscatory taxation of wealth created through black market dealing or collaboration with Germany were also pressed by political parties of the left.

(P. Ei.)

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CAPITAL PUNISHMENT is the penalty of death pronounced by a competent tribunal. Its history shows a shifting of the stress from sacrilege and offences against property to murder pure and simple. Treason, which has changed from the sacrilege of attacking the divinity of kingship to the modern crime of attacking the security of the State, has always been punishable by death. The laws of Hammurabi (*see* Babylonian Law) provide capital punishment somewhat indiscriminately and it is important to realize that the *lex talionis* of the ancient Hebrews represented an advance in civilization, as introducing the idea of degree into the law. The ancient Hebrews punished with death: adultery (Lev. 20, 10); bestiality (Ex. 22, 19; 20, 15–16); blasphemy (Lev. 24, 16); cursing father or mother (Ex. 21, 17; Lev. 20, 9); idolatry (Deut. 13, 6–10); incest (Lev. 20, 17); rape (Deut. 22, 25); sabbath breaking (Num. 15, 35, 36); unchastity (Deut. 22, 21); and witchcraft (Ex. 22, 18; Lev. 22, 27).

In Roman law (*q.v.*) capital punishment meant, besides the *summum supplicium* (death), those punishments that affected the *caput* (=status) of the citizen, viz., banishment (*aqua et igni interdictio*) under the republic or *deportatio* under the empire, condemnation *in opus perpetuum* or to the mines. The following offenses were capital in our sense: treason (*lex Julia majestatis*); adultery and sodomy (*lex Julia de adulteriis*); murder (*lex Cornelia de Sicariis*); forgery by slaves (*lex Cornelia de Falsis*); corruption (*lex Julia Peculatis*); kidnapping under certain circumstances (*lex Fabia de Plagiariis*); seduction (Digest 48, 11, 1, 2), and rape (D. 48, 6, 3, 4).

In Anglo-Saxon times murder was punishable by a fine or *bot* whereof two-thirds (*wer*) went to the relatives and one-third (*wite*) to the king. Some crimes however were *boteless* and the offender must die. In the 13th century death was, by the common law of England, the punishment for all felonies (except mayhem and petty larceny) but under the influence of the church the severity of the law was mitigated, at first for clerks and then for any who could read (*see* CLERGY, BENEFIT OF); and from the beginning of the 17th century to the middle of the 19th, by giving condemned felons the option of transportation (*see* DEPORTATION).

In 1766 Goldsmith wrote "Nor can I avoid even questioning the validity of that right which social combinations have assumed of capitally punishing offenses of a slight nature. In cases of murder their right is obvious, as it is the duty of us all from the laws of self-defense to cut off that man who has shown a disregard for the life of another. Against such all nature rises in arms; but it is not so against him who steals my property." This view was supported by Bentham (*q.v.*) and others with the result that instead of no less than 200 capital crimes at the beginning of the 19th century there are now four, viz., high treason, murder, piracy with violence and (except in Scotland and Ireland) destruction of dockyards, etc. Since 1838 the death penalty has been exacted under the ordinary law in England only for murder, but in 1916 Roger Casement was hanged for high treason (*q.v.*). The Infanticide Act 1922 makes the killing of a newly born child by its mother equivalent to manslaughter, punishable by imprisonment.

Under the Indian Penal Code, waging war against the king (s. 121) and murder (s. 302) are capital offenses. The Canadian criminal code of 1892 provides death for treason (ss. 68, 657), murder (231), rape (267), and piracy with violence (127). Roman-Dutch law (*q.v.*) applies in South Africa, where treason (*perduellio* and *laesa majestatis*), murder and rape are capital. In Australia, as elsewhere in the British empire, treason, murder and piracy with violence are capital, and in New South Wales and Victoria, rape also. In Queensland capital punishment was abolished by the Criminal Law Amendment Act of 1922. (F. T. G.)

Although at the time of the colonization of America, no less than 200 crimes, as we have seen, were punishable by death, the colonists greatly reduced this number, only 12 offenses being capital in the New England colonies. Ohio in 1788 and Pennsylvania in 1794 limited capital punishment to wilful and deliberate murder and in 1838 Rhode Island selected murder and arson. In 1892 a Federal law was passed which reduced the number of capital crimes to three, viz., treason, murder and rape; but for the most part the punishment of crime was undertaken by the constituent states. (X.)

Capital Punishment in 1942.—Before the rise of fascism in Europe, it seemed probable that the growing demand for the abolition of the death penalty in Europe and in South America would force a change in the United States. With the advance of the totalitarian powers from 1938 on, the tide of reaction toward drastic punishment was sweeping, as illustrated by the following tabulation. (*See* below.) Most of Europe in 1942 was under martial law, or had written new and more stringent codes.

A few exceptions arose in Europe like lone islands; Sweden, after 1910 an abolition state, was self-governing and did not restore the death penalty. With Sweden stands Portugal without capital punishment since 1886. In 1943 the federal government of Switzerland established the abolition of capital punishment in all cantons of the country. Switzerland had ended the death penalty through the federal constitution in 1874 but allowed cantons to retain liberty of actions. Fifteen cantons had abolished. In wartime the federal government acted and Switzerland as a whole, 25 cantons, became an abolition state.

Former abolition states under strict or modified martial law in 1942, were Belgium, Czechoslovakia, Denmark, Finland, Holland, Lithuania, Norway and Rumania. Rumania herself restored the death penalty in 1939, after 74 years of abolition. In Spain, without the death penalty from 1932 on, "a state of alarm," or modified martial law, obtained under General Franco, following wholesale executions. Even under the monarchy in Spain the vast majority of death sentences were commuted. Austria in 1938 automatically restored the death penalty following the return to the reich, after 22 years of abolition. Italy, through abrogation, had been without capital punishment from 1877. In 1899 the death penalty was abolished by law. The new fascist Italy rewrote its penal code, restoring the death penalty in 1939.

In England alone, parliamentary agitation to end the death penalty was still going on during World War II, and the 1935 recommendation of a Parliament-appointed Select committee to abolish the death penalty for an experimental period of five years was under active discussion. The death penalty, however, was still in force in 1943. Strongly supported by a Labour government, New Zealand remained the only part of the British empire to end the death penalty by law, in Sept. 1941. New Zealand at the same time abolished flogging in prison, still retained in Great Britain. In the new world no striking gains or losses were made, though legislative debate was active. Cuba alone joined eight other Latin American states in ending the death penalty in 1940 after abrogation since 1935.

Abolition of capital punishment was endorsed in 1941 by the influential Latin American Conference on Criminology, meeting in Chile with 15 South American and European delegations. South and Central American states which had already ended the death penalty were (1942): Argentina (1922); Brazil (1891); Colombia (1910); Ecuador (1895); Peru (1897); Mexico (1929); Costa Rica (1926); Honduras (1926). Mexico in 1943 by an overwhelming majority, upheld by the president, retained the abolition of capital punishment after an attempt by the chamber of deputies to restore the death penalty.

In the United States which had pioneered in agitation against the death penalty, no statutory gains were made after 1939. South Dakota restored the death penalty for homicide in 1939, giving the jury, however, the mandatory right to grant mercy. The six abolition states in 1942 were: Michigan (1847); Rhode Island (1852); Maine (1876); Minnesota (1911); North Dakota (1915); Wisconsin (1853). Massachusetts in 1943 joined the large majority of the states which have mitigated the death penalty by allowing the trial jury to recommend mercy in capital cases. The only states now retaining absolute capital punishment are: Vermont, Connecticut, North Carolina and New Mexico.

STATUS OF CAPITAL PUNISHMENT IN EUROPE (1942)

Austria.—Abolished capital punishment in 1918 except under martial law in time of crisis.

Capital punishment restored when Austria returned to the German reich, 1938.

Belgium.—Abrogated capital punishment through disuse in 1863.

Under martial law after seizure by Germany.

Czechoslovakia.—New penal code proposed abolishing the death penalty when the republic was established in 1918.

Under martial law after seizure by Germany.

Denmark.—Abrogated capital punishment through disuse from 1892. Abolished by statute in 1930.

Under martial law after seizure by Germany.

Finland.—Capital punishment abrogated from 1889 by disuse with the expiration of the 1918 period of martial law.

Under martial law as a result of successive Russian and German attacks.

Germany.—Under the republic antedating Hitler a strong move toward the abolition of capital punishment was under way, six assemblies having passed resolutions in favour, with the judicial committees of the reich recommending complete abolition.

Under Hitler capital punishment restored in all parts of the reich with robbery also made a capital crime.

Holland.—Abolished capital punishment in 1870, judges deciding length of prison term with an increasing drop in life terms.

Under martial law after seizure by Germany.

Italy.—Abrogated capital punishment from 1877. Abolished capital punishment in 1890.

Capital punishment restored in Italy through the new penal code initiated by Premier Mussolini.

Lithuania.—Abolished capital punishment in 1922

Under martial law, occupied successively by Russia and Germany.

Norway.—Abrogated capital punishment from 1875. Abolished by statute in 1905.

Under martial law after seizure by Germany.

Portugal.—Abolished capital punishment in 1886, the severest penalty under the constitution being 28 years in prison.

Abolition of capital punishment continued in Portugal.

Rumania.—Abolished capital punishment in 1865. Restored the death penalty in 1939.

Under martial law.

Spain.—Abolished the death penalty in 1932 when the new republican code was written. Extreme penalty 20 years.

"A state of alarm," or modified martial law, came into effect when Franco came into power (1939). Even under the monarchy, the majority of death sentences in Spain were commuted.

Sweden.—Abolished capital punishment in 1910. After 1865 judges had power to substitute lesser penalties. After 1910 abrogated by disuse. After 1921 abolished by law.

After 1921 there had been a steady decrease in homicide.

Switzerland.—Capital punishment abolished by the federal constitution of 1874 with the cantons (states) retaining liberty of action. Fifteen cantons (75% of population) have abolished capital punishment. In 1927 abolition for all cantons recommended by commission of judges. In 1943 the federal government established the abolition of capital punishment in all cantons.

GREAT BRITAIN (1942)

England.—A Select committee of Parliament proposed the abolition of capital punishment for an experimental period of five years in 1935, but the death penalty was still in effect at the end of 1942.

New Zealand.—Capital punishment and flogging both abolished in Sept. 1941. Bills sponsored by Labour government.

Only part of empire to insist on change in war time.

CAPITAL PUNISHMENT IN LATIN AMERICA (1942)

Latin American Conference.—Abolition of capital punishment was recommended at the second Latin American Conference on Criminology meeting in Chile Feb. 1941, with 15 continental delegations present. The movement to abolish capital punishment throughout Latin America has steadily gained ground.

Argentina.—Abolished capital punishment in 1922.

Brazil.—Abolished capital punishment in 1891.

Colombia.—Abolished capital punishment in 1910.

Ecuador.—Abolished capital punishment in 1895.

Peru.—Abolished capital punishment in 1897.

Mexico.—Abolished capital punishment in 1929.

Agitation to restore the penalty has been recently overcome.

Costa Rica.—Abolished capital punishment in 1926.

Honduras.—Abolished capital punishment in 1926.

Cuba.—Abolished capital punishment in 1940 through a new constitution. The death penalty had been suspended since 1935 to await the decision of the Constitutional Assembly.

PUNISHMENT FOR CAPITAL CRIME IN U.S.

Hanging: Delaware, Idaho, Iowa, Kansas, Louisiana, Maryland, Mississippi, Montana, New Hampshire, Washington, West Virginia. Utah (convict is allowed to choose between shooting or hanging as a means of execution; no convict has ever chosen hanging), Alaska. *Electrocution:* Alabama, Arkansas, Connecticut, Florida, Georgia, Illinois, Indiana, Kentucky, Massachusetts, Nebraska, New Jersey, New Mexico, New York, Ohio, Oklahoma, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Vermont, Virginia. *Lethal Gas:* Arizona, California, Colorado, Missouri, Nevada, North Carolina, Oregon, Wyoming. *Life:* Maine, Michigan, Minnesota, North Dakota, Rhode Island, Wisconsin. (V. Pl.)

Methods of Execution.—Ancient methods requiring no apparatus were drowning (Code of Hammurabi, ss. 109, 129, 133 143, 155) and precipitation from a height, as from the Tarpeian rock (Twelve Tables). Impaling was practised in Assyria. Stoning (Lev. xxiv:16, xx:27; Deut. xiii: 6–10, xxi:18–21; Num. xv: 35, 36) and burning (Lev. xxi.:9, xx.:14) were used by the ancient Hebrews. Crucifixion was used by the Romans for condemned persons who were not Roman citizens. Parricide, regarded with especial abhorrence by the Romans, was punished in the following extraordinary manner: The victim was sewn up in a sack with a dog, a cock, a viper and an ape and cast into the sea or river (*lex Pompeia de Parricidiis*, 55 B.C.). Hanging (*q.v.*) is now practised in many countries, *e.g.*—Albania, the British empire, Egypt, Hungary, Japan, Latvia and some of the United States. In Latvia the victim may be shot or hanged, while in Utah he has the choice. France employs the guillotine (*q.v.*) and Spain the garrotte (*q.v.*). Twenty-two of the United States now employ electrocution; eight use the lethal chamber. (F. T. G.)

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CAPITO, WOLFGANG (1478–1541), Lutheran divine, was born of humble parentage at Hagenau and died at Strasbourg. He was educated at Freiburg, and, becoming a priest, went in 1515 to Basle where he met Erasmus and Zwingli and entered into correspondence with Luther. In 1519, however, he was made chaplain to the archbishop of Mainz, an office which he resigned in 1522 to become a Protestant. In 1523 he settled at Strasbourg, where he remained until his death in November, 1541. He wrote with Bucer the *Confessio Tetrapolitana* (1530), and later produced the *Berner Synodus*, treating of church discipline. In 1534 he opposed the Anabaptists and two years afterwards assisted at the Wittenberg Concordia.

See J. W. Baum, *Capito u. Butzer* (Elberfeld, 1860) and A. Baum, *Magistrat u. Reformation in Strassburg bis 1520* (Strasbourg, 1887). Kalkoff, *Wolfgang Capito im Dunste Erzbischof Albrechts von Maine.*

CAPITULARY, a series of legislative or administrative acts emanating from the Merovingian and Carolingian kings, so called as being divided into sections or chapters (*capitula*). At the present day we do not possess a single capitulary in its original form; but very frequently copies of these isolated capitularies were included in various scattered manuscripts, among pieces of a very different nature, ecclesiastical or secular.

These capitularies make provisions of a most varied nature; it was therefore found necessary at quite an early date to classify them into chapters according to the subject. In 827 Ansegisus, abbot of St. Wandrille at Fontenelle, made such a collection, which soon gained an official authority.

After 827 new capitularies were naturally promulgated, and before 858 there appeared a second collection, quite unreliable, in three books, by an author calling himself Benedictus Levita. In 1677 Baluze issued the *Capitularia regum francorum*, in two folio volumes, in which he published first the capitularies of the Merovingian kings, then those of Pippin, of Charles and of Louis the Pious, which he had found complete in various manuscripts. After the date of 840, he published as supplements the unreliable collection of Ansegisus and Benedictus Levita, with the warning that the latter was quite untrustworthy. He then gave the capitularies of Charles the Bald, and of other Carolingian kings, either contemporaries or successors of Charles, which he had discovered in various places.

An edition of the capitularies was made in 1835 by Georg Pertz, in the *Monumenta Germaniae* (folio edition, vol. i., of the *Leges*). In 1883 Boretius published his first volume, containing all the detached capitularies up to 827, together with various appendices bearing on them, and the collection of Ansegisus. This work was continued by Victor Krause, who collected in vol. ii., the scattered capitularies of a date posterior to 828. Karl Zeumer and Albrecht Werminghoff drew up a detailed index of both volumes, in which all the essential words are noted.

Among the capitularies are to be found documents of a very varied kind. Boretius divided them into several classes:

(*a*) The *Capitula legibus addenda.*—There are additions made by the king of the Franks to the barbarian laws promulgated under the Merovingians, the Salic law, the Ripuarian or the Bavarian. Like the laws, they consist chiefly of scales of compensation, rules of procedure and points of civil law. They were solemnly promulgated in the local assemblies where the consent of the people was asked. Charlemagne and Louis the Pious seem to have made efforts to bring the other laws into harmony with the Salic law.

(*b*) The *Capitula ecclesiastica.*—These capitularies were elaborated in the councils of the bishops; the kings of the Franks sanctioned the canon of the councils, and made them obligatory on all the Christians in the kingdom.

(*c*) The *Capitula per se scribenda.*—These embodied political decrees which all subjects of the kingdom were bound to observe. They often bore the name of *edictum* or of *constitutio*, and the provisions made in them were permanent.

(*d*) The *Capitula missorum*, which are the instructions given by Charlemagne and his successors to the *missi* sent into the various parts of the empire. They are sometimes drawn up in common for all the *missi* of a certain year (*capitula missorum generalia*); sometimes for the *missi* sent only on a given circuit (*capitula missorum specialia*).

(*c*) With the capitularies have been incorporated various documents; for instance, the rules to be observed in administering the king's private domain (the celebrated capitulary *de villis*, which is doubtless a collection of the instructions sent at various times to the agents of these domains); the partitions of the kingdom among the king's sons, as, the *Divisio regnorum* of 806, or the *Ordinatio imperii* of 817; the oath of peace and brotherhood which was taken on various occasions by the sons of Louis the Pious, etc.

After the reign of Louis the Pious the capitularies became long and diffuse. Soon, from the 10th century onwards, no provision of general application emanates from the kings. Henceforth the kings only regulated private interests by charters; it was not until the reign of Philip Augustus that general provisions again appeared; but when they did so, they bore the name of ordinances (*ordonnances*).

There were also capitularies of the Lombards. These capitularies formed a continuation of the Lombard laws, and are printed as an appendix to these laws by Boretius in the folio edition of the *Monumenta Germaniae, Leges*, vol iv.

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CAPITULATIONS, treaties granted by a state and conferring the privilege of extra-territorial jurisdiction within its boundaries on the subjects of another state. In the 9th century the caliph Harun-al-Rashid granted guarantees and commercial facilities to the Franks. Similar concessions were made to certain Italian city states. Thus, in 1098, the prince of Antioch granted a charter of this nature to Genoa; the king of Jerusalem to Venice in 1123 and to Marseilles in 1136. Salah-ud-din (Saladin), sultan of Babylon (Cairo), granted a charter to the town of Pisa in 1173. The Byzantine emperors followed this example, and Genoa, Pisa and Venice all obtained capitulations. The explanation of the practice is to be found in the fact that the sovereignty of the state was held to apply only to its subjects. The privilege of citizenship was too precious to be extended to the alien, who was long practically an outlaw. But when the numbers, wealth and power of foreigners residing within the state became too great, it was found to be politic to subject them to some law, and it was held that this law should be their own. Under the Ottoman sultans the system already in existence was continued. The first capitulations concluded with a foreign state were those of 1536 granted to the French. They amounted to a treaty of commerce and a treaty allowing the establishment of Frenchmen in Turkey and fixing the jurisdiction to be exercised over them; individual and religious liberty was guaranteed to them, the king of France being empowered to appoint consuls in Turkey, the consuls being competent to judge the civil and criminal affairs of French subjects in Turkey according to French law, and to appeal to the officers of the sultan for their aid in the execution of their sentences. All subsequent capitulations followed this model. The capitulations were at first held to be in force only during the lifetime of the sultan by whom they were granted; thus in 1500 Sultan Selim II. renewed the French capitulations granted by his predecessor. In 1583 England obtained her first capitulation, until which time France had been the official protector of all Europeans established in Turkey. Later on, England claimed to protect the subjects of other nations, a claim rejected in the French capitulations of 1507, 1604 and 1607, the last-named of which explicitly laid down that the subjects of all nations not represented at Constantinople by an ambassador should be under French protection. In 1613 Holland obtained her first capitulation. In 1673 the French succeeded in obtaining the renewal of the capitulations which had remained unconfirmed since 1607 Louis XIV. had been anxious to secure the protectorate of all Catholics in Turkey, but was obliged to content himself with the recognition of his right to protect all Latins of non-Turkish nationality; his claim for the restoration to the Catholics of the holy places usurped by the Greeks was also rejected, the sultan only undertaking to promise to restore their churches to the Jesuit Capuchins. Later, France's friendship secured for Turkey a successful negotiation of the peace of Belgrade in 1739, and the result was the capitulation of 1740; this was no longer limited in duration to the sultan's lifetime but was in perpetuity, and could not be modified without the assent of the French. It conferred on the French ambassador precedence over his colleagues. Austria had obtained capitulations in 1718, modified in 1784; Russia secured similar privileges in 1784. In the course of the 18th century nearly every European power obtained capitulations, and such newly-established countries as the United States of America, Belgium and Greece, followed in the 19th century.

The post-War position of capitulations may be briefly stated. Capitulations are still in force in Abyssinia, China, Egypt and Morocco; they may be said to exist in Bulgaria, as Art. 175 of the Treaty of Neuilly provides that the immunities and privileges of foreigners as well as the rights of jurisdiction and of consular protection enjoyed by the Allied and Associated Powers in Bulgaria by virtue of the capitulations, usages and treaties, may form the subject of special conventions between each of the Allied and Associated Powers and Bulgaria; Great Britain possesses extra-territorial jurisdiction in Bahrein, Kuwait and Muscat. The capitulations still in force may be thus summarized according to countries.

Abyssinia.—The provisions of the Klobukowski Treaty of 1908 by which France was accorded consular jurisdiction in Abyssinia are applicable to all countries diplomatically represented in Abyssinia.

China.—Extra-territorial jurisdiction is enjoyed by Belgium, Brazil, Chile, Denmark, France, Great Britain, Italy, Japan, the Netherlands, Norway, Portugal, Spain, Sweden and the United States.

The Chinese do not recognize Chile's right to extra-territorial privileges and assert that the Japanese treaties, under which Japanese subjects enjoy extra-territorial rights in China have expired, though no steps have actually been taken to assume jurisdiction over Japanese subjects in China.

Belgium has agreed to Belgian subjects being amenable to Chinese jurisdiction as soon as the majority of the Powers now possessing extra-territorial privileges in China have agreed to relinquish them.

Italy, Denmark, Portugal and Spain have, by treaties, Nov. and Dec., 1928 agreed to their nationals being amenable to Chinese jurisdiction when all the Powers signatory to the Washington treaties of 1922 have agreed to abolition of extra-territoriality.

Egypt.—Capitulatory rights are possessed by Belgium, Denmark, France, Great Britain, Greece, Italy, and the Netherlands, Norway, Portugal, Russia, Spain, Sweden and the United States. Rumania has limited capitulatory rights.

Morocco.—Great Britain and the United States of America retain capitulatory rights in the French zone; and the United States in the Tangier zone. In the Spanish zone Great Britain, Japan and the United States of America retain these rights.

Since 1911 capitulatory rights have been abandoned in very many countries but in one instance alone—Tripolitania—were such rights relinquished prior to the World War The following summary shows the extent to which capitulations have been abandoned since 1911:—

Albania.—By Great Britain, Feb. 6, 1926.

China.—By Austria, Germany and the Soviet Union. Extra-territorial rights have also been lost by the subjects or citizens of the Succession States (Poland, Czechoslovakia, etc.) formed from the dissolution of Austro-Hungarian and Russian Empires.

Mexico relinquished her extra-territorial rights in China on November 12, 1929.

Crete.—By Great Britain, August 25, 1914.

Egypt.—By Austria, Germany and Hungary. By Persia in 1928.

Greece.—By Great Britain, in territories acquired by Greece after the Balkan Wars 1912–13, as a result of an agreement embodied in notes of August 25 and September 1, 1914.

Morocco.—In the French zone by Belgium, Bolivia, Costa Rica, Denmark, Greece, Italy, Japan, the Netherlands, Norway, Portugal, Russia, Spain, Sweden and Switzerland. In the Spanish zone by Belgium, Denmark, France, Greece, Italy, the Netherlands, Norway, Portugal, Russia, Sweden and Switzerland. Austria, by Articles 96–98 of the Treaty of St. Germain, September 10, 1919; Germany by Articles 141–143 of the Treaty of Versailles, June 28, 1919; Hungary by Articles 80–82 of the Treaty of Trianon, June 4, 1920 have renounced their capitulatory rights.

In the Tangier zone, by Belgium, France, Great Britain, Italy, the Netherlands, Portugal, Spain and Sweden.

Persia.—The capitulations, in respect of those Powers still possessing Capitulatory Rights, were abolished as May 10, 1928.

Siam.—The protocol relating to jurisdiction annexed to the general treaty with Siam of July 14, 1925, has abolished the system of jurisdiction heretofore established in Siam for British subjects who now become amenable to the Siamese Courts. In the interests of justice, however, cases may be evoked from the Siamese Courts and be dealt with by a British diplomatic or consular officer in accordance with English law. *See* SIAM

Tripolitania.—By Great Britain in October, 1911.

Turkey.—By those signatories of the Treaty of Lausanne, July 24, 1923, who possessed capitulatory rights in Turkey at the outbreak of the World War: and by Germany, Persia, the Soviet Union and the United States of America. *See* CONCESSIONS.

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CAPIZ, a municipality (with administrative centre and 34 *barrios* or districts) and capital of the province of Capiz, Panay Philippine Islands, on the Capiz or Panay river, about 4 mi. from its mouth on the north coast. Pop. (1939) 29,021 (a gain of 6,099 since 1918), of whom 14,027 were males, and 11 were whites. Capiz has railway connection with Iloilo. The leading industries are fishing and weaving of fabrics of cotton, abacá (Manila hemp) and piña. Sugar and palay (rice) are quite extensively raised, and the first named together with nipa thatch and copra are exported. The place is accessible to coasting vessels which afford direct trade with Manila and render Capiz a commercial centre of importance. Besides the agricultural products mentioned above, tobacco, maize (corn) and cacao are also grown. The town has a large and imposing Roman Catholic church as well as a Protestant church and hospital and good government buildings. It is the seat of the provincial high school, and 33·5% of its inhabitants of the age of 6 to 10, inclusive, were reported as attending school, and 42·7% of those ten years old and over were reported literate. The vernacular is a dialect of Panay-Bisayan. The place has often been visited by typhoons and suffered considerable damage therefrom. The number of parcels of land taxed in 1938 was 4,227, and the owners thereof numbered 2,542.

CAPMANY Y MONTPALAU, ANTONIO DE (1742–1813), Spanish polygraph, was born at Barcelona on Nov. 24, 1742. He retired from the army in 1770, and was subsequently elected secretary of the Royal Academy of History at Madrid. His principal works are: *Memorias históricas sobre la marina, commercio, y artes de la antigua ciudad de Barcelona* (4 vols., 1779–92); *Teatro histórico-critico de la elocuencia Española* (1786); *Filiosofía de la elocuencia* (1776), and *Cuestiones criticas sobre varios puntos de historia económica, politica, y militar* (1807). Capmany died at Barcelona on Nov. 14, 1813. His monograph on the history of his birthplace still preserves much of its original value.

CAPO D'ISTRIA, GIOVANNI ANTONIO (JOANNES), COUNT (1776–1831), Russian and Greek statesman, son of Count Antonio Capo d'Istria, the head of an old Corfiot family, was born in Corfu on Feb. 11, 1776, and studied at Padua. In 1800 he became secretary to the legislative council of the septinsular republic (Ionian Islands), and in 1807 he organised the defence of Santa Maura against Ali Pasha. A profound admirer of Russia, he entered her service in 1809 and became attaché at Vienna in 1811. After serving on a mission to the principalities in 1812, Capo d'Istria was attached to Barclay de Tolly's staff during the campaign in 1813 and, after a mission to Switzerland, was present in Paris and later at the Congress of Vienna. At that Congress he exercised great influence and prepared a memorandum for Alexander on German policy in which he advocated keeping Germany in dependence upon Russia. He also opposed the dismemberment of France, and was largely responsible for the treaty of Nov. 20, 1815, in which year he was made secretary of state, sharing the ministry of foreign affairs with Nesselrode, and assuming control of Bessarabia. After attending the Congress of Aix-la-Chapelle in 1818, Capo d'Istria paid a visit to Corfu where he listened to the complaints of the Corfiots against English rule. On his return to Russia, he visited England to lay their complaints before the British Cabinet by whom he was somewhat coldly received. He was responsible for drafting the protest of the Tsar against the Carlsbad Decrees (*see* ALEXANDER I [ALEKSANDER PAVLOVICH]), and in October 1820 attended the Congress at Troppau Metternich did his utmost to detach the Tsar's confidence from Capo d'Istria, and was successful in bringing about his resignation in 1822. Five years later the Greek national assembly elected Capo d'Istria to the presidency of the republic. Nicholas I. had succeeded Alexander upon the Russian throne, and the count hastened to Tsarskoye Selo from Geneva, where he had been living, in order to obtain the Tsar's permission to take up his new post. This was readily granted him, and he set forth as virtually a Russian agent in Greece. After a tour of Europe, during which he endeavoured to secure the support of the Governments for his new work, Capo d'Istria landed at Nauplia on Jan. 19, 1828

From the outset he had to face immense difficulties in Greece—a land with a bankrupt treasury, a half-barbarian population, and with its soil not yet freed from the presence of Ibrahim Pasha's army in the Morea. His international reputation was appreciated by the Greeks, but his aristocratic outlook and want of human sympathy soon alienated a democratic and turbulent people. Yet he fought against the restrictive policy of the European states in regard to Greece, and it was not until his marked preference for Phanariotes (*q.v.*) and Corfiots together with the promotion of his brothers to high commands had earned him widespread dislike that the incipient fires of revolt blazed up into open rebellion By calling in Russian aid to suppress the revolt, Capo d'Istria gave it the character of a national and patriotic rising; and his imprisonment of the leader of the Mavromichales clan aroused the fury of the Mainots. The Russian minister sought to make peace, and might have succeeded, but for Capo d'Istria's insolent treatment of the old Mavromichales chief, Petrobey, who gave the signal to his son and a cousin to wipe out the insult. On the following day (Oct. 9, 1831), Capo d'Istria was assassinated by these two men as he went into church.

BIBLIOGRAPHY.—Carl W. P. Mendelssohn-Bartholdy's *Graf Johann Kapodistrias* (Berlin, 1864) is based on all the sources, printed and unprinted, available at the time of publication, and contains an excellent guide to these. *See* also the historical sections of F. de Marten's *Recueil des traités conclus par la Russie*, etc (1874, etc), and W Alison Phillips, *The War of Greek Independence* (1897). Under the Russian title "Zapiska grapha Joanna Capodistrias" is published in the series of the Imperial Russian Historical Society, vol. iii. p. 163 (St. Petersburg, 1868) the *Aperçu de ma carrière publique*, written by Capo d'Istria for presentation to the emperor Alexander, and dated at Geneva Dec. 12 (24 N.S.) 1826 Of unpublished materials may be mentioned the letters of Capo d'Istria to Sir Richard Church, vol. xvi. of the Church Papers in the British Museum (*Add. mss.* 36453–36571). *See* further, bibliography to chapter vi. of vol. x. of the *Cambridge Modern History* (1907).

CAPODISTRIA, a town and seaport of Istria, Italy in the province of Pola, 15m. S.W. of Trieste by rail but also reached by steamer. Pop. (1936) 7,105 (town), 11,995 (commune) It is situated on a small island, which occupies the end of a large bay in the Gulf of Trieste, and which is connected with the mainland by a causeway half a mile in length. Capodistria is an old town with small streets, and has preserved remarkably well its Venetian character. There are some good Venetian pictures in the churches. The most noteworthy buildings are the cathedral, the *Palazzo del Podestà* and the *Loggia*, all of them situated in the principal square. There are extensive salt works near the town. Capodistria is usually identified with the town of Aegida, which received (in the 6th century A.D.) the name of Justinopolis from Justin II. When at the beginning of the 13th century Istria fell into the hands of the patriarchs of Aquileia, they made this town the capital of Istria (whence its name). It was captured by the Venetians in 1278.

CAPONIER (from the Fr. *caponnière*, properly a capon-cote or house), in fortification, a work constructed in the ditch of a fort so that fire from it can sweep the bottom of the ditch and prevent an enemy from establishing himself therein. The term is used in a military sense as early as in the late 17th century. In various bastioned systems of fortification a caponier served merely as a covered means of access to outworks, the bastion trace providing for the defence of the ditch by fire from the main parapet.

CAPORETTO, BATTLE OF. This is the title given to the heavy but soon retrieved defeat of the Italian force in Venezia. Beginning on Oct. 24, 1917, the Austro-German drive was finally thwarted on the general line of the Piave in December. The Italian offensive of Aug.-Sept. 1917 (*see* WORLD WAR I) had reduced Boroević's armies to the limit of resistance, so much so that, as Ludendorff records, "in the middle of September it became necessary to decide for the attack on Italy in order to prevent the collapse of Austria-Hungary."

There was a clear difference of opinion on the Italian side as to the best way of meeting the forthcoming attack. Cadorna felt he must stand on the defensive. Capello, who commanded the II. Army, was anxious to anticipate the enemy's move by an attack north-east from his positions on the Bainsizza plateau. His army was in the main aligned for attack, for a continuation of the offensive which had been broken off in September, and he judged it impossible, given the difficulty of communications and the risk of imminent attack, to take up the positions best adapted for defence. In this idea he had the support of more than one of his corps commanders, but Cadorna did not agree with Capello whose plan would have been sufficient to annihilate the Austro-German offensive.

I. THE AUSTRO-GERMAN ATTACK

Disposition of Italian Forces.—Cadorna had received satisfactory reports concerning the morale of his troops. He had enough men, though a number of his units were below strength; and he had enough guns, in spite of the withdrawal of the Allied batteries, though he would have been glad of more heavy artillery. Between Monte Rombone and Monte San Gabriele, Capello had some 2,200 guns and nearly 800 trench mortars. North of Tolmino the line on the left bank of the Isonzo was held by Cavaciocchi's IV. Corps, whose left wing held the Plezzo basin and was in contact with the Carnia force on Monte Rombone. Next came Badoglio's XXVII. Corps, whose left wing, the 19th Division, raised to the strength of an army corps, held the lines opposite Tolmino. The other three divisions which completed the XXVII. Corps were across the river south of the Lom plateau. Behind Cavaciocchi's right and the 19th Division, on the mountains west of the Isonzo, lay the VII. Corps, newly reconstituted with units from other corps, and commanded by Gen. Buongiovanni. On the right of the XXVII., holding the line as far as Monte Santo, were Caviglia's XXIV. Corps and Albricci's II. Corps.

The weak point of the Italian line was the Tolmino sector; the weakest part of the sector was at the junction of the XXVII. Corps (19th Division) with the IV. (46th Division), and the weakest position of all was that held by the right of the 46th Division, which was clinging to the slopes of Sleme and Mrzlivrh, completely dominated by the enemy and badly off for communications with its neighbours. The Tolmino sector was chosen for the main enemy attack, and here, owing to a complex of circumstances, the Austro-German forces won a success that led to a great Italian disaster. The Italian preparations were much handicapped by the illness of Capello.

The Attack Launched.—The main attack came in the direction anticipated, between Monte Rombone and south of Tolmino, and was conducted by a mixed German and Austrian army under Gen. Otto von Below. The army, which was known as the XIV. Army, consisted of nine Austrian divisions and seven German, in four groups. The northern group of four divisions (three Austrian and one German Jäger) was commanded by Krauss, who had been called back from the Bukovina. Next came a group of three divisions (one Austrian and two German) under the German, von Stein, and a group of two German divisions under the German, von Berrer. South of these two central groups was a mixed group (one Austrian and two German) under the Austrian, von Scotti. East of Tolmino lay four divisions in reserve. Boroevic had 20 divisions in his two Isonzo armies between Auzza and the sea. Below and Henriquez (II. Isonzo Army) had some 2,500 guns and 500 trench mortars.

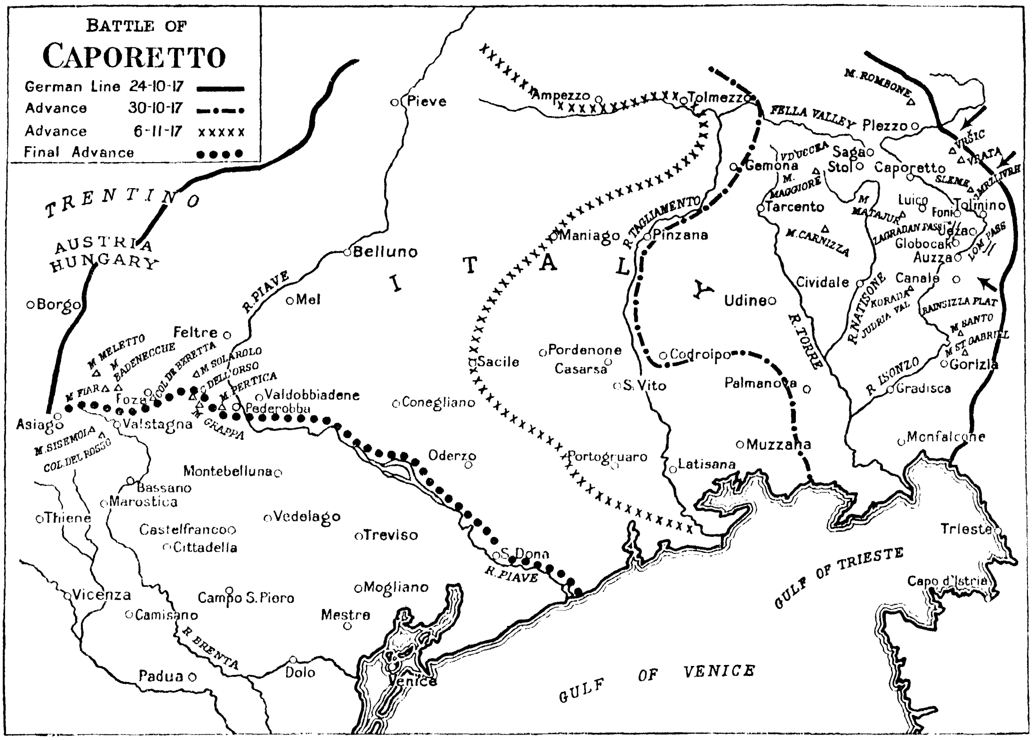
The bombardment began at 2 o'clock on the morning of Oct. 24, in wild autumn weather. There was a drizzle of snow on the high ridges, rain below, and mist everywhere. Towards dawn the fire died down, and it was thought on some parts of the defending front that the bad weather had counselled a delay in the attack. But the attackers were to make skilful use of the weather conditions, and only on Monte Rombone, on Krauss's extreme right, an attack in conjunction with the left wing of Krobatin's X. Army had to be given up owing to the snow.

Krauss's main attack was a straight drive through the Italian lines in the Plezzo basin, his first objective the Saga defile. But he meant to reach without delay the ridge of the Stol (6,467 ft.), which stood athwart a further direct advance. For this attack he detailed the 22nd Schützen Division, followed by a Kaiserjäger and a Kaiserschützen battalion, which were to go straight for the Stol, and by six battalions of the 3rd (Edelweiss) Division which were to make for the val Fella by way of the val d'Uccea. Krauss's left wing, the 55th (Bosnian) Division, attacked the Vršic-Vrata ridge, with the object of breaking through to the Isonzo and Caporetto.

Krauss's drive, after hard fighting, broke through the three front lines held by the Italian 50th Division, but the attacking troops were checked at the Saga defile. When evening fell this position was still in the hands of the Italians, but the battle had gone badly for the defenders farther south, and a retreat to the Stol became necessary. Krauss's Bosnians had met with no success against the left wing of the Italian 43rd Division, but Stein's group had carried all before it. Stein opened his attack with his right wing, the Austrian 50th Division, at 7.30 A.M., attacking the Italian 46th Division between Monte Nero and Vodil. A little later the Bavarian Alpenkorps, advancing from Tolmino, attacked the ridges east of the Passo di Zogradan, while Berrer and Scotti attacked farther south.

Success of the Silesians.—When both Stein's initial attacks were under way the 12th Silesian Division, under Gen. von Lequis, was sent in between them. Lequis attacked in two columns, one on each side of the river, making for Caporetto, where it was hoped he would join with Krauss's Bosnians. Both columns were completely successful. The right-hand column, aided by the strong attacks of the Austrian 50th Division, pierced the extreme right of the Italian 46th Division and pushed north-west with all speed. Across the river, where the Alpenkorps was making good headway on the slopes above the road, Lequis's left-hand column quickly reached the Italian second line, where the valley narrows below the hamlet of Foni. This line had been held until the eve of the battle by a brigade of the IV. Corps, but at the last moment the sector was transferred to the XXVII. Corps, and the Napoli Brigade was given to Badoglio to hold this important point. Only one battalion, however, was placed near the river. The rest of this regiment (the 76th) lay at the Zogradan pass, high on the ridge to the south-west, and the other regiment of the brigade (the 75th), together with the brigade command, was three miles away, on the western slopes below Zogradan. The single battalion, of which only a platoon was on the road, seems to have been taken completely by surprise. It was run over by the Silesians, who proceeded on their way up the valley practically unmolested.

Meanwhile, the Alpenkorps, Berrer's two divisions and Scotti's right wing were breaking up Badoglio's left, while the latter's right, across the river, and Caviglia's corps were being strongly



MAP SHOWING LINES OF THE AUSTRO-GERMAN ADVANCE, OCT. 24 TO NOV 6 1917 THE GERMAN ATTACK WAS LAUNCHED AGAINST THE ITALIAN ISONZO LINE AT ITS WEAKEST PART, THE TOLMINO SECTOR

attacked by Scotti's left and Henriquez's right The attack from Tolmino had been carried out with skill, speed and resolution, and by a capital error, which has never been satisfactorily explained, the Italian guns remained silent until too late Definite orders had been given both by Cadorna and by Capello that immediately upon the opening of the enemy's bombardment the Italian artillery should open fire on the enemy's trenches and zones of concentration, and that they should lay down a heavy barrage as soon as there were signs of movement. These orders were not carried out and, owing to great destruction of telephone wires, when the guns finally began their fire was fitful and uncertain. Taken by surprise, puzzled by the comparative silence of their own guns and blinded by mist, the troops of the 19th Division opposed a weak resistance to the Austro-German attack.

Henriquez's attack on the Bainsizza plateau, although it met with some initial success, was readily repulsed. Badoglio had hoped to hold the enemy attack from Tolmino and turn the scale by a counter-attack on the Lom plateau with his three divisions on the left bank of the Isonzo. But he was not afforded the chance of attempting any such manoeuvre. It was long before he received any news of how the day was going on the front of the 19th Division, and from the beginning of the action he was unable to communicate with his divisions across the river. In a message sent to Army Headquarters at 4 P.M. he reported the enemy success south of Jeza, but said that he had no news from the commands of the 19th Division and the IV. Corps, and that he was unable to communicate with anyone.

By 4 P.M. Lequis's Silesians were approaching Caporetto. The left-hand column was unmolested on its march. The right-hand column, which had cut in behind the Italian 43rd Division, was making the task of the Austrian 50th comparatively easy, and brushing aside the spasmodic opposition of such small detachments as came in its way. Cavaciocchi had filled his front lines too full, and sent practically all his reserves across the river, in immediate support of the 43rd and 46th Divisions

II. THE ITALIAN RETREAT

By evening Stein was pouring troops through the breach made by the Silesians, and was making good headway with the Austrian 50th Division on their right, while the Alpenkorps, Berrer and Scotti had in several places gained the high ridges dominating the head of the Judrio valley Krauss was still held up at Saga and Polounik, and his Bosnians had gained no more ground. But the break-through between Tolmino and Caporetto had made the Italian positions untenable.

At Cividale, where Capello had his headquarters and at the Comando Supremo in Udine, the first news that came from the IV Corps, and the absence of news from the XXVII, made a grave impression. Capello sent up the army reserves by the valley roads and dispatched Montuori to direct the "left wing (the IV. and VII Corps). By evening it was clear that the enemy had won a big success, though it was not yet clear to what an extent the whole Italian left was crumbling There seemed good reason to hope that the advance might be blocked in the narrow valleys west of the Isonzo. But by nightfall both the IV Corps and the 19th Division were practically broken in pieces The VII. Corps was beginning to be attacked at Luico, and its right was uncovered by the destruction of most of the 19th Division The right wing of the 19th was still holding on Globocak and down to the river, and troops were being brought back from the left bank to strengthen this line. But it was obvious that the positions on the Bainsizza could not be obtained, and orders were given to Caviglia, who had taken over Badoglio's troops beyond the river, to prepare for a retreat across the Isonzo.

At the moment the most dangerous point appeared to be the extreme left wing, where it was clear that Krauss would try and push through the val d'Uccea, the shortest way to the Tagliamento. Two Alpine groups had been dispatched to this sector the day before, and Cadorna gave orders that the val d'Uccea must be blocked at all costs. He sent out orders for resistance on three successive lines, all radiating from Monte Maggiore, which was the key position, but at the same time, as a precaution, he directed that plans and orders should be drawn up for a general retreat to the Tagliamento.

The news on the morning of Oct. 25 was increasingly grave. Krauss was pressing upon the Stol, and finding a weak resistance; no stand was being made at Creda; Monte Matajur had fallen, practically undefended. Other positions were seriously threatened, and there was no confidence that they would be held, for it was now known in Cividale and Udine that the behaviour of some of the troops in the line had been very unsatisfactory, and that this unexpected lack of spirit was communicating itself to some of the reserves. These had a difficult task in getting to the scene of action, for as they marched up the narrow mountain roads they were met by ever-increasing masses of fugitives, the bulk of whom belonged to the non-combatant services. This unfortunate state of affairs undoubtedly hastened the break-up of Capello's whole left wing.

Preparations for Retreat.—On the afternoon of Oct 25 Capello, who could fight no more against his illness, and had been told by the chief medical officer of the army that he must resign his command, proposed an immediate retreat to the Tagliamento, arguing that it was useless to send more reserves into the chaos among the hills west of the Isonzo Cadorna felt that unless he could delay the enemy advance down the Natisone and Judrio valleys he ran the risk of having his centre and right cut off Montuori, who now succeeded Capello in command of the II. Army, thought that he could hold on a line from Monte Maggiore to Monte Carnizza and thence across the valleys to Monte Korada. Cadorna decided to attempt a further stand while warning Tassoni (Carnia force), di Robilant (IV. Army) and the duke of Aosta to hold themselves in readiness for retreat, but at midnight on Oct. 26 he was wakened to hear that Monte Maggiore had fallen He at once drew up the orders for a general retreat beyond the Tagliamento, and his plans were already matured for the longer retreat across the Piave which he foresaw would be necessary in order to get to a shorter line. The retreat began on Oct. 27, and two days later provisional orders and plans were issued for the further retirement to the Piave.

Fortunately for Italy, and for the cause of the Entente, the Germans and Austrians were outrunning their transport. Krauss complained that only he and Krafft von Delmensingen, Below's chief-of-staff, had been inspired by adequate ambitions for the attack. The objective had been Cividale, or at best the Tagliamento. Krafft thought they should have had the Adige in view. Krauss expressed the opinion that the real objective should have been Lyons. It must be remembered, however, that the transport difficulties were very great. Germany could not spare troops or material for an unlimited effort here, and the unexpectedly weak resistance of the Italian II. Army could hardly have entered into the calculations of those who were bound not to take too many risks. Krauss admits that if Cavaciocchi had held the Stol in force his own move would have been frustrated.

The critical days for the Italians were Oct. 30 and 31, when the pressure from north and east threatened the flank and rear of the III. Army, whose task had been made more difficult by the premature blowing up, owing to a false alarm, of the permanent bridges at Casarsa, and by the fact that the Tagliamento had come down in sudden and violent flood. But by the evening of Nov. 1 the last of the duke of Aosta's troops had been successfully withdrawn across the river.

Cadorna's weakest point was the stretch of the river west of Tarcento, for which Krauss and Stein were making with all speed. Two divisions under Di Giorgio had been dispatched to hold this line, but their march athwart the line of the retreat had been very difficult. Stein's troops were repulsed with heavy loss, but on the evening of Nov. 2 Krauss's Bosnians succeeded in crossing at Cornino, and the following morning Di Giorgio was strongly attacked at Pinzana. Two days later his left was pushed back still farther, endangering the line of retreat for the Carnia force and once more threatening the whole Italian line with envelopment from the north.

On the morning of Nov. 4 Cadorna ordered the retreat to the Piave, and that night the troops holding the line of the Tagliamento resumed their march westward. The IV. Army in Cadore was now in a difficult position, but Di Giorgio and the other covering troops of the worn-out II. Army slowed down the enemy's advance and gave time for most of di Robilant's troops to get away from Cadore and come into line between the I. and III. Armies. But the greater part of Tassoni's Carnia force was caught between Krauss's troops and Krobatin's X. Army.

III. THE RECOVERY ON THE PIAVE

New Italian Positions.—By Nov. 8 the bulk of the IV. Army was in line. On Nov. 9 and 10 the last covering troops of the II. and III. Armies crossed the Piave from Pederobba to the sea. The line chosen to defend the fortunes of Italy implied a withdrawal of the right wing of the I. Army. Pecori-Giraldi retired from Asiago and Gallio and based his right on the fortified lines of the Meletta group, giving up the XVIII. Corps to di Robilant, who held the line from the Brenta to the Piave and the short stretch of the river as far as the Montello.

Reserves were coming in fast from the depots, including the young class of 1899. French and British divisions were already in Italy and others were on the way. But Diaz, who took over the command from Cadorna on Nov. 9, had to face a situation that seemed almost desperate. The Italian armies had lost some 320,000 men in killed, wounded and missing, the number of prisoners being estimated at 265,000. The bulk of the II. Army had to be counted out altogether and the total number of troops to be reorganized and refitted was over 300,000. More than 3,000 guns had been lost and over 1,700 trench mortars. It seemed very doubtful whether these greatly weakened forces could resist the renewed attacks of the victorious armies which had followed so closely on their heels. Fortunately, the plans for defence had been well and truly laid by Cadorna in the limited time that was available, and still more fortunately, as a result of the danger in 1916, he had caused elaborate preparations to be made in the Grappa sector. It was due to this forethought that resistance on the line now chosen was possible.

Diaz had little breathing space, though some days elapsed before the enemy could prepare for an attack in force on the new line, for Conrad, on the Trentino front, saw a chance and, though he was short of troops, struck at once while calling for reinforcements. He attacked Pecori's troops on Nov. 10 as they were preparing to come back to the line already indicated and continued his attack on the new positions. But ten days' fighting brought heavy losses and no success. Meanwhile, Boroević had tested the river defences. He got troops across in two places but failed to make further progress, and on Nov. 16 an attack in force failed completely, the Austrians losing some 1,500 killed and nearly as many prisoners.

Conrad and Boroević were making no headway, but a very dangerous attack was being conducted by Krauss between the Brenta and the Piave. Attempts to break through by the valley roads were quickly frustrated, and persistent efforts to capture the all-important ridge of Monte Tomba-Monfenera, which runs down from the Grappa *massif* to the Piave, failed to pierce the thin Italian lines. The struggle at this point lasted for five days, Nov. 18–22, and the Italian IX. Corps, under Ruggeri Laderchi, fought a great fight. The critical day was Nov. 22, when Krauss's Bosnians and German Jäger made a final effort to break through. The attacking columns reached the crest of Monte Tomba, but their bolt was shot. In the evening Ruggeri Laderchi counterattacked and drove the enemy off the ridge, except at one point. Next day reserves arrived and the line was firmly established on its positions.

Meanwhile, in the Grappa sector, Krauss had attacked on Nov. 21 with his centre and right, but after a week's fighting, in spite of reinforcements drawn from Stein and Krobatin, he had to call a halt. A fresh attack was preparing when the situation was eased by the arrival of the British and French divisions which had hitherto been waiting in reserve. On Dec. 2 three British divisions, under Gen. the earl of Cavan, took over the Montello sector, and a similar French force under Gen. Duchesne relieved the IX. Corps in the Monte Tomba region. It was expected that both these points would be the object of early attack, but as it turned out they were both left unmolested. Conrad and Krauss continued their attempts on the mountain front, but Krauss confined his efforts to the Grappa sector. Krauss could not immediately renew his attack, but on Dec. 3 Conrad, reinforced but still complaining that he was starved for means of attack, opened a heavy bombardment on the curve of the Italian front from Monte Sisemol to east of Monte Badenecche.

Next day he pinched out the Meletta-Badenecche salient and took Monte Fior and Castelgomberto in the rear, and the day following he pushed down towards Foza. The position was critical, but the Italians succeeded in establishing a new line farther south, covering Valstagna and the mouth of the Frenzela valley. On Dec. 23, after careful preparation, Conrad launched a new attack on the lines between Monte Sisemol and the Frenzela valley. He gained a big initial success, taking both Col dell' Orso and Monte Melago and cutting off a large number of prisoners. The next day the Italians counter-attacked and retook both the hills. They established themselves firmly in their reserve lines and repulsed another attack, the last, on Christmas Day.

Krauss's Final Effort.—Meanwhile, between Conrad's two efforts, Krauss had made a determined attempt to drive the Italians off Monte Grappa. His command had been increased to ten divisions, six Austro-Hungarian and four German, and he did not spare his troops. He opened his attack on Dec. 11 by a push on each wing; from the Brenta valley and Monte Pertica against Col della Berretta, and against both sides of the Col dell' Orso-Solaro-lo salient. On the left, in spite of repeated attacks that lasted ten days, his German divisions made little headway, but on the right, at the end of four days' hard fighting, he had taken Col Caprile and Col della Berretta. Four days more and he was in possession of Monte Asolone, which looks down the valle di Santa Felicitá to the longed-for haven of the plain. This was the term of the Austrian advance. On Dec. 20 the Italians counter-attacked and won back a good deal of the lost ground, the last move in the long struggle. Krauss accepted failure for the moment, hoping for an early spring offensive farther west. Five days later the snow came, the heavy winter fall that was a month late. The invaders had been favoured by the tardy coming of winter, which greatly prolonged the strain on the sorely-tried armies of Italy. But it gave also to the defending troops the chance to remake at once a shaken reputation. They took the chance and their recovery was a remarkable feat of courage.

Conclusion.—The narrative has indicated briefly the causes which led to the Italian disaster. The defending troops were subjected to a very severe trial; but it would seem clear that failure and disaster might have been largely averted if the preparations against the Austro-German attack and the actual conduct of the defence had been different. To sum up, there were too many troops in the front lines and too few in the "battle positions." Cadorna had not succeeded in making all his subordinates grasp the principles of defence in depth or of "elastic" defence. And, given the erroneous dispositions of the defensive lines, the reserves were too far back. The Italian armies on the Julian front had been constantly on the offensive. They had had no recent practice in meeting an attack on the grand scale. It was this lack of practice, no doubt, and a false confidence based on obsolete experience, which led to the belief that even if the opening phases of the battle were unfavourable to the defence, there would be ample time to restore the situation.

When retreat became inevitable, the prospects might well have seemed desperate to those who had to organize it. For the army, long used to the war of positions that had been the rule for 28 months, was in no condition to move. The retreat, with all its confusion, its mistakes and its tragedies, remains an astonishing achievement. The resistance which followed it, when the retiring armies turned and stood at bay on the mountains and on the Piave, was the greatest of Italian victories.

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CAPPADOCIA, in ancient geography, an extensive inland district of Asia Minor. In the time of Herodotus the Cappadocians occupied the whole region from Mount Taurus to the Euxine. That author tells us that the name of the Cappadocians was applied to them by the Persians, while they were termed by the Greeks "Syrians," or "White Syrians" (*Leucosyri*). Under the later kings of the Persian empire they were divided into two satrapies or governments, the one comprising the central and inland portion, to which the name of Cappadocia continued to be applied by Greek geographers, while the other was called Cappadocia κατά Πόντον, or simply Pontus (*q.v.*). This division had already come about before the time of Xenophon. As after the fall of the Persian government the two provinces continued to be separate, the distinction was perpetuated, and the name Cappadocia came to be restricted to the inland province (sometimes called Great Cappadocia), which alone will be considered in the present article.

Cappadocia, in this sense, was bounded on the south by the chain of Mount Taurus, east by the Euphrates, north by Pontus, and west vaguely by the great central salt "Desert" (*Axylon*). But it is impossible to define its limits with accuracy. It was about 250 m. in length by less than 150 in breadth. The region is a high upland tract, attaining to more than 3,000 ft., and constituting the most elevated portion of the great tableland of Asia Minor (*q.v.*). The western parts of the province, where it adjoins Lycaonia, extending thence to the foot of Mount Taurus are open treeless plains, affording pasture in modern as in ancient times to numerous flocks of sheep, but almost wholly desolate. But out of the midst of this great upland level rise detached groups or masses of mountains, mostly of volcanic origin, of which the loftiest are Mount Argaeus (still called by the Turks Erjish Dagh) (13,100 ft.), and Hassan Dagh to the south-west (8,000 ft.).

The eastern portion of the province is of a more varied and broken character, being traversed by the mountain system called by the Greeks Anti-Taurus. Between these mountains and the southern chain of Taurus, properly so-called, lies the region known in ancient times as Cataonia, occupying an upland plain surrounded by mountains.

The only two cities of Cappadocia considered by Strabo to deserve that appellation were Mazaca, the capital of the kingdom under its native monarchs (*see* CAESAREA MAZACA); and Tyana, not far from the foot of the Taurus, the site of which is marked by a great mound at a place called Kiz (or Ekuzi) Hissar, about 10 m. south-west of Nigdeh. Archelais, founded by Archelaus, the last king of the country, subsequently became a Roman colony, and a place of some importance. It is now Akserai.

Several localities in the Cappadocian country were the sites of famous temples. Among these the most celebrated were those of Comana (*q.v.*) and Venasa in Morimene, where a male god was served by over 3,000 *hieroduli*. The local sanctity of Venasa has been perpetuated by the Moslem veneration for Haji Bektash, the founder of the order of dervishes to which the Janissaries used in great part to belong. Cappadocia was remarkable for the number of its slaves, who constituted the principal wealth of its monarchs. Large numbers were sent to Rome but did not enjoy a good reputation. The Cappadocian peasants are still in the habit of taking service in the west of the peninsula and only returning to their homes after long absences; their labour is now much valued by employers, as they are a strong sober folk. The province was celebrated for its horses, as well as for its vast flocks of sheep; but from its elevation above the sea and the coldness of its climate, it could never have been rich and fertile.

HISTORY

Nothing is known of the history of Cappadocia before it became subject to the Persian empire, except that the country was the home of a great "Hittite" power centred at Boghaz-Keui (*see* Pteria). With the decline of the Syro-Cappadocians after their defeat by Croesus, Cappadocia was left in the power of a sort of feudal aristocracy. It was included in the third Persian satrapy by Darius but was governed by rulers of its own, more or less tributary to the Great King. Subdued by the satrap Datames, Cappadocia recovered independence under Ariarathes I., a contemporary of Alexander the Great.

The province was not visited by Alexander, who contented himself with the tributary acknowledgment of his sovereignty made by Ariarathes, and the continuity of the native dynasty was only interrupted for a short time after Alexander's death, when the kingdom fell to Eumenes. His claims were made good in 322 B.C. by the Regent Perdiccas, who crucified Ariarathes, but in the dissensions following Eumenes's death, the son of Ariarathes recovered his inheritance and left it to a line of successors. Under the fourth of the name Cappadocia came into relations with Rome, first as an enemy of Antiochus the Great, then as an ally against Perseus of Macedon. The kings henceforward threw in their lot with the republic against the Seleucids. Ariarathes V. marched with the Roman pro-consul, Crassus against Aristonicus, and their forces were annihilated (130 B.C.). His death led to interference by the rising power of Pontus; the Cappadocians, supported by Rome against Mithridates, elected a native, Ariobarzanes, to succeed (93 B.C.); but it was not till Rome had disposed of the Pontic and Armenian kings that his rule was established (63 B.C.). In the civil wars Cappadocia was now for Pompey, now for Caesar, now for Antony, now against him. The Ariobarzanes dynasty came to an end and Archelaus reigned by favour first of Antony, then of Octavian, and maintained tributary independence until A.D. 17, when the emperor Tiberius reduced Cappadocia to a province. Vespasian in A.D. 70 joined Armenia Minor to it and made the combined province a frontier bulwark. We still possess the report made to Hadrian by his legate Arrian (*q.v.*), which is a valuable picture of life in a Roman frontier province in the 2nd century (A.D. 131–137). Cappadocia remained part of the Eastern empire until the 11th century, though often ravaged both by Persians and Arabs. Before it passed into Seljuk hands (1074), and from them to the Osmanlis, it had already become largely Armenian; we find the southern part referred to as "Hermeniorum terra" by crusading chroniclers.

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CAPPEL, LOUIS (1585–1658), French Huguenot divine and scholar, was born at St. Elier, near Sedan. He studied theology at Sedan and Saumur; and Arabic at Oxford, where he spent two years. In 1613 he accepted the chair of Hebrew at Saumur, and in 1633 became professor of theology. As a Hebrew scholar he concluded that the vowel points and accents were not an original part of Hebrew, but were inserted by the Massorete Jews of Tiberias, not earlier than the 5th century A.D., and that the primitive Hebrew characters are those now known as the Samaritan, while the square characters are Aramaic and were substituted for the more ancient at the time of the captivity. Cappel's important *Critica Sacra* (1634) met with such theological opposition that he was only able to print it at Paris in 1650, by the aid of a son who had turned Catholic. The various readings in the Old Testament text and the differences between the ancient versions and the Massoretic text convinced him that the integrity of the Hebrew text, as held by Protestants, was untenable. This amounted to an attack on the verbal inspiration of Scripture. Bitter, however, as was the opposition, it was not long before his results were accepted by scholars.

Cappel's other works include the *Annotationes et Commentarii in Vetus Testamentum*, *Chronologia Sacra*, *Arcanum Punctuationis revelatum* (1624), the *Diatriba de veris et antiquis Ebraeorum literis* (1645), and *Commentarius de Capellorum gente*, which give an account of his family. *See* Herzog-Hauck, *Realencyklopädie*.

CAPPELLO, BIANCA (1548–1587), grand duchess of Tuscany, was the daughter of Bartolommeo Cappello, a member of a rich and ancient Venetian house, and celebrated for her great beauty. After a runaway marriage with Pietro Bonaventuri, a poor Florentine clerk, she became the mistress of Francesco, son and heir of the grand duke Cosimo de' Medici, who succeeded his father in 1574. Her husband having been murdered in Florence in 1572, and Francesco's wife having died in 1578, Bianca was married to him, the wedding being publicly announced on June 10, 1579. In Oct. 1587 both she and her husband died within a few days of each other in circumstances that at first gave rise to suspicions of poisoning. Colic, however, would seem to have been the real cause of their deaths.

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CAPPER, SIR THOMPSON (1863–1915), British major-general, was born at Lucknow on Oct. 20, 1863, the son of a Bengal civil servant. He entered the army in 1882, and served in the Chitral (1895), Sudan (1898–99) and South African (1900–02) campaigns. Capper was one of the outstanding scientific soldiers of his day, and after some experience as professor at the Staff College he became First Commandant of the Indian Staff College at Quetta. For the three years before the World War he held a command in Dublin and, on the outbreak of war, was given the command of the hurriedly improvised 7th Division, which was sent to Belgium in October for the relief of Antwerp, but was actually employed to defend Ypres and to block the way to the Channel forts. The division saw three weeks' hard fighting (Oct.–Nov. 1914), during which its infantry strength was reduced from 14 000 to 4,000 men. Capper continued to command the 7th Division in France, and was killed in the battle of Loos on Sept. 26, 1915.

CAPPERONNIER, CLAUDE (1671–1744), French classical scholar, born at Montdidier on May 1, 1671. He took orders but devoted himself almost entirely to classical studies. He published an edition of Quintilian (1725) and his edition of the ancient Latin Rhetoricians was published posthumously in 1756. He furnished much material for Robert Estienne's *Thesaurus Linguae Latinae*. His nephew, Jean Capperonnier (1716–1775), was also a distinguished scholar, and published valuable editions of classical authors—Caesar, Anacreon, Plautus, Sophocles.

CAPPONI, GINO, Marquis (1792–1876), Italian statesman and historian, was descended from an ancient Florentine family. In 1811 he married the marchesina Giulia Riccardi. After the return of the grand duke Ferdinand III. from exile in 1814, Capponi embarked upon a long series of travels that brought him into touch with the most notable intellects of his day. In London he met Lord John Russell; and his visit to Edinburgh, where he made the acquaintance of Francis Jeffrey, inspired him to found, on his return home, a literary review like the *Edinburgh*—the *Antologia*. He also contributed to the *Archivio Storico*. After dallying with politics, he devoted himself to the economic development of Tuscany until in 1848 the grand duke Leopold II. decided to grant his people a constitution. Capponi threw himself heartily into the ruler's plans, and finally took office as prime minister. His conduct of foreign affairs was far-sighted, and he endeavoured to retrieve the situation after Charles Albert had been defeated on the Mincio. Although he had lost his sight in 1844, he continued to devote himself to his favourite historical studies. These he resumed on his resignation from the premiership in Oct. 1848, when he began his great work, the *Storia della Repubblica di Firenze*. In 1859 he voted for the union of Tuscany with Piedmont, and in 1860 he was created a senator by King Victor Emmanuel. A large number of his miscellaneous writings have been published under the title *Scritti Inediti.*

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CAPPONI, PIERO (1447–1496), Florentine statesman and soldier, was employed as ambassador by Lorenzo de' Medici. After Lorenzo's death in 1492, Capponi became a leader of the anti-Medicean party. He later became chief of the republic, in which capacity he conducted the negotiations with Charles VIII. of France with conspicuous skill. Charles entered Florence in Nov. 1494 and sought to intimidate the republic; but Capponi's firm attitude soon caused the king to moderate his demands. After Charles's departure, Capponi led the army of the republic against the Pisans. He was killed while besieging the castle of Soiana on Sept. 25, 1496.

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CAPPS, EDWARD (1866–). American classical scholar, was born in Jacksonville (Ill.), on Dec. 21, 1866. He graduated at Illinois college in 1887, and received the degree of Ph.D. at Yale university in 1891. In 1890 he was appointed tutor at Yale. He was professor of Greek language and literature at the University of Chicago from 1892 to 1907. In 1903 he was special lecturer at Harvard, and during the next two years studied at Athens, and Halle, Germany. During 1906–7 he was managing editor of *Classical Philology*, and in 1907 was called to Princeton university as professor of classics. In 1914 he was president of the American Philological Association, and in 1917 was Turnbull lecturer on poetry at Johns Hopkins University. In 1918 he was appointed head of the American Red Cross Commission to Greece, and became also chairman of the managing committee of the American School of Classical Studies at Athens. In 1920 he was appointed minister to Greece, resigning in March 1921 and returning to Princeton. He is a leading authority on the Greek theatre. He was editor-in-chief of the University of Chicago decennial publications, 29 vols., and became the American editor of the Loeb Classical Library.

His works include: *The Greek Stage according to the Extant Dramas* (1891); *From Homer to Theocritus* (1901); *The Introduction of Comedy into the City Dionysia* (1903); and *Four Plays of Menander* (1910).

CAPRAIA (anc. *Capraria*, from Lat. *capra*, wild-goat), an island of Italy, off the north-west coast (the highest point 1,466 ft. above sea-level), belonging to the province of Leghorn, and 42 mi. S.S.E. of Leghorn by sea. Pop. (1936) 341. It produces wine, and is a centre of the anchovy fishery. It became Genoese in 1527 and was strongly fortified. About 20 mi. to the north is the island of Gorgona (highest point 836 ft.), also famous for its anchovies. Both islands have penal colonies.

CAPRARA, GIOVANNI BATTISTA (1733–1810). Italian cardinal, was born on May 29, 1733, at Bologna of the family of the counts of Montecuculi. Having acted as nuncio at Cologne, Lucerne and Vienna, he received a cardinal's hat in 1792, and in 1801, at the special request of Bonaparte, was deputed by the Vatican as legate in France to execute the terms of the Concordat. When he was formally received on April 9, 1802, he read a Latin declaration promising to respect the Gallican liberties, and this he was afterwards alleged to have signed. He was no match for Napoleon and did not enforce the conditions he had made before instituting the "constitutional" bishops of Orleans and Vannes. He gave way on important points, and Napoleon secured his appointment as archbishop of Milan in 1802. In 1803, however, Caprara protested against the organic articles added to the Concordat by the French Government. He was the channel of communication between Pius VII. and Napoleon in the arrangement for the latter's coronation. He died in Paris on June 21, 1810. In 1802 he published *Concordat et recueil des bulles et brefs de N.S. Pie VII. sur les affaires de l'Église en France.*

CAPRERA, an island N.E. of Sardinia, 4 mi. in length. Pop. (1936) 819. It is connected by a bridge with La Maddalena. Its chief interest lies in its connection with Garibaldi, who first established himself there in 1856, and died there on June 2, 1882. His tomb is visited on this anniversary by Italians from all parts.

CAPRI (anc. *Capreae*), an island in the province of Naples (from which town it is 17 mi. S.), on the S. side of the Bay of Naples. Pop. (1936) of the island, 12,088; of Capri, 3,353 (town), 7,984 (commune); of Anacapri, 2,613 (commune); of Marina Grande, 1,281 (town), 1,491 (commune). It is 4 mi. long and the greatest width is 1½ mi., area 5½ sq mi. The highest point is Monte Solaro (1,920 ft.) on the west, while at the east cliffs rise 900 ft. sheer from the sea. The usual landing-place is on the north side (Marina Grande) with a funicular railway up to the town; but the Marina Piccola, on the south, is used when there is a strong north wind. The towns, Capri (450 ft.) and Anacapri (980 ft.), until the construction of a carriage road in 1874 were connected only by a flight of 784 steps. The island lacks water, and is dusty during drought, but is fertile, producing fruit, wine and olive oil. The indigenous flora comprises 850 species. The prosperity of the island usually depends mainly upon foreign visitors (ordinarily some 60,000 annually). The famous Blue Grotto, the most celebrated of many sea caves known in Roman times, was rediscovered in 1826.

The high land in the west of the island and the less elevated region in the east are formed of limestones similar to the Urgonian (Lr. Cretaceous) of Sicily. The intervening depression, which is probably bounded on the west by a fault, is filled to a large extent by sandstones and marls of Eocene age. A superficial layer of recent volcanic tuff occurs in several parts of the island. At the Blue Grotto, as in other parts of the island, indications of recent changes of sea-level are seen.

Neolithic remains have been found in the Grotto delle Felci, *see* Rellini, in *Monumenti dei Lincei* xxix. (1924) 305 *sqq.*, a cave on the south coast. Capri belonged to Neapolis, until the time of Augustus, who took it in exchange for Aenaria (Ischia) and often resided there. Tiberius, who spent the last ten years of his life at Capri, built no fewer than twelve villas there; to these the great majority of ancient remains on the island belong; the best preserved, on the east extremity, consisting of vaulted substructures and the foundations of a *pharos* (lighthouse). This was known as Villa Jovis, and the other eleven were perhaps named after other deities. Numerous ancient cisterns show that in Roman as in modern times rain-water was largely used for lack of springs. The wife and sister of Commodus were banished hither. The mediaeval town was at the Marina Grande; and to it belonged the early church of S. Costanzo. In the 15th century the inhabitants took refuge from pirates higher up, at the two towns of Capri and Anacapri. In 1806 the island was taken by the English fleet under Sir Sidney Smith, and strongly fortified, but in 1808 it was retaken by the French under Lamarque. In 1815 it was restored to Ferdinand I. of the Two Sicilies.

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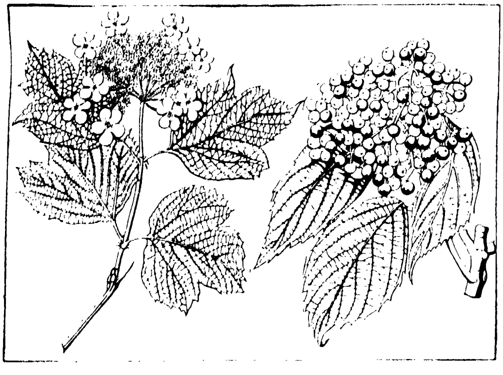
CAPRICCIO or **CAPRICE,** a musical term for a lively composition of a more or less fanciful nature, not following a set musical form, although the first known, written for the harpsichord, partook of the nature of a fugue. The word is also used for pieces of a showy types in the nature of transcriptions and variations.

CAPRICORNUS ("the goat"), in astronomy, the tenth sign of the zodiac, represented by the symbol ♑, intended to denote the crooked horns of this animal. The word is derived from Lat. *caper*, a goat, and *cornu*, a horn. It was represented by the ancients as a creature having the forepart a goat, and the hindpart a fish, or sometimes simply as a goat.

CAPRIFOLIACEAE, a family of shrubs and trees, characterized by having the petals of the flower united. The plants are sympetalous Dicotyledons; common representatives are *Sambucus* (elder), *Viburnum* (guelder-rose and wayfaring tree), *Lonicera* (*see* HONEYSUCKLE); *Adoxa* (moschatel), a small herb with a creeping stem and small yellowish-green flowers, is occasionally found on damp hedge-banks; *Linnaea*, a slender creeping evergreen with a thread-like stem and pink bell-shaped flower, a northern plant, occurs in cold woods and mountains of Asia, Europe and North America. The leaves are opposite, simple as in honeysuckle, or compound as in elder; they have usually no stipules. The flowers are regular as in *Viburnum* and *Sambucus*, more rarely two-lipped as in *Lonicera;* the sepals and petals are usually five in number and placed above the ovary, the five stamens are attached to the corolla-tube, there are three to five carpels, and the fruit is a berry as in honeysuckle or snowberry (*Symphoricarpus*), or a stone fruit, with several, usually three, stones, as in *Sambucus.*

In *Sambucus* and *Viburnum* the small white flowers are massed in heads or panicles; honey is secreted at the base of the styles and, the tube of the flower being very short, is exposed to flies and insects with short probosces. The flowers of *Lonicera*, which have a long tube, open in the evening, when they are sweet-scented and are visited by hawk-moths. The family contains about 300 species, chiefly natives of the north temperate zone and the mountains of the tropics. Several genera afford ornamental plants; such are *Lonicera*, erect shrubs or twiners with long tubed white, yellow or red flowers; *Symphoricarpus*, a North American shrub, with small whitish pendulous flowers and white berries; *Diervilla* (also known as *Weigelia*), and *Viburnum*, including *V. Opulus*, guelder rose, in the cultivated forms of which the corolla has become enlarged at the expense of the essential organs and the flowers are neuter.



FLOWERING BRANCH OF GUELDER ROSE (VIBURNUM OPULUS) SHOWING THE STERILE OUTER FLOWERS WITH LARGE COROLLAS

Attractive to insects which pollinate the fertile inner flowers with reduced corollas

The family is more abundant in the eastern part of North America than in the western mountain region, the large genera being honeysuckle (*Lonicera*) and arrow-wood (*Viburnum*).

CAPRIMULGIDAE: *see* NIGHTJAR; NIGHTHAWK, WHIP-POOR-WILL.

CAPRIVI DE CAPRERA DE MONTECUCCOLI, GEORG LEO VON, COUNT (1831–1899), German soldier and statesman, was born on Feb. 24, 1831, at Charlottenburg. The family springs from Carniola, and the name was originally written Kopriva; in the 18th century one branch settled in Wernigerode, and several members entered the Prussian service; the father of the chancellor held a high judicial post, and was made a life member of the Prussian House of Lords. Caprivi was educated in Berlin, and entered the army in 1849; he took part in the campaign of 1866, being attached to the staff of the I. Army. In 1870 he served as chief of staff to the X. Army Corps, which formed part of the II. Army, and took part in the battles before Metz as well as in those round Orleans, in which he highly distinguished himself. One of the most delicate strategical problems of the whole war was the question of whether to change the direction of the X. Corps on the morning of the 16th of August before Vionville, and in this, as well as in the actual manoeuvres of the corps on that day, Caprivi, as representative of, and counsellor to, his chief, General v. Voigts-Rhetz, took a leading part. At the battle of Beaune-la-Rolande, the turning-point of the Orleans campaign, the X. Corps bore the brunt of the fighting. After the peace he held several important military offices, and in 1883 was made chief of the admiralty, in which post he had to command the fleet and to organize and represent the department in the Reichstag. He resigned in 1888, when the command was separated from the representation in parliament, and was appointed commander of the X. Army Corps. Bismarck had already referred to him as a possible successor to himself, for Caprivi had shown great administrative ability, and was unconnected with any political party, and in March 1890 he was appointed chancellor, Prussian minister president and foreign minister. He was quite unknown to the public, and the choice caused some surprise, but was fully justified. The chief events of his administration, which lasted for four years, are narrated elsewhere, in the article on Germany. He showed great ability in quickly mastering the business, with which he was hitherto quite unacquainted, as he himself acknowledged; his speeches in the Reichstag were admirably clear, dignified, and to the point. His first achievement was the conclusion in July 1890 of a general agreement with Great Britain regarding the spheres of influence of the two countries in Africa. Bismarck had supported the colonial parties in Germany in pretensions to which it was impossible for Great Britain to give her consent, and the relations between the two powers were in consequence somewhat strained. Caprivi adopted a conciliatory attitude, and succeeded in negotiating terms with Lord Salisbury which gave to Germany all she could reasonably expect. But the abandonment of an aggressive policy in the East Africa and Nigeria, and the withdrawal of German claims to Zanzibar (in exchange for Heligoland) aroused the hostility of the colonial parties, who bitterly attacked the new chancellor. Caprivi had, however, by making the frontiers of the Congo Free State and German East Africa meet, "cut" the Cape to Cairo connection of the British, an achievement which caused much dismay in British colonial circles, regular treaties having been obtained from native chiefs over large areas which the chancellor secured for Germany. In Nigeria also Caprivi by the 1890 agreement, and by another concluded in 1893, made an excellent bargain for his country, while in South-West Africa he obtained a long but narrow extension eastward to the Zambezi of the German protectorate (this strip of territory being known as "Caprivi's Finger"). In his African policy the chancellor proved far-sighted, and gained for the new protectorates a period for internal development and consolidation. The Anglo-German agreement of 1890 was followed by commercial treaties with Austria, Rumania, etc.; by concluding them he earned the express commendation of the emperor and the title of count, but he was from this time relentlessly attacked by the Agrarians, who made it a ground for their distrust that he was not himself a landed proprietor; and from this time he had to depend greatly on the support of the Liberals and other parties who had been formerly in opposition. The reorganization of the army caused a parliamentary crisis, but he carried it through successfully, only, however, to earn the enmity of the more old-fashioned soldiers, who would not forgive him for shortening the period of service. His position was seriously compromised by the failure in 1892 to carry an education bill, which he had defended by saying that the question at issue was Christianity or Atheism, and he resigned the presidency of the Prussian ministry, which was then given to Count Eulenburg. In 1894, a difference arose between Eulenburg and Caprivi concerning the bill for an amendment of the criminal code (the *Umsturz Vorlage*), and in October the emperor dismissed both. Caprivi's fall was probably the work of the Agrarians, but it was also due to the fact that, while he showed very high ability in conducting the business of the country, he made no attempt to secure his personal position by forming a party either in parliament or at court. He interpreted his position rather as a soldier; he did his duty, but did not think of defending himself. He suffered much from the attacks made on him by the followers of Bismarck, and he was closely associated with the social ostracism of that statesman; we do not know, however, in regard either to this or to the other events of his administration, to what extent Caprivi was really the author of the policy he carried out, and to what extent he was obeying the orders of the emperor. With a loyalty which cannot be too highly praised, he always refused even after his abrupt dismissal, to justify himself, and he could not be persuaded even to write memoirs for later publication. The last years of his life were spent in absolute retirement, for he could not even return to the military duties which he had left with great reluctance at the orders of the emperor. He died unmarried on Feb. 6, 1899, at the age of 68,

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(J. W. H.)

CAPRONNIER, JEAN BAPTISTE (1814–1801), Belgian stained-glass painter, was born in Brussels in 1814, and died there in 1801. He had much to do with the modern revival of glass-painting, and first made his reputation by his clever restorations of old examples. He carried out windows for churches in Brussels, Bruges, Amsterdam, and elsewhere, and his work was commissioned also for France, Italy, and England. At the Paris Exhibition of 1855 he won the only medal given for glass-painting.

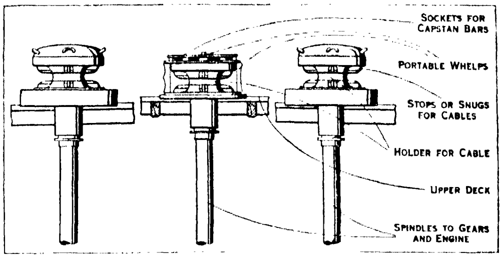
CAPSICUM, a genus of plants, the fruits of which are used as peppers. As used in medicine, the ripe fruit of *Capsicum mimum* (or *frutescans*), containing the active principle capsaicin (capsacutin), has remarkable physiological properties. Applied to the skin or mucous membrane, it causes redness and later vesication. Internally in small doses it stimulates gastric secretions but if used in excess causes subacute gastritis. In single excessive doses it causes renal irritation and inflammation and strangury. Capsicum is valuable in atony of the stomach due to chronic alcoholism, in the flatulency of the aged, and in functional torpidity of the kidney. Externally capsicum plaster placed over the affected muscles is useful in rheumatism and lumbago. Capsicum wool, known as calorific wool, made by dissolving the oleoresin of capsicum in ether and pouring it on to absorbent cotton-wool, is useful in rheumatic affections.

CAPSTAN. An appliance used on board ship and on dock walls, for heaving-in or veering cables and hawsers, whether of chain, steel or hemp. It differs from a windlass, which is used for the same purposes, in having the axis on which the cable or rope is wound vertical instead of horizontal.

The earlier forms were of a comparatively simple character, made of wood with an iron spindle and worked by manual labour with wooden capstan bars. As heavier cables were supplied to ships, difficulty was found, when riding at anchor, in holding, checking and veering cable. A cable-holder (W. H. Harfield's) was tested in H.M.S. "Newcastle" (wooden frigate) in 1870 and proved effective; its first development in 1870 was the application in the form of a windlass secured to the deck, driven by a messenger chain from the capstan, fitted in H M S. "Inflexible." Modern warships are fitted with a capstan in the centre-line, which may be capable of taking a chain cable as well as a hawser; also a cable-holder for each bower cable, all power-worked. The sheet cable, which normally rides round a dummy cable-holder, can be brought to the centre-line capstan by means of rollers. (*See* Anchor.)

Well-known types of cable-holders, like Napier's and Harfield's, differ chiefly in mechanical details. The principle of each type is that there is a long vertical shaft connected at the bottom by worm gearing to the engine. On the forecastle, at the top of the shaft, is pivoted the cable-holder, which can either revolve freely, as when cable is running out, or be locked to the shaft for "heaving in." In the latest types the locking arrangement is a "dead" lock, in an earlier one it was frictional. In the newer type too, a frictional band-brake is fitted to control the cable when it is running out. In the older type the friction plates acted as a brake. Cable-holders are not fitted with hand gear, nor can they be used for hauling in a hawser. The centre-line capstan can be either connected to the engine or worked by hand. For the latter, long bars are shipped into recesses in the capstan head at equal intervals to enable it to be "manned." The bars are kept in place by a rope "swifter" passed round their extreme ends. To prevent the capstan taking charge when weighing, pawls and pawl stops are brought into use.

In the latest types of capstan the whelps (projections to grip a hawser) are portable and ship over the sprockets, *i.e.* the part of the capstan fitted with "stops" or "snugs" to take chain cable.



Cableholders and Capstan on the Forecastle of a Battleship

The middle line capstan can be worked by hand by means of capstan bars, after being disconnected from the engine. Portable whelps can be shipped to bring-to a hemp or wire hawser. The cableholders can only be used for chain cable

In older types, the capstan was only fitted for winding in hawsers and could only be used to work cables by employing a hook-rope or "messenger."

Merchant ships are usually fitted with a windlass type of anchor gear having a horizontal axis. The two bower cables lead over the sprockets of a cable-holder at each end of the driving shaft; outboard of these, at the extremities, are drums for bringing to hawsers. The cable-holders are frictionally connected to the driving shaft on much the same principle as the vertical type in warships.

The machinery for driving capstans and cable-holders on board ship may be steam or electric. Power-capstans on dock sides are generally electric or hydraulic. The derivation of the term "capstan" is connected with the O.Fr. *capestan* or *cabestan*, from Lat. *capistrum* a halter, *capere* to take hold of

(E. A.)

CAPSULE, a term in botany for a dry seed vessel, as in the poppy, iris, foxglove, etc., with one or more cavities. When ripe the capsule opens and scatters the seed (*see* Fruit). The word is used also for a small gelatinous case enclosing a dose of medicine, and for a metal cap or cover on bottles and jars. In anatomy the term is used to denote a cover or envelope partly or wholly surrounding a structure. Every diarthrodial joint possesses a fibrous or ligamentous capsule, lined with synovial membrane, attached to the adjacent ends of the articulating bones. The term is particularly applied to the sac which encloses the crystalline lens of the eye; to Glisson's capsule, a thin areolar coat of fibrous tissue lying inside the tunica serosa of the liver; to the glomerular capsules in the kidney substance; to the suprarenal capsules, two small flattened organs in the epigastric region; and to the internal and external capsules of the brain (*q.v.*).

CAPTAIN, in its general application refers to the leader, master, chief or person of similar status in any walk of life, as illustrated in Deut. i. 15—"So I took the *chief* of your tribes, wise men and known, and made them *heads* over you, *Captains* over thousands, and *Captains* over hundreds, and *Captains* over fifties and *Captains* over tens, and *officers* among your tribes." In the realm of sport the "Captain of the side" exists in all team games. "Captains of Industry" is also another common expression. The word is derived from Lat. *caput*, the head; Ger. *Hauptman*; Sp. *Capitán*; It. *Capitano*.

In its limited sense it applies to a definite rank of an officer in the fighting services. It is the oldest military rank extant and implied a far higher command before the 16th century than it does now. Even in the military sense a great commander of whatever rank is sometimes referred to as a "Great Captain." The mediaeval rank of "captain-general" was equal to commander-in-chief and it persisted in that general sense to the 18th century. In 1772 the Prince of Wales was appointed Captain-General of the Honourable Artillery Company. In the British service it still survives in one solitary instance, in that the official title of the Governor of Jamaica is "Captain-general and Governor-in-chief." In the Spanish Army it is the rank of an army corps commander.

Up to about the middle of the 18th century the field officers had companies, the executive command being vested in the three senior lieutenants, styled "captain-lieutenants," being the modern equivalent of "acting-captains."

The captain of a ship, whether naval or mercantile marine, is the officer in charge of the vessel, and all persons whether officers, crew or passengers are by virtue of their being embarked, subject to his commands in all matters affecting the safety of the vessel and the well-being of the community on board. In the British Navy, the principal war-ships are commanded by captains, or, as they used to be known, "Post Captains." Smaller ships may have commanders or lieutenant-commanders in command, and they would be known on board as "the captain," but this does not warrant their using the rank, nor is it correct so to address them in writing.

It is, however, an old custom in the British Navy, less prevalent to-day, to give commanders the courtesy title of captain, although, in fact, they are of a definitely junior rank. The equivalent rank of captain is also held by officers of the non-military branch, *e.g.*, engineer-captain, surgeon-captain, paymaster-captain, but they should not be addressed simply as "captain" without the proper prefix to the rank. The equivalent ranks in the British Navy, Army and Air Force are Captain, R.N., Colonel, Group-Captain R.A.F. (T. J. E.)

The United States.—This rank is used in the U.S. army and navy, the navy rank of captain corresponding to the army rank of colonel. The appropriate command of a captain in the army is the company of infantry, the troop of cavalry and the battery of artillery all of which are tactical as well as administrative units. Army officers of this rank generally comprise the staff of regiments and assistants to the staff of the higher echelons.

The appropriate command of a captain in the navy is the capital ship, the light cruiser, the division of destroyers or the yard. Staff assignments, in general, include chief of staff of a battleship division, and assistant chief of staff of a battle fleet. The insignia for the army is two parallel silver bars worn on the shoulder strap of the uniform, and for the navy, four parallel rows of gold braid on the cuff of the blue uniform and on the shoulder strap of the white uniform

CAPTAIN OF INDUSTRY. A term sometimes used as an alternative for entrepreneur; one who by bringing together land, capital and labour, and causing them to function, is so important an agent in modern production. (*See* ENTREPRENEUR.)

CAPTAL, a mediaeval feudal title in Gascony, best known in connection with the famous soldier Jean de Grailly Captal of Buch (died 1376), immortalized by Froissart as the confidant of the Black Prince and the champion of the English cause against France.

CAPTION, a term still used in law, especially Scots, for arrest or apprehension. The term also has an old legal use, to signify the part of an indictment or document, etc., which shows where, when, and by what authority it is taken, found or executed; so its opening or heading. From this is derived the modern sense of the heading of an article in a book or newspaper. In Scotland a process caption is a summary warrant for the incarceration of a party who has borrowed and refused to return, or who has without authority taken away, documents in the custody of the court.

CAPTIVE: *see* LAWS OF WAR: *Prisoners of War*

CAPTURE AT SEA: *see* BLOCKADE; CONTRABAND; NEUTRALITY; PRIZE; VISIT AND SEARCH.

CAPUA, the chief ancient city of Campania, and one of the most important towns of ancient Italy, situated 16 m. N. of Neapolis, on the north-east edge of the Campanian plain. Its site in a position not naturally defensible, together with the regularity of its plan, indicates that it is not a very ancient town, though it probably occupies the site of an early Oscan settlement. It was founded about 600 B.C. The origin of the name is *Campus*, a plain, as the adjective *Campanus* shows. Etruscan supremacy in Campania ended with the Samnite invasion in the latter half of the 5th century B.C.; these conquerors, however, themselves became luxurious, and made alliance with Rome against the Samnite mountain tribes; the dependent communities Casilinum, Calatia, Atella shared in this and Campania fell under Roman supremacy about 340 B.C. (*See* CAMPANIA.) After the second Samnite War the Ager Falernus on the right bank of the Volturnus was distributed among citizens of Rome, the *tribus Falerna* being thus formed, and in 318 the powers of the native officials (*meddices*) were limited by the appointment of officials with the title *praefecti Capuam Cumas* (taking their name from the most important towns of Campania); these were at first mere deputies of the *praetor urbanus*, but after 123 B.C. were elected Roman magistrates, four in number; they governed the whole of Campania until the time of Augustus, when they were abolished.

Roads to Rome.—In 312 B.C. Capua was connected with Rome by the construction of the *Via Appia*, which left Rome by the *Porta Capena*. The *Via Latina* was perhaps prolonged to Casilinum when Capua fell under Roman supremacy, *i.e.*, before the construction of the *Via Appia*. The importance of Capua increased steadily during the 3rd century, and at the beginning of the second Punic War it was considered to be only slightly behind Rome and Carthage themselves, and was able to furnish 30,000 infantry and 4,000 cavalry.

Until after the defeat of Cannae it remained faithful to Rome, but, after a vain demand that one of the consuls should always be selected from it, it transferred its allegiance to Hannibal, who made it his winter-quarters, with bad results to the *moral* of his troops (*see* PUNIC WARS). After a long siege it was taken by the Romans in 211 B.C., its magistrates and communal organization were abolished, the inhabitants losing their civic rights, and its territory became Roman state domain.

Reorganization.—Parts of it were sold in 205 and 199 B.C., another part was divided among the citizens of the new colonies of Volturnum and Liternum established near the coast in 104 B.C. Illegal encroachments by private persons had to be bought out in 162 B.C. and, after that period, it was let not to large but to small proprietors. Frequent attempts were made by the democratic leaders to divide the land among new settlers. The inhabitants of this thickly-populated district were grouped round important shrines, especially that of Diana Tifatina, in connection with which a *pagus Dianae* existed on the west slope of the Mons Tifata. The town of Capua was entirely dependent on the *praefecti*. It produced spelt, wine, roses, spices, unguents, etc., and fine bronze objects. Its luxury remained proverbial; and Campania is especially spoken of as the home of gladiatorial combats. From the gladiatorial schools of Campania came Spartacus and his followers in 73 B.C. Julius Caesar as consul in 59 B.C. established a colony in connection with his agrarian law, and 20,000 Roman citizens were settled in this territory.

The number of colonists was increased by Mark Antony, Augustus (who constructed an aqueduct from the Mons Tifata, and gave the town of Capua estates in the district of Cnossus in Crete to the value of £120,000) and Nero. In the 4th century it was the seat of the *consularis Campaniae* and its chief town, though Ausonius puts it behind Mediolanum (Milan) and Aquileia in his *ordo nobilium urbium*. Under Constantine a Christian church was founded in Capua.

Destruction.—In A.D. 456 it was taken and destroyed by Gaiseric, but must have been soon rebuilt; it was, however, finally destroyed by the Saracens in 840 and the church of S. Maria Maggiore, founded about 497, alone remained. It contains 52 ancient marble columns, but was modernized in 1766. The site was occupied in the late middle ages by a village which has, however, outgrown the mediaeval Capua in modern days.

Remains.—Important cemeteries have been discovered on all sides of it, the earliest of which go back to the 7th or 6th century B.C. The tombs are of various forms, partly chambers with frescoes on the walls, partly cubical blocks of peperino, hollowed out, with grooved lids. They contained vases of bronze with incised designs of Etruscan style and of clay, some of Greek, some of local manufacture, and paintings. On the east of the town, a temple has Oscan votive inscriptions, some of them inscribed upon terra-cotta tablets, others on *cippi*, while of a group of 150 tufa statuettes (representing a matron holding one or more children in her lap) three bore Latin inscriptions of the early imperial period. The extreme length of the town from east to west is most accurately determined by the fact that the *Via Appia*, which runs from north-west to south-east from Casilinum to Calatia, turns due east very soon after passing the so-called Arco Campano (a triumphal arch of good brickwork, once faced with marble, with three openings), and continues to run in this direction for 5,413½ English feet (= 6,000 ancient Oscan feet). The west gate was the Porta Romana; remains of the east gate (the name of which we do not know) have been found. This fact shows that the main street of the town was perfectly orientated, and that before the *Via Appia* was constructed, *i.e.*, in all probability in pre-Roman times. The width of the town from north to south cannot be so accurately determined, but the plan was almost certainly rectangular. There are remains of *thermae* on the north of the *Via Appia* and of a theatre opposite, on the south. The former consisted of a large *cryptoporticus* round three sides of a court, the south side being open to the road; it now lies under the prisons. The stage of the theatre had its back to the road. A fine subterranean Mithraeum has been found, in which the sacrifice of the bull is shown in painting and not (as usual) in sculpture. (*Notizie degli Scavi* [1924], 353.)

Environs.—Outside the town on the north is the amphitheatre, built in the time of Augustus, restored by Hadrian and dedicated by Antoninus Pius, as the inscription over the main entrance recorded. The exterior was formed by 80 Doric arcades of four storeys each, but only two arches now remain. The keystones were adorned with heads of divinities. The interior is better preserved; beneath the arena are subterranean passages like those in the amphitheatre at Puteoli. It is one of the largest in existence; the longer diameter is 185 yd., the shorter 152, and the arena measures 83 by 49 yd., the corresponding dimensions in the Colosseum at Rome being 205, 170, 93 and 58 yd. To the east are considerable remains of baths.

On the *Via Appia*, to the south-east of the east gate of the town, are two large and well-preserved Roman tombs. To the north is the Pagus Dianae; the site of the temple is occupied by the Benedictine church of S. Angelo in Formis (944), reconstructed by the abbot Desiderius (afterwards Pope Victor III.) of Monte Cassino in 1073, with interesting paintings (11th–12th cent.), forming a complete representation of all the chief episodes of the New Testament. Deposits of votive objects (*favissae*), removed from the ancient temple from time to time as new ones came in and occupied all the available space, have been found, and considerable remains of buildings belonging to the Vicus Dianae (among them a triumphal arch and some baths, also a hall with frescoes, representing the goddess herself ready for the chase) still exist.

The ancient road from Capua went on beyond the Vicus Dianae to the Volturnus (remains of the bridge still exist) and then turned east along the river valley to Caiatia and Telesia. Other roads ran to Puteoli and Cumae (the so-called *Via Campana*) and to Neapolis, and as we have seen the *Via Appia* passed through Capua, which was thus the most important road centre of Campania (*q.v.*). *See* Giacomo's well illustrated *Da Capua a Caserta* (Bergamo, 1924).

CAPUA, a town and archiepiscopal see of Campania, Italy, in the province of Naples, 7 mi. W. by rail from the town of Caserta. Pop. (1936) 10,128 (town), 14,183 (commune). It was erected in 856 by Bishop Landulf on the site of Casilinum (*q.v.*) after the destruction of the ancient Capua by the Saracens in 840, but it only occupies the site of the original pre-Roman town on the left (south) bank of the river. The cathedral of S. Stefano, erected in 856 has a handsome atrium and a lofty Lombard campanile, and an interior (modernized) with three aisles; both it and the atrium have ancient granite columns. The Romanesque crypt, with ancient columns, has also been restored. In 1232–1240 Frederick II. erected a castle to guard the (still existing) Roman bridge over the Volturno. This was demolished in 1557. The Museo Campano contains antiquities from the ancient Capua. Capua changed hands frequently during the middle ages. In 1501 it was attacked by Caesar Borgia. It remained a part of the kingdom of Naples until Nov. 2, 1860, when it surrendered to the Italians.

CAPUANA, LUIGI (1839–1915), Italian poet and critic, was born at Mines, Sicily, on May 27, 1839. His *Giacinta* (1879) may be said to be the earliest of the Italian realistic novels. He wrote many other novels which found a wide public in Italy. They deal with complicated psychological problems, the most famous being *Il Profumo* (1890) and the Sicilian story, which is generally accounted his masterpiece, *Il marchese di Roccaverdina* (1901). Of Agrippina Solmi in this novel Croce wrote: "The passion of that humble contadina is no more mere analysis; it is poetry." Capuana also wrote children's books, made a collection of Sicilian plays and produced some volumes of criticism. He died at Catania on Nov. 28, 1915.

See P. Vetro, *Luigi Capuana, La vita e le opere* (Catania, 1922).

CAPUCHIN MONKEY, a tropical American monkey, *Cebus capucinus;* the name is often extended to embrace all species of the same genus, whose range extends from Nicaragua to Paraguay. These monkeys are the typical representatives of the family Cebidae, and belong to a sub-family in which the tail is generally prehensile. From the other genera of that group (Cebinae) with prehensile tails capuchins are distinguished by the comparative shortness of that appendage, and the absence of a naked area on the under surface of its extremity. The hair is not woolly, the general build is rather stout, and the limbs are of moderate length and slenderness. The name capuchin is derived from the cowl-like form assumed by the thick hair on the crown. These monkeys go about in troops, frequenting the summits of tall forest-trees. In addition to fruits, they consume tender shoots and buds, insects, eggs and young birds. Many of the species are difficult to distinguish, and little is known of their habits in a wild state (*see* PRIMATES).

CAPUCHINS, an order of friars in the Roman Catholic Church, chief among the permanent offshoots of the Franciscans. It arose about the year 1520, when Matteo di Bassi, an "Observant" Franciscan, became possessed of the idea that the habit worn by the Franciscans was not the one that St. Francis had worn; accordingly he made himself a pointed or pyramidal hood and also allowed his beard to grow and went about barefooted. His superiors tried to suppress these innovations, but in 1528 he obtained the sanction of Clement VII. and also the permission to live as a hermit and to go about everywhere preaching to the poor; and these permissions were not only for himself, but for all such as might join him in the attempt to restore the most literal observance possible of St. Francis's rule. Matteo was soon joined by others and a recognized order grew out of the movement, their hood (*capuche*) giving them their popular name. In 1529 they had four houses and held their first general chapter, at which their special rules were drawn up. The eremitical idea was abandoned, but the life was to be one of extreme austerity, simplicity and poverty—in all things as near an approach to St. Francis's idea as was practicable. The great external work was preaching and spiritual ministrations among the poor. In theology the Capuchins abandoned the later Franciscan school of Scotus, and returned to the earlier school of Bonaventura (*q.v.*). The new congregation at the outset underwent a series of misfortunes, of which the most disastrous was the secession of the third vicar, Bernardino Ochino (*q.v.*), who became a Calvinist, 1543, and married. This brought the whole congregation under suspicion of heretical tendencies and the pope resolved to suppress it; he was with difficulty induced to allow it to continue, but the Capuchins were forbidden to preach, a prohibition that lasted for two years. The congregation then began to multiply with extraordinary rapidity, and by the end of the 16th century the Capuchins had spread all over the Catholic parts of Europe, and in 1619 they were constituted into an independent order, with a general of their own. They were one of the chief factors in the Catholic Counter-reformation, working assiduously among the poor, preaching, catechizing, confessing in all parts, and impressing the minds of the common people by the great poverty and austerity of their life. By these means they were also extraordinarily successful in making converts from Protestantism to Catholicism. Nor were their activities confined to Europe; from an early date they undertook missions to the heathen in America, Asia and Africa, and at the middle of the 17th century a Capuchin missionary college was founded in Rome for the purpose of preparing their subjects for foreign missions. A large number of Capuchins suffered martyrdom for the Gospel. This activity in Europe and elsewhere continued until the close of the 18th century.

Like all other orders, the Capuchins suffered severely from the secularizations and revolutions of the end of the 18th century and the first half of the 19th; but they survived the strain, and during the latter part of the 19th century rapidly recovered ground. They still keep up their missionary work and have some 200 missionary stations in all parts of the world—notably India, Abyssinia and the Turkish empire. Though "the poorest of all orders," it has attracted into its ranks an extraordinary number of the highest nobility and even of royalty. The celebrated Father Matthew, the apostle of Temperance in Ireland, was a Capuchin friar. Like the Franciscans the Capuchins wear a brown habit.

In order fully to grasp the meaning of the Capuchin reform, it is necessary to know the outlines of Franciscan history (*see* FRANCISCANS). References to the literature will be found in the article "Kapuzinerorden" in Wetzer und Welte, *Kirchenlexicon* (2nd ed.), which is the best general sketch on the subject. Shorter sketches, with the needful references, are given in Max Heimbucher, *Orden und Kongregationen* (1896), i. § 41, and in Herzog-Hauck, *Realencyklopädie* (3rd ed.), art "Kapuziner," F. Cuthbert, art. "Capuchin Friars Minor" in the *Catholic Encyclopaedia*. On their missions, *see* Spitz, art. "Missions (Christian, Roman Catholic)," in Hastings, *Encyclopaedia of Religion and Ethics*, viii., pp 713 ff.

CAPULETS and MONTAGUES, the English forms of the Italian names Capelletti and Montecchi, made familiar through Shakespeare's tragedy of *Romeo and Juliet*. They represent two legendary noble families of Verona in the 14th century whose enmity rendered tragical the loves of their two children. The legend, which may have been of Eastern origin, finds a parallel in Ovid's story of Pyramus and Thisbe. Dante mentions the two lovers in his *Purgatorio*; Shakespeare seems to have owed his version to Arthur Broke (*q.v.*).

CAPULIN MOUNTAIN NATIONAL MONUMENT, a tract of about 680 ac. in the extreme northeast corner of New Mexico, U.S.A., set aside as a Government reservation in 1916. It is a region of extinct volcanoes, the principal one being Capulin mountain which is about 1½ m. in diameter at its base and rises 1,500 ft. above the plain. There are also numerous "plugs" or lava columns isolated by erosion from the softer rock which once surrounded them.

CAPUS, ALFRED (1858–1922), French author, was born at Aix, in Provence. He joined the staff of the *Figaro* in 1894. Among his plays are *Brignol et sa fille* (Vaudeville, Nov. 23, 1894); *Innocent* (1896), written with Alphonse Allais; *Petites Folles* (1897); *Rosine* (1897); *Mariage bourgeois* (1898); *Les Maris de Léontine* (1900); *Les Deux Écoles* (1902); *La Châtelaine* (1902); *L'Adversaire* (1903), with Emmanuel Arène, produced in London by Mr. George Alexander as *The Man of the Moment*, and *Notre Jeunesse* (1904), the first of his plays to be represented at the Théâtre Français; *Monsieur Piégois* (1905); *L'Attentat* (1906), in collaboration with Lucien Descaves; *L'Aventurier* (1910); *La Traversée* (1920).

See Edouard Quet, *Alfred Capus* (1904).

CAPYBARA or **CARPINCHO** (*Hydrochoerus capybara*), the largest living rodent characterized by its partially-webbed toes, of which there are four in front and three behind, hoof-like nails, sparse hair, short ears, cleft upper lip and the absence of a tail (*see* RODENTIA). Capybaras are aquatic rodents, frequenting the banks of lakes and rivers in South America from Guiana to the river Plate. They associate in herds, and spend most of the day in covert on the banks, feeding in the evening and morning. They swim and dive with expertness, often remaining below the surface for several minutes. Their food consists of water-plants and bark, but in cultivated districts they do much harm to crops. Their cry is a low, abrupt grunt. From five to eight is the usual number in a litter, of which there appears to be only one in the year. Extinct species of capybara occur in the Tertiary deposits of Argentina, some considerably larger than the living form. Capybaras belong to the guinea pig family. When full-grown the length of the animal is about 4 ft., the girth 3 ft., and the weight up to 100 lb

CAR, a term originally applied to a small two-wheeled vehicle for transport (*see* CARRIAGE), but also to almost anything in the nature of a carriage, chariot, etc., and to the carrying part of a balloon. With some specific qualification (tram-car, street-car, railway-car, sleeping-car, motor-car, etc.) it is combined to serve as a general word instead of carriage or vehicle. It has also passed into use in aeronautics. From Ireland comes the "jaunting-car," which is in general use, both in the towns, where it is the commonest public carriage for hire, and in the country districts, where it is employed to carry the mails and for the use of tourists. The gentry and well-to-do farmers use it as a private carriage in all parts of Ireland. The genuine Irish jaunting-car is a two-wheeled vehicle constructed to carry four persons besides the driver. In the centre, at right angles to the axle, is a "well" about 18 in. deep, used for carrying parcels or small luggage, and covered with a lid which is usually furnished with a cushion. The "well" provides a low back to each of the two seats, which are in the form of wings placed over each wheel with foot boards hanging outside the wheel on hinges, so that when not in use they can be turned up over the seats, thus reducing the width of the car (sometimes very necessary in the narrow country roads) and protecting the seats from the weather. The passengers on each side sit with their backs to each other, with the "well" between them The driver sits on a movable box-seat, or "dicky," a few inches high, placed across the head of the "well," with a footboard to which there is usually no splash-board attached.

A more modern form of jaunting-car, known as a "long car," chiefly used for tourists, is a four-wheeled vehicle constructed on the same plan which accommodates as many as eight or ten passengers on each side, and two in addition on a high box-seat beside the driver. In the city of Cork a carriage known as an "inside car" is in common use. It is a two-wheeled covered carriage in which the passengers sit face to face as in a wagonette. In remote country districts the poorer peasants still sometimes use a primitive form of vehicle, called a "low-backed car," a simple square shallow box or shelf of wood fastened to an axle without springs. The two wheels are solid wooden disks of the rudest construction, generally without the protection of metal tires, and so small in diameter that the body of the car is raised only a few inches from the ground.

CARABINIERS, originally 16th century light cavalry armed with "large pistols called carabins having barrels 3ft. long." English carabiniers are mentioned as early as 1597 at the battle of Turnhout under Sir Francis Vere. The early practice in England and France was to attach a proportion of men armed with carabins to each regiment and it was not until the 17th century that regiments of carabiniers were formed The original duties of carabiniers were analogous to those of grenadiers of the infantry, in fact they were mounted infantry In 1660 the life guards were equipped with carabins (or carbines) whilst the other cavalry regiments had swords and pistols until 1678. As a reward for its services in Ireland in 1692 William III. designated the Ninth Horse "The Carabiniers" (later the 6th Dragoon Guards, or The Carabiniers), and although the term "carabiniers" was more common in France than in England it was not until 1693 that Louis XIV. constituted his companies of carabiniers into a corps with the distinct title of Royal Carabiniers. He had, however, regimented them for tactical purposes at Neerwinden in that year. In the old German army there was one Carabinier regiment, viz., the 2nd Saxon Reiter Regiment, but since the inauguration of the reichswehr in 1921 this regiment is "traditionally represented" by a squadron of the present 12th (Saxon) cavalry regiment. In Italy the gendarmerie are called *carabinieri*.

CARABOBO, next to the smallest of the 20 States of Venezuela, bounded north by the Caribbean Sea, east by the State of

Aragua, south by Cojedes and west by Yaracuy. Its area is 1,672 sq.mi., and its population (1941 official census) was 191,442. The greater part of its surface is mountainous with moderately elevated valleys of great fertility and productiveness, but south of the cordillera there are extensive grassy plains conterminous with those of Guárico and Cojedes, on which large herds of cattle are pastured. The principal products of the state are cattle, hides and cheese from the southern plains, coffee and cereals from the higher valleys, sugar and *aguardiente* from the lower valleys about Lake Valencia, and cacao, coconuts and coconut fibre from the coast. Various minerals are also found in its southwest districts. The capital is Valencia (pop. of the district 91,131 in 1941; of the city, 53,938), a large manufacturing centre in the heart of a productive cacao and banana district. Puerto Cabello, 35 mi. N.W. of Valencia by rail or highway, has an excellent harbour—the second most important in Venezuela. Pop. of the district (1941) 32,837; of the town, 22,087. Carabobo is best known for the battle fought on June 24, 1821, on a plain at the southern exit from the passes through the cordillera in this State, between the revolutionists under Bolívar and the Spanish forces under La Torre. It was one of the four important battles of the war, though the forces engaged were only a part of the two armies and numbered 2,400 revolutionists (composed of 1,500 mounted *llaneros* known as the "Apure legion," and 900 British), and 3,000 Spaniards. The day was won by the British, who drove the Spaniards from the field at the point of the bayonet, although at a terrible loss of life. The British legion was afterwards acclaimed by Bolívar as "*Salvadores de mi Patria*." The Spanish forces continued the war until near the end of 1823, but their operations were restricted to the districts on the coast.

CARACAL, the capital of the department of Romanatzi, Rumania, between the Jiu and Oet rivers. Pop *c.* 16,000. The town is named after the Roman Emperor Caracalla and the ruins of his tower, built A.D. 217, are to be seen. Trade is in grain.

CARACAL (*Lynx caracal*), sometimes called Persian lynx, an animal widely distributed throughout south-western Asia and a large portion of Africa. It is somewhat larger than a fox, uniform reddish brown above, and whitish beneath, with two white spots above each of the eyes, and a tuft of long black hair at the tip of the ears. It dwells among grass and bushes. Its prey consists of gazelles, small deer, hares and peafowl and other birds. The caracal is easily tamed and in some parts of India is trained to capture small antelopes, deer and large birds.

CARACALLA (or CARACALLUS) **MARCUS AURELIUS ANTONINUS** (186–217), Roman emperor, eldest son of the emperor Septimius Severus, was born at Lugdunum (Lyons) on April 4, 186. His original name was Bassianus; his nickname Caracalla was derived from the long Gallic tunic which he wore. After the death of Severus (211) at Eboracum (York) in Britain, Caracalla and his brother Geta, who had accompanied their father, returned to Rome as co-emperors. In order to secure the sole power Caracalla murdered his brother (212) and afterwards put to death some 20,000 of Geta's supporters, amongst them the jurist Papinianus. In the same year he bestowed Roman citizenship on all free inhabitants of the empire, the object being partly to increase the yield from the inheritance-tax, to which only Roman citizens were liable. His own extravagances and the demands of the soldiery were a perpetual drain upon his resources.

In 213 he defeated the Alamanni who had broken through the Raetian lines; in 214, after a few months spent in Rome, he went to the Danube. After wintering in Asia he crossed, in 215, to Alexandria, where in revenge for some disrespect shown him he ordered a general massacre. In 216 he ravaged Mesopotamia

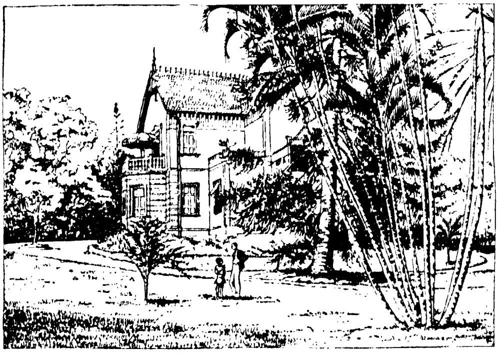
He spent the winter at Edessa, and in 217, when he recommenced his campaign, he was murdered at Carrhae on April 8, at the instigation of Opellius (Opilius) Macrinus, praefect of the praetorian guard, who succeeded him.

The most famous of the buildings with which Caracalla adorned Rome are the baths and the triumphal arch of Septimius Severus in the forum.

CARACARA, the name given to four American genera of the family Falconidae. Also called carrion-hawks, the caracaras are recognized by their long legs and the brightly coloured naked skin of the cheeks and throat. They are gregarious and feed largely on carrion, birds, reptiles and amphibians. Audubon's caracara (*Polyborus cheriway*) is resident in Florida, Texas, Arizona and Lower California to northwestern South America, and on islands off the west coast of Mexico.

Nine other species are found throughout Central and South America, including the common caracara (*P. plancus*), from the Amazon to Tierra del Fuego; the chimango or beetle-eater (*Milvago chimango*), of southern South America; and the black caracara (*Daptrius ater*), of tropical South America.

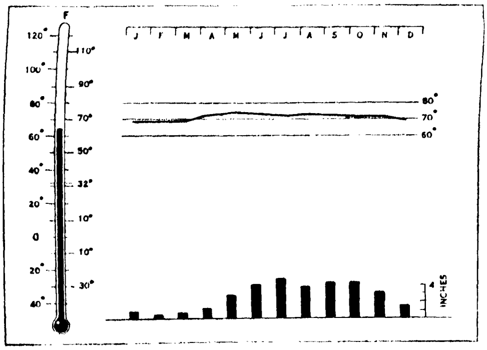
CARACAS, the principal city and the capital of the United States of Venezuela, situated at the western extremity of an elevated valley of the Venezuelan Coast range known as the plain of Chacao, 6½m. S.S.E. of La Guaira, its port on the Caribbean coast, in lat. 10° 30′ N., long. 66° 6′ W. The plain is covered with well-cultivated plantations. The Guaira river, a branch of the Tuy, traverses it from west to east, and flows past the city on the south. Among its many small tributaries are the Catuche, Caroata and Anauco, which flow down through the city from the north and give it a natural surface drainage. The city is built at the narrow end of the valley and at the foot of the Cerro de Avila, its topographical centre, the elevation of the Plaza de Bolívar being 3,025 feet. Two miles north-east is the famous Silla de Caracas, whose twin summits, like a gigantic old-fashioned saddle (*silla*), rise to an elevation of 8,622ft.; and the Naiguetá, still farther eastward overlooks the valley from a height of 9,186 feet. The climate of Caracas is subject to extreme and rapid variations in temperature, to alternations of dry and humid winds, to chilling night mists brought up from the coast by the westerly winds, and to other influences productive of malaria, catarrh, fevers, bilious disorders and rheumatism. The maximum and minimum temperatures range from 84° to 48° F, the annual mean being about 66°, and the daily variation is often as much as 15°. The city is built with its streets running between the cardinal points of the compass. Two intersecting central streets also divide the city into four sections, in each of which the streets are methodically named and numbered, as North 3rd, or West 2nd, etc., according to direction and location. This method of numeration dates from the time of Guzmán Blanco, but the common people adhere to the bestowed upon the city squares in earlier times. There are



BY COURTESY OF THOMAS LEE

MODERN HOME OF AN UPPER CLASS FAMILY IN CARACAS

several handsome squares and public gardens, adorned with statues, trees and shrubbery. The principal square is the Plaza de Bolívar, the conventional centre of the city, in which stands a bronze equestrian statue of Bolívar, and on which face the cathedral, archbishop's residence, Casa Amarilla, the national library, general post office and other public offices. The Independencia park, formerly called Calvario park, which occupies a hill on the west side of the city, is the largest and most attractive of the public gardens. On the outskirts there is the famous "Paraiso" drive. Among the public edifices are the capitol, which occupies a whole square, the university, the cathedral, pantheon, masonic temple, national library, and a number of large churches. The city is generously provided with all the modern public services. The principal water supply is derived from the Macarao river, 15m. distant. Railway connection with the port of La Guaira was opened in 1883 by means of a line 23m. long. Another line (the Gran Ferrocarril de Venezuela) passes through the mountains to Valencia, 111m. distant, and two short lines run to neighbouring villages. The archbishop of Venezuela resides in Caracas and has ecclesiastical jurisdiction over the dioceses of Ciudad Bolivar, Calabozo, Barquisimeto, Mérida, Maracaibo, Valencia, Coro, Cumaná and San Cristóbal. There are now some manufactures of note.



WEATHER GRAPH OF CARACAS. THE THERMOMETER INDICATES THE ANNUAL MEAN TEMPERATURE. THE CURVE SHOWS THE MONTHLY MEAN TEMPERATURE AND THE COLUMNS INDICATE THE NORMAL MONTHLY AMOUNT OF PRECIPITATION

Caracas was founded in 1567 by Diego de Losada under the pious title of Santiago de León de Caracas, and has been successively capital of the province of Caracas, of the captaincy-general of Caracas and Venezuela, and of the republic of Venezuela. It is also one of the two chief cities, or capitals, of the Federal district. It was the birthplace of Simón Bolivar, and claims the distinction of being the first colony in South America to overthrow Spanish colonial authority. The city was almost entirely destroyed by the great earthquake of 1812. In the war of independence it was repeatedly subjected to pillage and slaughter by both parties in the strife, and did not recover its losses for many years. In 1810 its population was estimated at 50,000; 71 years later the census of 1881 gave it only 55,638, but in 1941 the population of the city proper had risen to 269,030.

CARACCIOLO, FRANCESCO, PRINCE (1732–1799), Neapolitan admiral and revolutionary, was born on Jan. 18, 1732. He learnt his seamanship under Rodney, and fought with distinction in the British service in the American War of Independence, against the Barbary pirates, and against the French at Toulon. He was the only prominent Neapolitan trusted by King Ferdinand IV., and he remained loyal to the king until the latter's cowardly flight. In Jan. 1799 Caracciolo returned to Naples, where he found himself welcomed with great enthusiasm, and the city seething with revolution. He assumed command of the new Republic's naval forces and fought against the British and Neapolitan squadrons. Finally he found himself surrounded by the British fleet at sea while on land Cardinal Ruffo's army made resistance useless. In trying to escape in disguise, Caracciolo was arrested and brought in chains on board Nelson's flagship. There he was summarily tried and sentenced to death; the sentence being immediately executed by his being hanged from the yard-arm of the "Minerva" on June 30, 1799. The whole trial and execution were indefensible, alike on the grounds of legality and naval usage, and are to be ascribed to personal spite on the part of Queen Maria Carolina working through the influence of Lady Hamilton over Nelson.

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CARACOLE, a French word, meaning the wheeling about of a horse (*cf.* Span. *caracol*, a snail). In horsemanship a half-turn to the left or right, or to both alternately, so as to describe a zigzag course; the term is loosely used to describe any display of fancy riding. In architecture, a spiral staircase in a tower.

CARACTACUS or (better) **CARATACUS,** the Latin form of the Celtic Caradoc (fl. A.D. 50), British chieftain of the tribe of Catuvellauni, a son of Cunobelinus, king of the Trinobantes. He led the native resistance against Aulus Plautus (A.D. 43–47), and after being defeated, probably at Wallingford, and afterwards at Colchester, he withdrew into South Wales. He was finally defeated by Ostorius Scapula in A.D. 50, somewhere in Shropshire, perhaps at Caer Caradock, where there are remains of an old camp. Caractacus and his family were captured and taken to Rome, where the Emperor Claudius granted them life.

See Tac. *Ann.* xii. 31, 37, *Hist.* 3, 45; Dio Cassius, lx., 19–22; E. Guest, *Origines Celticae* (1883).

CARAGIALI, IOAN (1852–1912), Rumanian dramatist and novelist, was born on Jan. 29, 1852, at Ploiesti. In his comedies, *The Stormy Night* (1880) and *The Lost Letter* (1885), he satirized the effects on Rumanian society of too hasty an introduction of western customs, and the pretensions of the bourgeois classes in Rumania at that time. He also wrote some powerful short stories, notably *The Easter Torch* (1890), and *The Sin* (1892). His *Momenta* were collected in 1900 and his plays in 1907. He died on June 22, 1912, in Berlin.

CARALES, the most important ancient city of Sardinia, situated on the south coast (Gr. Κάραλις, mod. *Cagliari*, *q.v.*). It is attributed to the Carthaginians, and Punic tombs exist in considerable numbers near the present cemetery on the east, and still more on the rocky plateau to the north-west of the town. They are hewn perpendicularly in the rock, while the Roman tombs are excavated horizontally (Taramelli in *Monumenti dei Lincei*, XXI.). It first appears in Roman history in the Second Punic War, and probably obtained full Roman civic rights from Julius Caesar. In imperial times it was the most important town in the island, mainly owing to its fine sheltered harbour, where a detachment of the *classis Misenensis* (the fleet of Misenum) was stationed. In the 4th and 5th centuries it was probably the seat of the governor (*praeses Sardiniae*). It is mentioned as an important harbour in the Gothic and Gildonic wars. It was also the chief point of the road system of Sardinia. Roads ran hence to Olbia by the east coast, and through the centre of the island, to Othoca (Oristano) direct, and thence to Olbia (probably the most frequented route), through the mining district to Sulci and along the south and west coasts to Othoca. The site of the mediaeval town with its Pisan fortifications must have been the Carthaginian acropolis; such a site could not have been neglected. The Romans, too, probably made use of it, though the lower quarters were mainly occupied in imperial times. The nucleus of the Roman *municipium* is probably represented by the present quarter of the Marina, in which the streets intersect at right angles and Roman remains are often found. An inscription found some way to the north towards the amphitheatre speaks of paving in the squares and streets, and of drains constructed under Domitian in A.D. 83. The amphitheatre in a natural depression of the rock just below the acropolis, opens towards the sea with a fine view. Its axes are 95½ and 79 yards, and it is in the main cut in the rock, though parts are concrete. Below it, to the south, are considerable remains of ancient reservoirs for rain-water, upon which the city entirely depended. Not far from the shore are remains of Roman baths, with a fine coloured mosaic pavement. To the east was the necropolis of

Bonaria, with both Punic and Roman tombs, and, on the site of the present cemetery, Christian catacombs. But the western quarter seems to have been far more important; it extended along the lagoon of S. Gilla (to the north-west of the town, which until the middle ages was an open bay) and on the lower slopes of the hill which rises above it. A large Roman house (or group of houses) is still visible. Beyond this quarter begins an extensive Roman necropolis. It is probable that the acropolis of Carales was occupied even in prehistoric times; but more abundant traces of prehistoric settlements have been found on the Capo S. Elia to the south-east of the modern town. An inscription records the existence of a temple of Venus Erycina on this promontory in Roman times. The museum contains an interesting collection of objects from many of the sites mentioned, and also from other parts of the island; it is in fact the most important in Sardinia, especially for its prehistoric bronzes (*see* SARDINIA).

CARAN D'ACHE, the pseudonym (meaning "lead-pencil") of Emmanuel Poiré (1858–1909), caricaturist and illustrator, who was born and educated at Moscow, being the grandson of one of Napoleon's officers who had settled in Russia. He determined to be a military painter, and when he arrived in Paris from Russia was advised by Detaille. He served five years in the army, where the principal work allotted to him was the drawing of uniforms for the Ministry of War. He drew for *La Vie militaire* a series of illustrations, among them being some good-tempered caricatures of the German army. His special gift lay in pictorial anecdote, the story being represented at its different stages with irresistible effect, in the artist's own mannered simplicity. Much of his work was contributed to *La Vie Parisienne*, *Le Figaro Illustré*, *La Caricature*, *Le Chat Noir*, and he also issued various albums of sketches, the *Carnet de chèques* (1893), illustrating the Panama scandals, *Album de croquis militaires et d'histoire sans légendes* (1896), *Histoire de Marlborough* (1897), etc., besides illustrating a good many books, notably the *Prince Kozakokoff* of Bernadaky. He died on Feb. 26, 1909.

CARAPACE, the upper shell of a crustacean or tortoise.

CARAPEGUA, an interior town of Paraguay, 37m. south-east of Asunción on the old route between that city and the missions. The 1934 estimated population was 17,389 (probably the population of the large rural district about the town is included in this estimate). The town (founded in 1725) is situated in a fertile country producing cotton, tobacco, Indian corn, and sugar-cane.

CARAT, a unit of weight for diamonds, other gems, and pearls; it also indicates the purity or fineness of precious metals. Originally grains or leguminous seeds were used for the weighing of precious stones and as these were not of uniform size or weight the carat in different gem centres varied considerably. Thus, the London market for many years used a carat equal to 0·2053 grams (3·163 troy grains); in Florence it was 0·1972 grams; in Amsterdam 0·2057 grams, and so on. After various attempts to simplify and standardize the carat, the metric carat of 0·200 grams, or 200 milligrams, was adopted in the United States in 1913, and has now become the standard in the principal countries of the world. The metric carat permits the weight of gems to be expressed conveniently in decimals, whereas formerly it was customary to use a clumsy series of fractions, such as ½, ¼, ⅛, 1/16, 1/32, and 1/64 of a carat.

When the term carat is used to indicate the purity or fineness of metals it means 1/24th part. Thus, 18-carat gold consists of eighteen parts of gold and six parts of alloy. *See* Kraus and Holden, *Gems and Gem Materials*.

CARAUSIUS, MARCUS AURELIUS, tyrant or usurper in Britain, A.D. 286–293, was a Menapian from Belgic Gaul, a man of humble origin. In the Roman army he rapidly obtained promotion and was stationed by the emperor Maximian at Gessoriacum (Bononia, *Boulogne*) to ward off Frankish and Saxon pirates. On being accused of partnership with the barbarians he was sentenced to death by the emperor, but he escaped to Britain and proclaimed himself an independent ruler. In 289 Maximian attempted to recover the island, but his fleet was damaged by a storm and he was compelled to acknowledge the rule of Carausius in Britain. Numerous coins are extant bearing the heads of Carausius, Diocletian and Maximian, and the legend "Carausius et fratres sui." In 292 Constantius Chlorus captured Gessoriacum (hitherto in possession of Carausius) and then made preparations to reconquer Britain, but before they were completed Carausius was murdered by Allectus, his praefect of the guards (Aurelius Victor, *Caesares*, 39; Eutropius ix. 21, 22; Eumenius, *Panegyrici* ii. 12, v.12).

See J. Watts de Peyster, *The History of Carausius, the Dutch Augustus* (1858); P. H. Webb, *The Reign and Coinage of Carausius* (1908).

CARAVACA, a town of south-eastern Spain, in the province of Murcia, near the left bank of the river Argos, a tributary of the Segura. Pop. (1940) 9,620 (mun., 20,645). Caravaca is dominated by the mediaeval castle of Santa Cruz, the 17th century chapel which has a miraculous cross celebrated for its healing power, in honour of which a yearly festival is held on May 3. The hills to the north are rich in copper, marble and iron. Though over 15 mi. from the nearest railway station, Calasparra, the town is a considerable industrial centre, with large iron-works, tanneries and cloth, paper, oil and chocolate factories.

CARAVAGGIO, MICHELANGELO AMERIGHI (or MERIGI) **DA** (1569–1609), Italian painter, the son of a mason, was born in the village of Caravaggio, in Lombardy, from which he received his name. He painted portraits for about five years at Milan, and then went to Venice and to Rome, where he produced his first picture of note, "The Card Players." He despised every sort of idealism, became the head of the Naturalisti (unmodified imitators of ordinary nature) in painting, and adopted a style of potent contrasts of light and shadow, laid on with a sort of fury. At the close of a stormy life he fled to Malta and Sicily and died of fever on the beach at Pontercole in 1609. His best pictures are the "Entombment of Christ," now in the Vatican; "St. Sebastian," in the Roman Capitol; a magnificent whole-length portrait of a grand-master of the Knights of Malta, Alof de Vignacourt, and his page, in the Louvre; and the Borghese "Supper at Emmaus."

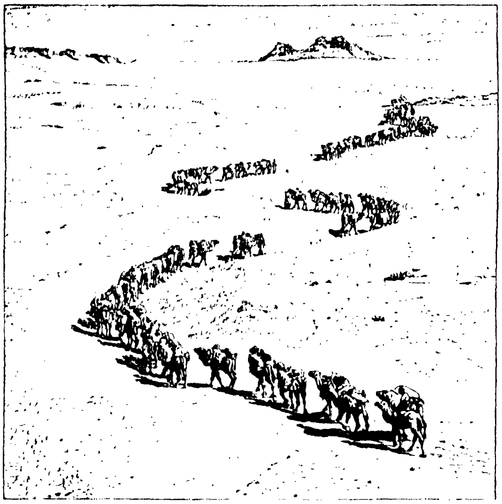
CARAVAGGIO, POLIDORO CALDARA DA (1495 or 1492–1543), a celebrated painter of frieze and other decorations in the Vatican. Polidoro's works, as well as those of his master, Maturino of Florence, have mostly perished, but are well known by the fine etchings of P. S. Bartoli, C. Alberti, etc. On the sack of Rome by the army of the Constable de Bourbon in 1527, Polidoro fled to Naples. Thence he went to Messina. He was murdered by an assistant, Tonno Calabrese, in 1543. Two of his principal paintings are a Crucifixion, painted in Messina, and "Christ bearing the Cross" in the Naples gallery.

CARAVAN, a word of Persian origin (more correctly *Karawan*), adopted into the later Arabic vocabulary. (1) A covered cart, drawn by horse or motor power, used for living purposes, chiefly by gypsies and holiday makers. (2) A body of traders travelling together for greater security against robbers (and in particular against Bedouins, Kurds, Tatars and the like, whose grazing grounds the proposed route may traverse) and for mutual assistance in the matter of provisions, water and so forth. In Arabia proper the name caravan is rarely employed in speech and never in writing, strictly Arabic words such as *Rikb* ("assembled riders") or *Qāfila* ("wayfaring band") being in ordinary use.

The precautions of the caravan are due to the absence of settled government, inns and roads. Strings of camels are generally employed for the transport of heavy goods, especially where the track, like that between Damascus and Baghdad, for example, lies across level, sandy and arid districts. The camels are harnessed in strings of 50 or more at a time, a hair-rope connecting the rear of one beast with the head of another; the leader is gaily decorated with parti-coloured trappings, tassels and bells; an unladen ass precedes the file, for guidance.

Where the route is rocky and steep, as between Damascus and Aleppo, mules, or even asses, are used for burdens. The wealthier members ride, where possible, on horseback. Every man carries arms; but these are in truth more for show than for use, and are commonly flung away in the presence of any serious robber attack.

hould greater peril than usual be anticipated, the protection of company of soldiers is habitually pre-engaged,—an expensive, nd ordinarily a useless adjunct. A leader or director, called *'arawan-Bashi* (headman), or, out of compliment, *Karawan-eraskier* (general), but most often simply *Raïs* (chief), is be-ore starting appointed by common consent. His duties are those f general manager, spokesman, arbitrator and so forth; his re-uneration is indefinite. But in the matter of sales or purchases, ther on the way or at the destination, each member of the cara-m acts for himself. The number of camels or mules in a single aravan varies from 40 or so up to 600 and more; sometimes, s on the reopening of a long-closed route, it reaches 1,000.



MERCHANT CARAVAN CROSSING THE DESERT WASTES OF CENTRAL ASIA

Caravan Seasons.—The ordinary caravan seasons are the onths of spring, early summer and later autumn. Friday, in cordance with a recommendation made in the Koran itself, is e favourite day for setting out, the most auspicious hour being at immediately following noonday prayer. The first day's march ever does more than just clear the starting-point. Subsequently ch day's route is divided into two stages,—from 3 or 4 A.M. about 10 in the forenoon, and from between 2 and 3 P.M. till or even 8 in the evening. Thus the time passed daily on the ad averages from 10 to 12 hours, and, as the ordinary pace of laden camel does not exceed 2m an hour, that of a mule being ¾, a distance varying from 23 to 28m. is covered every marching day. But prolonged halts of two, three, four and even more ays often occur. The hours of halt, start and movement, the recise lines of route, and the selection or avoidance of particular calities are determined by common consent. But if, as some-mes happens, the services of a professional guide, or those of military officer have been engaged, his decisions are final. While e caravan is on its way, the five stated daily prayers are, within ertain limits, anticipated, deferred or curtailed, so as the better coincide with the regular and necessary halts,—a practice uthorized by orthodox Mohammedan custom and tradition

Two caravans are mentioned in Genesis xxxvii; the route on hich they were passing seems to have coincided with that nowa-ays travelled by Syrian caravans on their way to Egypt. Allu-ions to caravans may be found in Job, in Isaiah and the Psalms.

Pilgrims to Mecca.—The yearly pilgrim-bands, bound from arious quarters of the Mohammedan world to their common estination, Mecca, are sometimes, but inaccurately, styled by uropean writers caravans; their proper designation is *Hajj*, a ollective word for pilgrimages and pilgrims. The two principal ilgrim-caravans start yearly, the one from Damascus, or, to speak more exactly, from Mozarib, a village station three days' journey to the south of the Syrian capital, the other from Cairo in Egypt. This latter was formerly joined on its route, near Akaba of the Red Sea, by the North African Hajj, which, however, now goes from Egypt by sea from Suez; the former gathers up bands from Anatolia, Kurdistan, Mesopotamia and Syria. Since 1908, the Syrian and Egyptian Hajj have been able to travel by the railway from Damascus to the Hejäz. Besides these a third, but smaller, Hajj of Persians, chiefly sets out from Suk-esh-Sheiukh, in the neighbourhood of Meshed Ali, on the lower Euphrates; a fourth of negroes, Nubians, etc. unites at Yambu on the Hejäz coast, whither they have crossed from Kosseir in Upper Egypt; a fifth, of Indians and Malays, centres at Jidda; a sixth and seventh of southern or eastern Arabs arrive, the former from Yemen, the latter from Nejd.

The Syrian Hajj is headed by the pasha of Damascus either in person or by a vicarious official of high rank, and is further accompanied by the *Sorrah Amir* or "Guardian of the Purse," a Turkish officer from Constantinople. The Egyptian company is commanded by an amir or ruler, appointed by the Cairene government, and is accompanied by the famous "Mahmal," or sacred pavilion. The other bands above mentioned have each their own amir, besides their *mekowwams* or agents, whose business it is to see after provisions, water and the like, and are not seldom encumbered with a numerous retinue of servants and other attendants. Lastly, a considerable force of soldiery accompanies both the Syrian and the Egyptian Hajj.

Bedouins and Pilgrims.—No guides properly so-called attend these pilgrim-caravans, the routes followed being invariably the same, and well known. But Bedouin bands generally offer themselves by way of escort, and not seldom designedly lead their clients into the dangers from which they bargain to keep them safe. This they are the readier to do because, in addition to the personal luxuries with which many of the pilgrims provide themselves for the journey, a large amount of wealth, both in merchandise and coins, is habitually to be found among the travellers, who, in accordance with Mohammedan tradition, consider it not merely lawful but praiseworthy to unite mercantile speculation with religious duty. Nor has any one, the pasha himself or the amir and the military, when present, excepted, any acknowledged authority or general control in the pilgrim-caravans; nor is there any orderly subdivision of management or service. The pilgrims do, indeed, often coalesce in companies among themselves for mutual help, but necessity, circumstance or caprice governs all details, and thus it happens that numbers, sometimes as many as a third of the entire Hajj, yearly perish by their own negligence or by misfortune,—dying, some of thirst, others of fatigue and sickness, others at the hand of robbers on the way.

The numbers which compose these pilgrim caravans are much exaggerated by popular rumour; yet it is certain that the Syrian and Egyptian sometimes amount to 5,000 each, with 25,000 or 30,000 camels in train. Large supplies of food and water have to be carried, the more so at times when the pilgrim season, following as it does the Mohammedan calendar, which is lunar, falls for years together in the very hottest season. Hence, too, the journey is usually accomplished by night marches, the hours being from 3 to 4 P.M. to 6 or 7 A.M. of the following day. Torches are lighted on the road, the pace is slower than that of an ordinary caravan, and does not exceed 2m an hour.

See MECCA and ISLAM

CARAVANSERAI. A public building, for the shelter of a caravan (*q.v.*) and of wayfarers generally in Asiatic Turkey. It is commonly constructed in the neighbourhood, but not within the walls, of a town or village. It is quadrangular in form, with a dead wall outside; this wall has small windows high up, but in the lower parts merely a few narrow air-holes. Inside, a cloister-like arcade, surrounded by cellular store-rooms, forms the ground floor, and a somewhat lighter arcade, giving access to little dwelling-rooms, runs round it above. Broad open flights of stone steps connect the storeys. The central court is open to the sky, and generally has in its centre a well with a fountain-basin beside it. A spacious gateway, high and wide enough to admit the passage of a loaded camel, forms the sole entrance, which is furnished with heavy doors, and is further guarded within by massive iron chains, drawn across at night. The entry is paved with flag-stones, and there are stone seats on each side. The court itself is generally paved, and large enough to admit of three or four hundred crouching camels or tethered mules; the bales of merchandise are piled away under the lower arcade, or stored up in the cellars behind it. The upstairs apartments are for human lodging; cooking is usually carried on in one or more corners of the quadrangle below. Should the caravanserai be a small one, the merchants and their goods alone find place within, the beasts of burden being left outside. A porter, appointed by the municipal authority of the place, is always present, lodged just within the gate, and sometimes one or more assistants. These form a guard of the building and of the goods and persons in it, and have the right to maintain order and, within certain limits, decorum; but they have no further control over the temporary occupants of the place, which is always kept open for all arrivals from prayer-time at early dawn till late in the evening. A small gratuity is expected by the porter, but he has no legal claim for payment, his maintenance being provided for out of the funds of the institution. Neither food nor provender is supplied.

Many caravanserais in Syria, Mesopotamia and Anatolia have considerable architectural merit; their style of construction is in general that known as Saracenic; their massive walls are of hewn stone; their proportions apt and grand. The portals especially are often decorated with intricate carving; so also is the prayer-niche within. These buildings, with their belongings, are works of charity, and are supported, repaired and so forth out of funds derived from pious legacies, most often of land or rentals. Sometimes a municipality takes on itself to construct and maintain a caravanserai; but in any case the institution is tax-free, and its revenues are inalienable. When, as sometimes happens, those revenues have been dissipated by peculation, neglect or change of times, the caravanserai passes through downward stages of dilapidation to total ruin (of which only too many examples may be seen) unless some new charity intervenes to repair and renew it.

Khans, i.e., places analogous to inns and hotels, where not lodging only, but often food and other necessaries or comforts may be had for payment, are sometimes by inaccurate writers confounded with caravanserais. They are generally to be found within the town or village precincts, and are of much smaller dimensions than caravanserais. The khan of Asad Pasha at Damascus is a model of constructive skill and architectural beauty.

CARAVEL, a light ship, of the 15th and 16th centuries, much used by the Spanish and Portuguese for long voyages. It was a broad-beamed vessel, with a double tower at the stern (the sterncastle), and a single one in the bows (the forecastle, a term which survives). Two of the three ships in which the Columbus expedition sailed were caravels, and the ship of Columbus himself was not fully decked. A nautical writer says that "her figure was that of a cask sawn in halves lengthwise and raised up at both ends. Such a contrivance might be safely trusted to blow along before the breeze; it is impossible to understand how vessels thus built and rigged managed to keep a true course when they braced up their yards." But they were eminently picturesque, and they made some glorious voyages. Carvel, the older English form of the word, is now used only in the term "carvel-built," for a boat in which the planking is flush with the edges laid side to side, as distinct from one "clinker-built," where the edges overlap.

CARAVELAS, a small seaport of southern Baía, Brazil, on the Caravelas river a few miles above its mouth, which is dangerously obstructed by sandbars. Pop. of *município* (1940) 14,754. Caravelas was once the centre of a flourishing whale fishery, but has since fallen into decay. It is the port of the Baía and Minas railway, whose traffic is comparatively unimportant.

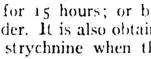
CARAWAY, the fruit, or so-called seed, of *Carum Carvi*, an umbelliferous plant growing throughout the northern and central parts of Europe and Asia, and naturalized in waste places in England and in North America from Newfoundland to Colorado. The plant has finely-cut leaves and compound umbels of small white flowers. The fruits, commonly called caraway seeds, are flattened and ovate. Caraway has a pleasant aromatic odour when bruised, and an agreeable spicy taste. It yields a volatile oil, the chief constituent of which is carvone (1 methyl-4-isopropenyl-Δ^6cyclohexen(e)-2-one). The plant is cultivated in north and central Europe and Morocco, as well as in the south of England, the produce of more northerly latitudes being richer in essential oil than that grown in southern regions. The oil is obtained by distillation for use in medicine as an aromatic stimulant and carminative, and as a flavouring material in cookery and in liqueurs for drinking. Caraway seeds are, however, more extensively consumed entire in certain kinds of cheese, cakes and bread.

CARAYAN, an independent linguistic stock of South American Indians, named from the Caraya (Karaya), its most important tribe. The Carayan tribes live in central Brazil on the Araguaya river from near its mouth south to about 14° S. lat. Krause finds their culture very similar to that of the Arawakan and Cariban tribes of Guiana, and thinks the Carayas may have come to their historic habitat from north of the Amazon. They are a primarily agricultural and fishing folk, living in rather crude thatched huts, and showing in general a simple type of culture. Their hair is occasionally curly. The men practise kynodesmy, while the women wear a fringed girdle. Tattoo, body painting and labrets constitute their ornament, together with arm and leg bands of various sorts. The bow, club and spear are their chief weapons. They have no form of armour or shield. Dug-out canoes are used for river travel. Pottery is made, but they have no textiles. Monogamy prevails except for chiefs, who have very little power. The dead are buried and then after an interval the bones are exhumed and buried in a pot. There are elaborate dance ceremonies, employing masks, held in connection with puberty festivals, at the men's houses where the youths live, but these ceremonials have thus far not been adequately described.

See F. Krause, *In den Wildnissen Brasiliens* (Leipzig, 1911).

CARBALLO, a town of north-western Spain, in the province of Corunna. It lies on the right bank of the river Allones, 20 mi S.W. of Corunna, its nearest railway station. Pop (1940) 1,584 (mun., 18,150). Though a market centre for local cereals and dairy produce, Carballo is chiefly noted for the hot sulphurous springs of San Juan de Carballo, on the opposite bank of the Allones which make it a minor watering place.

CARBAZOLE, a constituent of coal tar, occurring with crude anthracene, crystallizing in plates or tables, melting point 238° C, and readily subliming. It may be separated from crude anthracene by fusing it with potassium hydroxide. By this treatment it is converted into carbazole-potassium, which can be easily separated by distilling off the anthracene. The separation is, however, preferably effected on a large scale by extracting the crude anthracene with heavy coal-tar pyridine (b.p. 140–180° C) in which solvent the carbazole dissolves more readily than anthracene.

Carbazole, 

may be prepared synthetically by passing the vapours of diphenylamine or aniline through a red-hot tube; by heating 2,2′-diaminodiphenyl with 25% sulphuric acid to 200° C for 15 hours; or by heating thiodiphenylamine with copper powder. It is also obtained as a decomposition product of brucine or strychnine when these are distilled with zinc dust. Carbazole dissolves readily in the common organic solvents. Melted in combination with oxalic acid it gives carbazole blue. The potassium salt reacts with the alkyl iodides to give *N*-substituted alkyl derivatives. It gives the pine-shaving reaction, in this respect resembling pyrrole (*q.v.*). The chief importance of carbazole lies in the production of hydrone blue (Alizone blue), a vat dye which in many respects rivals indigo. This dye is prepared by condensing carbazole with nitrosophenol in concentrated sulphuric acid. The resulting indophenol is then heated with alcoholic sodium tetrasulphide. Greener shades of hydrone blue are obtained from the *N*-alkyl carbazoles.

CARBIDES are, strictly, compounds of carbon with one other element. The term, however, is generally used to designate only those binary compounds of carbon which are comparatively infusible and non-volatile. Carbides are generally products of the electric furnace, and it may be said that Henri Moissan, who made many brilliant researches with this furnace, founded the chemistry of carbides. The volatile carbon compounds of oxygen, sulphur and the halogens are not included in the category of carbides.

The two most important carbides are calcium carbide and silicon carbide (carborundum, *q.v.*). Calcium carbide, which is of industrial value as the source of acetylene (*q.v.*), is manufactured by heating together lime and coke or powdered coal in an electric furnace, the molten product being tapped off at 1,800° C. The lime may be replaced by limestone (calcium carbonate). The electric furnace is employed merely as a convenient source of heat; there is no specific electrolytic action in the process, $CaO+3C=CaC_2+CO$. Commercial calcium carbide is a brownish-grey crystalline mass decomposed by water with evolution of acetylene, $CaC_2+2H_2O=Ca(OH)_2+C_2H_2$ The carbides of strontium and barium, which resemble the calcium compound, are prepared in a similar manner. Moissan prepared carbides from the alkali metals as greyish-white powders by heating them in a stream of acetylene, when, in the case of sodium, an intermediate product, Na_2C_2,C_2H_2 (or C_2HNa) was formed; this on further heating evolved acetylene and left a residue of sodium carbide, C_2Na_2. Aluminium and beryllium carbides, yellow and yellowish-brown crystalline products respectively, are of scientific interest since they evolve pure methane when decomposed by water. The former is made by heating together aluminium and carbon, the reaction proceeding rapidly at 1,400° C. The latter is produced by the reduction of beryllia with carbon at 1,900° C. Carbides or acetylides of doubtful composition are precipitated by passing acetylene into ammoniacal solutions of cuprous and argentous salts, the products being reddish-brown and yellowish-white respectively. These compounds are explosive, as are also the acetylides of mercury and of gold

The carbides may be roughly classified according to their interactions with water or dilute acids: (1) The acetylides, which evolve acetylene, are those of the alkali metals, the alkaline-earth metals, the currency group, and the carbides of magnesium and mercury; (2) the methanides are the carbides of aluminium, beryllium and manganese, since these substances evolve methane. Manganese *carbide*, Mn_3C, *obtained by the interaction of* carbon and manganese oxide, Mn_3O_4, at 1,500° C, is decomposed by water with evolution of methane and hydrogen; (3) mixed carbides, which on treatment with water or acids evolve both acetylene and methane, as for example, the carbides of the rare-earth metals (lanthanum, yttrium, etc.). Uranium carbide, U_2C_3 or UC_2, is decomposed by water to give hydrogen, acetylene, ethylene and methane. Iron carbide (cementite), Fe_3C, is decomposed by hot acids with evolution of hydrogen and a mixture of hydrocarbons; (4) carbides not decomposed by water or dilute acids The last group includes silicon carbide, SiC, obtained in pale green to steel-blue crystals; this is a typical furnace product which due to its extreme hardness is widely employed as an abrasive (*q.v.*) Boron carbide, CB_6, titanium carbide, TiC, and zirconium carbide, ZrC_2, are hard refractory substances all prepared in the electric furnace, the first by combination of its constituent elements and the other two by reduction of the corresponding oxides by carbon.

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CARBINE, a word which came into use towards the end of the 16th century to denote a form of small fire-arm, shorter than the musket and chiefly used by mounted men (Fr. *carabine*, Ger. *Karabiner*). It has retained this significance, through all subsequent modifications of small-arm design, to the present day, and is now as a rule a shortened and otherwise slightly modified form of the ordinary rifle (*see* SMALL ARMS, THE DEVELOPMENT OF). During and since World War I, however, it has been largely replaced by the ordinary rifle even for cavalry.

CARBO, the name of a Roman plebeian family of the gens Papiria The following are the most important members:—

1. GAIUS PAPIRIUS CARBO, tribune of the people (131 B.C.), carried a law extending voting by ballot to the enactment and repeal of laws; another proposal, that the tribunes should be allowed to become candidates for the same office in the year immediately following, was defeated by Scipio Aemilianus. In 130 he became a member of the Gracchan land-commission (*see* GRACCHUS, GAIUS SEMPRONIUS). Carbo was suspected of having been concerned in the sudden death of Scipio (129). He subsequently went over to the optimates, and (when consul in 120) successfully defended Lucius Opimius, the murderer of Gaius Gracchus. But the optimates did not trust Carbo. He was impeached by Licinius Crassus on a charge of murdering citizens without a trial, and committed suicide.

See Livy, *Epit.* 59; Appian, *Bell. Civ.* i. 18; Vell. Pat. ii. 4; Val Max. iii. 7, 6; A. H. J. Greenidge, *History of Rome* (1904).

2. His son GAIUS PAPIRIUS CARBO, surnamed Arvina, was a supporter of the aristocracy, and was put to death by the Marian party in 82. He is known chiefly for the law (Plautia Papiria) carried by him and M. Plautius Silvanus when tribunes of the people in 90 (or 89), whereby the Roman franchise was offered to every Italian ally domiciled in Italy at the time when the law was enacted, provided he made application personally within 60 days to the praetor at Rome.

See Cicero, *Pro Archia*, 4; Vell. Pat. ii. 26; Appian, *Bell, Civ.* i. 88.

3. GNAEUS PAPIRIUS CARBO (*c.* 130–82 B.C.), nephew of (1). He was a strong supporter of the Marian party, and took part in the blockade of Rome (87). In 85 he was chosen by Cinna as his colleague in the consulship, and the two prepared to carry on war against Sulla, who had announced his intention of returning to Italy. Cinna and Carbo declared themselves consuls for the following year, but Cinna was murdered by his own soldiers, leaving Carbo sole consul. In 82 Carbo, then consul for the third time, fought a drawn battle with Sulla near Clusium, but he was utterly defeated by Sulla's general, Metellus Pius (*see* under METELLUS PIUS, QUINTUS CAECILIUS) near Faventia. Carbo fled from Italy, but was captured at Cossyra (Pentellaria), and put to death by Pompey.

See Appian, *Bell. Civ.* i. 67–98; Livy, *Epit* 79, 84, 88, 89; Plutarch, *Pompey*, 5, 6, 10, and *Sulla*, 28; Cicero, *ad Fam.* ix 21; Eutropius, v 8, 9; Orosius, v. 20; Valerius Maximas, v. 3, 5, ix 13, 2; art. SULLA, LUCIUS CORNELIUS.

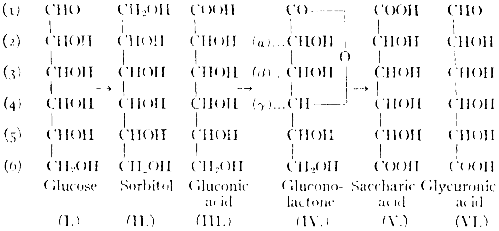
CARBOHYDRATES, a group of substances which includes the sugars, starches, and celluloses, along with the many varied products, either found in nature or prepared in the laboratory, which are closely related to them chemically. This group of compounds is comparable in importance with the proteins and fats. Its members play an all-important part in the lives of plants and animals, as structural elements and in the maintenance of functional activity Cane sugar, glucose, fructose, and the various forms of starch and cellulose may be cited as typical representatives. Their industrial importance may be estimated from the fact that amongst the undertakings directly dependent on carbohydrate materials are the cotton industry, the manufacture of paper, the artificial silk industries, certain branches of the explosives industry, brewing and the manufacture of power alcohol.

Chemically, the carbohydrates are characterised by great reactivity. As found in nature they are almost invariably optically active (*see* STEREOCHEMISTRY). They reveal exceedingly complex possibilities of isomerism and many of them occur in amorphous colloidal forms. For these reasons, their study has provided problems of exceptional interest and difficulty, and in spite of the long-continued efforts of chemists, it is only within recent years that definite knowledge has been obtained concerning the internal structure of even the simplest members. Formaldehyde undergoes polymerization (*q.v.*) in presence of alkali to give a product resembling fructose, and since formaldehyde is itself obtainable by reduction of carbonic acid, the synthetic processes which go on in the leaf of the plant with the formation of carbohydrates are partly explained.

The simplest carbohydrates function as polyhydroxyaldehydes or ketones containing from 3 to 9 carbon atoms, although, as will be seen later, these assume a cyclic character. With few exceptions they correspond to the formula $(CH_2O)_n$. They are soluble in water and possess a sweet taste. These simpler members, the sugars, may be regarded as the units of which the more complex carbohydrates are built up. The simplest sugars are termed monosaccharides and their nomenclature is based on the value of n in the above formula. If $n=3$ the substance is said to be a triose, if $n=6$ a hexose and so on. The commonest and most important representatives of the two classes of sugars are glucose (an aldohexose) and fructose (a ketohexose) and the reactions of these two will now be considered in greater detail. In essential respects the chemistry of the other monosaccharides may be taken to be similar either to that of glucose or to that of fructose.

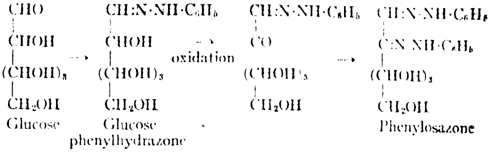
Glucose.—Glucose, dextrose or grape sugar, $C_6H_{12}O_6$, is widely distributed in plants and animals. It occurs alone or combined with other sugars as in cane sugar, milk sugar, etc., or combined with alcohols of various types to form glucosides (*q.v.*). Glucose may be prepared readily from starch or from cane sugar by the action of dilute acids. It is very soluble in water and is easily fermented by yeast to give alcohol. From its aqueous solution it separates in warty masses containing one molecule of water of crystallization, m.p. 86°. It may be obtained from other solvents in two distinct forms (*see* below). In its chemical properties glucose resembles an aldehyde and is a strong reducing agent, quickly precipitating gold and silver from warm solutions of their salts. Solutions of glucose do not, however, restore the colour to Schiff's reagent. The reaction between glucose and an alkaline solution of copper hydroxide (Fehling's solution), which results in the precipitation of cuprous oxide, is used to estimate glucose in aqueous solution. In the absence of other sugars, glucose may be estimated by observing the extent to which it rotates the plane of polarized light since a given weight of pure glucose has a fixed rotation. This is known as its specific rotation.

The aldehydic functions disappear on reduction of glucose with nascent hydrogen, and a hexahydric alcohol, sorbitol (II.), is formed which, when further reduced with hydrogen iodide, yields a derivative of normal hexane, $CH_3{\cdot}(CH_2)_3{\cdot}CHI{\cdot}CH_3$. This proves that the arrangement of the six carbon atoms of glucose does not involve a branched chain of carbon atoms. That there are five hydroxyl groups present in the glucose molecule is shown by the fact that glucose gives penta-acetyl and penta methyl derivatives and on the basis of the facts so far considered the simplest formula for glucose would be (I.). Furthermore, oxidation with bromine water yields gluconic acid (III.) which, even in aqueous solution, is transformed partly into the γ-lactone, $[\alpha]_D+68°$, m.p. 130 35° (IV.). Reduction of gluconolactone in aqueous solution with sodium amalgam and dilute acid gives glucose, whilst on oxidation with nitric acid both glucose and its lactone yield saccharic acid (V.).



$$
\begin{array}{lcccccccccc}
(1) & \mathrm{CHO} & & \mathrm{CH_2OH} & \mathrm{COOH} & & & \mathrm{CO}\text{------}\rceil & & \mathrm{COOH} & \mathrm{CHO}\\
(2) & \mathrm{CHOH} & & \mathrm{CHOH} & \mathrm{CHOH} & & (\alpha)\ldots & \mathrm{CHOH}\ \ | & & \mathrm{CHOH} & \mathrm{CHOH}\\
 & & & & & & & \qquad\mathrm{O} & & & \\
(3) & \mathrm{CHOH} & & \mathrm{CHOH} & \mathrm{CHOH} & & (\beta)\ldots & \mathrm{CHOH}\ \ | & & \mathrm{CHOH} & \mathrm{CHOH}\\
 & & \longrightarrow & & & \longrightarrow & & & \longrightarrow & & \\
(4) & \mathrm{CHOH} & & \mathrm{CHOH} & \mathrm{CHOH} & & (\gamma)\ldots & \mathrm{CH}\text{------}\rfloor & & \mathrm{CHOH} & \mathrm{CHOH}\\
(5) & \mathrm{CHOH} & & \mathrm{CHOH} & \mathrm{CHOH} & & & \mathrm{CHOH} & & \mathrm{CHOH} & \mathrm{CHOH}\\
(6) & \mathrm{CH_2OH} & & \mathrm{CH_2OH} & \mathrm{CH_2OH} & & & \mathrm{CH_2OH} & & \mathrm{COOH} & \mathrm{COOH}\\
 & \text{Glucose} & & \text{Sorbitol} & \text{Gluconic acid} & & & \text{Glucono-lactone} & & \text{Saccharic acid} & \text{Glycuronic acid}\\
 & (\text{I.}) & & (\text{II.}) & (\text{III.}) & & & (\text{IV.}) & & (\text{V.}) & (\text{VI.})
\end{array}
$$

The aldehydic functions are further illustrated by the action of such reagents as hydroxylamine and phenylhydrazine, which give respectively glucose-oxime and glucose-phenylhydrazone. Excess of the latter reagent causes oxidation, with the production of glucose-phenylosazone (m.p. 210°), a substance of characteristic appearance which is often used as a qualitative test for the presence of glucose. The oxidation can be shown to involve the second carbon atom and the formation of the osazone may be summarized thus:

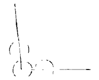


$$
\begin{array}{ccccccc}
\mathrm{CHO} & & \mathrm{CH{:}N{\cdot}NH{\cdot}C_6H_5} & & \mathrm{CH{:}N{\cdot}NH{\cdot}C_6H_5} & & \mathrm{CH{:}N{\cdot}NH{\cdot}C_6H_5}\\
\mathrm{CHOH} & & \mathrm{CHOH} & \xrightarrow[\text{oxidation}]{} & \mathrm{CO} & & \mathrm{C{:}N{\cdot}NH{\cdot}C_6H_5}\\
 & \longrightarrow & & & & \longrightarrow & \\
(\mathrm{CHOH})_3 & & (\mathrm{CHOH})_3 & & (\mathrm{CHOH})_3 & & (\mathrm{CHOH})_3\\
\mathrm{CH_2OH} & & \mathrm{CH_2OH} & & \mathrm{CH_2OH} & & \mathrm{CH_2OH}\\
\text{Glucose} & & \text{Glucose phenylhydrazone} & & & & \text{Phenylosazone}
\end{array}
$$

Glycuronic Acid.—The reactive grouping (No. 1 in formula I.) which functions as an aldehydic group in glucose can be masked (as in the glucosides), and then oxidation of the terminal primary alcoholic group (6) may be effected, and in this way it is possible to obtain glycuronic acid (VI.), which is of special importance in metabolism, since many objectionable substances are removed from the body in the form of their condensation products with it in the form of glucosides (*see* below).

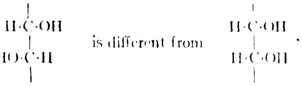
The aldehydic formula for glucose explains satisfactorily most of the observations mentioned above, but it is impossible to account on this basis for the existence of two isomeric crystalline α and β-forms of the sugar or of its simple derivatives.

Stereochemistry of the Sugars.—To visualize the arrangement in space of the sugar molecule, it is imperative to know how a simple chain of six carbon atoms is disposed. It has been shown that three carbon atoms are linked together in such a manner that they are inclined at an angle of 109° 28′, thus:



If six such atoms are joined then the fifth and sixth will approach near in space to the first, that is, the chain of atoms curls round on itself. Even more important, is the recognition that when two other atoms are attached to each of these carbon atoms, these also will make an angle of 109° 28′. Hence to portray such a figure on a plane surface, such as this page, is impossible, and some pictorial convention must be devised. Thus in representing the H and OH attached to a carbon atom it is always assumed that the reader sees each individual carbon atom projected into the plane of the printed page, but the H and OH group attached to this carbon atom will emerge upwards from the page at the above angle.

Only thus is it possible to realize that the expression

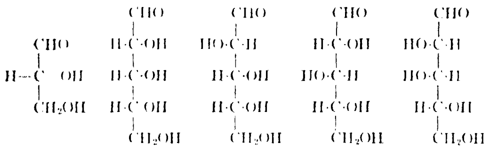


$$
\begin{array}{c} | \\ \mathrm{H{\cdot}C{\cdot}OH} \\ | \\ \mathrm{HO{\cdot}C{\cdot}H} \\ | \end{array}
\quad \text{is different from} \quad
\begin{array}{c} | \\ \mathrm{H{\cdot}C{\cdot}OH} \\ | \\ \mathrm{H{\cdot}C{\cdot}OH} \\ | \end{array}.
$$

Otherwise it may be erroneously considered that the former can be made to be identical with the latter by merely revolving the second carbon atom round the first. In the study of sugar chemistry, spherical models of the atoms are essential aids to the realization of these factors of the distribution of groups in three-dimensional space.

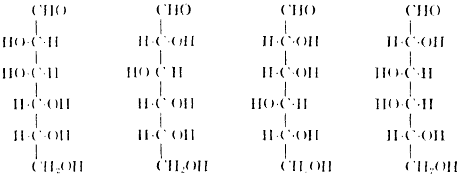
In the following expressions it is assumed: (*a*) that the chain of carbon atoms has been uncurled and placed in a straight line; (*b*) that the two or more addenda which point outwards from this plane are projected downwards into the plane of the paper.

Reference to the aldehydic formula (VI., *see* below) for glucose shows that the second, third, fourth, and fifth carbon atoms are asymmetric (*see* STEREOCHEMISTRY), and accordingly there exist 2^4 or 16 isomeric aldohexoses differing only in the stereochemical arrangement of the -H and -OH groups round the asymmetric carbon atoms. The 16 are arranged in 8 pairs, the two members of each pair being identical except that one form has a dextro-configuration (*d*-series) and the other a laevo configuration (*l* series). All eight aldohexoses are known. Similarly, on theoretical principles there could exist 2^3 or 8 aldopentoses which may be arranged in 4 pairs. Corresponding to these there exist *d*- and *l*-modifications of xylose, ribose, arabinose, and lyxose. The naturally occurring dextrorotatory glucose is genetically related to the dextrorotatory form of glyceraldehyde, to which is assigned the projection formula (A), and the sugars are therefore classified into two series, called the *d*- and the *l*-series respectively, according as they may be built up by synthetical means from *d*- or *l*-glyceraldehyde (Rosanoff). On this basis the four *d*-forms of the aldopentoses can be represented by the projection formulae shown below.



(A) (I.) *d* Ribose (II.) *d* Arabinose (III.) *d* Xylose (IV.) *d*-Lyxose

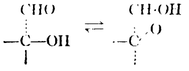
The physical and chemical behaviour of these sugars renders possible the accurate diagnosis of the above configurations and it is on this basis that the formulae are assigned. Similarly there exist 16 aldohexoses 8 of the *d* series, and 8 of the *l*-series - the chief representatives in the *d*-series being those formulated below. The corresponding formulae for those in the *l*-series are the mirror images of the formulae now given.

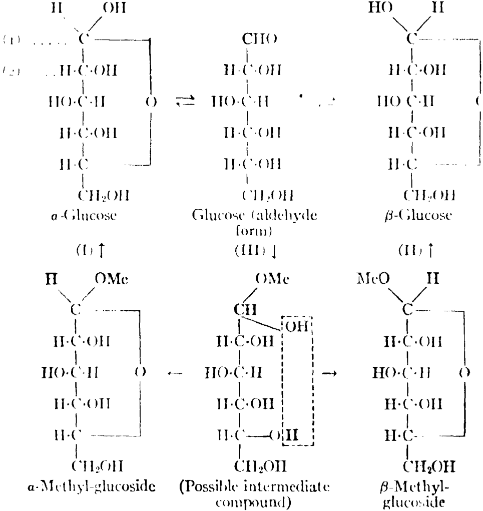


(V.) Mannose (VI.) Glucose (VII.) Gulose (VIII.) Galactose

Synthetic Glucosides and the Structure of Glucose.—Aldehydes ordinarily react with one or with two molecules of ethyl alcohol to give either an alcoholate, $R{\cdot}CH\genfrac{}{}{0pt}{}{OEt}{OH}$ or an acetal, $R{\cdot}CH\genfrac{}{}{0pt}{}{OEt}{OEt}$. Methyl alcohol in the presence of an acid as catalyst yields, a dimethyl-acetal, $R{\cdot}CHO \rightarrow R{\cdot}CH(OMe)_2$. A sugar aldose, however, under similar conditions reacts with one molecule of methyl alcohol, with elimination of one molecule of water: $C_6H_{12}O_6 + CH_3{\cdot}OH \rightarrow C_7H_{14}O_6 + H_2O$. The resulting compound, a methyl-aldoside, can only be represented, on the basis of rules of valency, as a *cyclic* compound (V. and VI., below). It is isolated in two different forms which are interconvertible. Thus, by the agency of methyl alcohol containing 0·5% hydrogen chloride, glucose is converted on heating into, (1) α methyl-glucoside having m.p. 166° and a specific rotation of +150°, and (2) β methyl glucoside having m.p. 105° and a rotation of −34°. These differ remarkably in their behaviour towards enzymes. The enzyme maltase is specific for α-methyl glucoside, converting it into glucose and methyl alcohol. The enzymes of emulsin, on the other hand, convert the β glucoside into glucose and methyl alcohol. Heating with aqueous mineral acid regenerates glucose from each glucoside.

A striking fact, related to these observations, is that dextrorotatory glucose can also be isolated in two crystalline forms which are interconvertible, and so also can its penta acetate, its penta-benzoate, as well as other derivatives. By crystallizing glucose from alcohol or from acetic acid the α form is obtained, m.p. 146°, having a specific rotation $[\alpha]_D + 113°$. From solution in pyridine the crystalline β-form is isolated, m.p. 148°, $[\alpha]_D + 17°$. Each of these forms changes in aqueous solution to an equilibrium mixture having $[\alpha]_D + 52·5°$, this change being known as "mutarotation." These two forms are structurally related to the α- and β-methyl glucosides, and since the cyclic formulae (V. and VI.) have been assigned to the latter, the α- and β-forms of glucose may similarly be represented by formulae (I.) and (II.). Hence the formulation of glucose as an aldehyde must now be superseded by these more precise representations which admit of the explanation of all the aldehydic functions of glucose (as also for other sugars) whilst serving the better to elucidate the very special properties of sugars as modified aldehydes. It is seen that the —OH on the fifth carbon atom of the hexose chain is spatially near to the aldehyde group in the transitory phase, and by interaction the CHO deprives the OH of its hydrogen, thus:

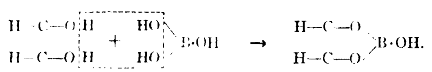




α-Glucose (I.) ↑ Glucose (aldehyde form) (III.) ↓ β-Glucose (II.) ↑

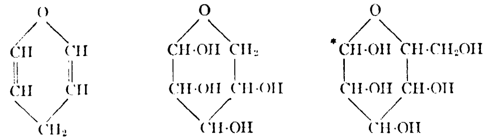
α-Methyl-glucoside (V) (Possible intermediate compound) (IV) β-Methyl-glucoside (VI)

In formulae (I.) and (II.) it is seen that the potential aldehyde group now becomes asymmetric and the arrangement of the H and OH in space in two possible ways at carbon atom No. 1 accounts for the existence of the two stereochemical forms, α- and β-, having different specific rotations. It has been shown that the glucoside (V.) is hydrolysed to the glucose form (I.) and the glucoside (VI.) to (II.) by the action of enzymes. The analogous optical properties also support these inter-relations of sugar and glucoside. Moreover, the presence of the two OH groups on the right of the contiguous carbon atoms (1) and (2) in α glucose (I.) is demonstrated by the ease with which this form, as distinct from the β-form, combines with boric acid.



The general form of the structure here assigned to glucose and its glucosides applies equally to all the simple sugars, both of the pentose and hexose class; so that the generalization is reached that the ordinary varieties of these sugars exist as six-atom rings. To preserve the relationship between aldehyde and ring-forms the structures are usually written as (I.) and (II.) above, but actually a model constructed on these lines would more accurately represent the sugars as hexagonal figures. Indeed, the sugars may be clearly pictured if we consider that they are derivatives of a parent substance, γ-pyran (A), which, if suitably hydroxylated and reduced would give the sugar form (B) which has been named pyranose, wherein the group marked

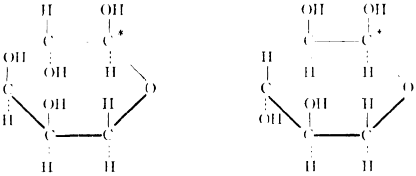
* is the potential aldehyde (or reducing) group. This is a



γ-Pyran (A) Pyranose (B) Hexa-pyranose (C)

pentose. The corresponding formula for a hexose is (C), which contains as a side chain a $-CH_2OH$ group.

The spatial distribution of the H and OH atoms or groups accounts for the existence of arabinose, xylose, ribose, and lyxose. These sugars may thus be named arabo-pyranose, xylo-pyranose, etc., the spatial relationships being clearly seen if we show the 6-atom ring in perspective, with the H and OH at each of the five C atoms either directed above this plane of the ring or below it.

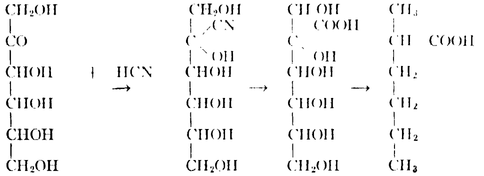


Arabo pyranose (*d* form) Xylo pyranose (*d* form)

The configurations for lyxose and ribose may be similarly sketched by referring to the provisional formulae for the pentoses given earlier. These would be designated lyxo-pyranose and ribo-pyranose on this nomenclature, which combines both structural and spatial considerations.

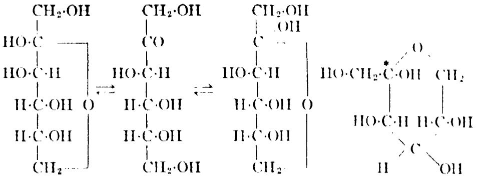
In the same way, formula (C) represents the common forms of glucose, of mannose and of galactose, which may be correctly described as gluco-pyranose, galacto-pyranose, etc. But the spatial relationships of H and OH at the carbon atoms of the ring are not shown in (C).

Fructose.—Fructose, laevulose or fruit sugar, $C_6H_{12}O_6$, is the commonest of the ketoses. It is formed along with glucose by inversion of cane sugar (sucrose) and occurs mixed with glucose in fruit juices. It is best prepared by digesting the polysaccharide, inulin (*q.v.*) with dilute oxalic acid. Crystalline fructose, m.p. 95°, is strongly laevorotatory in solution, having $[\alpha]_D$ $-134°$, which changes by mutarotation to $-92°$. Although laevorotatory its configuration is closely related to *d*-glucose, and hence it is named *d*-fructose. This fact is established in that by nascent hydrogen fructose passes into *d*-sorbitol, as does glucose. Fructose gives the same phenylosazone as glucose. It combines additively with hydrogen cyanide, and hydrolysis of this product, followed by reduction of the OH groups by hydriodic acid, gives methylbutylacetic acid (II.). Hence the provisional formula for fructose represents the sugar as a ketone (I.)



Fructose (I.) (II.)

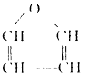
The mutarotation of fructose shows that an α-form of the sugar exists, and again, as with glucose, the ketone formula (III.) must give place to the cyclic, 6-atom ring structure indicated in the expressions (IV.) and (V.) for α-and β forms; but (VI.) is the most reasonable mode of formulating (V.) as fructo-pyranose.



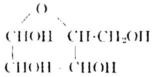
(IV.) (III.) (V.) (VI.)

Fructose, like glucose, is fermentable by yeast. It probably plays a different part in metabolism from glucose, and seems to be more intimately connected with tissue formation, whilst glucose is more concerned with respiration.

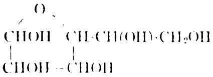
The Labile or γ-Sugars (Furanoses).—Whilst fructose on isolation is found to have the above 6-atom ring, yet there is strong evidence that when fructose occurs in combination in cane sugar and in inulin the structure is different and has a five-atom ring. The first sugar derivative of this type to be recognized (Emil Fischer) was γ-methyl-glucoside, which is obtained by condensing glucose and methyl alcohol containing 1% HCl *in the cold*. It is now known that most simple sugars can assume the γ- or labile form under analogous conditions. Derivatives of these have been prepared, and they are shown to be related, not to pyran as the parent substance, but to furan, and are therefore named furanoses.



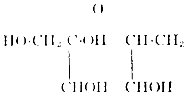
Furan



Xylo (etc.) furanose

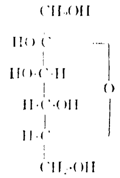


Gluco (etc.) furanose



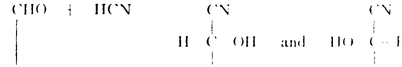
Fructo-furanose

or *e.g.*



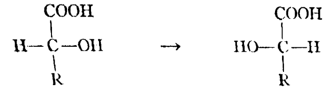
The above constitutional problems have been elucidated by studying sugar derivatives such as methylated, acetylated, and benzoylated sugars, and also the acetone sugars. A summary of the development of the experimental proofs has appeared in the *Annual Reports of the Chemical Society* (Organic Chemistry, Aliphatic Division) for the years 1923-1927; *see* also W. N. Haworth, *The Constitution of Sugars* (London, 1928).

Synthesis of Sugars—By combining certain reactions which have been already considered it is possible to pass from any monosaccharide to the one containing an additional carbon atom. Thus addition of HCN to glucose (A) (Kiliani) gives two



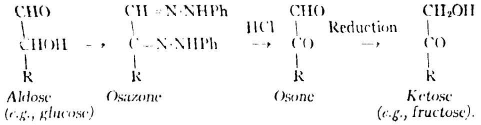
nitriles (B and C), hydrolysable to the acids, the lactones of which may be reduced by Fischer's method to the corresponding heptoses. The opposite effect, or degradation, can be accomplished by several methods. In one of these the calcium salt of gluconic acid is oxidized with hydrogen peroxide in the presence of ferric acetate, when the following reaction takes place: $R\cdot CHOH\cdot COOH \xrightarrow{O} R\cdot CHO+CO_2+H_2O$. In this case *d*-glucose yields *d*-arabinose.

The action of pyridine or quinoline on the lactones of gluconic acid results in the inversion of the groups attached to the second carbon atom (epimerization). Mannonolactone is thus produced which may be reduced to mannose. The reaction is general and has been used frequently in the synthesis of rare sugars.



$$\mathrm{H{-}C(COOH)(R){-}OH} \rightarrow \mathrm{HO{-}C(COOH)(R){-}H}$$

An aldose may be converted into a ketose through the osazone, the reactions being clear from the following scheme:



The reverse (*e.g.*, glucose) transformation may be effected in the following way:

$$\mathrm{R{\cdot}CO{\cdot}CH_2OH} \rightarrow \mathrm{R{\cdot}CHOH{\cdot}CH_2OH} \rightarrow \mathrm{R{\cdot}CHOH{\cdot}COOH} \rightarrow \text{Lactone} \downarrow \text{Aldose}$$

Ketose (*e.g.*, fructose) — Alcohol (*e.g.*, mannitol) — Acid (*e.g.*, mannonic acid) — Aldose (*e.g.*, mannose).

The elucidation of these and similar reactions prepared the way for the complete synthesis of the natural sugars from their elements. Glyceraldehyde, $\mathrm{CHO{\cdot}CHOH{\cdot}CH_2OH}$, gives with dilute alkali dihydroxyacetone, $\mathrm{CH_2OH{\cdot}CO{\cdot}CH_2OH}$, the crude mixture of the two being termed glycerose. These two molecules then unite by an aldol condensation to give *α* acrose, which was identified as *dl* fructose by means of its osazone.

$$\mathrm{CH_2OH{\cdot}CO{\cdot}CH_2OH + CHO{\cdot}CHOH{\cdot}CH_2OH}$$
$$\rightarrow \mathrm{CH_2OH{\cdot}CO{\cdot}CHOH{\cdot}CHOH{\cdot}CHOH{\cdot}CH_2OH.}$$

The osazone yielded the osone which was then reduced to the pure *dl* fructose (*see* above). The operations were next continued according to the scheme: *α*-acrose→*α*-acritol (mainly *dl*-mannitol) →*dl* mannose→*dl* mannonic acid→*d* mannonic acid→*d* mannose→*d* glucosazone→*d*-glucosone→*d*-fructose. Also *d*-mannonic acid→*d* gluconic acid→*d*-glucose. The *l*-series of sugars may be obtained similarly from *l*-mannonic acid.

The photosynthesis of carbohydrates in the plant from carbon dioxide requires the presence of chlorophyll (*q.v.*). Very recently it has been claimed that on suitable coloured surfaces carbon dioxide and water can be induced to yield true carbohydrate material under the influence of light. The reaction requires intense energy supplies.

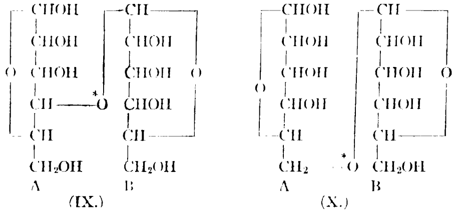
Disaccharides.—The disaccharides, $C_{12}H_{22}O_{11}$, are formed by the combination of two monosaccharide molecules with loss of one molecule of water: $2C_6H_{12}O_6 \rightarrow C_{12}H_{22}O_{11} + H_2O$. The reaction always involves one of the reducing groups and may involve both. The disaccharides may therefore be regarded as analogues of the methylglucosides in which the methyl radical is replaced by a sugar residue. As glucosides, they are readily hydrolysed to the component sugars by dilute acids and show the characteristic specific reactions towards enzymes. For example, maltose, an *α* glucosidic disaccharide, is readily hydrolysed in aqueous solution by maltase, whilst cellobiose, a *β* glucosidic disaccharide, is attacked by emulsin and not by maltase. According as one or both reducing groups are involved in the disaccharide linkage there exist reducing and non reducing disaccharides, the former reducing Fehling's solution and behaving like an ordinary aldose or ketose. Typical examples are lactose (reducing) and cane sugar (non-reducing)

In general the chemistry of the disaccharides resembles that of the monosaccharides, with the exception that the scope of the reactions which can be utilized is limited by the presence of the easily severed glucosidic linkage by which the two halves of the molecule are joined. The OH groups may be substituted by acetyl groups (*e.g.*, octa-acetyl sucrose) or by methoxy-groups (octamethyl-sucrose, etc.) or by other groups. Hydrazones, oximes and osazones are formed by the reducing disaccharides and oxidation at the reducing group gives rise to the bionic acids, which correspond with a hexonic acid such as gluconic acid

Disaccharide formation is not limited to the union of two similar molecules: compounds of glucose and galactose, glucose and fructose, etc., also occur, and these may exist either in *α*- or *β*-forms. For these reasons the elucidation of the structure of the disaccharides has been a most complex problem. The methylated sugars have furnished a valuable means to this end.

Lactose.—Lactose or milk sugar may be obtained by evaporation of whey from milk. It is not encountered in the vegetable kingdom. It reduces Fehling's solution, gives a characteristic osazone, exists in *α*- and *β*-modifications, shows mutarotation, and forms methyl lactosides. *α* Lactose has $[\alpha]_D+90°$, m.p. 223°. Oxidation with bromine water gives lactobionic acid which can be hydrolysed to a mixture of gluconic acid and galactose. *Lactose therefore contains one glucose and one galactose residue and these two hexoses can be obtained from lactose by hydrolysis.* The free reducing group in lactose is situated in the glucose portion. Lactose is thus a glucose *β*-galactoside, having the structural formula (IX.), wherein A = glucose, and B = galactose.

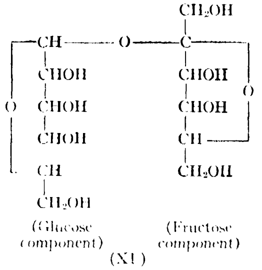
Similar experiments have been carried out with all the common reducing disaccharides and it is found that they may be accommodated by one or other of the two general formulae (IX. and X.), where A = glucose, B = either glucose or galactose according to the disaccharide selected; and the junction * may be either *α*- or *β*- as required by a particular example.



Other Disaccharide Compounds.—*Maltose* is formed by the action of the enzyme diastase on starch during the generation of cereals (preparation of malt). It is prepared by the hydrolysis of starch by diastase and forms crystals resembling glucose, $[\alpha]_D+137°$ (equil. value), mutarotating upwards. Hydrolysis by acids or by the enzyme maltase gives two molecules of glucose. The structure of maltose is similar to that of lactose (formula IX., A and B = glucose) except that the sugar is a glucose *α*-glucoside (* = *α*).

Cellobiose (m.p. 225° $[\alpha]_D+16°$, *β*-form; equil. value +35°) is obtainable in the form of its octa acetyl derivative from cotton cellulose by treatment with acetic anhydride and sulphuric acid under special conditions. Its special interest lies in the apparently close relationship between it and cellulose. Structurally it resembles maltose except in the nature of the glucosidic linkage which is *β*-. It is glucose *β* glucoside (formula IX.). *Gentiobiose* (m.p. 190 195° $[\alpha]_D-11°$, equil. value +9·6°) is a reducing disaccharide obtained by partial hydrolysis of the trisaccharide gentianose. It is the sugar present in the glucoside amygdalin (*q.v.*). It differs structurally from maltose and corresponds with formula (X.). *Melibiose* (m.p. 88 95°, $[\alpha]_D$ 124°, equil. value 143°) is one of the hydrolytic products of the trisaccharide raffinose. It contains glucose and galactose residues, corresponds structurally with gentiobiose (formula X.) but is glucose *α*-galactoside.

Sucrose or cane sugar (m.p. 160°, $[\alpha]_D+66{\cdot}5°$) is the most important non-reducing disaccharide. For description of its physical properties and the mode of extraction from the sugar cane and the sugar beet, *see* SUGAR. It is very readily hydrolysed by dilute acids to a mixture of equal quantities of glucose and fructose (termed invert sugar), but sucrose itself does not reduce Fehling's solution. In this case both reducing groups are involved in the disaccharide linkage. It gives octa-acetyl, octa-methyl derivatives, etc., and from a study of the latter the structure of sucrose has been determined (formula XI.); it involves a pyranose structure in the glucose portion and a furanose structure in the fructose half of the molecule.



(XI.)
Sucrose (cane sugar)

In addition to the disaccharides similar compounds are known in which three sugar molecules are linked together (*trisaccharides*). The best known of these are raffinose (from cotton seed meal), melezitose (from the manna exuded from the Douglas Fir) and gentianose (from gentian roots).

Polysaccharides.—The empirical formula of the members of this series is $C_6H_{10}O_5$, or in some cases $C_5H_8O_4$. Their molecular weight is, however, very high; they are mostly amorphous, colloidal complexes, which break down on hydrolysis to monosaccharides containing 5 or 6 carbon atoms. Several of the individual substances are of great industrial importance and are fundamental in the synthetic processes taking place in the living cell. Their colloidal nature and high molecular weight greatly increase the difficulties inherent in their chemical investigation, and the structural formula of no one of them can at present be regarded as definitely established.

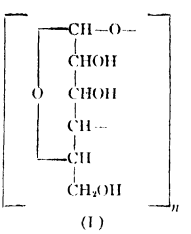
Cellulose.—The name cellulose has been given to several products found in the vegetable kingdom. These consist for the most part of complexes of various extraneous materials with normal cellulose, the purest form of the latter being found in cotton. The same cellulose is present also to a greater or less extent in flax, hemp, wood, straw, etc. For the part played by cellulose in paper making, *see* PAPER MANUFACTURE.

Cotton cellulose is a white fibrous substance, which contains when air-dried some 7% of moisture. It is insoluble in all the usual solvents, but dissolves readily in an ammoniacal solution of copper hydroxide (Schweitzer's reagent) and in the concentrated solutions of certain metallic salts. On dilution it is again precipitated. It is unaffected by moist chlorine, and as this reagent converts into soluble substances almost all the materials which accompany cellulose this provides a convenient method for its purification and estimation. Treatment of unglazed paper with strong sulphuric acid converts the superficial layer into the so called "amyloid" modification, with production of parchment paper. Another, somewhat similar transformation is the conversion of cellulose (cotton) into mercerized cotton by the action of cold 15–25% sodium hydroxide solution. Various indefinite substances known as hydrocelluloses and oxycelluloses are produced respectively by the action of acids and of oxidizing agents.

The most important compounds of cellulose are the esters. These include the nitrates which are used in the manufacture of explosives (*q.v.*), celluloid, photographic films, etc. The xanthate, formed by the action of caustic soda and carbon disulphide ($R{\cdot}OH+CS_2+NaOH \rightarrow R{\cdot}O{\cdot}CS{\cdot}SNa+H_2O$), is of prime importance in the viscose industry, in which a suitably prepared cellulose xanthate solution is forced through fine orifices into an acid bath, with the regeneration of cellulose in the form of silky filaments (*see* SYNTHETIC FIBRES).

The acetates of cellulose, produced by the action of acetic anhydride in the presence of a catalyst, are of equal importance in that in one or other of their forms they are the basis of cellulose acetate silk, of non-inflammable films, and of many varnishes and lacquers; they can be used as insulating materials in electrical work.

Much attention is being given to the problem of the internal structure of cellulose. It can be converted into glucose quantitatively by hydrolysis and so consists solely of glucose residues. The first and fourth carbon atoms of the C_6 unit are concerned in the mutual union of these glucose residues, which are all identical in structure in cellulose (formula I.). The acetolysis of cotton cellulose to give cellobiose (*see* above) strengthens this view.



(I.)

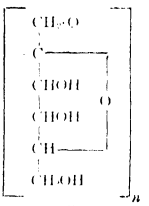
On the basis of X-ray measurements cellulose can be regarded as a closely packed array of continuous chains of gluco-pyranose residues, arranged as formula (I.) and having the same mode of linking as the related disaccharide cellobiose.

Starch.—This polysaccharide is present in assimilating plants and occurs in large amounts in cereals, grains, roots, tubers, etc. It occurs in the form of granules built up of concentric layers round a nucleus. When heated with water the outer integument of the granule bursts and an opalescent liquid is formed which sets to a paste when cold. The granules and the paste give a characteristic deep blue colour with iodine. It has been claimed that starch can be separated into two portions termed amylose and amylopectin, which differ in their colour reactions with iodine (the latter giving a violet coloration and the former blue) and in their capacity to give a starch paste.

The action of diastase on starch yields the disaccharide maltose. Complete hydrolysis yields glucose quantitatively. The controlled action of acids or ferments has led to the preparation of a large number of substances intermediate between starch and maltose. These are classed generally as dextrins. They differ considerably from one another in physical properties and their relationship to starch on the one hand and to the simple monosaccharides on the other has yet to be worked out. Little can be said at present regarding the structural relationship of starch and cellulose, but that maltose is closely connected with the structure of starch seems to be clear (*see* also FERMENTATION).

Glycogen or animal starch, $(C_6H_{10}O_5)_n$, occurs in the animal muscle and in the liver of mammalia. It gives a red coloration with iodine and is readily hydrolysed to give glucose in quantitative yield. It is more labile than ordinary starch which it resembles in many particulars. Like starch and cellulose, its methylated derivative yields 2:3:6 trimethylglucose on hydrolysis. *Lichenin* or moss starch, $(C_6H_{10}O_5)_n$, is yet another example of a polysaccharide built up solely of glucose units. It occurs in Iceland moss. Chemically it has many properties in common with cellulose.

Inulin, $(C_6H_{10}O_5)_n$, is of common occurrence in plants as a reserve foodstuff, where it may often take the place of starch. It is composed entirely of fructose units and hydrolysis of inulin by oxalic acid provides the best method for obtaining ordinary crystalline fructose. Despite this fact the fructose unit in inulin is not the pyranose type of fructose, but is the furanose or labile type of the sugar. Iodine gives a yellow colour with inulin. The two groups concerned in the union of the fructose units in the complex are the primary alcoholic group at the first carbon atom and the reducing group attached to the second carbon of the ketose. The number of such units has not yet been ascertained. *See* special articles on various carbohydrates.



Inulin

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CARBOLIC ACID or **PHENOL** discovered in 1834 by F. Runge in coal tar. A Laurent in 1841, first obtained it in a pure crystalline condition, determined its composition and named it phenyl hydrate or phenic acid. It is, in fact, to be regarded as derived from benzene, the simplest hydrocarbon of the so-called aromatic series (*see* also CHEMISTRY: *Organic*), through the replacement of one hydrogen atom by the hydroxyl or alcoholic group, ·OH. Thus it stands in the same relation to benzene as ordinary methyl alcohol (wood spirit), CH_3OH, does to methane (marsh-gas), CH_4; just as methyl alcohol is hydroxy-methane so is phenol hydroxy-benzene, and, having the formula C_6H_5OH, is the prototype and simplest member of one of the most important groups of compounds in organic chemistry. Although, as explained above, it has certain analogies of composition with methyl and other alcohols of the aliphatic series, its properties differ greatly from those of an alcohol, properly so called, and this difference must be attributed to the great difference in structure and properties between the paraffin hydrocarbons, on the one hand (methane, ethane, etc.), and the coal-tar hydrocarbons (benzene, toluene, naphthalene, etc.), on the other. It is found in nature as a product of animal metabolism, occurring in the urine of man, horse and other mammals, also in the degradation products of proteins. It is formed in many chemical processes, particularly by the decomposition of organic matter such as wood or coal at high temperatures (carbonization). It has been observed in small quantities in Galician and Russian petroleum. It is contained in coal tar in proportions of from 0·1 to 1·0%, and its principal commercial source is that fraction of coal tar which distils from 180°–220° C. For the manufacture of carbolic acid, this fraction is treated with an 8–10% aqueous solution of caustic soda. The phenol and its homologues are thereby dissolved in this solution, forming carbolate (phenoxide or phenate), whilst the hydrocarbon oils together with small quantities of pyridine and other evil-smelling bases are left as an oily layer floating above the carbolate solution. The latter is drawn off, steamed for the removal of adhering or dissolved neutral hydrocarbons, and then treated with carbon dioxide, which decomposes the carbolate to give sodium carbonate and thus liberates the carbolic acid and the higher phenols or cresols, forming a black oily layer of crude carbolic acid of characteristic odour.

The separated crude carbolic acid contains about 15–20% of water, traces of inorganic salts and other impurities from which it is freed by repeated fractional distillation, and, in this manner, the crude product is separated into fractions rich in phenol which crystallize upon cooling and fractions containing the cresols (higher homologues of phenol) which fail to crystallize. The raw crystals are passed through centrifuges in which they are freed from adhering "cresylic" liquid and they are then submitted to a final fractionation yielding a distillate of commercial carbolic acid in form of crystals of melting point 30°–40° C. The mixture of cresols or liquid carbolic acid forms an article of commerce, but is frequently further worked up and more or less efficiently separated into its constituents. Comparison of the boiling points of the pure compounds—phenol, 181·3° C; ortho-cresol, 188·0°; para-cresol, 199·5°; meta-cresol, 200·0°; symmetrical xylenol, 218·0°—shows that by fractional distillation they may be separated into phenol, ortho-cresol and a not easily separable mixture of para- and meta-cresols. A product rich in meta-cresol is of importance for the manufacture of explosives.

At times when carbolic acid is in great demand or when slackness in the demand for the products accompanying it in coal tar does not commercially justify its extraction, it is manufactured by synthesis from benzol. Only one process is carried out industrially. Benzol is sulphonated with fuming sulphuric acid, the resultant benzenesulphonic acid after neutralization with milk of lime is converted into its sodium salt and the sodium benzenesulphonate is fused at 340° C with an excess of sodium hydroxide in cast iron vessels provided with powerful stirrers. The melt, on treatment with a limited amount of water, yields a solution of sodium phenate (carbolate or phenoxide) and a solid residue of sodium sulphite. From the carbolate solution crude carbolic acid is liberated by means of carbon dioxide and distilled, as in tar-works practice. As, however, the synthetic product is not associated with cresols, fractionation is simpler, and a very pure carbolic acid is obtained.

Properties of Phenol or Carbolic Acid.—Phenol crystallizes in colourless needles of characteristic odour. If chemically pure, the crystals are not hygroscopic and remain colourless, but when containing even slight impurities they are highly deliquescent and slowly assume a pink colour. Phenol has melting point 42·5–43° C, boiling point 181·3° C under 760mm. pressure; specific gravity ($d20°$, 20°) 1·0722; calorific value 7,810 calories (14,060 B.T.U.). It forms a hydrate $C_6H_5{\cdot}OH,H_2O$ of melting point 17·2° C. By mixing phenol with water two immiscible solutions are formed, one of phenol in water and one of water in phenol, but on adding more water a clear solution results; 100 parts of water dissolve at 11° C 4·8 and at 77° C 11·8 parts of phenol, whilst at 84° C phenol and water are miscible in any proportion. It is readily soluble in alcohol, ether, carbon disulphide, chloroform, glacial acetic acid and somewhat in light petroleum. It is also readily soluble in caustic alkalis, slightly soluble in aqueous ammonia solution, but almost insoluble in sodium carbonate solution. Good solvents are also gallic acids and a solution of sodium benzenesulphonate. It is volatile in steam. It gives a violet coloration with ferric chloride and a white precipitate of tribromophenol with bromine water. Phenol is a weak acid and forms salts with alkalis which react alkaline to litmus. It is readily acted upon by chlorine, bromine, iodine, sulphuric and nitric acid, chloroform in alkaline solution, formaldehyde, oxidizing and reducing agents, and a large number of derivatives can be obtained from it by these and other reagents.

Uses of Phenol.—The ease with which phenol reacts with a great number of chemical compounds marks it as a substance of wide and varied applicability in the chemical and other industries. It is used to a moderate extent as an intermediate in dyestuff manufacture. It is a component of the azo-dyes, such as diamine green B, brilliant yellow, chrysophenin and aurin or rosolic acid. The last is used as an indicator (*q.v.*) in chemical analysis and for colouring varnishes or in form of its sodium salt, yellow corallin, for printing wall paper. By heating phenol with phthalic anhydride and sulphuric acid another important indicator, phenolphthalein, is obtained, which is colourless in neutral or acid solution but turns deep red with caustic alkalis. Phenolphthalein also finds application as a purgative. A number of dye-stuffs are derived from the products of the nitration of phenol, ortho- and para-nitrophenol and their derivatives.

A very important product of the nitration, *i.e.*, the interaction of nitric acid with phenol, is picric acid, or 2:4:6-trinitrophenol. It was formerly used as a yellow dye-stuff, but its importance lies in its application as an explosive (lyddite). At the outbreak of the World War it was most widely used for bursting charges in high-explosive shells, although it was gradually replaced by the more reliable and efficient trinitrotoluol (T.N.T.). Another high explosive, mainly used in the French army, is trinitro-meta-cresol, derived from one of the three cresols, the higher homologues of phenol. In chemical warfare chloropicrin, a compound made by chlorination and oxidation of picric acid or its salts by means of bleaching powder, has been used as a lachrymator, mostly in combination with stannic chloride. Picric acid has usefulness in an entirely different direction, namely as a substitute for "carron oil" for the dressing of burns, and in the treatment of skin diseases such as erysipelas and eczema.

To the non-chemist phenol, or carbolic acid as it is usually named in this connection, is mostly associated with its antiseptic and disinfectant properties. It is a strong germicide and parasiticide. It now plays a much less important rôle in surgery than it did in the first days of antisepsis, and on account of its irritant action and the danger of absorption it has become unpopular even as a dressing or lotion after operation or injuries, when it may lead to gangrene, necessitating amputation. Although, therefore, in surgical practice it has been largely superseded by its derivatives and other substances, it is still used as a standard of germicidal efficacy for the comparison and evaluation of other disinfectants. Amongst antiseptics directly obtained from phenol may be mentioned:—tribromophenol (bromol), phenolsulphonic acid (aseptol), di-iodophenol-para-sulphonic acid (sozoiodol). Moreover it is also widely used, either by itself in aqueous solutions or in soaps, tooth-powders and similar preparations.

One of the most important phenol derivatives is salicylic acid (*q.v.*), produced from dry sodium phenate (phenoxide) and carbonic acid at 130°C, the sodium salicylate formed being acidified to produce the acid. It is used in therapeutics and as an intermediate for over 100 azo-dyes. It is a powerful food preservative, though condemned by health authorities and not permitted in some countries for this purpose. Some derivatives of phenol are used in perfumery, the most prominent of which is coumarin (*q.v.*) synthesized by way of salicylaldehyde. Phenol finds a quantitatively important and steadily growing application in the production of artificial resins and plastic materials made by its condensation with formaldehyde. (*See* RESINS: *Synthetic.*) Several photographic developers, such as metol, ortol and rodinal, are obtained from phenol, as are also certain sensitizers of the photographic plate. By the hydrogenation of phenol with nickel as catalyst at a temperature of 100°–180°C *cyclo*hexanol or hexaline is obtained, a solvent used for intensifying the detergent action of soaps, particularly in the textile industry.

Physiological Properties.—Carbolic acid has a pungent and, in very dilute solutions, a somewhat sweet taste. It coagulates the proteins of the tissues, and forms, when concentrated, a white opaque scar on the skin which becomes red and shiny and falls off after a few days, leaving a light brown stain for several weeks. It acts as a caustic, and causes irritation and necrosis of the mucous membranes and even in dilute solution produces local anaesthesia which lasts for many hours. It is found in urine, mostly coupled with sulphuric or glucuronic acid, principally formed in the liver. It is oxidized in the body to hydroquinone (quinol) and pyrocatechol, these products causing a green coloration of the urine. Carbolic acid is formed by degradation of proteins.

Toxicology.—Carbolic acid acts upon the central nervous system by absorption through the unbroken skin, the intestines, wounds or the respiratory organs. The larger portion of toxic doses is excreted, partly through the lungs, thus causing inflammation of the air passages and corrosion of the points of entry. It is a typical nerve poison acting first by exciting and then by paralyzing. Administered as a chronic poison it degenerates kidney and liver, but the effect varies for different individuals. The fatal dose may vary considerably, but is in the adult of the order of one gram when introduced into open wounds and eight grams when taken by the mouth. In the latter case the patient collapses, and the skin becomes cold and clammy. By paralysis of the respiratory organs, the breathing gets shallow, the patient dying in a state of coma.

As antidote in cases of carbolic acid poisoning soluble sulphates, such as sodium or magnesium sulphate, used to be administered. These have been found to be of little or no use, because the phenol does not combine with sulphates as such, but with organic sulphur while being oxidized to sulphuric acid in the body. The first treatment is the removal of the poison by the stomach tube followed by the thorough rinsing of the stomach with water to which 10% of alcohol has been added. Saccharated solution of lime is also recommended. When coma and collapse set in, the patient should be sustained by the external application of warmth and by such nerve stimulants as caffeine or strychnine; artificial respiration may eventually be used, although there is little prospect of resuscitation, where intoxication has advanced so far. (R. LE.)

CARBOLOY: *see* TOOL STEEL.

CARBON, a non-metallic element, is found in the free state as diamond, graphite and as crude forms of the former (symbol C, atomic number 6, atomic weight 12·000); in combination it occurs in all animal and vegetable tissues, in coal and petroleum and (as carbonate) in many minerals such as chalk or limestone, dolomite, calcite, witherite, calamine and spathic iron ore; as carbon dioxide (*q.v.*) it occurs in the atmosphere. It is a solid which assumes different forms having widely different properties. The *diamond* has the highest specific gravity (3·52) of these, and its high refractive index (2·417 for sodium light) is responsible for its characteristic brilliance. Very small diamonds have been made artificially by causing carbon to crystallize from molten iron under very high pressures. (*See* H. Moissan, *The Electric Furnace*, 1904.) Genuine diamonds differ from "paste" imitations in being transparent to Röntgen rays. *Carbonado* and *bort* (*boart*) are "black diamonds"; they are diamonds with a small percentage of impurity, and therefore valueless as gems. *Graphite* is an extremely soft form of carbon of much lower density (ranging from 2·0 to 2·6; the purest is about 2·25); it is probably of organic origin as it usually contains about 1% of hydrogen. Carbon is deposited in this form when it condenses from the vapour state in the electric furnace or in the arc. The purest artificial graphite (Acheson) contains only 0·5% of ash and is produced in a furnace of fire-brick lined with carborundum (*q.v.*), the space between and around the carbon electrodes being filled with petroleum coke. Graphite differs from diamond in being a conductor of electricity. The heats of combustion of diamond and graphite are both very close to 94,000 calories per 12 grams, so that it is not certain which is the stable form at ordinary temperatures, but diamonds are converted into graphite at high temperatures under ordinary pressures. Diamond and graphite crystallize in the cubic and hexagonal systems respectively. Graphite is slowly attacked by mixtures of sulphuric acid with nitric acid, potassium chlorate or chromic acid, to give "graphitic acid" and finally mellitic acid, $C_6(COOH)_6$, whereas the diamond is unaffected by such treatment. Graphite (*q.v.*) is used in "lead" pencils, in polishes (as "black lead"), and as a lubricant for machinery.

Numerous varieties of carbon are classed as "amorphous" in contrast to the foregoing crystalline varieties; the commonest are lamp-black, gas carbon, animal charcoal, sugar charcoal and wood charcoal. They are formed by burning substances, from which they are named, in a limited supply of air. *Lamp-black* is thus formed from tars, resins, turpentine, etc., and is collected on blankets suspended in condensing chambers; even after further purification by heating in closed vessels, it still contains oily impurities, it is used in printers' ink, in paints and in calico printing. *Gas carbon* is produced in gas manufacture (*q.v.*) and collects on the walls of retorts; it is a very dense and fairly pure form of carbon and is used for the rods of arc lamps. *Coke* is the residue from gas retorts; specially designed retorts and processes are used for the production of the coke used in metallurgical operations. The *charcoals* are very porous, and consequently their specific gravity is apparently only about 0·25, but when the air is pumped out of the pores this becomes 1·4–1·9. *Sugar charcoal* is purified by heating in a current of hydrogen chloride, extraction with water, and further heating in a current of hydrogen until free from hydrogen chloride. *Animal charcoal*, from bones, horns, etc., contains only about 10% of carbon and about 80% of calcium phosphate; a purer form is obtained by calcining blood with potassium carbonate. Being very porous, it is used for decolourizing solutions (*e.g.*, of sugars) and for filtration of contaminated water. *Wood charcoal* is produced either by the wasteful process of slowly burning carefully stacked wood or by carbonizing it in retorts, in which case certain volatile products, such as acetone, wood spirit and pyroligneous acid are retained, and the last two are worked up for methyl alcohol and acetic acid respectively. Specially prepared blocks of wood charcoal are used in "blowpipe" analysis. (*See* CHEMISTRY: *Analytical.*) The absorptive powers of charcoals for gases are greatly improved by regulated heating, and are very pronounced at low temperatures. (*See* CHARCOAL.) All the varieties of amorphous carbon are readily attacked by the reagents mentioned in connection with graphite.

The specific heats of all varieties of carbon are abnormally low at ordinary temperatures, but become nearly normal at about 1,000° C; that of diamond is only about half that of graphite at -50° C, but they gradually become more nearly equal at higher temperatures; graphite and wood charcoal have nearly the same specific heats at ordinary temperatures.

Carbon volatilizes at 3,600° C. In the electric arc it unites with hydrogen to give acetylene, C_2H_2 (M. Berthelot), but small proportions H_2 of methane and ethane are also produced; at lower temperatures the conditions are more favourable for methane, CH_4, and W. A. Bone and H. F. Coward obtained almost quantitative yields of this gas from very pure carbon and hydrogen at 1,200° C. Carbon unites directly with fluorine to give the tetrafluoride, CF_4; it burns in oxygen to give oxides; and when heated in sulphur vapour it gives carbon disulphide (*q.v.*). When heated with nitrogenous substances and alkaline carbonates, it gives cyanides (*q.v.*); and in the electric furnace it gives carbides (*q.v.*) with many elements, that with silicon being the abrasive carborundum (*q.v.*). (A. D. M.)

CARBONADO, a name given in Brazil to a dark massive form of impure diamond, known also as "carbonate" and in trade simply as carbon. It is sometimes called black diamond. Generally it is found in small masses of irregular polyhedral form, black, brown or dark-grey in colour, with a dull resinoid lustre; and breaking with a granular fracture, paler in colour, and in some cases much resembling that of fine-grained steel. Being slightly cellular, its specific gravity is rather less than that of crystallized diamond. It is found almost exclusively in the state of Bahia in Brazil, where it occurs in the *cascalho* or diamond-bearing gravel. Borneo also yields it in small quantity. Formerly of little or no value, it came into use on the introduction of diamond-drills (*see* BORING), and is now extremely valuable for mounting in the steel crowns used for diamond-boring.

CARBONARI, the members of certain secret revolutionary societies that played an active part in the history of Italy and France early in the 19th century. The Carbonari (Ital. "charcoal burners") gained importance in southern Italy during the reign of Joachim Murat (1808–15). They aimed at freeing the country from foreign rule and obtaining constitutional liberties, and were ready to support the Bourbons or Murat, if either had fulfilled these aspirations. Murat himself had at first protected them, especially when he was quarrelling with Napoleon, but later, some Carbonarist disorders having broken out in Calabria, Murat sent General Manhès against the rebels, and the movement was ruthlessly quelled in Sept. 1813. But Malghella, Murat's minister of police, continued secretly to protect the Carbonari and even to organize them, so that on the return of the Bourbons in 1815 King Ferdinand IV. found his kingdom swarming with them. The society comprised nobles, officers of the army, small landlords, government officials, peasants, and even priests. Its organization was curious and mysterious, and had a fantastic ritual. A lodge was called a *vendita* ("sale"), members saluted each other as *buoni cugini* ("good cousins"), God was the "Grand Master of the Universe," Christ the "Honorary Grand Master." Its red, blue, and black flag was the standard of revolution in Italy until substituted by the red, white, and green in 1831.

When King Ferdinand felt himself secure he determined to exterminate the Carbonari, and to this end his minister of police, the Prince of Canosa, set up another secret society called the *Calderai del Contrappeso* ("braziers of the counterpoise"), recruited from the brigands and the dregs of the people, who committed hideous excesses against supposed Liberals, but failed to exterminate the movement. On the contrary, Carbonarism flourished and spread to other parts of Italy. Among the foreigners who joined it for love of Italy was Lord Byron. The first rising promoted by the Carbonari was the Neapolitan revolution of 1820. Some regiments comprised many Carbonari, and on July 1 a military mutiny broke out at Monteforte, to the cry of "God, the King, and the Constitution." The troops sent against them sympathized with the mutineers, and the king, being powerless to resist, granted the Constitution (July 13), which he swore on the altar to observe. But the Carbonari were unable to carry on the government and after the separatist revolt of Sicily had broken out the king obtained from the Emperor of Austria the loan of an army. Early in 1821 a force of 50,000 Austrians defeated the constitutionalists under General Pepe and the king dismissed parliament, and set to work to persecute the movement.

A similar movement broke out in Piedmont in March 1821. Here as in Naples the Carbonari comprised many men of rank, and they were more or less encouraged by Charles Albert, the heir-presumptive. The rising was crushed, and a number of the leaders were condemned to death or long terms of imprisonment, but most of them escaped.

The French revolution of 1830 had its echo in central Italy. In the papal states a society called the *Sanfedisti* or *Bande della Santa Fede* had been formed to counteract the Carbonari, and their behaviour and character resembled those of the Calderai of Naples. In 1831 Romagna and the Marches rose in rebellion and shook off the papal yoke with astonishing ease. At Parma and Modena the rulers were expelled by Carbonarist risings, but re-established by the Austrians, who occupied Romagna and restored the province to the Pope. Among those implicated in the Carbonarist movement was Louis Napoleon, although it does not appear that he ever actually became a Carbonaro. Even in after years, when he was ruling France as Napoleon III., he never quite forgot that he had once been a conspirator, a fact which influenced his Italian policy. The Carbonari, after these events, ceased to have much importance, their place being taken by the more energetic Young Italy Society presided over by Mazzini.

In France, Carbonarism began to take root about 1820. The example of the Spanish and Italian revolutions incited the French Carbonari, and risings occurred at Belfort, Thouars, La Rochelle and other towns in 1821, which were easily quelled. The Carbonarist lodges were centres of discontent until 1830, when, after contributing to the July revolution of that year, most of their members adhered to Louis Philippe's Government.

The Carbonarist movement undoubtedly played an important part in the Italian Risorgimento, and if it did not actively contribute to the wars and revolutions of 1848–49, 1859–60 and 1866, it prepared the way for those events.

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CARBONATED BEVERAGES: *see* AERATED WATERS.

CARBONATES. (1) The metallic carbonates are the salts of carbonic acid, H_2CO_3. Many of them are white solids, but some, such as those of copper (blue or green) and nickel (green), possess colours which are characteristic of the metal concerned. Many are found as minerals, the more important of such naturally occurring carbonates being cerussite (lead carbonate, $PbCO_3$), malachite and azurite (both basic copper carbonates), calamine (zinc carbonate, $ZnCO_3$), witherite (barium carbonate, $BaCO_3$), strontianite (strontium carbonate, $SrCO_3$), calcite, and aragonite (calcium carbonate, $CaCO_3$), dolomite (calcium magnesium carbonate, $CaCO_3.MgCO_3$); sodium "sesquicarbonate," $Na_2CO_3.NaHCO_3.2H_2O$, occurs as a deposit in African lakes and is called "trona." Most metals form carbonates (aluminium and chromium are exceptions), the alkali metals yielding both acid and normal carbonates of the types $MHCO_3$ and M_2CO_3 (M = one atom of a univalent metal); whilst bismuth, copper and magnesium appear only to form basic carbonates. The acid carbonates (bicarbonates) of the alkali metals can be prepared by saturating an aqueous solution of the alkaline hydroxide with carbon dioxide, $M \cdot OH + CO_2 = MHCO_3$, and from these acid salts the normal salts may be obtained by gentle heating, carbon dioxide and water being evolved at the same time, $2MHCO_3 = M_2CO_3 + HO_2 + CO_2$. Most other carbonates are formed by precipitation of salts of the metals by means of alkaline carbonates. All carbonates, except those of the alkali metals and of thallium, are insoluble in water, and the majority decompose when heated strongly, carbon dioxide being liberated and a residue of an oxide of the metal left. Carbonates of the heavy metals, as silver, yield the metal on strong ignition. Alkaline carbonates undergo a very slight decomposition, even at a very bright red heat. The carbonates are decomposed by mineral acids, with formation of the corresponding salt of the acid, and liberation of carbon dioxide. Many carbonates which are insoluble in water dissolve in water containing carbon dioxide, giving bicarbonates which cause "temporary" hardness (*see* CALCIUM). The individual carbonates are described under the various metals.

(2) The organic carbonates are the esters of carbonic acid, H_2CO_3, and of the unknown ortho-carbonic acid, $C(OH)_4$. The acid esters of carbonic acid of the type $HO·CO·OR$ are not known in the free state.

Potassium ethyl carbonate, $KO·CO·OC_2H_5$, is obtained in the form of pearly scales when carbon dioxide is passed into an alcoholic solution of potassium ethoxide, $CO_2+KOC_2H_5=KO·CO·OC_2H_5$. It is not very stable, water decomposing it into alcohol and the alkaline carbonate. The normal esters may be prepared by the action of silver carbonate on the alkyl iodides, or by the action of alcohols on the chlorocarbonic esters. These normal esters are colourless, pleasant-smelling liquids, which are readily soluble in water. They show all the reactions of esters, being readily hydrolyzed by caustic alkalis, and reacting with ammonia to produce carbamic esters and urea. Heating with phosphorus pentachloride eliminates an alkyl group and a chlorocarbonic ester is formed. Dimethyl carbonate, $CO(OCH_3)_2$, is a colourless liquid, which boils at 90·6° C, and is prepared by heating the methyl ester of chlorocarbonic acid with lead oxide. Diethyl carbonate, $CO(OH_2H_5)_2$, is a colourless liquid, which boils at 125·8° C; its specific gravity is 0·978 (20° C). When it is heated to 120° C with sodium ethoxide it decomposes into ethyl ether and sodium ethyl carbonate.

Ortho-carbonic ester, $C(OC_2H_5)_4$, is formed by the action of sodium ethoxide on chloropicrin, $CCl_3NO_2+4C_2H_5ONa=C(OC_2H_5)_4+NaNO_2+3NaCl$. It is an ethereal-smelling liquid, which boils at 158–159° C, and has a specific gravity of 0·925. When heated with ammonia it yields guanidine, and boiled with alcoholic potash it yields potassium carbonate.

Chlorocarbonic ester, $Cl·CO·OC_2H_5$, is formed by the addition of well-cooled absolute alcohol to phosgene (carbonyl chloride). It is a pungent-smelling liquid, which fumes strongly on exposure to air. It boils at 93·1° C, and has a specific gravity of 1·144 (15° C). When heated with ammonia it yields urethane. Sodium amalgam converts it into formic acid; with alcohol it yields the normal carbonic ester. It is easily broken down by many substances into ethyl chloride and carbon dioxide.

Percarbonates.—Barium percarbonate, $BaCO_4$, is a white solid obtained by passing an excess of carbon dioxide into water containing barium peroxide in suspension; it is fairly stable, and yields hydrogen peroxide when treated with acids. Two potassium percarbonates having the formula $K_2C_2O_6$ are known. One is obtained by the electrolysis of a concentrated solution of the carbonate at −20° C, and the other by the action of carbon dioxide on potassium peroxide; the former liberates iodine from a solution of potassium iodide without loss of oxygen: $K_2C_2O_6+2KI=2K_2CO_3+I_2$, but the latter suffers loss of a part of its oxygen in the same circumstances. Sodium carbonate is not sufficiently soluble to permit of percarbonates being made by the electrolytic method, but the other method gives rise to a number of percarbonates, *e.g.*, $Na_2C_2O_6$, Na_2CO_4, Na_2CO_5, $NaHCO_4$. The first of these resembles the second type of potassium percarbonate. An attempt has been made to classify percarbonates according as they are (1) merely carbonates with hydrogen peroxide in crystallization, (2) permonocarbonates, (3) perdicarbonates (compare persulphates; *see* SULPHUR). Percarbonates find their chief use in bleaching, and the potassium salt is used as "antihypo" in photography for eliminating excess of "hypo."

CARBON COMPOUNDS. The element carbon is remarkable for the number and variety of compounds to which it can give rise in combination with common elements such as hydrogen, oxygen and nitrogen. Organic chemistry is defined as "the chemistry of carbon compounds," and a few of the vast number known (some hundreds of thousands) are described in that article and under individual headings; only some of the simplest are described here.

Three oxides of carbon are well defined, viz., the suboxide C_3O_2, the monoxide (or carbonic oxide), CO, and the dioxide (or carbonic acid gas), CO_2; other suboxides, such as mellitic anhydride, $C_{12}O_9$, have been described. *Carbon suboxide* is formed by the action of phosphoric oxide on malonic acid or its ethyl ester at 300° C under diminished pressure; the reaction is essentially one of dehydration: $CH_2(COOC_2H_5)_2=2C_2H_4+2H_2O+C_3O_2$, and the oxide has the properties to be expected of a ketene (*q.v.*), since it is probably $OC:C:CO$, and of an anhydride of malonic acid. Its composition is confirmed by explosion with oxygen, whereupon it gives the correct amount of carbon dioxide ($C_3O_2+2O_2=3CO_2$), and by vapour-density determinations. It boils at 7° C and has a colourless, suffocating vapour. When kept in a sealed tube, it slowly undergoes polymerization (*q.v.*) to a dark red mass which is soluble in water.

Carbon monoxide and dioxide are produced simultaneously when carbon is burnt in oxygen (T. F. E. Rhead and R. V. Wheeler), the relative proportions depending upon the amount of oxygen and other conditions. They are both concerned in many balanced reactions of great industrial importance; thus, in metallurgical processes and producer-gas the equilibrium $CO_2+C\rightleftarrows 2CO$ is often involved, and under atmospheric pressure this is largely in favour of the monoxide, which constitutes 90% of the gas at 950° C and 94% at 850° C; increased pressure tends to increase the proportion of the dioxide. With steam and hydrogen, as in the "water-gas" equilibrium, both oxides are involved: $CO+H_2O\rightleftarrows CO_2+H_2$; at 400° C the dioxide and hydrogen predominate largely, but above 830° C the other pair predominates; this equilibrium is theoretically independent of the pressure. A knowledge of these equilibria (for the fundamental principles of which reference should be made to the articles CHEMICAL ACTION and CHEMISTRY: *Physical*) is necessary in dealing with the production of these two oxides now to be described.

Carbon monoxide is found in volcanic gases and is a constituent (6–12%) of ordinary coal-gas. It was first prepared by J. M. F. Lassone (1776) by heating zinc oxide and carbon, and was considered to be identical with hydrogen, but W. Cruikshank (1800) and F. Clément and J. B. Désormes (1801) showed it to contain only carbon and oxygen, and J. Dalton (1803) showed that it had only half as much of the latter as carbon dioxide. It may be prepared by passing carbon dioxide over red-hot carbon (*see* above) or red-hot iron; by heating many metallic oxides with carbon; by heating formic or oxalic acid or their salts with sulphuric acid (in the case of oxalic acid an equal volume of dioxide is produced); or best, by heating potassium ferrocyanide with a large volume of concentrated sulphuric acid: $K_4Fe(CN)_6+8H_2SO_4+6H_2O=4KHSO_4+FeSO_4+3(NH_4)_2SO_4+6CO$. It is a colourless, odourless gas of density 0·967 (air = 1), and is not easily liquefied; its critical temperature is −139·5° C and its critical pressure 35·5 atmospheres; its boiling point is −190° C and its melting point −200° C; it is only very slightly soluble in water. In all these and many other physical properties it shows an extremely close resemblance to nitrogen—a matter of interest in view of the electronic structure of the two molecules. Carbon monoxide burns with a well-known pale blue flame, giving the dioxide, but its burning is greatly retarded in dry air. It is very poisonous, uniting with the haemoglobin of the blood to give carboxyhaemoglobin, which has a characteristic absorption spectrum capable of detecting minute traces of the gas. It combines directly with heated alkaline hydroxides (or soda-lime) to give formates ($KOH+CO=H·COOK$), and with chlorine to give carbonyl chloride (*see* below). Under high pressures and with a suitable catalyst it combines with hydrogen to give alcohols (*see* ALCOHOLS; PRESSURE CHEMISTRY) a reaction of increasing importance. It unites with many metals (*e.g.*, nickel, iron, cobalt, molybdenum and ruthenium) to give carbonyls (*q.v.*), that of nickel, $Ni(CO)_4$, being used in the manufacture of the pure metal; potassium carbonyl,

$K_6(CO)_6$, at times formed in heating the carbonate with coke, as well as by direct union, is explosive and is of a different type, being a benzene derivative. Carbon monoxide is a powerful reducing reagent, and its reduction of iodine pentoxide to iodine is utilized in detecting and estimating minute quantities of the gas in air; it is absorbed by ammoniacal or hydrochloric acid solutions of cuprous chloride (colourless crystals of the resulting compound, $CuCl{\cdot}CO{\cdot}2H_2O$, may be obtained), and this reaction is used in gas analysis. For a series of interesting syntheses from carbon monoxide and various other gases and vapours in the silent electric discharge, *see* S. M. Losanitsch and M. Z. Jovanitschitsch, *Berichte*, 1897, 30, p. 135.

Carbon dioxide, first discovered by Van Helmont (1577–1644) in the products of combustion and fermentation, was called *gas sylvestre*, and later J. Black called it "fixed air," owing to its being a constituent of carbonated alkalis. A. L. Lavoisier (1781–1788) demonstrated its nature by burning carbon in oxygen. It is a regular component of the atmosphere (normally 3 volumes per 10,000), and is found in mineral waters, volcanic gases, certain grottos near Naples, and in the Poison Valley, Java. It occurs as carbonate in many minerals (*see* CARBONATES). It may be prepared by burning carbon in excess of air or oxygen, by heating many carbonates, such as chalk, or bicarbonates or by the action of acids on these: $M_2CO_3+2HCl=2MCl+H_2O+CO_2$. It is formed in the process of respiration, in the combustion of all carboniferous material, and in fermentation, much of the liquid carbon dioxide of commerce being derived from breweries.

It is a colourless gas, possessing a faint pungent smell and a slightly acid taste. It does not burn and does not ordinarily support combustion, but burning magnesium or alkali metals will continue to burn in it, giving oxides and liberating carbon. It is 1·529 times heavier than air, and only requires a pressure of 35 atmospheres to liquefy it at 0° C. Its critical temperature and pressure are 31° C and 72·9 atmos.; the liquid freezes at −56° C under 5 atmos., and the solid sublimes at −79° C under atmospheric pressure. The solid "snow" is used in the treatment of warts and other skin troubles. At 0° C 1 volume of water dissolves 1·79 volumes of the gas (0·33%), and it is twice as soluble in alcohol. The physical properties of carbon dioxide display a remarkable resemblance to those of nitrous oxide (compare carbon monoxide and nitrogen, above). The aqueous solution is very feebly acidic, owing to the presence of a small proportion of carbonic acid, H_2CO_3; solutions of caustic alkalis absorb the gas readily to give carbonates (*q.v.*) and ultimately bicarbonates. With lime- or baryta water the gas gives a white precipitate of the corresponding carbonate, and these reactions are used in the detection and estimation of the gas. Carbon dioxide and ammonia gases unite to give ammonium carbamate, $NH_2{\cdot}COONH_4$ (*see* AMMONIA). If passed over molten sodium, carbon dioxide converts it to sodium oxalate, $Na_2C_2O_4$. At high temperatures, carbon dioxide dissociates slightly: $2CO_2 \rightleftarrows 2CO+O_2$; under atmospheric pressure only 0·1% is thus decomposed at 1,300° C, but about 40% at 3,000° C. Plants absorb carbon dioxide from the air and utilize the carbon in "photosynthesis" in virtue of the light-energy transmitted by the chlorophyll. Industrially, carbon dioxide is used in the manufacture of soda by the Solvay process (*see* ALKALI MANUFACTURE), in the sugar industry, in the manufacture of mineral waters and in making artificial ice.

Carbonyl chloride (phosgene), $COCl_2$, is produced by the direct union of carbon monoxide and chlorine in sunlight, but in practice charcoal is used as a catalyst; it may also be prepared by heating carbon tetrachloride with fuming sulphuric acid:

$$2SO_3+CCl_4=S_2O_5Cl_2+COCl_2.$$

It is a colourless, poisonous gas with an unpleasant, pungent smell, and it decomposes rapidly with water: $COCl_2+H_2O=2HCl+CO_2$; it was used on a large scale in the World War, and has a characteristic action on the heart. It has a vapour density of 3.46 (air=1) and may be condensed to a liquid (specific gravity 1·43 at 0° C) which boils at 8° C, and to a solid of melting point −127° C; it is readily soluble in toluene and is often stored in this way; it is decomposed by heat, the equilibrium $COCl_2 \rightleftarrows CO+Cl_2$ being equally distributed at 450° C and entirely to the right at 800° C under ordinary pressure. It reacts with alcohols to form chlorocarbonic (or chloroformic) esters or carbonates, according to which of the reactants is in excess, and with ammonia to give urea (*q.v.*). It is used commercially in the manufacture of Michler's ketone (a starting point for certain dyes) and benzophenone (*q.v.*). *Carbonyl bromide* is also known.

Carbon tetrachloride, CCl_4, is best prepared by passing chlorine into carbon disulphide containing a little iodine or antimony pentachloride as a "carrier"; it boils at 76° C, and has a specific gravity of 1·595 at 0° C. Its chief uses are as a fire-extinguisher, as a solvent and in dry-cleaning; its use as a hair-wash is dangerous. The *tetrabromide* and *tetraiodide* are also known. The *tetrafluoride* is the only one of the four that can be produced by direct combination of the elements; the lighter forms of charcoal inflame spontaneously in fluorine, but the denser forms have to be heated somewhat; it boils at −15° C under atmospheric pressure.

Carbon oxysulphide, COS, can be produced by direct union of the monoxide with sulphur, or from the interaction of sulphur trioxide and carbon disulphide at 100° C; it is better produced by decomposing ammonium thiocarbonate by hydrochloric acid; the only impurities are carbon dioxide and hydrogen sulphide, which are easily removed (A. Stock). The colourless and odourless gas can be liquefied at −47° C; it burns with a blue flame, is decomposed by heat, and dissolves in water to give a solution which slowly decomposes to carbon dioxide and sulphuretted hydrogen; dissolution in caustic alkalis gives sulphides and carbonates: $COS+4KOH=K_2CO_3+K_2S+2H_2O$. (A. D. M.)

CARBONDALE, a city of Jackson county, Illinois, U.S.A., 80 mi. S.E. of St. Louis; on federal highway 51, and served by the Illinois Central railway system. Pop. (1940) 8,550. It is an important coal-mining region, as the name intimates, and peaches, apples and other fruits are grown extensively. The city is a railway division point, and has a number of manufacturing industries. It is the seat of the Southern Illinois State Normal university (established in 1874), which has an enrolment of over 3,000.

CARBONDALE, a city in the anthracite fields of Lackawanna county (Pa.), U.S.A., amid beautiful mountain scenery near the upper end of the Lackawanna river valley, 16 mi. N.E. of Scranton. It is on Federal highway 106 and is served by the Delaware and Hudson, the Erie and the New York, Ontario and Western railways. Pop. (1940) 19,371. Its primary industry is coal mining, but it also has railway shops and manufactures of silk, cut glass, boilers, tanks and chemicals. Carbondale was settled in 1824 and was chartered as a city in 1851.

CARBON DIOXIDE, a colourless gas at ordinary temperatures. It is found to be the most common oxide (*q.v.*) of carbon and is one of the usual products of combustion (*q.v.*) of all carbon compounds; it is the chief constituent of the breath exhaled by animals (*see* RESPIRATION). Commercially it is used extensively in the manufacture of aerated waters (*q.v.*). Solid carbon dioxide (the so-called carbonic acid snow) is used as a freezing agent, alone or in conjunction with ether (*q.v.*). (*See also* CARBON and LIQUEFACTION OF GASES.)

CARBON DISULPHIDE, carbon bisulphide, thiocarbonic anhydride, or sulphocarbonic acid, is a chemical compound, CS_2, composed of 12 parts by weight of carbon and 64 parts by weight of sulphur. It was discovered in 1796 by W. A. Lampadius, who obtained it by heating a mixture of charcoal and pyrites. In 1802, F. Clément and J. B. Désormes obtained the compound by heating charcoal with sulphur.

Carbon disulphide is prepared commercially by the reaction of sulphur with specially prepared wood charcoal at about 900°C. either in a direct fired retort or an electric furnace. The crude carbon disulphide, containing hydrogen sulphide and sulphur, is purified by distillation.

Pure carbon disulphide is a colourless and extremely volatile liquid with a sweet ethereal odour and an acrid taste. Due to reactions not thoroughly understood, the compound on ageing acquires a very unpleasant odour and tends to darken in colour. It boils at 46.3°C., solidifies at −111°C. and melts at −108.6°C. The critical temperature of carbon disulphide is 275°C.; its critical pressure, 77.8 atmospheres; its specific gravity (20°/4°), 1.2628; and its refractive index (20°C.), 1.635.

The compound is only slightly soluble in water but mixes in all proportions with absolute alcohol, ether, benzene and various light oils. It is an excellent solvent for sulphur, rubber, resins, phosphorus, iodine, waxes, vegetable and animal fats and oils.

Carbon disulphide burns in air with a pale blue flame to form sulphur dioxide and carbon dioxide. Zinc and hydrochloric acid reduce it to tri-thioformaldehyde. Upon reaction with hydrogen in the vapour phase, methane and hydrogen sulphide are the main products, although appreciable yields of methyl mercaptan are obtained if the conditions for reduction are properly controlled. It reacts with chlorine in the presence of an iron catalyst to form carbon tetrachloride and sulphur monochloride, and with ammonia it yields ammonium thiocyanate, or thiourea depending upon the conditions employed. Carbon disulphide reacts with aqueous alkalis, to form a mixture of an alkaline carbonate and an alkaline thiocarbonate. $6KOH+3CS_2 \quad K_2CO_3+2K_2CS_3+3H_2O$. Alcoholic potassium hydroxide converts it into a xanthate, $CS_2+KOH+ROH \quad H_2O+RO.CS.SK$. Hypochlorite solution converts it into carbonate and sulphate, $CS_2+8KOCl+6KOH \quad 2K_2SO_4+K_2CO_3+8KCl+3H_2O$. Upon boiling a mixture of aniline and carbon disulphide, thiocarbanilide is formed. Ethylene dithiourea may be produced by reaction of ethylenediamine and CS_2 in caustic solution at 30° C. Hydrogen sulphide is produced by reaction of carbon disulphide with steam.

Carbon disulphide is produced in large quantities for use in the manufacture of viscose rayon, ammonium thiocyanate, thiourea and thiourea formaldehyde resins; in the cold vulcanization of rubber; as a solvent, in the production of xanthates for use in ore flotation; as a fumigant, insecticide, germicide and fungicide; and as a paint and varnish remover. About 60% of the carbon disulphide produced is used in the manufacture of viscose rayon; 30%, in the manufacture of carbon tetrachloride; and the remaining 10% for miscellaneous purposes.

Considerable caution must be exercised in the use of carbon disulphide due to its inflammability and to its toxicity. Air containing as low as 1.2 volume percent of carbon disulphide is inflammable and under certain conditions a carbon disulphide air mixture will ignite spontaneously at about 100°C. Prolonged exposure to an atmosphere containing more than one to ten parts per 1,000,000 of carbon disulphide is considered hazardous. Frequent exposure to toxic concentrations results in chronic poisoning which manifests itself by headaches, nausea, excitement and violent temper and chronic dementia. Symptoms of acute poisoning include stupefaction, sense of intoxication and loss of consciousness.

Carbon monosulphide, CS, is formed as a result of passage of a silent electric discharge through a mixture containing carbon disulphide and either carbon monoxide or hydrogen. Carbon monosulphide readily condenses into a polymer $(CS)x$.

Carbon subsulphide, C_3S_2, is a red, tear-exciting liquid and is obtained by the passage of carbon disulphide through an electric arc. A sulphide, C_2S_3, which is only sparingly soluble in carbon disulphide is formed during the decomposition of the disulphide. (C. M. Tr.)

CARBONIC ACID, the acid assumed to be formed when carbon dioxide is dissolved in water (formula, H_2CO_3); its salts are termed carbonates. The name is also given to the neutral carbon dioxide from its power of forming salts with oxides, and on account of the acid nature of its solution; and, although not systematic, this use of the term is very common.

CARBONIC ACID SNOW. Carbon dioxide under heavy pressure in cylinders is allowed to escape into a suitable cylindrical receptacle the diameter of which varies according to the size of the lesion to be treated. A semi-solid snow is formed and this can be compressed into a pencil. The pencil, covered with a towel or cotton wool to protect the operator's hands, is cut to a suitable size and applied to the lesion, such as a naevus, port-wine stain or lupus patch. If the lesion be small, the pencil should cover the whole of it when pressed down; if large, an area about one inch in diameter should be treated at a time. Each application of pencil should last from about half a minute to one minute.

CARBONIFEROUS SYSTEM, in geology, the whole of the great series of stratified rocks and associated volcanic rocks which occur above the Devonian and below the Permian systems. The period of time during which these rocks were accumulated is known as the Carboniferous period, and forms the last and most important of the major Palaeozoic systems. During this period were deposited the thick coal-bearing strata, which are of such great economic importance in many countries of the Northern Hemisphere; and this system of rocks, first referred to as "Carboniferous" in England and Wales, has been widely recognized by its fossils and by the similarity of its deposits in Europe, Asia, northern Africa and North America, and in small isolated areas in the Southern Hemisphere. Similar deposits of a slightly later date, usually referred to in England as Permo-Carboniferous, occur in India, the Urals, North America, South Africa and Australasia. By American geologists these deposits are, however, now referred to the Permian.

As typically developed in England and Wales, the Carboniferous period opens with marine conditions, at first localized and confined to small areas, but later spreading and covering the greater part both of the north and south of the country. At the bottom of this sea or seas were laid down a varied series of sediments, mainly calcareous, but including a considerable amount of detrital matter in the north. This initial period, predominantly marine, is usually termed Lower Carboniferous, and includes but few workable coal-seams, the rocks being termed "Mountain Limestone" or "Shales with Limestone" according to their character. These marine conditions were succeeded by detrital deposits, consisting of sandstone, often feldspathic and more or less coarse in grain, with intercalated shales containing marine faunas. These rocks are generally referred to as the "Millstone Grit Series," and form the lower part of the Upper Carboniferous. Succeeding these beds occurs a third great group of rocks, the "Coal Measures," which consist of sandstones, shales and coal-seams, with marls occurring in the highest portion of the sequence.

Thus as typically developed in the Midlands of England, there is a sequence easily divisible into three parts :—

Coal Measures	Upper	Red and grey sandstones; marls and clays with occasional breccias; thin coal and limestones with *Spirorbis*, workable coals in the South Wales, Bristol, Somerset and Forest of Dean coalfields.
	Middle	Sandstones, marls, shales and the most important of the British coals.
	Lower	Flaggy hard sandstones (ganister), shales and thin coal seams.
Millstone Grit		Grits (coarse and fine), shales, thin coal seams and occasional thin limestones. The shales contain bands with marine fossils (goniatites and thin shelled lamellibranches).
Carboniferous Limestone Series		A complex assemblage of beds, largely calcareous but varying much according to locality. The uppermost beds (Yoredale series) present only in the north and in Gower, exhibit a rhythmical succession of sandstones, limestones and shales. The lower beds are more dominantly calcareous, and the basement beds are seen only in the south. A distinct facies with goniatites occurs in Craven and in Devonshire and is closely allied to the Continental Culm.

The calcareous Lower Carboniferous rocks of England exhibit considerable changes of facies, accompanied by more or less distinct faunas. These may be grouped as:—

(1) Standard limestones and shales with fauna of brachiopods and corals.

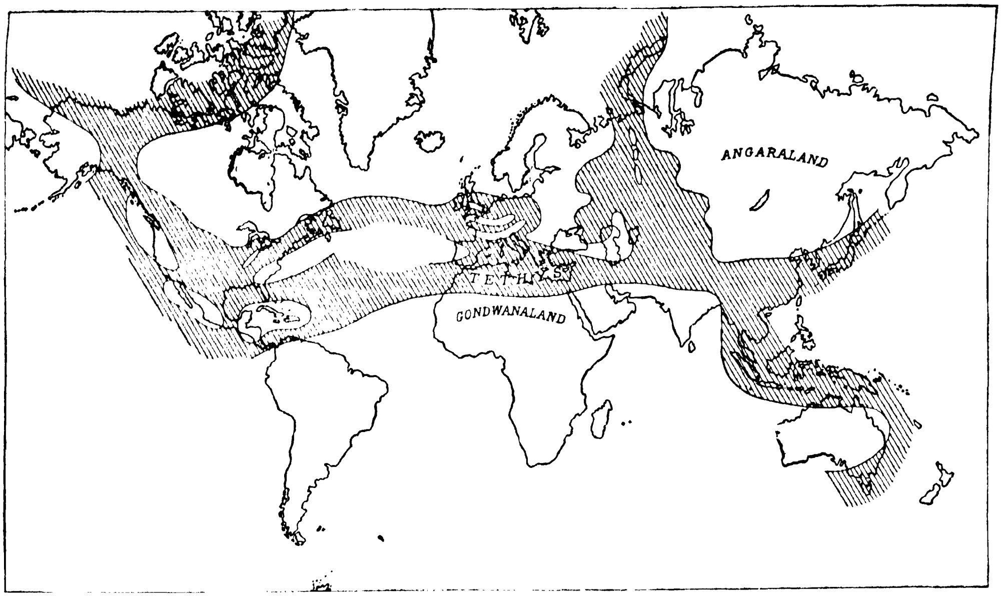
(2) Knoll-reef limestones, more or less imbedded, with a rich fauna of brachiopods, Lamellibranchs and occasionally goniatites.

(3) Thinly bedded dark argillaceous cherty limestones and shales with abundant crinoids, zaphrentid and cyathaxonid corals, and brachiopods such as *Schizophoria resupinata*.

(4) Calcareous shales with occasional thin limestone bands and bullions, containing a *Posidonomya* and goniatite fauna (Bowland shales).

(5) Cherty shales with radiolaria (Devonshire and Westphalia).

(6) Algal, oolitic and dolomitic limestones, with bryozoa (lagoon phase of Dixon).



MAP OF THE WORLD DURING LOWER CARBONIFEROUS PERIOD

The shaded area was occupied by seas, of which Tethys was the southern sea, during the Lower Carboniferous period In Western Europe and Eastern North America this area became land in the Upper Carboniferous period, and here are to be found the great European and American coal fields

In the north of England the standard limestone phase, whilst persisting later than in the south and midlands, became invaded by intercalations of detrital deposits (shales and sandstones), forming the Yoredale series. This series is splendidly developed in Wensleydale, Swaledale and Teesdale, and in its upper part, above the Main Limestone, becomes dominantly detrital in character passing up into the overlying Millstone Grit, with a slight stratigraphical break at the junction. The three main stratigraphical divisions represent fairly accurately the major phases of the Carboniferous system as developed in England whilst leaving room for debate as to the position of the boundaries between these divisions Taken as a whole, the system broadly shows us a complete cycle of deposits between the Old Red Sandstone and the upper red beds of the Coal Measures.

On commencing to trace the Carboniferous deposits away from England and Wales, it is found that the lithological character of the deposits affords but an uncertain guide, and recourse has to be had to fossils (whether of animals or plants), as a guide to relative age and position. Nevertheless, using these aids to correlation it is found that considerable tracts of the earth's surface were evidently connected either as seas or land areas, often surprisingly uniform in the character of their deposits. In western Europe there is no sharp line of demarcation between the Devonian and the Carboniferous rocks; neither can the fossil faunas and floras be clearly separated at any well-defined line; this is true in Britain, Belgium, Russia and Westphalia. Again at the summit of the Carboniferous series, as in Russia, Bohemia, the Saar region and Texas, both the rocks and their fossil contents merge gradually into those of the succeeding Permian system

American geologists elevate the Upper and Lower Carboniferous into distinct systems—the Pennsylvanian and Mississippian respectively. Further they group the Mississippian with the Devonian, and the Pennsylvanian with the Permian, restricting the term Carboniferous to the latter group. Having regard to the wide-spread unconformity which exists in North America between the Mississippian and Pennsylvanian this is understandable, but no such wide-spread or prolonged break is known in Europe.

In Europe the Lower Carboniferous (Dinantian or Avonian) is generally divided into two divisions, an older termed the Tournaisian, and a younger termed the Viséan, and one or both of these divisions have been recognized also in Asia and north Africa. Similarly in North America the Lower Carboniferous (Mississippian) has been divided into two stages, an earlier termed the Waverlian, and a younger termed the Tennesseean.

In England and in Europe generally the Tournaisian seas were local and inhabited by varied faunas, rendering correlation frequently difficult, as for instance in the correlation of the lower beds of Cumberland and Westmoreland with those of the Bristol and Belgian basins. The Viséan sea, on the other hand, in Europe and especially in England and Scotland, occupied much wider areas than that of the Tournaisian period, and the fauna became more generally diffused. The separation of Viséan from Tournaisian in western Europe is based almost entirely on faunal evidence, there being few marked breaks in marine sedimentation.

In North America the conditions during the Lower Carboniferous period, whilst generally marine over large tracts of the present United States, appear otherwise to have been largely the reverse of those prevalent in Europe. The Waverlian (Tournaisian) seas spread over great areas of the North American continent, estimated by Schuchert at its maximum at 20% of the present continental area The Tennesseean (Viséan) seas, on the other hand, appear to have been comparatively restricted in North America, with a maximum submergence of 12% of the continent. Coupled with this marked reversal of European conditions there were of course wide-spread physiographical changes in North America at the junction of the Waverlian and Tennesseean, as well as the more important break in the eastern part of the continent at the top of the Tennesseean.

Various attempts have been made to establish a uniform table of major subdivisions of the Carboniferous period, based on changes in the fossil fauna and flora. These have been locally successful, but no one group of organisms was sufficiently widespread for its component species to be of use as zonal indices throughout the period or in all areas. As a result, any complete zonal scheme is largely a patchwork of more or less overlapping divisions. The following main divisions are generally recognized throughout Europe:—

(5) Stephanian (or Uralian).
(4) Westphalian (or Moscovian).
(3) Lancastrian (or Namurian, or Lanarkian).
(2) Viséan.
(1) Tournaisian.

PALAEOGRAPHY AND STRATIGRAPHY

Tournaisian.—The Carboniferous period opened in western Europe with the northward advance of the pre-existing Devonian seas over the old Devonian land surface. In England and Wales, so far as is known, comparatively little of the present land area was submerged. The bulk if not the whole of Scotland either remained dry land or was occupied by fresh water, and was the scene around Edinburgh of vigorous volcanic activity. In the south-west of England and in southern Wales the sea rapidly advanced to the southern edge of the ancient land mass of central England, and formed extensive deposits first of shales and then of crinoidal and dolomitic limestones extending from southern Wales through the Bristol area and across the English channel into Belgium. The age of the thin deposits of culm shales and radiolarian cherts found in Devonshire and Westphalia is rather uncertain, although it is presumed that part at any rate of these beds correspond in age with the more normal Tournaisian beds with a brachiopod and coral fauna found in Belgium and Somerset. In northern England the middle and upper parts of the Tournaisian, although with a somewhat different fauna, have been found in the Lake District and in the Craven Lowlands of Yorkshire, but the Tournaisian is absent in northern Yorkshire and Durham, Derbyshire and northern Wales. Towards the close of the period occurred a considerable local development of knoll-reef (unstratified) shelly limestones (Waulsortian phase), seen as Waulsort in Belgium, Co. Clare and St. Doulaghs (Ireland) and Clitheroe (Lancs.) The Tournaisian zones formulated by Vaughan, based on corals and brachiopods, are generally recognized, and include:—

C_1	Marked by abundance of *Caninia* in specialized forms.
Z K	Marked by special brachiopods and zaphrentid corals. The equivalent beds in the Craven area of Yorkshire-Lancashire are only feebly fossiliferous, and the horizons have not yet been determined in detail.

In Ireland the basement shales and lower limestones of Cos. Clare and Sligo are of this age

In western Europe the Tournaisian period is represented in its type locality the Tournai region of Belgium, but the unfossiliferous character of much of the Kieselkalk and Kieselschiefer of Westphalia makes the occurrence of beds of Tournaisian age in western Germany somewhat uncertain, unless one includes in the Tournaisian the beds with *Protocanites* at the extreme base of the Westphalian Carboniferous sequence. The exact correlation of the *Pericyclus* zones of Dr. H. Schmidt with the coral zones of Vaughan has not yet been accomplished.

The southern sea (the ancient *Tethys*) whose northern waters washed the southern part of central England in the Tournaisian period (with narrow gulfs extending farther north to Cumberland and Craven) is thus traceable by its deposits only obscurely through Germany towards Silesia Marine deposits of this age reappear in central Russia (Kaluga), in the Urals and in the Kuznetzk coal-field in Siberia. Beds of this age may be present both in China and Japan, but their provenance appears doubtful.

In North America, according to Schuchert, "the submergence of Waverlian time began first in the Gulf States and along the western side of the Cincinnati uplift. At this early stage of the inundation the seas were small in extent, but in Middle Kinderhookian time the waterways were greatly expanded. The most striking change of the time, however, was the reappearance of the Cordilleric sea, depositing far and wide throughout the Rocky Mountains a great mass of limestones. . . . This Cordilleric sea . . . probably extended into the Arctic ocean." At the same period detrital deposits were being accumulated east and north of the Cincinnati uplift in the States of Ohio, Michigan and Pennsylvania, with freshwater beds in the east (Pocono series). In New Brunswick and Nova Scotia were deposited the arkoses and sandstones of the Horton and Albert formations.

No definite records of a Tournaisian fauna from the Southern Hemisphere appear yet to have been made.

So far as west European waters were concerned the sea life of this period appears to have consisted mainly of corals such as *Caninia* and *Zaphrentis*, brachiopods of the type of *Productus burlingtonensis* and *Spirifer koninckí* and crinoids. Goniatites were rare and local, being confined to the *Protocanites* beds at the extreme base in Westphalia and isolated occurrences of a *Pericyclus* fauna as at St. Doulaghs near Dublin There appears to have been a similar scarcity of goniatites in North America, and they are unknown in the southern hemisphere

Viséan.—The Viséan sea spread over the whole of England and Wales with the exception of the central block of Archaean rocks extending from the centre of Wales through the Midlands towards Brabant. It thus overlapped the shores of the Tournaisian sea in most areas, spreading over the flat shelf of northern Yorkshire, Durham and so into the Northumbrian and Scottish basins The influence of a land mass to the north and northwest was reflected in the predominantly detrital character of the beds in Northumberland and Scotland, but in Yorkshire and even more markedly in Derbyshire and northern Wales a great thickness of pure limestone accumulated. The Tournaisian genera of corals and brachiopods continued in existence, and new coral genera such as *Clisiophyllum* and *Lithostrotion* made their appearance The productids reached their acme in such forms as *Productus giganteus* and *P. maximus*, and marine life in the upper portion (D_2) was exceptionally abundant. The freer communication of the seaways rendered the fauna less local, but correlation in many places has been made difficult by the striking changes of facies in lithology and fauna. Of these facies the most important and striking undoubtedly is that seen in the Craven Lowlands Here around Clitheroe and Skipton, the lithology consists in the main of calcareous shales (Bowland Shales) with local developments of cherty limestones (Pendleside Limestone), and the fauna, analogous to that of the German and Devonshire Culm, consists of goniatites and *Posidonomya.* The goniatites form delicate zonal indices and spread far and wide through Europe, northern Africa and the central States of North America (Oklahoma, etc.) Presumably these forms were free-swimming at some stage of their individual ontogeny, but they seem to have had very definite limiting conditions, for the main genera are unknown in Durham, Northumberland and Scotland. This curious restriction may have been due to lack of suitable food or low temperature of the northern waters. The change in facies of the marine fauna is well seen in the Craven Fault area of Yorkshire, where the alteration is striking and abrupt, it being far easier to correlate the fossils of the Skipton area with those of the same facies in Oklahoma than it is to correlate them with the fossils of the same age only a few miles north in the Yorkshire Dale country.

In southern Wales and Somerset the limestone sequence is more or less truncated at the top, there being no representative of the Yoredale Series except in Gower

In Belgium the development is very similar to that of the coral-brachiopod facies of England, but in Westphalia the period commences with cherty shales and limestones and changes to fossiliferous platy limestones with a goniatite and *Posidonomya* fauna Farther east, around Brilon, the beds are more shaly and reminiscent of the Bowland Shales. In Silesia the beds of this age included shales and conglomeratic sandstones of enormous thickness, with a flora of Lower Carboniferous type and occasional goniatites and *Posidonomya.*

In Scotland the Lowland area (Ayrshire to Fifeshire) was still occupied by fresh water or an estuary, in which was laid down the Calciferous Sandstone Series and Oil Shale Group. Succeeding these beds occur the Lower Limestone Group of Scotland, which consists of a series of thin marine limestones with thick intercalated shales and sandstones, approximately equivalent in age to the uppermost Viséan. The whole group thickens greatly eastward, attaining a maximum thickness in Fifeshire.

In Northumberland the sequence is similar to the Scottish one, and has been divided into a lower part (Tuedian) and an upper part (Bernician). The Tuedian consists of the Cementstone Group and Fell Sandstone Series of uncertain age, succeeded by a Coal Measure phase in the Lower Bernician. Succeeding this occurs the Upper Bernician with occasional thin limestones corresponding to the Yoredale limestones, and representing the upper Viséan.

Ireland was largely occupied by sea during this period, but the faunal sequence and correlation has not yet been worked out except on the east coast near Dublin and in Co. Clare. Exposures at Great Ormes Head in northern Wales and in the south of the Isle of Man serve to connect the English Midland Province with the Irish sequence.

Seas of this period extended through Russia and Siberia to China and Japan and contained the same coral and brachiopod assemblage of fossils, which appeared again in the west of North America. A similar fauna is found in the Burindi Series of New South Wales. Towards the close of the period the localized abundance of goniatites formed the most striking feature in the generally luxuriant marine life. The segregation of this goniatite and *Posidonomya* fauna into well-defined areas free from the Productid and coral fauna, is one of the most striking and curious features in Carboniferous oecology. It is clear that the separation of the two faunas was effected without recourse to any serious diastrophic movements such as the Poseidon Deep suggested by Schuchert to account for the differences in the American and European faunas. Indeed, the existence of such a Deep appears to be negatived by the identity of the Caney Shale fauna of Oklahoma and the Bowland Shale fauna of Craven, coupled as it may be with the close similarity of the Nebraskan and Scottish lamellibranchs a little later. The goniatite fauna, abundantly preserved in Craven and probably in Ireland, in Belgium and Westphalia, and less abundantly in Silesia, occurs also in the Pyrenees, in northern Africa, and with traces as far east as Siam, and reappears in great force in Oklahoma and the adjoining states of North America. It has not yet been recorded from the Southern Hemisphere.

In North America the sediments of this period were less extensive than in the Tournaisian period. They consist in the Central Interior area (of the United States of America) of limestones and oolites with sandy, calcareous shales on the flanks, and with beds of continental origin in the north-east. In New Brunswick, Nova Scotia and south-western Newfoundland occur narrow connected troughs between mountain ranges, with conglomerates, sands, thin dolomites and gypsum. Shell-feeding sharks were especially abundant in North America at the opening of the period, and extensive fish remains have also been found at the top of the series in the Red Beds of the Yoredale Series near Leyburn (Yorks.). The following life zones have been generally recognized in western Europe -

Corals and Brachiopods		Goniatites	
D_3	*Orionastrea.*	P_2	*Goniatites spirale* (group).
D_2	*Lonsdaleia floriformis and Productus giganteus.*	P_1	*Goniatites crenistria* (group)
D_1	*Cyathophyllum murchisoni.*	B	*Beyrichoceras.*
S	(*Seminula*) *Lithostrotion martini*		*Prolecanites.* *Pericyclus.*
C_2	Late *Caninias.*		

The exact equivalence of the coral and goniatite zones has not yet been worked out

Lancastrian (Millstone Grit and Lower Coal Measures).—Succeeding the period represented by the highest beds of the Viséan division considerable physiographic changes occurred in western Europe. For some little time the greater part of the south-west of England had been above water, and it is probable that slight emergence took place at this period both in Belgium and Westphalia. Indeed, the only area in which an apparently complete succession of life forms has been worked out is in the Craven area of Yorkshire and Lancashire.

A low and narrow ridge appears to have separated this basin from the Northumbrian and Scottish basins, where alone the Lower Carboniferous brachiopod fauna continued to exist. In the Craven basin or gulf a long series of goniatite forms succeeded one another, and the stratigraphy is well developed and clearly seen in the Pennine area generally. Several new genera of goniatites appeared (*Eumorphoceras, Homoceras, Reticuloceras,* etc.) and rapidly evolved. By means of these forms it has been possible to subdivide and distinguish at least four great outpourings of coarse felspathic grit (arkose) into the Pennine area, which grits together with the intercalated shales and subordinate sandstones form the Millstone Grit Series.

The major grit beds are:—

(4) Rough Rock, of *Gastrioceras subcrenatum* age. (G)
(3) 3rd Grit of Lancashire, of *Reticuloceras bilingue* age. (R_2)
(2) Kinderscout Grit, of *Reticuloceras reticulatum* age. (R_1)
(1) Grassington Grit, of *Eumorphoceras* age. (E)

Of these four major grit invasions, the first or Grassington Grit reaches a maximum thickness near Burnsall, forms the Pendle Top Grit and caps many of the highest of the northern Pennine peaks. To the south it dies out, and is absent in Derbyshire. The Kinderscout Grit attains a maximum in the Peak District of Derbyshire, and gradually thins to the north being probably not more than 50ft. thick near Clapham (Yorks.). The 3rd Grit of Lancashire has recently been proved by boring to thicken rapidly to the south-west, reaching a concealed maximum near Horwich (Lancs.). These three grit invasions have maxima in distinct but adjacent territories of the deltaic basin, which appears to have been subsiding irregularly and disconnectedly. On the other hand, the fourth grit invasion (the Rough Rock) is known all over the Midland Province, and is fairly regular in its thickness. This fact, together with the immigration of freshwater mollusca into the area, suggest that depression and sedimentation were becoming much smoother in action, and this is again reflected in the finer grain of the Lower Coal Measure sandstones. The thin coal-seams of the Millstone Grit with their marine roofs are strongly suggestive of pauses in depression followed by a jerky subsidence which let in the adjacent sea (compare the buried forest bed and its marine roof in the Humber and other English estuaries in recent time).

At approximately the same period coarse detrital beds were laid down in many other areas in western Europe, but they nowhere appear to have been of the same coarseness and thickness as those of Lancashire, with the possible exception of the Silesian beds (of rather uncertain horizon). The source of the grit sediment of the Millstone Grit is not clear, as is also the exact mode of transport, but it seems probable that a northerly or north-westerly source furnished the bulk of the sediment, and it is significant that the whole of the fossiliferous bands in the Millstone Grit are marine (with the exception of one *Carbonicola* band near the summit). Similar grits occur in Newfoundland. It would appear that the Roslin Sandstone of Scotland is of approximately the same age, but the fauna is distinct and correlation is somewhat uncertain. The Flözleere Sandstein of Westphalia is of the same horizon as the Millstone Grit, and contains the same goniatite and lamellibranch succession.

Intercalated between the Grassington Grit and the Kinderscout Grit is an important series of marine shales, the Sabden Shales, containing many goniatite zones of upper E (*Eumorphoceras*), H (*Homoceras*) and R_1 (*Reticuloceras*) age. A similar shale series is present in Ireland (Foyne's island), Belgium (Chokier), and is partly represented in Westphalia, but in the latter area there is a slight suggestion of a sedimentation break, as several of the "H" goniatite zones have not yet been recorded. This sedimentation break was much more severe in southern Wales, where the earliest Upper Carboniferous goniatites so far recorded are of "H" age, and indeed the earliest goniatite is not uncommonly the basal goniatite of R_1 (*Reticuloceras inconstans*). At Haverfordwest the break extends up to R_2, where *R. bilingue* is the first zonal goniatite present above the break.

In Silesia the period is represented by the Hultschiner Schichten and Ostrauer Schichten of the Sudetische Stufe.

The Lancastrian period in western Europe thus witnesses a great expansion in area of the goniatite fauna, and also of coarse detrital sediments. But the period has not yet been definitely recognized either in eastern Europe or America, except in the highest or *Gastrioceras* beds, which appear to have been very widespread.

The major life zones represented are:—

G. *Gastrioceras.*
R_2. *Reticuloceras reticulatum* muts. $\alpha, \beta \sigma \gamma$.
R_1. *Reticuloceras inconstans* and *R. reticulatum* (type form).
H. *Homoceras* (*H. beyrichianum*, etc.).
E. *Eumorphoceras* and *Cravenoceras* (early *Homoceras*).

By reason of the marked change in the goniatite fauna, and the expansion which took place in the detrital deposits at the beginning of the Lancastrian period, it has been suggested that the base of the Lancastrian division should be regarded as marking the inception of the Upper Carboniferous, as understood in Europe. It should, however, be pointed out that the change in the flora observed in Scotland occurs somewhat higher, namely, at or about the junction of the E and H goniatite zones. On the other hand, the Variscan mountain building commenced before the close of the Viséan period, as here understood.

In Scotland the period commences with the Edge Coal series (perhaps the equivalent of the Grassington Grits), succeeded by the Upper Limestone Group (probably the equivalent of the Sabden Shales) and the Scottish Millstone Grit (perhaps the equivalent of the Upper Sabden Shales and Kinderscout Grits). It is curious to note that the whole of the dominant and rapidly evolving goniatite genera are absent from the Scottish and Northumbrian basins, the goniatites present in Scotland belonging to two closely allied genera, *Dimorphoceras* and *Anthracoceras*, of feeble ornamentation and sluggish evolution. It is this fact which renders correlation of the Scottish beds difficult.

In eastern North America the break between the Mississippian and Pennsylvanian is so profound that it seems probable that the lower part of the Lancastrian is missing. Colour is given to this supposition by the apparent absence of the lower and middle Lancastrian goniatites from the area. According to Schuchert, in the earliest Pennsylvanian "the seaways were small and restricted to Texas, Oklahoma and Arkansas, and long before the submergence became general, three freshwater deltas were forming, one centring about Pottsville, Pa., another about the Kanawha river, West Virginia, and the third in the area of the Cahaba valley of Alabama. Finally these areas also came under the influence of the spreading seas at or before the close of Pottsvillian time. The submergence was most extreme in late middle Pennsylvanian time, when about 30% of North America was again under the sea."

Freshwater molluscs first became established in England towards the close of the period, when forms of *Carbonicola* occurred abundantly at several horizons in zone G. The same is true of Westphalia and the Franco-Belgian basin.

Westphalian (Middle and Upper Coal Measures).—Succeeding the coarse detrital beds of the Millstone Grit and Lower Coal Measures is a thick succession of fine-grained sandstones, clays, shales and coal-seams, forming the major coal-fields of western Europe. At or about the same period occur the Pennsylvanian Coal Measures of eastern North America, but in eastern Europe (Donetz Basin) the deposits are predominantly marine (Moscovian) with a *Fusulina* fauna.

In Britain occur the well-known adjoining coal-fields of Yorkshire, Nottinghamshire, Derbyshire, Lancashire and Staffordshire containing amongst other seams the celebrated Barnsley and Silkstone coals. Of this age also are the coal-fields of south Wales, and there are minor coal-fields in Scotland, Northumberland (and Durham) and Somerset. In most of these there are occasional thin marine intercalations, which often form the roof of a thin coal-seam. The major seams, however, have no marine roof, indicating that they were deposited during a period of tranquil subsidence, and not during a pause in subsidence. In this connection one may observe that the enormously thick measures of Silesia contain correspondingly thick coal-seams. In Britain the productive measures are succeeded by the Upper Coal Measures of Staffordshire and southern Wales, which consist mainly of red marls and sandstones and are the highest Carboniferous beds in the British Isles.

The Westphalian beds have been divided by means of the flora into three broad zones, the lowest characterized by *Neuropteris gigantea* and *N. Schlehani*, the middle by species of *Lonchopteris*, and the highest by *Neuropteris rarinervis* and *Sphenophyllum emarginatum*. A more detailed division by means of the non-marine mollusca has recently been propounded by Davies and Trueman and is as under:—

(5) *Anthracomya tenuis.*
(4) *Anthracomya phillipsi.*
(3) *Anthracomya pulchra.*
(2) *Carbonicola similis.*
(1) *Anthracomya modiolaris.*

The coal-fields of the Ruhr in Westphalia (Gaskohle and Gasflammkohle groups) correspond with this division, as do also the Saarbrücker beds of the Saar, and the Sattelgruppe and Muldengruppe of Silesia. Further east occurs the mixed marine and coal-bearing series in the Donetz Basin of Russia with a fauna including *Spirifer mosquensis.*

Stephanian.—The highest Carboniferous beds of western Europe are those of the isolated basins in the centre and south of France, with a *Pecopteris* flora and abundant insect remains. It is possible that the highest beds of northern Staffordshire and southern Wales may represent this period, but there is at present no definite means of correlation. Approximately equivalent are the Ottweiler beds of Silesia and the marine limestones of the Urals containing *Schwagerina.* A Stephanian flora is found also in Spain and Italy, and there is a mixed Uralian fauna and Stephanian flora in the Carnic Alps. The Uralian sea was present in Asia Minor, Persia, India and China. In North America the period is represented by the upper productive coal measures of the Monongahela series and the Cisco formation of Texas.

The extensive "Permo-Carboniferous" glaciation of the Southern Hemisphere, and the succeeding *Glossopteris* flora of Gondwanaland, are now classed by the American geologists in the Permian system.

Europe generally during the Carboniferous period was divided into an eastern and western area of deposition by a land mass stretching from Scandinavia to southwest Russia. To the east and west of this land mass the conditions were very distinct. To the east a shallow brachiopod sea existed over the greater part of what is now Russia, with islands in the Urals, and this sea persisted during the greater part of Carboniferous time, with somewhat divergent conditions in the Donetz Basin. During the whole range of the period there were in this area few strong tectonic movements. In western Europe, on the other hand, during the Carboniferous period there began the great mountain-building movements called Variscan or Hercynian. These movements, which commenced in the Lower Carboniferous, were continued in Lancastrian and Westphalian time with an energetic pressure towards the north. As a result, Middle Europe became a stable united land mass with great folds at the borders of the old Franco-Podolian ridge. This late Palaeozoic, augmented Franco-Podolian massif is termed by Bubnoff the Middle European Ridge. Volcanic activity reached a considerable intensity; Scotland especially was the scene of great eruptions, remarkably well preserved. In Derbyshire submarine lava flows, now termed "toadstones," occurred, and in the area of the later Variscan mountains (Brittany, Central plateau, Vosges, Schwarzwald, Bohemian Massif) occurred great grano-dioritic intrusions.

Thickness of Carboniferous Rocks.—The great variety of conditions under which the sediments and limestones were formed naturally produced corresponding inequalities in the thickness. In the Eurasian land area the greatest thickness of Carboniferous rocks is in the west; in North America it is in the east. In Britain the Carboniferous limestone series is 2,000–3,500ft. thick; in the Urals over 4,500ft.; the Culm in Moravia is credited with the enormous thickness of over 42,000ft. The Upper Carboniferous in Lancashire is from 12,000 to 13,000ft.; elsewhere in Britain it is thinner. In western Germany this portion attains a thickness of 10,000ft. In Pennsylvania the sandstone and shale, at its maximum, reaches 4,400ft., but even within the limits of the State this formation has thinned out to no more than 300ft. in places. In Colorado the Lower Carboniferous is only 400–500ft. thick; while the limestones of the Mississippi basin amount to 1,500ft. and in Virginia to 2,000ft.

LIFE OF THE CARBONIFEROUS PERIOD

Fauna of the Marine Strata.—Numerically, the most important inhabitants of the clear Carboniferous seas were the crinoids, corals, Foraminifera and brachiopods. Each of these groups contributed at one place or another towards the upbuilding of great masses of limestone. For the first time in the earth's history we find Foraminifera taking a prominent part in the marine faunas; the genus *Fusulina* was abundant in what is now Russia, China, Japan, North America; *Valvulina* had a wide range, as also had *Endothyra* and *Archaediscus; Saccammina* is a form well known in Britain and Belgium, and many others have been described; some Carboniferous genera are still extant. Corals flourished in the clearer waters and have been used in Britain and Belgium as zonal forms. Crinoids were specially abundant in Scotland and the United States. Brachiopods reached their acme, the most important genus being *Productus*, now divided into several subgenera. Whilst many brachiopod species were long-lived, several forms have proved useful as zonal indices, and as a supplement to coral evidence of relative time. Amongst the cephalopods, the goniatites became abundant for the first time toward the close of the Lower Carboniferous (Visean), and swarmed in many of the marine bands of the Upper Carboniferous (Lancastrian). They are represented by several closely allied genera which exhibit distinct evolutionary trends, and furnish very delicate zonal indices.

Trilobites were infrequent in the Lower Carboniferous, and practically extinct in the Upper Carboniferous. Fish, whilst no doubt numerous, and represented mainly by sharks, are not common as fossils, and their remains are usually in localized deposits, as the Red Beds of Wensleydale.

Flora and Fauna of the Continental Facies.—The strata deposited during this period are the earliest in which the remains of plants take a prominent place. The true ferns, including tree ferns with a height of upwards of 60ft., were associated with many plants possessing a fern-like habit and others whose affinities have not yet been determined. Our modern diminutive "horse-tails" were represented in the Carboniferous period by gigantic calamites, often with a diameter of 1 to 2ft., and a height of 50 to 90ft. The Carboniferous forerunners of the tiny club-moss were then great trees with dichotomously branching stems and crowded linear leaves, such as *Lepidodendron* and *Sigillaria*, with trunks sometimes 5ft. in diameter and 100ft. high.

The animals preserved include freshwater mollusca such as *Anthracomya*, *Naiadites* and *Carbonicola*, crustaceans and fishes. Many insects, etc., have been obtained from the coal-fields of Saarbruck and Commentry, cockroaches being especially abundant. Land-snails have been found in tree trunks in Nova Scotia, and from the uppermost coal measures of Worcestershire. In the later Carboniferous rocks the earliest amphibians make their appearance, they were all stegocephalians (labyrinthodonts) with long bodies, bony plates on the head, and undeveloped limbs.

Economic Products.—Foremost among the useful products of the Carboniferous rocks is coal (*q.v.*) itself; most of the petroleum of the Appalachian and mid-continent fields, U.S.A.—about one-quarter of the country's total; but associated with the coal-seams in Great Britain, North America and elsewhere, are very important beds of ironstone, fire-clay, terra-cotta clay and occasionally oil shale and alum shale.

In the Carboniferous Limestone series, the purer kinds of limestone are used for the manufacture of lime, bleaching powder and similar products, also as a flux in the melting of iron; some of the less pure varieties are used in making cement. Some of the harder and more crystalline limestones are beautiful marbles.

The sandstones are used for building, and for millstones and grindstones. Crushed and screened they are often used as an aggregate for concrete. In veins in the limestone occur lead and other metallic ores, now but little worked in Britain.

Bibliography.—For a good general account of the Carboniferous system, *see* A. Geikie, *Text Book of Geology*, vol. ii. (4th ed., 1903); and for the American development *see* Pirsson and Schuchert, *Text Book of Geology* (2nd ed., 1924). *See* also *Recent Additions to Geological Literature*, Geological Society of London, pub. ann. since 1893. For a good account of the British coal-fields, see *Coal in Great Britain* (2nd ed., 1927) by J. W. Gibson, and the bibliography to Coal.

CARBON MONOXIDE POISONING results from breathing atmospheres containing the gas. Carbon monoxide is produced by burning carbon-containing fuels in a deficiency of air or oxygen. Common producers are room heaters, gas ranges, automobile exhausts, mine explosions, blasting, iron and steel furnaces and burning electric installation. Since the gas is colourless, tasteless and odourless (in the concentration usually encountered), its detection is difficult. Mice and birds are more quickly affected by it than man. The activated iodine pentoxide indicator, however, detects the presence of dangerous amounts in less than one minute. The gas exerts its extremely dangerous action on the body by displacing oxygen from its combination with haemoglobin, destroying the body tissue. Frequent symptoms are headache, weakness, nausea, fainting, paralysis of the nervous system and slowing of pulse and respiration. Treatment is by removal to fresh air; application of artificial respiration, administration of pure oxygen, or a mixture of 5% of carbon dioxide in oxygen for 20 min. or more; stimulation of circulation, complete relaxation; symptomatic treatment for after-effects.

CARBON PAPER, a tissue of varying weight coated with a colour, generally carbon, and some waxy medium. It is usually coated on one side but may be coated on both sides for special purposes. For typewriting duplication which is its chief usage it is of course coated on one side only. The paper upon which the coating is applied varies in weight from 4 to 10 lb. per ream of 480 sheets 20 by 30in. and is made from fibres such as rag, chemical wood, manila and jute. As it must be strong and durable it must not contain any ground wood pulp. The coloured waxy material which transmits the duplication is soft so that at least five copies can be made. It is also so strongly coloured and of such durability that a sheet will make at least 12 first carbons that are clear and legible. This coating is composed of waxes such as Japan, paraffin (kerosene) and canauba, and such oils as oleine and rosin thoroughly amalgamated with a colour which in the case of black paper is always carbon or gas black.

In coloured papers the colour consists of an aniline dye base combined with fatty acids as stearic and oleic or a fat soluble dye dissolved in the oleine or rosin oil present in the mixture. The actual manufacture of carbon paper resolves itself into two processes, viz., the preparation of the coating material and its application to the paper. The waxes and oils are melted in a steam-jacketed kettle at a temperature of approximately 300° F and the colour stirred in. Afterwards the hot mixture is passed through a steel plate grinding mill and is then ready for the coating machine. This machine, of web-type construction takes the paper in roll form, passing it over the coating roller which revolves in a steam-heated ink foundation containing the hot coating mixture and then over a spiral wire wiper which controls the thickness of the coating. From this wiper it passes over water-cooled rollers which chill and harden the coating, and subsequently it is rolled upon itself at the end of the machine. The roll is then cut into sheets in sizes according to its usage. (N. U.)

CARBONURIA, the presence of carbon in the urine. This is normally present as an end product of metabolism. It is found mainly in the form of carbon dioxide but small quantities of the element are also present. Anything causing an increase of metabolism will increase the quantity of carbon. After illuminating gas poisoning it is found in the form of carbon monoxide.

CARBONYLS, METALLIC, are compounds of the metals with carbon monoxide. Of these the most important is *nickel carbonyl*, $Ni(CO)_4$, used in the manufacture of pure nickel. This substance is readily produced by passing carbon monoxide over finely divided nickel at 30–50° C. and is condensed in a freezing mixture of ice and salt to a colourless liquid, boiling at 43·3° C, and solidifying in acicular crystals at −25° C (L. Mond, 1890).

Prior to 1890 it had been observed in Mond's laboratory that, when exposed to an atmosphere contaminated with producer gas, nickel-plated taps and fittings became tarnished. This tarnish was ultimately traced to the action on the metal of the carbon monoxide contained in the producer gas. This observation led to systematic experiments on the interaction of carbon monoxide and nickel under varying conditions and thence to the discovery of nickel carbonyl, a volatile liquid having totally unsuspected properties and representing a new class of metallic derivatives. Mond and his co-workers then extended their researches to the allies of nickel and thus discovered the carbonyls of cobalt, iron, molybdenum and ruthenium. When passed through a hot tube at 180–200° C, this carbonyl is dissociated with deposition of nickel as a brilliant mirror. Hence the use of the carbonyl in the extraction and purification of nickel, since the associated metals do not so readily furnish volatile carbonyls.

Under the conditions employed in the preparation of nickel carbonyl, cobalt yields no analogous compound; but above 150° C and under a pressure of 30–40 atmospheres, this metal unites with carbon monoxide to form *cobalt tetracarbonyl* $\{Co(CO)_4\}_2$, an orange crystalline substance with the doubled molecular formula, which slowly dissociates at 60° C into cobalt tricarbonyl, $Co(CO)_3$; thus obtained it consists of sparingly soluble black crystals of unknown molecular weight. *Iron pentacarbonyl*, $Fe(CO)_5$, a pale yellow viscid liquid, is produced by warming finely divided iron at 100–120° C in a slow current of carbon monoxide, it distils, undecomposed, at 102.8° C, and solidifies to a mass of yellow needles below −21° C. At 180° C it is completely dissociated. When exposed to sunlight below 60° C, the pentacarbonyl becomes transformed into orange-red hexagonal plates of iron enneacarbonyl $Fe_2(CO)_9$, which are almost insoluble in ether, benzene or light petroleum. When these crystals are heated to between 50° and 60° C in the presence of ether, ligroin or toluene, the liquid becomes green and deposits green prismatic crystals of iron tetracarbonyl $\{Fe(CO)_4\}$. This compound, the analogue of nickel carbonyl, is stable under atmospheric conditions but at 140–150° C it dissociates into iron and carbon monoxide. *Ruthenium carbonyl*, $Ru(CO)_2$, an orange-yellow deposit, is formed by passing carbon monoxide over ruthenium black. *Molybdenum carbonyl*, $Mo(CO)_6$, is obtained in highly refracting white crystals by the interaction of finely divided molybdenum and carbon monoxide at 200° C and under 200–250 atmospheres. These crystals sublime at 30–40° C in an atmosphere of hydrogen and carbon monoxide. Chromium is stated to yield a volatile carbonyl when carbon monoxide is absorbed by magnesium phenyl bromide in presence of chromic chloride (A. Job and A. Cassal, 1927; *see* GRIGNARD REAGENTS).

In addition to the foregoing compounds, where the metal is entirely associated with carbon monoxide, there are many complex metallic salts containing the carbonyl group, such as the carbonyl derivative of cuprous chloride, $Cu_2Cl_2.CO.2H_2O$, produced when the cuprous salt is employed in gas analysis. Platinous chloride furnishes carbonyl derivatives, *e.g.*, $PtCl_2.CO$, which decomposes at 300° C into platinum and phosgene $PtCl_2CO = Pt + COCl_2$. Palladium forms a similar compound, $PdCl_2CO$. The crude ferrocyanides from coal gas contain salts of carbonylferrocyanic acid, $H_3[Fe(CO)(CN)_5]$. (G. T. M.)

CARBORUNDUM, the name given by Edward G. Acheson in America to a substance he obtained accidentally when experimenting in 1891 with the electric furnace in the hope of producing artificial diamonds. These experiments were followed by others with an incandescent furnace of which a larger form is now used for the industrial manufacture of the product. Although it had previously been discovered by a few other experimenters, Acheson generally receives credit for the discovery of carborundum, and gave it its name because he believed it to be a compound of carbon and corundum, a naturally occurring crystalline form of alumina (*q.v.*). It was subsequently found to be silicon carbide (*q.v.*), and is now manufactured on a large scale for use as an abrasive in the metallurgy of iron and steel. It has various other trade-names, crystolon, carbolon, carbonite, samite, etc., and is sometimes used with diamond dust, for cutting diamonds.

The name carborundum is protected by trade-mark registration in Canada, Australia, New Zealand and the United States, and similar protection has been applied for in the Union of South Africa.

CARBOY, a large globular glass vessel or bottle, encased in wicker or iron-work for protection, used chiefly for holding vitriol, nitric acid and other corrosive liquids. (From the Pers. *qarābah*, a flagon.)

CARBUNCLE, in mineralogy, a garnet (*q.v.*) cut with a convex surface. In medicine, the name given to an acute local inflammation of the deeper layers of the skin, followed by sloughing. It is accompanied by great local tension and constitutional disturbance, and pain is often acute. A hard, flattened swelling of a deep red colour occurs on the back, face or extremities. This gradually extends until it may become as large as a dinner plate. Towards the centre of the mass numerous small openings form on the surface, from which blood and matter escape, and through which a yellow slough or "core" of leathery consistence can be seen. Carbuncle is apt to occur in persons whose health is depressed by mental worries, or chronic disease of the kidneys or blood vessels, or diabetes. The best treatment is surgical.

CARBURETTOR, a device to form an explosive mixture of air and a hydrocarbon liquid fuel of a volatile nature such as petrol or gasoline. The function of a carburettor may be divided into three steps: to discharge into the air stream the desired amount of fuel; to atomize the fuel; and to make a homogeneous air fuel mixture. (*See* MOTOR CAR.) Carburettors have to be multiplied in large power engine outfits for aeroplanes, four being employed for a 12-cylinder engine, and they require an altitude control to compensate for the rarer atmosphere at high altitudes. Carburetion is a process also required in the manufacture of air gas and carburetted water gas (*see* WATER GAS).

CARCAGÉNTE or **CARCAJENTE,** a town of eastern Spain, in the province of Valencia, near the right bank of the river Júcar, at the junction of the Valencia-Murcia and Carcagente Denia-Alicante railways. Pop. (1940) 11,017 (mun. 17,846). Carcagénte is a picturesque old town with Roman remains, surrounded by the dense olive, carob, palm, mulberry and orange groves of some of the most productive land, thanks to irrigation, of the Valencian plain. Its many cupolas contrast with the chimneys of modern silk mills and linen factories. Orange essences and soap are made and rice cultivation is important locally owing to the warm, moist climate of the low-lying Júcar valley.

CÁRCAR, a municipality (with administrative centre and 10 *barrios* or districts) of the province and island of Cebu, Philippine Islands, on the Cárcar river near its mouth at the head of Cárcar bay, 23 mi. S.W. of Cebu, the provincial capital. Pop. (1939) 36,308 (a loss of 1,084 from 1918), of whom 17,290 were males, and 11 were whites. Founded in 1624 the municipality lies in a territory which, while rugged, produces both maize (corn) and sugar in considerable amounts. With its railway connection leading to Cebu and by branch to other municipalities, and being accessible to coasting vessels, Cárcar is a trade centre of considerable importance. Vernacular is Cebuano. Of those from the ages of 6 to 19, inclusive, 27.2% attended school, and of those 10 years old and over 40.1% were literate. (C. S. L.)

CARCASS, the dead body of an animal; a butcher's term for the body of an animal without the head, extremities and offal. Also an iron case filled with combustibles and fired from a howitzer to set fire to buildings, ships, etc., the flames issuing through holes pierced in the sides.

CARCASSONNE, a city of southwestern France, capital of the department of Aude, 57 mi. S.E. of Toulouse, on the railway to Narbonne. Pop. (1936) 30,076. Carcassonne lies near the eastward bend of the river Aude, which divides it into two distinct towns, the Ville Basse and the ancient Cité, connected by two bridges, one modern, the other 13th century with a chapel of 15th century date at one end. The old town occupies the site of *Carcaso*, city of Gallia Narbonensis, with pre-Roman origins, on an isolated hillock on the right bank of the river. In its larger relations the position of this historic fortress is interesting. It lies in the gap between the Montagne Noire on the north and the outliers of the Pyrénees (Mouthoumet) on the south. This northward avenue leads from the Mediterranean coasts round the central plateau to Aquitaine and northern France; and from its location in the transition zone Carcassonne had great human significance. On the disintegration of the Roman empire, it fell into the hands of the Visigoths, who, in spite of the attacks of the Franks, especially in 585, retained possession till 724, when they were expelled by the Arabs, destined in turn to yield before long to Pippin the Short. From about 819 to 1082 Carcassonne formed a separate countship, and later, till 1247, a viscountship. Towards the end of the 11th century the viscounts of Carcassonne assumed the style of viscounts of Béziers, a town which they had dominated since the fall of the Carolingian empire. The viscounty of Carcassonne, together with that of Béziers, was confiscated to the crown in 1247, as a result of the part played by the viscount Raymond Roger against Simon de Montfort in the Albigensian crusade, during which the city was taken (1209) by the Crusaders (*see* ALBIGENSES). A revolt of the city against the royal authority was severely punished in 1262 by the expulsion of its principal inhabitants, who were, however, permitted to take up their quarters on the other side of the river. This was the origin of the new town, which was fortified in 1347. In 1356 the citadel successfully resisted the Black Prince. During the religious wars, Carcassonne changed hands several times, and did not recognize Henry IV. till 1596 Its importance as a frontier station disappeared in 1659, when Roussillon was annexed to France. The narrow streets are still inhabited. The ramparts are surmounted by towers, and can be entered only by two fortified gates, to the east and west. Excavations have demonstrated that the castle occupies the site of the Gallo-Roman Castellum. The foundations of the towers of the inner rampart are mostly Roman or Visigothic. The rest, including the castle, seem to belong to the 11th or 12th century, while the outer circuit is mainly the work of Louis IX (1260–70). The old cathedral of St. Nazaire dates from the 11th to the 14th century. The Romanesque nave was begun in 1096; the transept and choir, which contain magnificent stained glass of the Renaissance period, are Gothic. Both the fortifications and the church were restored between 1850 and 1880 by Viollet-le-Duc, whose work Boeswillwald continued.

Across the Aude lies the well-planned new town, with streets intersecting each other at right angles. The most interesting buildings are the cathedral of St. Michel, dating from the 13th century but restored in modern times, and St. Vincent, a church of the 14th century, with an exceptionally wide nave (66 ft.).

Carcassonne is the seat of a bishop, a prefect and a court of assizes and has tribunals of first instance and of commerce The old cloth industry is almost extinct. The town is, however, an important wine-market, and the vineyards of the vicinity are the chief source of its prosperity, which is enhanced by its port on the Canal du Midi. Tanning and leather-dressing, the manufacture of agricultural implements and corks, cooperage, and the preparation of preserved fruits are the chief industries.

See E. E. Viollet le Duc, *La Cité de Carcassonne* (Paris, 1858); L. Fedie, *Histoire de Carcassonne* (Carcassonne, 1887).

CARDAMOMS, the fruit of several plants of the genera *Elettaria* and *Amomum*, belonging to the family Zingiberaceae, the principal of which is *Elettaria Cardamomum*, from which the true official or Malabar cardamom is derived. The Malabar cardamom plant is a large perennial herb with a thick fleshy rootstock, which sends up flowering stems 6 to 12 ft. high. The large leaves are arranged in two rows, have long sheaths enveloping the stem and a lanceolate spreading blade 1 to 2½ ft. long. The fruit is an ovate-triangular, three-celled, three-valved capsule (about ¼ to ¾ in. long, of dirty yellow colour) enclosing numerous angular seeds, which form the valuable part of the plant. It is a native of the mountainous parts of the Malabar coast of India. A cardamom of larger size growing in Ceylon, formerly regarded as a distinct species, is now known to be only a variety. In commerce, several varieties are distinguished according to their size and flavour. The most esteemed are known as "shorts," a name given to such capsules as are from a quarter to half an inch long and about a quarter broad. The Ceylon cardamom attains a length of an inch and a half and is about a third of an inch broad, with a brownish pericarp and a distinct aromatic odour. The fruits of various species of *Amomum* pass in commerce as cardamoms, *e.g.*, *A. Cardamomum*, a native of Siam and Java.

CARDAN (Ital. CARDANO), **GIROLAMO** (GERONYMO or HIERONIMO) (1501–1576), Italian mathematician, physician and astrologer, born at Pavia, was the illegitimate son of Facio Cardano (1444–1524), a learned jurist of Milan. He was educated at Pavia and at Padua, where he graduated in medicine. He was, however, excluded from the college of physicians at Milan on account of his illegitimate birth. In 1534 he became a public lecturer in geometry, on the foundation of one Thomas Plat, at Milan, and also (1535) physician to the Augustine Friars, whose prior he cured. A cure of the child of the Milanese senator Sfondrato led to his admission into the medical body, of which he actually became rector in 1541. In 1530 he published his *Practica arithmeticae generalis*, and he corresponded with Niccolo Tartaglia, who had discovered a solution of cubic equations. In 1543 the University of Pavia, driven by war to teach at Milan, offered Cardan its chair of medicine, and he accompanied the university on its return to Pavia in 1544.

In his comprehensive treatise on Algebra (*Artis magnae sive de regulis Algebrae liber unus*, Nuremberg, 1545) Cardan published the cubic solution, which he had obtained from Tartaglia under pledge of secrecy. In 1543 he had published his celebrated treatise on astrology.

His works on algebra and astrology had procured for him a European renown, and flattering offers from Pope Paul III. and the king of Denmark, which he declined. In 1551 his reputation was crowned by the publication of his great work, *De Subtilitate Rerum*, which embodied both the soundest physical learning of his time and its most advanced spirit of speculation. It contains indications for a method of teaching the blind to read and write by the sense of touch, and elsewhere Cardan suggests the use of signs for teaching the deaf. *De Varietate Rerum* (1557), is a supplement to it. Cardan gives false explanations of common phenomena, but glimpses of principles not fully understood by him or acceptable to his age are of interest. Inorganic nature he asserts to be animated no less than the organic; all creation is development; all animals were originally worms; the inferior metals must be regarded as *conatus naturae* towards gold. The indefinite variability of species is implied in the remark that nature is seldom content with a single variation from a type. The oviparous habits of birds are explained, precisely in the manner of modern naturalists, by their value for the perpetuation of the species. Animals were not created for the use of man, but exist for their own sakes. The origin of life depends upon cosmic laws, which Cardan naturally connects with astrology. The physical divergencies of mankind arise from the effects of climate and circumstances.

In 1552 Cardan was summoned to Scotland to attend Archbishop Hamilton of St. Andrews The chief interest of his journey lies in his account of the disputes of the medical faculty at Paris over the new anatomical teaching of his friend Vesalius, and his favourable opinion, as an ecclesiastically unbiased observer, of the character and ability of Edward VI of England.

Cardan had now reached the height of his prosperity; but later his fortune turned. His son, Giovanni Battista, also a physician, had contracted an imprudent marriage with a girl named Brandonia Seroni, who proved unfaithful. The injured husband's revenge by poison was detected, and the exceptional severity of the punishment—execution—seems to justify Cardan in attributing it to the rancour of his medical rivals (1560). The blow all but crushed him. His reputation and his practice waned. He was banished from Milan on some accusation unspecified, and although the decree was rescinded he accepted a professorship at Bologna (1562). There he was arrested (1570), deprived of his professorship and removed to Rome, where he spent his remaining years in receipt of a pension from the pope, and wrote his commentaries, *De Vita Propria*, which, with *De Libris Propriis*, is our principal authority for his biography.

Bibliography.—Cardan's most important treatises, *De Subtilitate* and *De Varietate Rerum*, are combined and fully analysed in vol. ii. of Rixner and Siber's *Leben und Lehrmeinungen berühmter Physiker am Ende des xvi. und am Anfange des xvii. Jahrhunderts* (Sulzbach, 1820). His works were edited by Sponius (Lyons, 1663). A biography was prefixed by Gabriel Naudé, whose unreasonable deprecation has unduly lowered Cardan's character with posterity. *See* H. Morley, *Jerome Cardan* (1854); W. G. Waters, *Jerome Cardan* (1898); D. E. Smith, *Rara Arithmetica* (Boston, 1908).

CARDBOARD. The earliest cardboard was a layer of papyrus, beaten by hand to the desired thickness, pressed and dried by the sun. In the middle ages cardboard was made in the East from grasses. Playing cards so manufactured were painted by hand. The manufacture of machine-made cards is somewhat similar to paper-making. The fibre is boiled, beaten, coloured, if desired, and then put through a machine of the paper-making class. Modern board machines, particularly in America, Canada, England, Germany, Holland, Finland and Scandinavia, have grown enormously in size and capacity during the last decade. Australia also manufactures a portion of the cardboard required for home consumption. In 1927 there were three board-making machines in Australia, one mill producing 4,000 tons per annum.

Finland has a large and increasing production of mechanical wood pulp boards and the output totals about 35,000 tons per year. The exports of wood pulp board from Finland, Jan.–Sept. 1927, totalled 25,712 tons.

One of the cheapest forms of machine-made board is made in Holland and is made from straw which is boiled, beaten and worked up on machines somewhat similar to paper-making machines. In the year 1926 Holland exported 226,510,644 kg. to the value of 20,180,224 gld. Of these exports Great Britain took 183,217,604 kg. to the value of 16,211,036 gld. and America purchased 10,204,014 kg. valued at 934,544 gld. Ireland, South Africa, British India, The Argentine, Australia and New Zealand are also large buyers of Dutch-made strawboards.

Duties on Paper.—As early as March 24, 1801, says Mr. A. Dykes Spicer in *The Paper Trade*, an Act provided for the imposition of duties on paper, pasteboard, millboard and scaleboard made in Great Britain or imported. These duties were of two kinds, *i.e.*, customs and excise. Under the former a duty of 10d. per lb. was imposed on goods scheduled as first-class. Pasteboard, millboard and scaleboard paid 20s. per cwt. About the beginning of last century the average amount charged on all paper made in Great Britain was from 2d. to 2½d. per lb., and £200,000 were obtained from this charge. No paper-maker was allowed to make boards, nor might a board mill be opened within ¼ mile of a paper mill. After considerable agitation the duty on pasteboard imported into Great Britain was raised to £3.8s.2d. per cwt. In 1853, 2½d. per lb. was imposed on imported pasteboard. In 1860 Gladstone introduced a bill, which was carried by a majority of nine, for the repeal of the paper duty as a whole. On May 18, 1861, Gladstone moved that the paper duties be repealed and both the import and excise duties ceased.

Growth of Container Industry.—Since 1900 the container industry has developed enormously, and this has resulted in a greatly increased consumption of cardboard of various special kinds. Many items of food are customarily packeted. The enormous growth of the cigarette industry has also, particularly in America and Great Britain, meant the annual consumption of thousands of tons of light cardboard of fairly good special quality. The soap industry is another large consumer of cardboard for wrapping, and the boot and shoe industry and the textile trades also favour the use of the paper-box or a combination of wood and board manufactured from straw, waste-paper or wood-pulp.

Toward the end of last century America held a commanding position in the manufacture of boards for making good-class paper-boxes, and "American board" was accepted as a trade term. Great Britain now competes successfully for European trade. Approximately 200,000 tons of boards are manufactured in England and Scotland annually. Canada has also made great and rapid strides in the production of boards made from wood pulp. It is probable that the industry will continue to grow. Since World War I, Finland has made a successful bid for a share in the world's markets, and Germany, Austria, Belgium, France and Italy also maintain a substantial output of cardboard for home requirements and for export. The trade in Christmas and New Year greetings has also become a great and specialized industry in Europe and America, and cardboard enters largely into the manufacture of these lines. (*See* Box-making.)

British Imports.—In the year 1924, imports of millboard, leatherboard, cardboard and pasteboard into Great Britain totalled 1,284,986 cwt. to the value of £1,335,030; in 1925, 1,414,175 cwt. to the value of £1,476,008, and in 1926, 1,670,005 cwt. to the value of £1,727,009. In 1924 the British imports of strawboard totalled 3,748,078 cwt. to the value of £1,050,950; in 1925, 3,594,138 cwt. to the value of £1,500,045 and in 1926, 3,880,437 cwt. to the value of £1,501,501. During 1924 Great Britain exported 156,485 cwt. of millboard, strawboard, leatherboard and cardboard to the value of £256,440; in 1925, 144,100 cwt. valued at £245,287; in 1926, 154,087 cwt. valued at £274,754. During 1926 Great Britain exported playing cards to the value of £61,847, and boxes and cartons of paper and cardboard valued at £107,654; while in the same year the re-exports of various millboards, leatherboards, and cardboards amounted to 9,254 cwt., valued at £12,592, besides 8,360 cwt. of strawboard valued at £4,728. During the first nine months of 1927 the British imports of millboard, leatherboard, cardboard and pasteboard amounted to 1,313,102 cwt. valued at £1,302,020, and the exports of millboards, etc., totalled 147,582 cwt., valued at £244,640.

Boards made in Great Britain and in the United States include real strawboards, leatherboards, fence-boards, shoe stiffeners, shanks, millboards, jacquard cards, boards made from straw, old paper and wood pulp, glazed and rolled pressing boards, presspahn boards, fibre boards, chromo and art-coated boards, coated box boards, cloth-lined boards, hand-made millboards, boards for trunk-making, waterproof panel boards, drawing-boards, flaxibre, air-dried millboards for account books, pure rope hand-made boards for book-binders, folio boards, veneer boards, "SX" boards (for walls, ceilings, etc.), enamel boards, container boards, insulated boards, waterproof panel boards (for ships' cabins, electric cars, motor vans, exteriors and interiors of houses, etc.) hollow ware (from pressed wood pulp), pasteboards, mount boards, ticket boards, engine boards, middles, railway boards (for railway tickets), ticket boards (as used on public vehicles, for sports, etc.), duplex, triplex, etc., Bristol boards, ivory boards (for visiting cards), embossing boards, silk boards, etching boards, and various other kinds of boards. (*See* Paper Manufacture.)

Standard Sizes.—The standard sizes for boards range from thin strawboards 22in. x 32in., 8oz. to 20oz., to folding box boards of no standard size but usually 28in. x 30in. Cut cards are qualified under nine heads namely: Thirds, 1½in. x 3in.; extra-thirds, 1¾in. x 3in.; small, 2⅜in. x 3⅝in.; carte-de-visite, 2½in x 4⅛in.; large, 3in. x 4½in.; postcard, 3½in. x 5½in.; court, 3½in. x 4½in.; double small, 3⅝in. x 4¾in.; cabinet (photo), 4¼in. x 6½in; double large, 4½in. x 6in.; quad small, 4¾in. x 7½in.; quad large, 6in. x 9in. Boards trimmed are royal, postal, imperial, large imperial and index.

Cardboard Proper.—Cardboard proper or, to use the correct term, pasteboard, is made by combining several sheets of paper together by the application of paste or other similar adhesive by hand or machine. Pasteboards can be made to almost any desired thickness by using varying substances of raw material known in the trade as "middles" for the body or "middle" which, when combined with a covering of white paper on each side, varies in thickness from 1/64th to 1/16th of an inch, so far as this class of board is used for general commercial purposes by the printing trade. The greater tonnage of paste or pasted boards is made on huge machines from "middles," and white covering papers in reels, the thinner substances, as a rule, being combined from three reels (one of "middles" and two of white paper) placed on the pasting end of the machine, where either the "middle" or the covering paper receives a coating of paste from revolving rollers and is then passed over steam heated drying cylinders, finally being cut into sheets of a special or standard size whichever may be required.

Method of Manufacture.—Some makers produce the complete board in one operation whilst others re-wind after calendering, and cut the reels into sheets later on. Either method may produce a satisfactory board. By the same process coloured pasteboard can be made by using tinted paper instead of white. The advantages of making pasteboards by hand are several. Small quantities of any materials (forming the "body" or "middles") can be pasted up with suitable or selected papers, and in any size which is economical for the printer (or anyone else) to use. Almost any substance thicker than that which can be produced on a big machine can be combined, hand pressed, dried and glazed between zinc sheets under varying pressure on a rolling-machine.

Lined Boards.—Large quantities of thick strawboards, wood pulp and other thick boards are lined up in this way, or by a specially constructed machine capable of treating this kind of material. Pasteboards are used mostly in the printing trade in standard sizes, viz., 20in. x 25in., 22in. x 32in. and 22½in. x 28½in., to be printed in either one or more colours and then cut to any desired size. Pasteboards (white and coloured) are cut into standard sizes of cards, most of which are used by printers. These cards are cut by rotary card cutting machines to ensure clean edges and accurate measurement. Pasteboards are also used largely in the manufacture of certain kinds of cardboard boxes and folding cartons; also by pattern card makers, and in the hosiery and lace trades; in fact, indirectly in all trades where cardboard is a necessary item.

The manufacture of pasteboards in Great Britain runs into a huge annual tonnage, but very large quantities are imported from the Continent, especially from Germany. The industry in the United States has reached enormous dimensions, but the official census of manufactures only distinguishes that part of the industry not carried on by paper-makers, and precise dimensions cannot therefore be stated. (J. L. Gr.)

CARDENAL, PEIRE (*c.* 1205–1305), French troubadour, was born at Puy-en-Velay of good family, and unlike other troubadours seems to have received a fair education, as he was intended for the Church. The national disorders, which led him to flee from Narbonne and Toulouse to escape the armies of Simon de Montfort, are reflected in the pessimism of his work, which is also extremely anti-clerical. With little taste for amorous poetry, Cardenal became one of the foremost cultivators of the moral *sirventés*.

CÁRDENAS (*San Juan de Dios de Cárdenas*), a maritime town of Cuba, in Matanzas province, about 75m. east of Havana, on the level and somewhat marshy shore of a spacious bay of the northern coast of the island, sheltered by a long promontory. Pop. (1943 census) 37,059; *municipio* 45,280. area 124 sq.mi. It has a railway communication with the trunk system of the island, and communicates by regular steamers with all the coast towns. The city lies between the sea and hills. There are broad streets, various squares (including the Plaza de Colón, with a bronze statue of Columbus given to the city by Queen Isabella II. and erected in 1862) and substantial business buildings. Cardenas is one of the principal sugar-exporting towns of Cuba. The shallowness of the harbour necessitates lighterage and repeated loading of cargoes. The surrounding region is famed for its fertility. A large quantity of asphalt has been taken from the bed of the harbour. A flow of fresh water from the bed of the harbour is another peculiar feature; it comes presumably from the outlets of subterranean rivers. There is a large United States business element, which has been, indeed, prominent in the city ever since its foundation. At El Varadero, on a peninsula at the mouth of the bay, there is fine sea-bathing on a long beach, and El Varadero is a winter resort. Cárdenas was founded in 1828, and in 1861 already had 12,910 inhabitants. In 1850, Narciso Lopez landed there on a filibustering expedition, but could secure no support for his efforts on behalf of Cuban independence. On May 11, 1898, it was the scene of the first bloodshed in the Spanish-American war.

CARDIFF, a city, municipal, county and parliamentary borough, seaport and county town of Glamorganshire, South Wales, situated on the Taff, 1 m. above its outflow, 145¼ m. from London by the G.W.R. via Badminton, and 45½ m. E.S.E. of Swansea. A large number of branch lines once owned by different companies focus on Cardiff. These are all now run by the G.W.R. The Glamorganshire canal, opened in 1794, runs from Cardiff to Merthyr Tydfil, with a branch to Aberdare. The increase of the population of Cardiff during the 19th century was phenomenal; from 1,870 inhabitants in 1801, it grew to 32,954 in 1861, and in 1938 was estimated at 223,110. The borough, which originally comprised only the parishes of St. John's and St. Mary's, was in 1875 and 1895 extended so as to include Roath and a large part of Llandaff, known as Canton, on the right of the Taff. The whole area was united as one civil parish in 1903. Subsequent extensions of the boundaries have raised the area of the county borough to 26.2 sq.mi.

History and Historic Buildings.—In documents of the first half of the 12th century the name is variously spelt as *Kairdif*, *Cairti* and *Kardid*. The Welsh form of the name, Caerdydd, suggests that the name means "the fort of (Aulus?) Didius," rather than Caer Dâf ("the fortress on the Taff"), which is nowhere found (except in Leland), though Caer Dyv once existed as a variant. No traces have been found of any pre-Roman settlement at Cardiff. Excavations from 1889 onward showed that Cardiff had been a Roman station, and also revealed the sequence of subsequent changes. There was first, on the site occupied by the present castle, a camp of about ten acres, probably constructed after the conquest of the Silures A.D. 75–77, so as to command the passage of the Taff, which was here crossed by the *Via Maritima* running from Gloucester to St. David's. In later Roman times there were added a series of polygonal bastions, of the type found at Caerwent. To this period also belongs the massive rampart, over 10 ft. thick, and the north gateway, one of the most perfect Roman gateways in Britain. In post-Roman times the native princes of Glamorgan had their principal demesne, not at the camp but a mile to the north of Llystalybont, while Saxon invaders threw up within the camp a large moated mound on which the Normans about the beginning of the 12th century built the great shell-keep. A study of place names has revealed that the neighbourhood was in the hands of Scandinavian raiders in the 9th and 10th centuries. The builder of the Norman Castle was probably Robert, earl of Gloucester, who also built Bristol castle. Then or possibly even earlier the old rampart was for two-thirds of its circuit buried under enormous earthworks, the remainder being rebuilt. It was in the keep that Robert, duke of Normandy, was imprisoned from 1108 to 1134. Additions in Decorated and Perpendicular styles are due to the Despensers and to Beauchamp, earl of Warwick, while the present residential part ranges from the 15th–19th centuries. The original ditch, about 20 yd. wide, still exists on three sides, but it is now converted into a "feeder" for the docks and canal. The re-planning of the streets in front of the Castle (1924–26) has considerably improved this area.

Under the Norman Fitz Hamon, Cardiff became the caput of the seignory of Glamorgan, and the castle the residence of its lords. The castle and lordship descended through the families of De Clare, Despenser, Beauchamp and Neville to Richard III., on whose fall they escheated to the Crown, and were granted later, first to Jasper Tudor, and finally by Edward VI. in 1550 to Sir William Herbert, afterwards created Baron Herbert of Cardiff and earl of Pembroke. Through the daughter and granddaughter of the 7th earl the castle and estates became the property of the 1st marquess of Bute (who was created Baron Cardiff in 1776), to whose direct descendant they now belong.

The town received its earliest known grant of municipal privileges before 1147 from Fitz Hamon's successor Robert, earl of Gloucester. In 1284 the inhabitants petitioned the burgesses of Hereford for a certified copy of the customs of the latter town, and these furnished a model for the later demands of the growing community at Cardiff from its lords, while Cardiff in turn furnished the model for the Glamorgan towns such as Neath and Kenfig. In 1324 Edward II. granted a number of exemptions to Cardiff and other towns in South Wales, and this grant was confirmed by Edward III., Henry IV., Henry VI. and Edward IV. Its most important early charter was that granted in 1340 by Hugh le Despenser, whereby the burgesses acquired the right to nominate persons from whom the constable of the castle should select a bailiff and other officers; two ancient fairs, held on June 29 and Sept. 19, were confirmed, and extensive trading privileges were granted, including the right to form a merchant guild. A charter of 1421 made the constable of the castle mayor of the town but Queen Elizabeth granted a confirmatory charter to the mayor and bailiffs direct without reference to the lord of the castle. The town was treated as a borough by prescription until 1608, when James I confirmed its status, adding to its rights of self-government and granting a third fair (on Nov. 30). The first step toward the modern improvement of the town was in 1774, when a special act was obtained for the purpose. Nineteen private acts and provisional orders were obtained during the 19th century.

In 1404 Owen Glendower burned the town, except the quarters of the Friars Minors. In 1645, after the battle of Naseby, Charles I visited the town, which until then had been mainly Royalist, but about a month later was taken by the Parliamentarians. In 1648, a week after the Royalists had been decisively defeated by Colonel Horton at St. Fagan's, 4 mi. west of Cardiff, Cromwell passed through the town on his way to Pembroke. Outside the northwest angle of the castle, Richard de Clare in 1256 founded a Dominican priory, which was burned by Glendower in 1404. Though rebuilt, the building fell into decay after the dissolution. The site was excavated in 1887. Outside the northeast angle a Franciscan friary was founded in 1280 by Gilbert de Clare, which at the dissolution became the residence of a branch of the Herbert family. Its site was explored in 1896. The church of St. John the Baptist, in Perpendicular style, has a fine tower built about 1443 by Hart, who also built the towers of Wrexham and St. Stephen's, Bristol. A sculptured stone reredos by W. Goscombe John was erected in 1896. The original church of St. Mary's, at the mouth of the river, was swept away by a tidal wave in 1607.

Modern Buildings.—Probably no town in the kingdom has a finer group of public buildings than those in Cathays park. On the south side of the park are the law courts and city hall (1906) and the still unfinished Welsh National Museum. In 1905 Cardiff was selected by a privy council committee to be the site of the state-aided national museum of Wales, the corporation offering the site in Cathays park. A charter providing for its government was granted in 1907. The museum has absorbed the municipal museum and art gallery previously in the library building. There are also collections of archaeological finds, metalwork and Welsh domestic appliances, as well as specimens of the Welsh flora and fauna. On the west side of the park, from south to north are the University of Wales registry (1903), the Glamorgan County hall (1911) and the Cardiff Technical college (1916). On the east side is the University College of South Wales and Monmouthshire (1909). The college was founded in 1883 and carried on work for some time in temporary buildings pending the erection of the present ones. Since 1893 the college has been one of the constituent colleges of the University of Wales. It has faculties of arts, science, music and medicine, the latter possessing fine well-equipped buildings in Newport road. Aberdare hall is a hostel for the women students. Newer buildings in the park are the offices of the Welsh Board of Health (1938) and the Temple of Peace, to accommodate the Welsh Council of the League of Nations union. The business buildings have developed fast and streets have been widened. The Taff is spanned by two important bridges, one a four-arched bridge, rebuilt in 1858–59, leading to Llandaff and the other a cantilever with a central swinging span of 190 feet. The modern churches include St. Luke, Canton (1911), St. Joseph, Cathays (1913) and St. Samson (1923). In 1912 the parish of St. Stephen was formed, in 1920 that of Upper Grangetown and in 1923 that of St. David. The Baptist Theological college of Pontypool was removed to Cardiff in 1895. Although Cardiff had suffered 30 air raids by the end of 1941, there were remarkably few hits on important targets, most of the damage being to house property near the docks. The city owns over 700 ac. of parks and "open spaces," including 200 ac. at The Heath, Roath park with a lake and botanical garden, Llandaff fields and Cathays park (60 ac.), while Plymouth Great wood (42 ac.), presented to the city by the earl of Plymouth, was opened in 1923. The municipal airport was extended in 1939.

Commerce and Industries.—Edward II's charter of 1324 indicates that Cardiff had become even then a trading and shipping centre of some importance. It enjoyed a brief existence as a staple town from 1327 to 1332. During the reigns of Elizabeth and James I it was notorious as a resort of pirates. It was for centuries a "head port," its limits extending from Chepstow to Llanelly; in the 18th century it sank to the position of "a creek" of the port of Bristol, but about 1840 it was made independent, its limits for customs purposes being defined as from the Rhymney estuary to Nash point, so that technically the "port of Cardiff" includes Barry and Penarth as well as Cardiff proper. Down to the end of the 18th century there was only a primitive quay on the riverside for shipping purposes. Coal was brought down from the hills on the backs of mules, and iron carried in two-ton wagons. In 1798 the first dock (12 ac. in extent) was constructed at the terminus of the Glamorgan canal from Merthyr. When east Glamorgan became more interested in coal exporting (after about 1850), Cardiff developed greatly. Railways from all directions focused there, the slope from the high-lying coal fields facilitating transport of the heavily-laden trains and of the returning empty wagons. With the demand for south Wales steam coal (1850–1914), Cardiff became the greatest coal exporting port in the world.

The influence of the 2nd marquess of Bute cannot be overestimated. He risked his entire fortune in the promotion of a docks scheme. In 1830 he obtained the first act for the construction of a dock which (now known as the Bute West dock) was opened in 1839 and measures (with its basin) 20½ ac. The opening of the Taff Vale railway in 1840 and of the South Wales railway to Cardiff in 1850 necessitated further accommodation, and the trustees of the marquess (who died in 1848) began in 1851 and opened in 1855 the Bute East dock and basin measuring 40½ ac. The Rhymney railway to Cardiff was completed in 1858 and the trade of the port so vastly increased that the shipment of coal and coke went up from 4,562 tons in 1830 to 1,796,000 tons in 1860. In 1864 the Bute trustees unsuccessfully sought powers for constructing three additional docks, but under the more limited powers granted in 1866, the Roath basin (13 ac.) was opened in 1874, and (under a substituted act of 1882) the Roath dock (33 ac.) was opened in 1887. These docks fell far short of the requirements of the district, for in 1865 the Taff Vale Railway company opened a dock of 26 ac. under the headland at Penarth, while in 1884 a group of colliery owners, dissatisfied with their treatment at Cardiff, obtained powers to construct docks at Barry. The Bute trustees in 1885 acquired the Glamorgan canal and its dock, and in the next year obtained an act for vesting their various docks and the canal in the Cardiff Railway company. The Alexandra dock of 52 ac., authorized in 1894, was opened in 1907, bringing the whole dock area of Cardiff to about 210 ac. Timber floats occupy about 22 ac. There are some 7 mi. of quays. The landing of foreign cattle is permitted by the board of trade, and there are cattle lairs and abattoirs near the Cardiff wharf. The period following World War I saw a great disruption of Cardiff's export trade. The docks passed to the management of the G.W.R. in 1922.

The east moors, stretching toward the outlet of the Rhymney river, became an important metallurgical quarter when the local ores of the coal field were replaced by those imported mostly from Spain. The smelting works consequently migrated to the coastal regions. The influx of population connected with the coal trade brought with it a large Irish element giving Cardiff a considerable Roman Catholic population and when Wales was made a separate Roman Catholic province in 1916, it became the seat of the archbishop. Copper works were established in 1866, followed long after by tin-stamping and enamel works. In 1888 the Dowlais Iron Co. (now Messrs. Guest Keen Baldwins Iron and Steel Co., Ltd.) acquired some 90 ac. for iron works. There are also in the city large grain mills and breweries, a biscuit factory, wire and hemp roperies, fuel works, general foundries and engineering works.

Administrative.—In virtue of its being the shire town, Cardiff acquired in 1535 the right to send one representative to parliament, which it did until 1832, from which date Cowbridge and

Llantrisant have been joined with it as contributory boroughs returning one member. Following subsequent changes in representation consequent upon the growth of the city, the 1918 act allocated three members to Cardiff. The great sessions for the county were during their whole existence from 1542 to 1830 held at Cardiff, but the assizes (which replaced them) have since then been held at Swansea and Cardiff alternately, as also are the quarter sessions for Glamorgan. The borough has a separate commission of the peace, having a stipendiary magistrate since 1858. It was granted a separate court of quarter sessions in 1890, it was constituted a county borough in 1888, and, by letters patent dated Oct. 28, 1905, it was created a city and the dignity of lord mayor conferred on its chief magistrate. Under powers secured in 1884, the town obtains its chief water supply from a gathering ground near the sources of the Taff on the old red sandstone beyond the northern out-crop of the mineral basin and on the southern slopes of the Brecknock Beacons. Here two reservoirs of a combined capacity of 668,000,000 gal. were constructed. In 1911 another reservoir was begun in the Taff Fawr valley and opened after World War I. A gas company first incorporated in 1837 supplies the city, while the corporation supplies electric power. In 1925–27 a central electrical power station was constructed at Treforest.

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CARDIGAN, JAMES THOMAS BRUDENELL, 7TH EARL OF (1797–1868), English soldier, born at Hambleden, Bucks, Oct. 16, 1797. He entered the army in 1824, and as lieutenant-colonel, first in the 15th Hussars (1832–34), and later in the 11th Hussars, made himself unpopular. Within two years he held 105 courts-martial, and made more than 700 arrests. He succeeded to the peerage in 1837. In 1840 he fought a duel with a former officer, Capt. Tuckett, and in 1841 was tried before the house of lords on a charge of shooting his adversary, but was acquitted. In 1854, at the outbreak of the Crimean War, he was appointed to command the light cavalry brigade, and in the charge of the light brigade at Balaclava, he was the first man to reach the Russian lines. He was created K.C.B. in 1855, and was appointed inspector-general of cavalry, and lieutenant-general in 1861. He died, without heirs, March 28, 1868, and the family titles passed to the 2nd marquess of Ailesbury.

CARDIGAN (Aberteifi), municipal borough, Cardiganshire, Wales, on the right bank of the Teifi about 3 mi. above its mouth. Pop. (est. 1938) 3,202. Area 7.1 sq.mi. It is connected by an ancient stone bridge with Bridgend on the southern or Pembroke bank of the river. The castle was originally built by Gruffydd ap Rhys on an old site and was rebuilt by the Normans. It changed hands frequently during the middle ages. During the later part of the 12th century it became the residence of Rhys ap Gruffydd a powerful Welsh chieftain who ruled over most of south Wales. The castle was finally destroyed by the parliamentarians in 1645. The priory church of St. Mary has been much altered, but in its east window there are remains of ancient glass. About a mile below Cardigan are the ruins of St. Dogmael's abbey, founded in the 12th century by Martin of Tours for the Benedictine order of St. Bernard of Tiron. Henry VIII's charter of 1542 confirmed earlier privileges granted by Edward I and other kings, and provided for the government of the town by a mayor, two bailiffs and a coroner. The 18th and early 19th centuries saw Cardigan a busy river port with an extensive coastal trade, but the advent of steamships together with silting up of the Teifi mouth brought the trade of the town almost to extinction.

CARDIGANSHIRE, a county of South Wales (Ceredigion, Sir Aberteifi), bounded north by Merioneth, east by Montgomery, Radnor and Brecon, south by Carmarthen and Pembroke, and west by Cardigan Bay and the Irish Sea. With an area of 692.5 sq.mi. it ranks fifth in size of the Welsh counties. Cardiganshire may be divided physically into a coastal plateau on the west and a high plateau to the east. The latter is bordered by a rather sharp westward slope and shows finger like projections above the coastal plateau. The high plateau culminates in Plynlymon (2,468 ft.) composed mainly of a set of grits and shales of Bala (Ordovician age). Most of the high plateau is above the 800 ft. contour; it is a sheep rearing region of sparse population and poor communications with much boulder clay as surface soil. The valleys of the coastal plateau are composed in the east of flags and soft shales of the Valentian series (Lower Silurian system) and in the western section by the Tarannon series, gritty strata of considerable thickness. The latter (the Aberystwyth grits) occur in two belts, one along the coast from Borth to Llangranog and the other forming a band following the high plateau from near Cwmystwyth southwards along the east side of the Teifi valley. The coastal plateau is lower and thus able to support a larger population mainly dependent on stock raising. A zone of geological faults cuts through both plateaux. East-north-east to west-south-west and parts of this fault system are occupied by the Ystwyth and Wyre rivers. South of the Wyre for some distance the coastline is lower and more approachable but the coastal plateau again reaches to the sea cliffs south of New Quay. Behind the approachable coast between the Wyre and the Aeron is the moorland of Mynydd Bach and beyond this again the swampy central section of the Upper Teifi with the southward continuation of the Plynlymon moorland in the background. The principal rivers pursue for a greater part of their length a course nearly parallel to the coast and the main watershed and then turn often abruptly west and north-west to the sea. The Upper Aeron, upper Rheidol and the Teifi exhibit this feature very clearly. The westward section of the Teifi from Lampeter to Cardigan forms the southern boundary of the county. In the north-eastern section of the county in an area about 20 miles long and four miles wide extending in a south-south-easterly direction from the Dovey estuary to Cwmystwyth is a metalliferous area of great importance historically. Lead, silver and zinc have been mined here for many centuries and in large quantities. Mining is now discontinued. The entire county shows evidence of heavy glaciation. The valleys are mostly U-shaped especially those with a westerly trend (*e.g.*, Clarach valley). The high plateau has many examples of "cirques" while boulder clay occupies many of the lower valley slopes and much of the coast of Cardigan bay. The great Tregaron bog is thought to represent a former lake behind a boulder clay dam while Borth bog seems the result of a hindering of moor drainage owing to the building up of a storm beach by the sea from the remains of a former boulder clay plain no doubt a part of the legendary Cantref y Gwaelod. The large amount of boulder clay accounts largely for the fact that the sea penetrates inland along the valleys as in south Pembrokeshire or Cornwal or Devon. The drift in Cardigan bay together with the post glacial subsidence accounts for those peculiar features the "Sarns" (causeway) such as Sarn Cynfelin, Sarn Baurig and others, which figure in the legendary lore of the county as the remains of the "Cantref y Gwaelod" (the lowland hundred) seems to have become submerged through the drunken negligence of Seithenyn, its prince, who omitted one night to close the sluices of the sea dykes with disastrous results. As in other regions of western Britain the earliest remains of man are found on the high ground, hence the high ground of north and south Cardiganshire is dotted with tumuli and cairns. The finds of the bronze age are not very numerous but include a number of stone battle axes and are all on the western side of the county, marking possible trackways from the interior as well as ways in on the west from Ireland. One of the most conspicuous features of north Cardiganshire is the large number of hill-top camps supposedly of Romano-British age. They seem to be associated with the metalliferous veins in the north and guard important landing places on the coast, *e.g.*, at Pendinas, Aberystwyth and at Llanrhystyd. There are traces in the eastern part of the county of a Roman trackway known in Welsh as Sarn Helen which seems to have run via Llanio through the hills to Carmarthen. The post-Roman centuries were marked by numerous raids, especially from Ireland upon the open coast. The raiders were perhaps attracted by the mineral wealth of the area. It is interesting to note that the place-name "Gwyddel" (Irish) occurs frequently in the region behind the section of open coast. The raiding was long continued and the raiders later included Scandinavian elements from their settlement at Dublin. Counteracting, as it were, this movement of destruction was the civilizing and Christianizing influence of the Celtic Saint movement which seems to have been a special feature of this county. Llanddewi Brefi, a village in the centre of the county, is said to have been headquarters of St. David, the patron saint; while St. Padarn founded Llanbadarn Fawr (1 mi. E. of Aberystwyth) which in the 8th century became merged in the see of St. David's. A memorial of these days is the church of Ysbytty Cynfyn (14 mi. E. of Aberystwyth) for in its churchyard walls are included megalithic stones which once formed part of a stone circle. This illustrates the continuity of tradition which is an important feature of the far west. In post-Roman days the whole basin of the Teifi is said to have fallen to the power of Ceredig, son of Cunedda Wledig of north Wales and from Ceredig's name has been derived that of the present county. Norman penetration of hilly Cardiganshire was slow. The county was granted, it is said in 1111, to Gilbert Fitz Richard of Clare, and its history during the 12th and 13th centuries is one of a long series of skirmishes between the Normans, who sought to keep open the valley lines of communication, and the Welsh herdsmen among the hills. The county was so unsettled in this respect that in the early 15th century Owen Glendower actually held a court in Aberystwyth castle. The Cistercian abbey of St. Mary at Strata-Florida (*q.v.*), founded by Rhys ap Griffith in 1164, continued to be prosperous and influential during the periods of Welsh independence. By the Statutes of Rhuddlan (1284), Edward I constituted Ceredigion out of the former principality of Wales, a shire on the English model, dividing the new county into six hundreds and fixing the assizes at Carmarthen. By the Act of Union in the reign of Henry VIII, the boundaries of the county were subsequently enlarged to their present size by the addition of certain outlying portions of the Marches around Tregaron and Cardigan and the assizes were assigned to the county town. Under Henry VIII the county was first empowered to send a representative to parliament and under Mary the same privilege was extended to the boroughs. During the Civil War the castles of Cardigan and Aberystwyth were held for Charles and reduced to ruins by the Cromwellian forces. The county became in the 18th century the centre of the Methodist movement, which seems to have had its greatest influence among the shepherds and cattle herders of the moorlands. Daniel Rowlands (1713–1790), the curate of Llangeitho, a village almost in the centre of the county, became one of the chief leaders in this important movement. The 17th and 18th centuries saw the coastal towns and villages especially Cardigan, Llangranog, Tresaith, Aberporth, New Quay, Aberayron, Aberystwyth and Borth enjoy a brisk coastal trade chiefly with Bristol. Owing to the bad landward communications of the county almost all imported material came by sea in those days. This trade was supplemented by fishing. After the fall in the importance of coastal trade—the above areas, especially New Quay, seem to have maintained seafaring skill and many of the young men leave these areas for Liverpool, Fleetwood, etc., and hold important posts in present day shipping concerns. Fishing on a small scale continues while these towns and villages have become summer resorts for the midlands and south Wales. The export trade as well as the general prosperity of the northern half of the county was much increased between 1830–80 by the extensive mining of lead previously referred to. The mines were worked intermittently for centuries, possibly from prehistoric days, but they reached their last maximum about 1870 when owing to difficulties of railway transport, obsolete machinery and the importation of foreign ores, the industry dwindled and has now almost passed away. Many families migrated to south Wales and others turned to a reliance on the scanty pastoral resources of the bleak moorlands. The unsettled state of agriculture during the middle of the 19th century produced in Cardiganshire great activity among the Rebecca rioters (1842–43) as well as political agitation against the payment of tithes and general evictions (1864). The great movements of the industrial revolution affected Cardiganshire adversely. It ultimately destroyed local industries and seafaring activity and caused Cardiganshire's greatest export henceforth to be men and not goods. Many families left the county to become milk vendors and drapers in the large cities, particularly London. The only industry that escaped complete extinction by the new developments was the weaving industry of the lower Teifi valley where the water is especially suitable for weaving processes. The area has much inherited skill in the trade and shows social and religious peculiarities. The county has long been celebrated for its breeding of horses and the local horse fairs are well attended by English and Welsh dealers. The changes following World War I seriously affected the industry. The ways from England into Cardiganshire being difficult has caused the county to retain the Welsh language to a greater extent than most other Welsh counties, and many social and religious customs have also been preserved

The county in virtue of its physical features is poorly served by communications, both road and rail. Aberystwyth is the terminus of the old Cambrian line (now G.W.R.) from Shrewsbury as well as of the G.W.R. branch line from Carmarthen via Lampeter and Tregaron. Secondary branch lines run from Pencader to Llandyssul and Newcastle Emlyn and from Lampeter to Aberayron. Cardigan town is reached by a G.W.R. branch line from Whitland. The area of the administrative county is 692.5 sq.mi.; pop. (est. 1938) 52,120. Wartime population movements caused an increase of 9% between Sept. 1939 and Feb. 1941. The municipal boroughs are Aberystwyth, pop. (est. 1938) 9,309, Cardigan (3,202) and Lampeter (2,114). Aberayron (1,169) and New Quay (1,076) are urban districts. Quarter sessions are held at Lampeter, and here also are held the assizes for the county, which lies in the south Wales circuit. There are nine petty sessional divisions. The county returns one member to parliament, and has no parliamentary borough. Ecclesiastically, it lies wholly in the diocese of St. David's.

CARDINAL, in the Roman Church, the title of the highest dignitaries next to the pope. The cardinals constitute the council or senate of the sovereign pontiff in the government of the church; they constitute a spiritual body called the Sacred College, act as administrators of the church during a vacancy of the Holy See and elect the new pope. Their present position is the result by a long process of evolution, of the association and co-operation with the pope of the chief clergy of Rome. The name is derived from *cardo*, hinge; it was originally of a more general application, and the word is still used adjectivally in the sense of pre-eminent or that on which everything else "hinges." As early as the end of the 5th century the term cardinal was applied at Rome to the priests permanently attached to the Roman *tituli* or parish churches immediately under the pope. It was also used until late in the middle ages for the leading clergy of the more important churches; but the title was gradually confined by usage to the Roman cardinals, until Pius V in 1567 reserved it to them exclusively.

The Sacred College.—The grouping of the cardinals into a body, the College of Cardinals, is connected, in the case at least of cardinal priests, with the ancient *presbyterium*, which existed in each church from the earliest times. The Sacred College as such was not, however, definitively constituted until the uniting of the three orders of cardinals into a single body, the body which was to elect the pope; and this only took place in the 12th century. Up till that time the elements remained distinct, and there were separate classes: the "Roman" bishops, *i.e.*, bishops of sees near Rome, presbyters of the *tituli* of Rome, and deacons of the Roman Church. Nowadays, the Sacred College is still composed of three orders: cardinal bishops, cardinal priests and cardinal deacons. But the process of evolution has not been the same in the case of all these orders.

Cardinal bishops are the bishops of suburbicarian churches, situated in the immediate neighbourhood of Rome. Very early we find them assisting the pope in his ritual functions and in dealing with important business; they formed a kind of permanent synod (*cf.* the *σύνοδος ἐνδημοῦσα* of Constantinople); and they also took the place of the pope in the ceremonies of the liturgy, except the most important ones, and especially in the service of the cathedral at Rome, the Lateran. The life of Stephen III. (768–772) in the *Liber Pontificalis* (ed. Duchesne, i. p. 478) states that he ordered solemn Mass to be said every Sunday on St. Peter's altar in the Lateran Church, *a septem Episcopis cardinalibus hebdomadariis, qui in ecclesia Salvatoris observant.* In 1058 they were called "cardinal bishops of the Lateran church" (St. Peter Damian, Ep. 1, lib. ii.). Their sees are the same to-day as they were then: Ostia, Porto, Santa Rufina (Sylva Candida), Albano, Sabina, Tusculum (Frascati) and Palestrina. From time immemorial the bishop of Ostia has had the right of wearing the "pallium" at the consecration of a pope who was not already a bishop; he is *ex officio* dean of the Sacred College, and consequently dean of the suburbicarian bishops. His see has been, since the 12th century, entitled Ostia and Velletri. The bishop of Porto is *ex officio* vice-dean of the Sacred College; his see was united by Calixtus II. to that of Santa Rufina, thus reducing the number of suburbicarian bishoprics and cardinal bishops to six; this number was confirmed by Sixtus V., and has not varied since.

The second order of cardinals is that of the cardinal priests. It represents and is a continuation of the ancient *presbyterium*; but in Rome the process of evolution was different from that in the other episcopal towns. In the latter, the division into parishes was but slowly accomplished; the bishop with the higher clergy, forming what became the chapter, were in residence at the cathedral, which was strictly the one parish church in the town. At Rome, on the contrary (and doubtless at Alexandria), certain churches, to which were attached certain districts, were at an early date entrusted to one or more priests. These churches, in which the sacraments of baptism and penance were administered, were called *tituli* (titles). According to the *Liber Pontificalis* (ed. Duchesne, i. pp. 122, 126, 164), the titles of Rome, numbering twenty-five, were already established as early as the 1st century; this seems hardly probable, but it was certainly the case in the 5th century. The priest (or the principal priest of two or more attached to the same church) serving one of these churches was the *presbyter cardinalis* of that title. Thus the Roman presbyterium did not give rise to a cathedral chapter, but to cardinal priests, each attached to his title. As the higher clergy of Rome gradually acquired a more important status, the relations between the cardinal priest and the church of which he bore the title became more and more nominal; but they have never entirely ceased. Every cardinal priest has his title, a church in Rome of which he is the spiritual head, and the name of which appears in his official signature, for instance, "Guglielmus tituli sancti Clementis sanctae romanae ecclesiae presbyter cardinalis O'Connell." When the attachment of the cardinal priest to his title had become no more than a tradition, the number of cardinal titles, which in the 11th century had reached twenty-eight, was increased according to need, and it was held an honour for a church to be made titulary. To-day the cardinal titles number fifty-three; since the number of cardinal priests never exceeds fifty, there are always a certain number of vacant titles.

Cardinal Deacons.—The third order of cardinals is that of the cardinal deacons. From an early date Christian Rome was divided into seven regions, each of which was administered (especially as regards the care of the poor) by a deacon. In course of time this division of the city disappeared, and the deacons came to be specially associated with certain "diaconal" churches, and gradually acquired a position analogous to that of the "cardinal" priests. In the 8th century Pope Adrian found sixteen diaconiae and founded two others (*Lib. Pont.* ed. Duchesne, i. p. 509); in the 12th century the cardinal deacons, who then numbered eighteen, were no longer distinguished by an ecclesiastical district, but by the name of the church connected with some diaconia (*loc. cit.* p. 364); and a cardinal deacon's connection with his diaconia eventually became merely nominal. Sixtus V. reduced the number of cardinal deacons to the present number, fourteen. A cardinal deacon does not mention his diaconia in his official signature: *e.g.* "Joannes diaconus cardinalis Mercati." In 1940 there were sixteen diaconiae listed in the *Annuario Pontificio;* two are always vacant.

Cardinals resident in Rome enjoy what is known as *ius optionis;* that is to say, when a cardinalitial office is vacant, the cardinal next in seniority can claim promotion to it; cardinal deacons can pass in this way after ten years to the order of priests.

Cardinal bishops must naturally be bishops; for cardinal priests it is enough to have received the priesthood, though many of them are actually bishops; similarly, it is enough for cardinal deacons to have received the diaconate, though most of them are priests.

The cardinal camerlengo or chamberlain (*camerarius*) is chosen by the pope from among the Sacred College and entrusted with the administration of the common property. His office is important, for during the vacancy of the Holy See he exercises all external authority, especially that connected with the Conclave.

The number of cardinals was fixed by Sixtus V. (1586) at 70: six cardinal bishops, fifty cardinal priests and fourteen cardinal deacons; but the Sacred College never reaches its full number, and there are always ten or so "vacant hats," as the saying goes. The rule laid down by Sixtus V. has not been modified since, but before his time the number of cardinals varied considerably. In 1331 John XXII. said that there were twenty cardinals; in 1378 they were reckoned at 23. Their number increased during the Great Schism because there were several rival obediences. The councils of Constance and Basel reduced the number of cardinals to 24; but in the 16th century that number was more than doubled. In 1517 Leo X., to secure a majority in the Sacred College, created 31 cardinals at once. The highest number was reached under Pius IV., when the cardinals numbered 76.

The Sacred College was originally composed, as we have seen, of members of the Roman clergy exclusively; but as early as the 11th century cases are found in which the pope summoned to its ranks persons who did not belong to the Roman church, particularly abbots, who were not even required to give up the direction of their monasteries. In the following century occur a few cases of bishops being created cardinals without having to leave their see, and of cardinals upon whom were conferred foreign bishoprics (*cf.* Thomassin, *Vetus et nova discipl.* vol. I. lib ii. cap. 114, n. 9). Most of the cardinals created by the Avignon popes were French, and in 1331 John XXII. remarks that 17 of the then existing 20 cardinals were French. The councils of Constance and Basel forbade that more than a third of the cardinals should belong to the same country. After the end of the Great Schism, the ancient customs were soon resumed; the cardinals were for the most part Italians, the non-Italian cardinals only amounting to a minority. The latter, with rare exceptions, are not resident in Rome; together with the rank of cardinal they receive a dispensation from residing *in curia*.

The reform of the College of Cardinals inaugurated by the councils of Constance and Basel, though without much immediate success, was not only concerned with the number and nationality of the cardinals; it also dealt with conditions of age, learning and other qualifications: men of the most honourable character, aged not less than thirty, were to be chosen; at least a third were to be chosen from among the graduates of the universities, persons of royal blood and princes were not to be admitted in too great numbers, and lastly, relatives of the pope were to be set aside. Moreover, in order to secure the effectiveness of these reforms, selection of the new cardinals was to be made by the votes of the members of the Sacred College given in writing. This mode of control was perhaps excessive, and the reform consequently remained ineffective. Up to the middle of the 16th century there were still instances of unfortunate and even scandalous appointments to the cardinalate of very young men, of relatives or favourites of the popes and of men whose qualifications were by no means ecclesiastical. But a real reform was at last effected by the council of Trent, and carried further by Sixtus V., whose regulations are still in force: a cardinal must, in the year of his promotion, be of the canonical age required for his reception into the order demanded by his rank, *i.e.* 22 for the diaconate, 23 for the priesthood and 30 for the episcopate, and if not already ordained he must take orders in the year of his appointment. Men of illegitimate birth are excluded, as well as near relatives of the pope (with one exception) and of the cardinals; the personal qualities to be most sought for are learning, holiness and an honourable life. All these recommendations have been, on the whole, well observed, and are so better than ever in the present day. We may add that the mendicant orders have been represented, under the regulations of Sixtus V., by at least four theologians. The cardinals' hats granted at the request of the heads of Catholic states are subject to negotiations analogous to those concerning nominations to the episcopate, though entailing no concordatory agreement, strictly speaking, on the part of the popes.

Creation.—The *creation* of cardinals (to use the official term) is in fact nowadays the function of the pope alone. It is accomplished by the publication of the persons chosen by the pope in secret consistory (*q.v.*). No other formality is essential; the provision of Eugenius IV., requiring the reception of insignia for promotion to be valid, was annulled by Pius V. in 1571. Similarly neither the consent nor the vote of the Sacred College is required. The injunctions of the councils of Constance and Basel as to the written vote of the cardinals became before very long a dead letter, but there still remains a relic of them. In the consistory, when the pope has nominated those whom he desires to raise to the purple, he puts to the cardinals present the question: "Quid vobis videtur?" The cardinals bend the head as a sign of their consent, and the pope then continues: "Itaque, auctoritate omnipotentis Dei, sanctorum Apostolorum Petri et Pauli, et Nostra, creamus et publicamus sanctae romanae Ecclesiae cardinales N. et N., etc."

The new dignitary, who has been warned of his nomination several weeks in advance by "biglietto" (note) from the office of the secretary of state, is then officially informed of it by a *ceremoniarius* of the pope; he at once waits upon the pope, to whom he is presented by one of the cardinals. The pope invests him with the rochet and red biretta, but there is no formal ceremony. The conferring of the cardinal's red hat takes place a few days later in a public consistory; while placing the hat on his head the pope pronounces the following words: "Ad laudem omnipotentis Dei et Sanctae Sedis ornamentum, accipe galerum rubrum, insigne singularis dignitatis cardinalatus, per quod designatur quod usque ad mortem et sanguinis effusionem inclusive pro exaltatione sanctae fidei, pace et quiete populi christiani, augmento et statu sacrosanctae romanae Ecclesiae, te intrepidum exhibere debeas, in nomine Patris et Filii et Spiritus Sancti." While pronouncing the last words the pope makes the sign of the cross three times over the new cardinal. The public consistory is immediately followed by a secret consistory, to accomplish the last ceremonies. The pope begins by closing the mouth of the new cardinal, as a symbol of the discretion he should observe; after this he bestows on him the cardinal's ring, assigns him a title or diaconia; and finally, after going through the formality of consulting the Sacred College, finishes with the symbolic ceremony of the opening of the mouth, signifying the right and duty of the new cardinal to express his opinion and vote in the matters which it will fall to him to consider.

When the new cardinal is resident abroad and appointed at the request of the head of his state, a member of the Noble Guard is sent on the day of the consistory to give him the cardinal's "calotte"; after a few days the red biretta is brought by a Roman prelate, and is conferred on him with great pomp by the head of the state. But the conferring of the red hat always takes place at the hands of the pope in a public consistory.

Sometimes the pope announces the creation of cardinals whose names he does not divulge, but reserves the right of publishing at a later date. These cardinals, whose names he conceals "in his breast," are for that reason called cardinals *in petto*. This practice seems to go back to Martin V., who may have used this expedient to avoid the necessity of soliciting the votes of the cardinals; but for a long time past the popes have resorted to it for quite other reasons. If the pope dies before making known the cardinals *in petto*, the promotion is void; if he publishes them, they take rank from the day of the first announcement. In March 1875 Pius IX announced the creation of several cardinals *in petto*, whose names would be given in his will. It was pointed out to him that this posthumous publication would not be a pontifical act, and ran the risk of being declared invalid; and he published the names in a subsequent consistory (Sept. 17).

The dignity of the cardinals is a participation in that of the sovereign pontiff, and as such places them above all other ecclesiastical dignitaries. This rank was first attributed to the cardinal bishops, and afterwards claimed by the rest. Their common prerogative was definitively established when they became the sole electors of the pope, at a period when the papacy, under pontiffs like Innocent III., shone with its most brilliant lustre. For example, at the council of Lyons in 1245 all the cardinals took precedence of the archbishops and bishops. It was in 1245, or perhaps the year before, that Innocent IV. granted the cardinals the privilege of wearing the red hat; the scarlet robe, which still forms their costume of ceremony, was already worn by cardinals performing the functions of legate; and the use was soon extended to all. As to their civil relations, cardinals were assimilated by the Catholic kings to the rank of princes of the blood royal. They were granted the official style of Eminence by Urban VIII (1630).

The most lofty function of the cardinals is the election of the pope (*see* CONCLAVE). But this function is necessarily intermittent, and they have many others to fulfil *sede plena*. On those rare occasions on which the pope officiates in person, they carry out, according to their respective orders, their former functions in the ritual. But they are, above all, the assistants of the pope in the administration of the Church; they fill certain permanent offices, such as those of chancellor, penitentiary, etc., or again, temporary missions, such as that of legate *a latere*; they have seats in the councils and tribunals which deal with the affairs of the Church, and the Roman congregations of cardinals (*see* CURIA ROMANA).

BIBLIOGRAPHY.—All works on canon law contain a treatise on the cardinals. *See* particularly, for the history, Thomassin, *Vetus et nova discipl.*, tom. I., lib. ii., cap. 113–115. For history and law, Phillips, *Kirchenrecht*, vol. vi.; Hinschius, *System des kathol. Kirchenrechts*, vol. i. p. 312. For the canonical aspect, Ferrari, *Prompta bibliotheca*, s.v. "Cardinales"; Bouix, *De curia romana* (Paris, 1859), pp. 5–141; Card. de Luca, *Relatio curiae romanae*, disc. 5. For details of the ceremonies and costume, Grimaldi, *Les Congrégations romaines* (Sienna, 1890), p. 99 *et seq.*; Barbier de Montault, *Le Costume et les usages ecclésiastiques* (Paris), *s.d.* For a list of the names of the cardinals, according to their titles, *see* De Mas-Latrie, *Trésor de chronologie*, col. 2219–2264; and in the chronological order of their promotion, from St. Leo IX. to Benedict XIV., *ibid.* 1177–1242; also *Annuario Pontificio* (Città del Vaticano, 1940).

CARDINAL FLOWER (*Lobelia cardinalis*), a late-flowering herbaceous perennial of the lobelia family, widely distributed in eastern North America. It grows in moist rich soil, often on muddy banks, from southern New Brunswick and Ontario westward to Colorado and south to Florida and Texas, blooming in late August or September. The plant, which attains a height of from 4 to 6 ft., bears a large cluster of very showy intensely red flowers, each about an inch long with a three-divided lower lip and a slender upright portion. This plant is one of the most handsome of North American wild flowers.

J. HORACE McFARLAND CO.

CARDINAL FLOWER (LOBELIA CARDINALIS): A NORTH AMERICAN PLANT BEARING HANDSOME CLUSTERS OF VIVID RED BLOSSOMS

CARDINALS, COLLEGE OF. The Codex of Canon Law, ordered to be codified by Pius X. and promulgated by Benedict XV. by the Bull, *Providentissima Mater*, in 1917, contains perhaps the last word to be said concerning the cardinalitial dignity and the privileges and duties attached to the office of those who wear the *ruber galerus*. The matter is there so well digested that little further compression is possible or comment necessary.

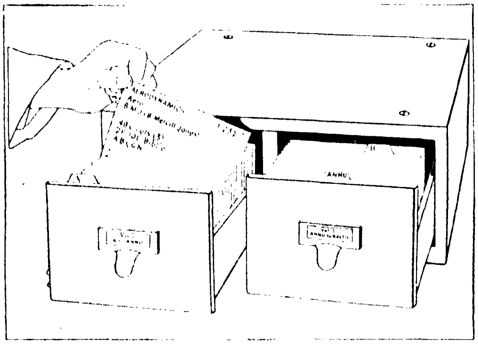
The cardinals are described as the Pope's counsellors and adjutants in the three orders of 6 cardinal bishops, 50 cardinal priests and 14 cardinal deacons. They are to be chosen freely from all countries for their doctrine, piety and prudence. The cardinal bishop first in promotion becomes dean of the Sacred College, but only as first among equals. Cardinals are required to live in Rome, unless they be bishops of dioceses other than the six suburbicarian sees; these latter are occupied by Cardinal bishops, the dean being Bishop of Ostia. Each Cardinal priest has a titular church, and each Cardinal deacon a *diaconia*, in Rome

The Code contains the Constitution of Pius X. *Vacante Sede Apostolica*, which summarizes most minutely the duties of the cardinals during the *interregnum* between one pontificate and the next. The cardinals have no power, except in matter of immediate business. The cardinals are required to meet and make the ceremonial arrangements for burying one Pope and for electing another. The ingress of the cardinals into conclave and their closure is minutely ordered. Secrecy is imposed upon all the cardinals and the conclavists under pain of excommunication. By the *Commissum nobis* Piux X. abolished the veto claimed by the Catholic powers under an unwritten law. *See* CARDINAL; CONCLAVE.

CARDINAL VIRTUES, a phrase used for the principal virtues on which conduct in general depends. Socrates and Plato (see *Republic*, iv. 427) take these to be Prudence, Courage (or Fortitude), Temperance and Justice. It is noticeable that the virtue of Benevolence, which has played so important a part in biblical ethics and in modern altruistic and sociological theories, is omitted by the ancients. Further, against the Platonic list it may be urged (1) that it is arbitrary, and (2) that the several virtues are not specifically distinct, that the basis of the division is unsound and that there is overlapping. It is said that St. Ambrose was the first to adapt the Platonic classification to Christian theology. By the Roman Catholic Church these virtues are regarded as *natural* as opposed to the *theological* virtues, Faith, Hope and Charity. Some authors, combining the two lists, have spoken of the Seven Cardinal Virtues. In English literature the phrase is found as far back as the *Cursor Mundi* (1300) and the *Ayenbite of Inwit* (1340).

BIBLIOGRAPHY.—B. Jowett, *Republic of Plato* (Eng. trans. Oxford, 1887, Introd. p. lviii.); Plato, *Protagoras* (320 330), Aristotle, *Nicomachean Ethics*, vi. 13, 6; Th. Ziegler, *Gesch. d. chr. Eth.* (2nd ed.); H. Sidgwick, *History of Ethics* (5th ed.), pp. 44, 133, 143; and *Methods of Ethics*, p. 375.

CARD INDEX. A method of filing which has the great and peculiar advantage of enabling a list of records to be kept in perfect alphabetical order even while its contents are increased or diminished.



SECTIONS OF CARD INDEX USED IN THE CONTINUOUS REVISION OF ENCYCLOPÆDIA BRITANNICA

Each name or subject is entered on a separate card, and the cards are arranged alphabetically in a suitable drawer or series of drawers. If a record becomes obsolete it is literally discarded. If a new record is needed, a fresh card is made out and placed in its proper alphabetical order. If and when the entire list grows beyond the filing cabinet's capacity, fresh drawers can be added. Thus, the untidy, unsightly and misleading character of a much amended book-list is avoided. The card system has been applied to bookkeeping. "Looseleaf ledgers" are popular.

Within wide limits, the size of the cards may be varied to suit the needs of the records required. So simple is the arrangement that no particular inventiveness is needed to give it effect, but many sorts of appliances are sold for the convenience of different businesses. The system is extensively employed in the continuous revision of ENCYCLOPÆDIA BRITANNICA.

CARDING. The process of using the "card" (Lat. *carduus*, a thistle or teasel) for combing textile fibrous materials. The practice of carding is of such great antiquity that its origin cannot be traced. It consists in combing or brushing fibres until they are straight and placed in parallel lines; in doing this, imperfect fibres are separated from perfect ones, all impurities are removed, and the sound fibres are in condition for further treatment. The teasels once used have long given place to hand cards, and these in turn to what, in the rudest form, were known as "stock cards," namely, two wire brushes, each 4in. broad by 12in. long, and having teeth bent at a uniform angle. One was nailed upon a bench with the teeth sloping from the operator, the other was similarly secured upon a two-handled bar with the teeth sloping towards the operator. The material to be treated was thinly spread upon the fixed card, and the movable one drawn by hand to and fro over it. When sufficiently carded, a rod furnished with parallel projecting needles, called a "needle stick," was pushed amongst the card teeth to strip the fibres from the comb. The strip thus procured was rolled into a sliver and spun.

James Hargreaves, the inventor of the spinning jenny, suspended the movable comb by passing two cords over pulleys fixed in the ceiling and attached balance weights to opposite ends of the cords. This enabled him to lengthen the cards, to apply two or three to the same stock and to manipulate the top one with less labour, as well as to produce more and better work. In May of 1748, Daniel Bourn, of Leominster, patented a machine in which four parallel rollers were covered with cards, and set close together. Fibres were fed to the first rotating roller, each in turn drew them from the preceding one, and a grid was employed to remove the carded material from the last roller. This introduced the principle of carding with revolving cylinders whose surfaces were clothed with cards working point to point. In December of the same year Lewis Paul, of Birmingham, the inventor of drawing rollers, patented two types of carding machines. In one, parallel rows of spaced cards were nailed upon a cylinder which was revolved by a winch handle. Beneath the cylinder a concave trough had a card fixed on the inside, so that as the fibres passed between the two series of teeth they were combed. This was the origin of "flat-carding," namely, nailing strips of stationary cards upon transverse pieces of wood and adjusting the strips or flats by screws to the cylinder. In 1762, the father of Sir Robert Peel, with the assistance of Hargreaves, erected and used a cylinder carding machine which differed in some important particulars from Bourn's invention.

But although roller-carding and flat-carding are the only principles in use at the present time, to Sir Richard Arkwright belongs the merit of introducing an automatic carding engine, for between the years 1773 and 1775 he combined the various improvements of his predecessors, entirely remodelled the machine, and added parts which made the operation continuous. So successful were these cards that some of them were in use at the beginning of the present century. Notwithstanding the numerous and important changes that have been made since Arkwright's time, carding remains essentially the same as established by him. (*See* COTTON AND THE COTTON INDUSTRY: *Cotton Machinery*.)

CARDIOID: *see* CURVES, SPECIAL.

CARDIOLOGY: *see* HEART, DISEASES OF THE.

CARDONA (perhaps the anc. *Udura*), a town of N.E. Spain in Barcelona province; 20 mi. N.W. of Mauresa, the nearest railway station. Pop. (1940) 3,661 (mun., 6,474). Cardona, built on a hill nearly surrounded by the river Cardoner, is dominated by a castle with triple 13th century walls and a fine Romanesque chapel (founded 1040). It is celebrated for extensive rock salt deposits which form a neighbouring hill 260 ft. high and 3 mi. in circumference. The salt, largely translucent, rests on sandstone and is covered by a thick layer of clay. The hill is worked like a mine; the rock is carved in Cardona into images, etc.

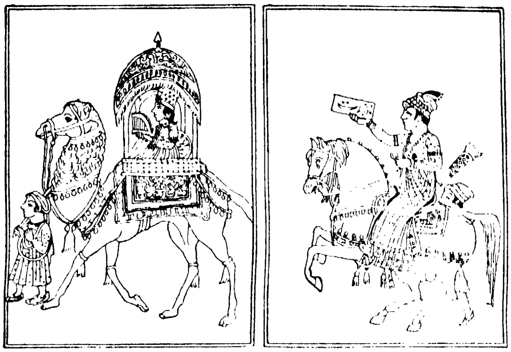
CARDOON, *Cynara Cardunculus* (family Compositae), a perennial plant from the south of Europe and Barbary, a near relation of the artichoke. The edible part, the chard (not to be confused with Swiss chard or leaf beet), is composed of the blanched and crisp stalks of the inner leaves. Besides the common and Spanish cardoons, there are the prickly-leaved Tours cardoon, the red-stemmed cardoon, and the Paris cardoon, all of superior quality, the Paris being the largest and most tender The species has been introduced into South America and has spread over great areas of the Pampas. The common artichoke is also used for the production of chard.

CARDOZO, BENJAMIN NATHAN (1870–1938), U.S. jurist, was born in New York city on May 24, 1870, and was graduated in 1889 from Columbia university, where he also received his master's degree in 1890. Although the law attracted him "with almost ecstatic consecration" he apparently hesitated at first to enter the profession. He was admitted to the bar of New York in 1891. In 1914 he became justice of the supreme court of New York, and the same year he was designated to serve as judge of the court of appeals, the state's highest tribunal. In 1917 he was elected for a full term as associate judge of that court. President Hoover appointed him associate justice of the U.S. supreme court Feb. 15, 1932. An idealist and humanitarian, Justice Cardozo described himself as a "judicial evolutionist." His decisions were widely studied, and he exerted a profound influence in liberalizing the commerce clause of the constitution and in upholding legislation of direct social implication. He died July 9, 1938, at Port Chester, New York. Among his publications were *Jurisdiction of the New York Court of Appeals* (1909); *The Nature of the Judicial Process* (1921); *The Growth of the Law* (1924); *The Paradoxes of Legal Science* (1928); and *Law and Literature and other Essays* (1931).

CARDS, PLAYING. For at least 600 years in Europe, and for many centuries more in oriental countries, playing cards have been a principal implement of gaming, conjuring and divination. They were of importance in early iconography and have been much used as an aid in education. During the 20th century they have served chiefly as equipment for casual pastimes. A survey completed in 1941 indicated that in the United States 83% of all families played card games and 87% kept playing cards in their homes. Similar familiarity with playing cards is general throughout the western hemisphere.

The history of playing cards has engaged the attention of more or less serious students since the 17th century, and there is a large literature on the subject. However, the apparent anxiety of these students to establish a definite time and place for the "invention" of playing cards persuaded most of them to credit legends unduly and construe obscure sources to suit their own conjecture; for example, the assertion that playing cards were invented in China for a concubine of the Emperor S'eun-Ho, A.D. 1120, the source adduced being a Chinese encyclopaedia of 1678. Yet T. F. Carter (*The Invention of Printing in China*, 1925) cites a reference to playing cards in China in A.D. 969. Long before that, the Chinese had paper money which Chinese cards so resembled in design that their respective times of emergence could hardly have been long separated. Originally the cards and money may have been identical, or, since in many societies gaming implements preceded money, either may with equal likelihood have engendered the other. In fact, controversy over the origin of playing cards has tended to divert opinion from the logical inference that playing cards were probably coeval, or nearly so, with the graphic arts in all countries where those arts emerged, and so could have originated among any or all the peoples—Egyptians, Arabs, Hindus, Chinese—to whom, variously, their invention has been credited.

The first use of playing cards was at least as much for divination as for gaming, and may be identified with religious rites and symbols. The passage quoted by Professor Carter is concerned solely with an augury drawn from cards. Stewart Culin, late director of the Brooklyn museum, showed that the designs of the earliest Korean cards—which, he believed, antedated the Chinese "money cards"—were derived from the divinatory use of the arrow. Hindu cards had ten suits, representing the ten incarnations of Vishnu. Through the middle ages playing cards were used in the west for fortunetelling, and this practice has continued to the present day. Mrs. Hargrave (see *Bibliography*) draws attention to the fact that a Saracen card game introduced into Italy in the 14th century was called "naib" (whence *naipes*, the Spanish word for playing cards) and that "naibi" in Hebrew means "sorcery."



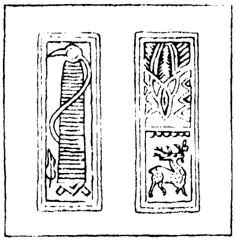
PERSIAN PLAYING CARDS OF THE 16TH CENTURY
The backs of these cards portray scenes from Persian court life

The time and place of the introduction of playing cards into Europe are no less matters of controversy than the origin of cards. That they were carried home by returning Crusaders, or were introduced into Spain or Italy by the Saracens; or were brought into eastern Europe by gypsies or by Tatars; these are some of the theories which have won support. If any of them is correct, Europe has known playing cards since the 13th century

However, supposed references to playing cards in a German manuscript *c.* 1300 and a French poem of 1328 are disputed and the earliest undisputed references are of the late 14th century and at about the same time in different countries: Germany 1377 Italy 1377, Luxembourg 1379, France 1382, Spain 1387 While this does not disprove an earlier existence of playing cards in Europe, it is argued that, for example, Dante's failure to mention them is significant, just as a similar omission by Chaucer indicates a comparatively late start for cards in England.

At least one type of playing card seems to have been indigenous to Italy: the *tarots*, or picture cards, as distinguished from the number cards of the east, which they may have antedated in Europe. There were 22 tarot cards, which by themselves were used for fortunetelling or simple games. Combined with 56 number cards they were used for a game (*tarocchi* in Italian, *tarok* in German, *tarot* in French) which is still played in northern Italy and central Europe. In this 78-card deck the tarots were called *attutti* (trumps) or *naibes*; they consisted of 21 numbered cards allegorically representative of material forces, natural elements virtues and vices, plus one unnumbered card, *il matto* (in French *le mat*), the fool—the precursor of our joker. The remainder of the deck consisted of four suits—*coppa* (chalice), *spada* (sword), *denare* (money), *batone* (baton)—resembling the four suits of Chinese cards (coins, strings, myriads, tens of myriads) Each suit had 10 cards, numbered 1 to 10, plus four "court" or "coat" cards, king, queen, knight and knave.

From these 56 cards evolved many shorter decks, including a 52-card French deck, a 32-card German deck and a 40-card Spanish deck. The French kept the king, queen knave and ten numeral cards in each of the four suits, which they called *pique* (spade), *coeur* (heart), *carreau* (diamond) and *trèfle* (club). This deck the English adopted, and through them the Americans. The German deck consists of 32 cards, each suit having three coat cards (one king and two knaves) and five number cards; the suits are *Herz* (heart), *Eichel* (club, of which the symbol is an acorn), *grün* (leaf) and *Schelle* (diamond, but the symbol is a bell). Because of the spread of national games such as whist, bridge, piquet, ecarté, and others, both the 52- and 32-card decks are used in all parts of the world



CHINESE PLAYING CARDS

The earliest European cards were elaborately hand-painted, and too costly for general use, but early in the 15th century wood engraving (*see* WOODCUTS AND WOOD-ENGRAVING) found its principal expression in the printing of playing cards, which thereupon spread to the common people with rapidity. The game of cards may have been late in reaching England, but by 1463 the English card makers petitioned for, and were awarded, a prohibition on the importation of playing cards. The wood-engraved cards were often coloured by means of stencils and dyes, a process of manufacture which remained in common use for more than 350 years thereafter.

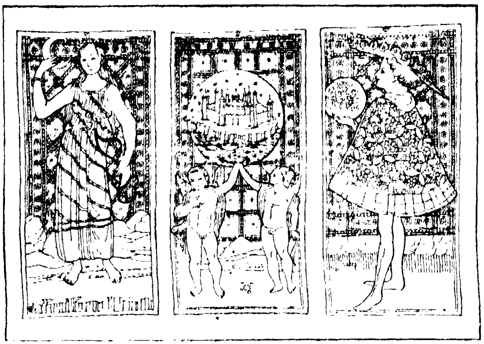
Playing cards have for centuries been made of pasteboard, for only the paste can make them properly opaque. Today they are either printed or lithographed (usually the latter) one or two packs to the sheet, each pack comprising 52 cards plus a joker and a card giving the scoring rules for contract bridge and other games. Whereas early cards were square, extremely oblong or (rarely) round, and as large as 6″ x 4″, the popular modern sizes are 3½″ x 2½″ and 3½″ x 2¼″. The cards are die-cut, with rounded corners, from the large sheet; scraped, sanded and sometimes lacquered on their edges. Every card manufacturer employs secret refinements on this process. It is estimated that from 54,000,000 to 77,000,000 packs were made and sold in the United States each year from 1941. Included were (after 1934) some quantity of cards made on cellulose acetate or nitrocellulose sheeting. Cards with Braille markings are prepared for the blind.

The evolution of playing cards has been notable but slow. Until the 20th century playing cards were much used for gambling games, and gamblers' superstitious fear of change delayed improvements. Cards depicting national heroes and current events have appeared continuously, but have succeeded only as novelties; soviet Russia's effort to replace traditional royal designs with revolutionary figures was abandoned (1928); and the figures on British and U.S. court cards are costumed as of the time of Henry VII and Henry VIII. It was not until after 1870 that "double head" cards (which may be read from either side) with indices in the corners became standard. The gambler's fear of being cheated prevented the use of decorative back designs until after 1850, for it was felt that plain white backs could not so easily be marked.

The form of playing cards has been much used for games requiring other than the usual designs and for divers purposes. Although one of the earliest manuscripts (1377) was the work of a monk who approved card playing as a harmless pastime, and through the 16th century several clerics issued playing cards bearing scriptural passages, after card playing became widespread it was looked upon with disfavour by the church. The Puritans termed playing cards "The devil's picture book," and to them and among other Protestants it was sinful even to have playing cards in the house. After 1843, especially in New England, cards similar to standard playing cards in form but not in design had been produced, and these were deemed permissible in devout homes. One of the most popular of these games, Rook, consists of four suits of consecutively numbered cards. The disappearance of faro (*q.v.*) and other card games from gambling houses, and the fact that in the United States card games are most often played without stakes, and in Great Britain for insignificant stakes or none, has influenced most churches to withdraw their objections to playing cards *per se*.

After 1508 or before, efforts were made to render education easier and more palatable by printing instructive text on the faces of playing cards. Cardinal Mazarin taught young Louis XIV his geography, history and other studies by this means. There is hardly a subject, from theology to war, which has not inspired a set of educational playing cards.

Taxes on playing cards are almost universal. In France and Spain their manufacture is a state monopoly. In England a patent to collect a duty on playing-card imports was granted (1615) by James I to Sir Richard Coningsby; the first internal tax came in 1628, when Charles I agreed to bar all imports and the manufacturers paid 2*s*. per gross packs to the crown, and 1*s* to the collector, 1 farthing per pack in all. This tax was gradually increased until in 1828 it had reached half a crown per pack. After 1765 the tax stamp had to be printed on the ace of spades, whence the tradition of the ornate design of that card. After 1828 the tax was reduced to a moderate figure, which finally became 3*d*. per pack. In the United States playing cards were first taxed in 1894, the first rate being 2 cents per pack. In 1944 it was 13 cents.



BY COURTESY OF ACCADÉMIA CARRARA

TAROT PLAYING CARDS

Collections of old playing cards may be found in many countries, among the most notable being those in the British museum and in the United States Playing Card company's card museum in Cincinnati.

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(A. H. MD.)

CARDUCCI, BARTOLOMMEO (1560–1610), Italian painter, better known as CARDUCHO, the Spanish corruption of his Italian patronymic, was born in Florence, where he studied architecture and sculpture under Ammanati, and painting under Zuccaero. He accompanied the latter to Madrid, where he painted the ceiling of the Escorial library, assisting also with the frescoes that adorn the cloisters. Most of his works are to be found in Spain; the most celebrated is a "Descent from the Cross," in the church of San Felipe el Real, in Madrid.

His younger brother VINCENZO (1568–1638), was born in Florence, and was trained as a painter by Bartolommeo, whom he followed to Madrid. He worked for Philip III and Philip IV, and his best pictures are those executed for the former monarch as decorations in the Prado. Examples of his work are preserved at Toledo and other Spanish cities. Among his pupils were Giovanni Ricci, Pedro Obregon, Vela, Francisco Collantes, and other distinguished representatives of the 17th-century Spanish school. He was also author of a treatise or dialogue, *De las Excelencias de la Pintura*, published in 1633.

CARDUCCI, GIOSUE (1835–1907), Italian poet, was born at Val-di-Castello, Tuscany, on July 27, 1835, the son of Michele Carducci, a physician who had suffered imprisonment in his youth for his share in the revolution of 1831. Carducci was educated at the University of Pisa, and began life as a public teacher. He had been appointed to a post in the municipal college at Arezzo, but the education department refused to confirm the appointment on account of his political opinions; and he then settled in Florence where he gave private lessons and edited a series of the Italian minor classics. In 1860 he became professor of Italian literature at Bologna, where he lectured for over 40 years with fruitful results for Italian criticism. At Florence he had been the centre of a group of young men bent on overthrowing the reigning romantic taste and on a return to classical models. The poems written during this period were collected under the title of *Rime* (1857), *Juvenilia* in the collected works. He showed at once his great power as a poet and the strength of his republican convictions in the hymn to Satan, *Inno a Satana* (written 1863, pr. 1865). *Levia Gravia* (1868) was a re-issue of the *Rime*, with some additions, but without the poems he had published separately in the interval. Then followed *Decennali* (1871), poems dealing with the main events of modern Italian history, and *Nuove Poesie* (1873), afterwards incorporated in *Giambi ed Epodi* (1882), and the three series of *Odi barbare* (1877–89). In these odes he renewed the efforts made by earlier Italian poets to adapt Latin prosody to Italian verse; he succeeded where his predecessors had failed. He did not attempt a mere imitation by the use of long and short syllables, but sought to reproduce the rhythm of the classical metres. He adopted classic forms because in thought and feeling he was Roman; he had a profound sense of the continuity of Italian history since the days of Rome's greatness. He was pagan at heart. "Other gods die," he wrote, "but the divinities of Greece know no setting."

BIBLIOGRAPHY.—Carducci's critical work may be studied in his *Opere* (20 vols., Bologna, 1889–1909), but he himself supervised a selection from his prose works, *Prose* (Bologna, 1905). His *Poesie* were separately printed (1902). *See* also *Lettere di Giosuè Carducci* (2 vols., 1911–14); G. L. Bickersteth, *Carducci: a selection from his poems*, with verse trans., notes, etc. (1913); G. Chiarini, *Memorie della vita di Giosuè Carducci* (Florence, 1903); B. Croce, *La letteratura della nuova Italia*, vol. ii. (1914); Orlo Williams, *Giosuè Carducci* (1914); E. Papini, *L'uomo Carducci* (1918).

CARDWELL, EDWARD (1787–1861), English theologian, was born at Blackburn in Lancashire in 1787. He was educated at Brasenose college, Oxford (B.A. 1809; M.A. 1812; B.D. 1819; D.D. 1831), and after being for several years tutor and lecturer, was appointed, in 1814, one of the examiners to the university. In 1825 he was chosen Camden professor of ancient history; and during his five years' professorship he published an edition of the *Ethics* of Aristotle (Oxford, 1828–30), and a course of his lectures on *The Coinage of the Greeks and Romans* (1833). In 1831 he succeeded Archbishop Whately as principal of St. Alban's Hall. He published in 1837 a student's edition of the Greek Testament, and an edition of the Greek and Latin texts of the *Josephus de Bello Judaico*, with illustrative notes (1837). He projected a history of the Church in England to be founded on David Wilkins's *Concilia Magnae Britanniae et Hiberniae*. Of this work he executed some portions only: *Documentary Annals of the Reformed Church of England from 1546 to 1716*, 2 vols. (Oxford, 1839); *History of Conferences, etc., connected with the Revision of the Book of Common Prayer* (1840); and *Synodalia, a Collection of Articles of Religion, Canons, and Proceedings of Convocation from 1547 to 1717* (1842). His *Reformatio Legum Ecclesiasticarum* (1850) treats of Church reform during the reigns of Henry VIII., Edward VI., and Elizabeth. Cardwell also edited Bishop Gibson's *Synodus Anglicana* (1854). He died at Oxford on May 23, 1861.

CARDWELL, EDWARD CARDWELL, VISCOUNT (1813–1886), English statesman, was the son of a merchant of Liverpool, where he was born on July 24, 1813. After a brilliant career at Oxford he entered parliament as member for Clitheroe in 1842, and in 1845 was made secretary to the Treasury. He supported Sir Robert Peel's free-trade policy and went out of office with him. In 1847 he was elected for Liverpool, but lost his seat in 1852 for having supported the repeal of the navigation laws. He soon found another constituency at Oxford, and upon the foundation of Lord Aberdeen's coalition ministry became president of the Board of Trade, although debarred by the jealousy of his Whig colleagues from a seat in the cabinet. In 1854 he carried, almost without opposition, a most important and complicated act consolidating all existing shipping laws; but in 1855 resigned, with his Peelite colleagues, upon the appointment of the Sevastopol enquiry committee, declining the offer of the chancellorship of the Exchequer pressed upon him by Lord Palmerston. In 1858 he moved the famous resolution condemnatory of Lord Ellenborough's despatch to Lord Canning on the affairs of Oude, which for a time seemed certain to overthrow the Derby government, but which ultimately dissolved into nothing. He obtained a seat in Lord Palmerston's cabinet of 1859, and, after filling the uncongenial posts of secretary for Ireland and chancellor of the duchy of Lancaster (1861), became secretary for the colonies in 1864. Here he reformed the system of colonial defence, refusing to keep troops in the colonies during time of peace unless their expense was defrayed by the colonists; he also laid the foundation of federation in Canada and, rightly or wrongly, censured Sir George Grey's (*q.v.*) conduct in New Zealand. Resigning with his friends in 1866, he again took office in 1868 as secretary for war. In this post he performed the most memorable actions of his life by the abolition of purchase and the institution of the short service system and the reserve in the army, measures which excited more opposition than any of the numerous reforms effected by the Gladstone government of that period, but which were entirely justified by their successful working afterwards. They laid the foundations, still almost unchanged, of the modern British Army. Cardwell justly ranks among the greatest military reformers since Louvois, and, like Haldane later, his achievement furnishes a proof that drastic reorganization in an army can only come from outside—the influence of a clear-sighted and militarily interested political chief. It is an ironical comment on the opposition which he met that to-day, although the Cardwell scheme of linked battalions, one at home and one on foreign service, is hampering the independent mechanization of the army at home, military opinion shrinks from modifying a scheme grown sacrosanct from long usage. On the resignation of the Gladstone ministry in 1874 he was raised to the peerage, but took no further prominent part in politics. His mental faculties, indeed, were considerably impaired during the last few years of his life, and he died at Torquay on Feb. 15, 1886. He was not a showy, hardly even a prominent politician, but effected far more than many more conspicuous men. The great administrator and the bold innovator were united in him in an exceptional degree.

CARDWELL, a town 100 mi. N. of Townsville, Queensland, Australia, on Rockingham bay. Pop. of town and district (1933) 4,416. Gold and tin are found in the neighbourhood; there are factories for preserve and sauce-making and for meat-extract and tinning production. Sugar and maize are the chief crops, and some timber is exported.

CAREW, SIR GEORGE (d. 1612), English diplomatist, second son of Sir Thomas Carew of Antony, was secretary to Sir Christopher Hatton, and was sent on an embassy to Sweden and Poland in 1598. In the reign of James he was employed in negotiating the treaty of union with Scotland, and from 1605 to 1609 he was ambassador to the court of France. On his return he wrote a *Relation of the State of France*, which remained in manuscript until 1749, when Dr. Birch appended it to his *Historical View of the Negotiations between the Courts of England, France and Brussels, from 1592 to 1617*.

CAREW, RICHARD (1555–1620), English poet and antiquary, was born on July 17 1555, at Antony House, East Antony, Cornwall. At the age of 11, he entered Christ Church, Oxford, and when only 14 was chosen to carry on an extempore debate with Sir Philip Sidney, in presence of the earls of Leicester and Warwick and other noblemen. From Oxford he removed to the Middle Temple, where he spent three years, and then went abroad. In 1580 he was appointed high-sheriff of Cornwall; he entered parliament in 1584; and he served under Sir Walter Raleigh, then lord lieutenant of Cornwall, as treasurer. He became a member of the Society of Antiquaries in 1580, and was a friend of William Camden and Sir Henry Spelman. His great work is the *Survey of Cornwall*, published in 1602, and reprinted in 1769 and 1811. It still possesses interest, apart from its antiquarian value, for the picture it gives of the life and interests of a country gentleman of the days of Elizabeth. Carew's other works are: a translation of the first five cantos of Tasso's *Gerusalemme* (1594), printed in the first instance without the author's knowledge, and entitled *Godfrey of Balloigne, or the Recouerie of Hierusalam; The Examination of Men's Wits* (1594), a translation of an Italian version of John Huarte's *Examen de Ingenios;* and *An Epistle concerning the Excellences of the English Tongue* (1605). Carew died on Nov. 6 1620.

His son, Sir RICHARD CAREW (d. 1643?) was the author of a *True and Readie Way to learn the Latine Tongue*, by writers of three nations, published by Samuel Hartlib in 1654.

CAREW, THOMAS (b. 1595), English poet, was born at West Wickham, Kent, the son of Sir Matthew Carew, master in chancery, and his wife, Alice Ingpenny, widow of Sir John Rivers, lord mayor of London. At the age of 13 he matriculated at Merton college, Oxford. He took his degree of B.A. early in 1611, and studied at the Middle Temple. Two years later he was sent to Italy as one of the ambassador Sir Dudley Carleton's household, and when the ambassador returned from Venice he seems to have kept Thomas Carew with him, for he is found in the capacity of secretary to Sir Dudley Carleton at The Hague, early in 1616. In Aug. 1618 Carew entered the service of Lord Herbert of Cherbury, in whose train he started for France in March 1619.

Carew became gentleman of the privy chamber in 1628. Probably in 1630 he was made "server" or taster-in-ordinary to the king. To this period may be attributed his close friendship with Sir John Suckling, Ben Jonson and Clarendon; the latter says that Carew was "a person of pleasant and facetious wit." Donne, whose celebrity as a court preacher lasted until his death in 1631, exercised a powerful if not entirely healthful influence over the genius of Carew. In Feb. 1633 a masque by the latter, entitled *Coelum Britanicum*, was acted in the banqueting house at Whitehall, and was printed in 1634. Carew was generally supposed to have died in 1638, but Clarendon tells us that "after 50 years of life spent with less severity and exactness than it ought to have been, he died with the greatest remorse for that licence." If Carew was more than 50 years of age he must have died in or after 1645, and in fact there were final additions made to his *Poems* in the 3rd edition of 1651.

Carew's poems, at their best, are brilliant lyrics of the purely sensuous order. They open to us, in his own phrase, "a mine of rich and pregnant fancy." His metrical style was influenced by Jonson and his imagery still more clearly by Donne, for whom he had an almost servile admiration. His intellectual power was not comparable with Donne's, but Carew had a lucidity and directness of lyrical utterance unknown to Donne. It is perhaps his greatest distinction that he was the earliest of the Cavalier song-writers by profession, of whom Rochester was the latest, poets who turned the disreputable incidents of an idle court life into poetry which was often of the rarest delicacy and the purest melody and colour. The longest and best of Carew's poems, "A Rapture," would be more widely appreciated if the rich flow of its imagination were restrained by greater reticence of taste.

The best edition of Carew's *Poems* is that prepared by Arthur Vincent in 1899.

CAREY, HENRY (d. 1743), English poet and musician, reputed to be an illegitimate son of George Savile, marquess of Halifax, was born towards the end of the 17th century. Carey studied under Olaus Linnert, Roseingrave and Geminiani. He wrote the words and music of *The Contrivances; or More Ways than One*, a farce produced at Drury Lane in 1715. His *Hanging and Marriage; or the Dead Man's Wedding* was acted at Lincoln's Inn Fields in 1722. *Chrononhotonthologos* (1734) was a successful burlesque of the bombast of the contemporary stage. The best of his other pieces were *A Wonder; or the Honest Yorkshireman* (1735), a ballad opera, and the *Dragon of Wantley* (1737), a burlesque opera, the music of which was by J. F. Lampe. Carey is best remembered by his songs. "Sally in our Alley" (printed in his *Musical Century*) was a sketch drawn after following a shoemaker's 'prentice and his sweetheart on a holiday. The present tune set to these words, however, is not the one written by Carey, but is borrowed from an earlier song, "The Country Lasse," which is printed in *The Merry Musician* (vol. iii., *c.* 1716). It has been claimed for him that he was the author of "God Save the King" (*see* NATIONAL ANTHEMS). He died in London on Oct. 4 1743. Edmund Kean, the tragedian, was one of his great-grandchildren.

CAREY, HENRY CHARLES (1793–1879), United States economist, was born in Philadelphia, Dec. 15, 1793, and died in the same city, Oct. 13, 1879. The son of Mathew Carey, an Irish immigrant who developed the foremost publishing house of his time (Carey & Lee) and expired in a welter of pamphlets and flurry of tempers, Henry Carey walked in the ways of his father but with more measured and discreet a step, becoming eventually the first United States economist of note. The eclecticism of Henry Carey, forever a wonder to the economics profession, may be traced in part to his father who wrote in his life time more than half a hundred pamphlets, expressing with vituperative skill the "harmony of interests" latent in the new world. A pious Catholic and staunch Republican, he fought the battles of the New England Federalists, all severe Protestants, for a tariff that would enhance the national power of the United States, protect its manufactures, create markets for its agriculture, and balance its economy. Like John Stuart Mill, Henry Carey learned economics at the side of his father, in peripatetic fashion.

Carey viewed nature as a grand *continuum* abounding in harmonies. Society originates in man's assault on the physical universe, which progresses as he associates with other men, and together they turn to ever more intelligent action while in the process mental power supersedes physical. With greater control over nature man's control over other men declines, and equalitarianism becomes diffused throughout society, culminating in an harmonious order of things, thus giving the lie to the dismal counsel proffered by the classical economists. Typical of United States economists, Carey rejected classical rent theory but offered a unique substitute, contending that cultivation progresses from the poor to better lands and yields increasing rather than diminishing returns. As society develops its economic resources, capital (including improved land) accumulates, reducing the rate of interest but increasing its amount. The worker's share, however, increases, for he becomes relatively more valuable. Aggregate real income rises and becomes more equally distributed. Apart from his economic harmonies, Carey is known for his advocacy of a protective tariff, which is characteristic of the United States school of economics whose founder he is often called. An admixture of Hamiltonian statecraft, German mercantilism, and the effusive optimism of the young and vigorous nation, the United States school had greatest significance in Europe where it was eagerly taken up as a foil against British *laissez faire*. (W. D. G.)

CAREY, WILLIAM (1761–1834), English oriental scholar, and pioneer of modern missionary enterprise, was born at Paulerspury, Northamptonshire, on Aug. 17, 1761. Becoming pastor of a Baptist church in Leicester in 1787 Carey helped to found the Baptist Missionary Society, and was one of the first to go to India, in 1793. At Serampore he established a church, a school and a printing-press for the publication of the Scriptures and philological works. In 1801 Carey was appointed professor of Oriental languages in a college founded at Fort William by the marquess of Wellesley. He prepared numerous philological works, consisting of grammars and dictionaries in the Mahratta, Sanskrit, Punjabi, Telinga, Bengali and Bhotanta dialects. From the Serampore press there issued in his lifetime over 200,000 Bibles and portions in nearly forty different languages and dialects, Carey himself undertaking most of the literary work. He died June 9, 1834.

See *Lives* by G. Smith (1884), and S. P. Carey (1923).

CARGILL, DONALD (1610?–1681), Scottish Covenanter, was educated at Aberdeen and St. Andrews. In 1655 he was appointed to the Barony parish in Glasgow from which he was ejected in 1662. He ventured back to celebrate the Communion, and was arrested, but soon liberated. He was wounded at Bothwell Bridge, and fled to Holland, where he remained a few months. On his return he joined Richard Cameron in publishing the Sanquhar declaration, and excommunicated the king and his officials. He was apprehended, and brought to Edinburgh, where he was beheaded on July 27, 1681.

CARGO, a ship-load, or the goods (or even, less technically, persons) carried on board a ship; and so, by analogy, a term used for any large amount. For the maritime law affecting the cargo of a ship, *see* AVERAGE; AFFREIGHTMENT; MARINE INSURANCE; SALVAGE; LIEN; for the specialities of cargo-ships *see* SHIP.

CARIA, an ancient district of Asia Minor, bounded on the north by Ionia and Lydia, on the west and south by the Aegean Sea, and on the east by Lycia and a small part of Phrygia. The coast-line consists of a succession of great promontories alternating with deep inlets. The most important inlet, the Ceramic Gulf, or Gulf of Cos, extends inland for 70 m., between the great mountain promontory terminating at Myndus on the north, and that which extends to Cnidus and the remarkable headland of Cape Krio on the south. North of this is the deep bay called in ancient times the Gulf of Iasus, and beyond this again was the deeper inlet which formerly extended inland between Miletus and Priene, but of which the outer part has been entirely filled up by the alluvial deposits of the Maeander. South of Cape Krio again is the gulf known as the Gulf of Doris, with several subordinate inlets, bounded on the south by the rugged promontory of Cynossema (mod. Cape Alupo). Between this headland and the frontier of Lycia is the sheltered bay of Marmarice, noted in modern times as one of the finest harbours of the Mediterranean.

Almost the whole of Caria is mountainous. The two great masses of Cadmus (Boz Dagh) and Salbacus (Baba Dagh) are in fact portions of the great chain of Taurus (*see* ASIA MINOR). From these lofty ranges there extends a broad tableland (in many parts more than 3,000 ft. high)

The coast is fringed by numerous islands, in some instances separated only by narrow straits from the mainland. Of these the most celebrated are Rhodes and Cos. The country known as Caria was shared between the Carians proper and the Caunians, who were a wilder people, inhabiting the district between Caria and Lycia. They were not considered to be of the same blood as the Carians, and were, therefore, excluded from the temple of the Carian Zeus at Mylasa, which was common to the Carians, Lydians and Mysians, though their language was the same as that of the Carians proper. Herodotus (i. 172) believed the Caunians to have been aborigines, the Carians having been originally called Leleges, who had been driven from the Aegean islands by the invading Greeks. This seems to have been a prevalent view among the Greek writers, for Thucydides (i. 8) states that when Delos was "purified" more than half the bodies found buried in it were those of "Carians."

A considerable number of short Carian inscriptions has been found, most of them in Egypt. They were first noticed by Lepsius at Abu-Simbel, where he correctly inferred that they were the work of the Carian mercenaries of Psammetichus. The language, so far as it has been deciphered, is "Asianic" and not Indo-European.

The excavations of W. R. Paton at Assarlik (*Journ. Hell. Studies,* 1887) and of F. Winter at Idrias have resulted in the discovery of Late-Mycenaean and Geometric pottery. Caria, however, figured but little in history. It was absorbed into the kingdom of Lydia, where Carian troops formed the bodyguard of the king. Cnidus and Halicarnassus on the coast were colonized by Dorians. At Halicarnassus (*q.v.*) the Mausoleum, the monument erected by Artemisia to her husband Mausolus, about 360 B.C., was excavated by Sir C. T. Newton in 1857–1858. Cnidus (*q.v.*) was excavated at the same time, when the "Cnidian Lion," now in the British Museum, was found crowning a tomb near the site of the old city (C. T. Newton, *History of Discoveries at Cnidus, Halicarnassus and Branchidae*).

In the Persian epoch, native dynasts established themselves in Caria and even extended their rule over the Greek cities. The last of them seems to have been Pixodarus, after whose death the crown was seized by a Persian, Orontobates, who offered a vigorous resistance to Alexander the Great. But his capital, Halicarnassus, was taken after a siege, and the principality of Caria conferred by Alexander on Ada, a princess of the native dynasty. Soon afterwards the country was incorporated into the Syrian empire and then into the kingdom of Pergamum, as part of which it passed into the Roman province of Asia.

See W. M. Ramsay, "Historical Geography of Asia Minor" (*R.G.S.* iv., 1890); W. Ruge and E. Friedrich, *Archäologische Karte von Kleinasien* (1899); Perrot and Chipiez, *History of Art in Phrygia, Lydia, Caria and Lycia* (Eng. trans., 1892); A. H. Sayce, "The Karian Language and Inscriptions" (*T.S.B.A.* ix. 1, 1887); P. Kretschmer, *Einleitung in die Geschichte der griechischen Sprache,* pp. 376–384 (1896). For the coinage *see* NUMISMATICS. (A. H. S.)

CARIBAN, one of the important linguistic stocks of South American Indians; the name is derived from the Caribs, the warlike and widely raiding Indians met first by Columbus in the Lesser Antilles and adjacent coast of Venezuela. The name Carib probably means "strangers." The Carib tribes in this region, where they were first met, were relatively recent invaders, having conquered and largely absorbed or driven out the older Arawakan (*q.v.*) inhabitants.

BY COURTESY OF THE MUSEUM OF THE UNIVERSITY OF PENNSYLVANIA

MAN-EATING CARIB INDIAN IN FULL REGALIA

Tribes of this stock held, at the time of the first European contact, most of Venezuela north of the Orinoco river, and westward to the present border of Colombia, possibly penetrating as far as the lower Magdalena. They held most of the interior of the Guianas and the region southwards to the Amazon. Scattered tribes of this stock are found as far west as the Guaques on the headwaters of the Caqueta river in Colombia, while others, such as the Apiaca and Pimenteiras were on the Tocantins and Paranhyba rivers in north-eastern Brazil. The Bakairi on the head-waters of the Xingu in Matto Grosso were the southernmost tribe, and this region of the Brazilian-Bolivian border is believed to have been the centre from which the Cariban tribes originally spread

The Cariban tribesmen were somewhat taller than the Arawakan, but like them they were prevailingly brachycephalic or round-headed. They sometimes had wavy hair. They were generally warlike, and often markedly cannibalistic, yet their general culture was on a par with that of their neighbours. In the Caribbean region they were excellent canoe-makers, and were one of the few peoples in the New World to employ sails.

See for lists of Cariban tribes, L. Adam, *Matériaux pour servir à l'etablissement d'une grammaire comparée des dialectes de la Famille Caribe* (Paris, 1893); T. Koch-Gruneberg, *Die Hianakoto-Umaua* (*Anthropos,* 1908 vol. iii., pp. 90–95).

CARIBBEAN SEA, an arm of the Atlantic ocean bounded by the islands of the West Indies on the east and north, by Venezuela, Colombia, Panama and Costa Rica on the south and by Nicaragua, Honduras, Guatemala, British Honduras and Mexico on the west. It is about 400 mi. wide at its narrowest point along the Windward isles at its easternmost boundary, about 700 mi. wide at its widest between Panama and Cuba, and approximately 1 500 mi long, with a total area of about 750,000 square miles. The Caribbean was discovered by Columbus on his first voyage, and was extensively explored by him on his subsequent journeys. On his fifth and last voyage he skirted its western shores from Honduras to Venezuela in a search for the "strait" to the China seas.

The opening of the Panama canal (*q.v.*) has converted the Caribbean sea into one of the great ship highways of the world, but for 400 years prior to this the Caribbean was the busiest route of travel, transport and battles in the western hemisphere. The Isthmus of Panama, some 50 mi. wide, early became the route for transhipment of the treasures of the Spanish colonies of the Orient and of South America, and the convoys of Spanish merchant ships became the objects of raids by pirates freebooters and buccaneers. The mainland bordering the Caribbean came to be called the "Spanish Main," and the fortified cities on its shores were the centre of Spanish colonial trade and the objects of raids by English, French and Dutch warships, privateers and pirates. An immense treasure passed across the Caribbean, for not only the estimated £1,500,000,000 of silver taken from Peru, but virtually all the traffic from (and to) Buenos Aires was carried overland across the Andes to Lima and by ships up the Pacific coast to Panama, there transhipped and thence by convoys of galleons to Spain. In later years the trade of the Caribbean colonies of Spain drifted into the hands of the English, and beginning with the capture of the island of Jamaica (*q.v.*) in 1655 (in the course of a raid ordered by Oliver Cromwell against the Spanish colony on the island of Santo Domingo), British outposts began to appear on the islands and mainland.

The strategic importance of the Caribbean region has been increasingly emphasized since the opening of the Panama canal. From its earliest history, however, it has been in the balance of diplomatic and commercial struggle, although seldom itself the prize or object of wars. During the slavery era, the islands produced an immense wealth of sugar and other plantation products, and during the earlier struggles for Canada, the French deliberately chose to hold their West Indian islands and to leave the bleak wastes of Canada to the British. Cuba (*q.v.*) has been the object of intrigue and controversy from the first sign of the weakening of Spain's hold upon her colonies of the New World, but was left to be the very last foothold of Spain. France, England and the United States all frankly sought occasions to annex the "gem of Antilles." Cuba's independence in the end was directly due to the fact that in the declaration of war against Spain on April 19, 1898, the United States Congress expressly stated that it would under no circumstances take over the sovereignty of Cuba, a pledge carried out to the letter, in spite of a two years' intervention early in the republican life of Cuba

The British control of the Caribbean was from the first due largely to naval strength and commercial pre-eminence. By the end of the 16th century English ships were the predominating merchantmen between all Europe and the West Indies and the Spanish Main, and following the capture of Jamaica in 1655, there began the establishment of British colonies on certain islands and on three well-defined regions on the mainland, Belize (*q.v*), the Mosquito coast of Nicaragua, and in what is now British Guiana (*q.v.*). The break-up of the Spanish empire at the beginning of the 19th century, and the abolition of slavery in the half century that followed, left the Caribbean islands relatively insignificant for a time, as commercial units, but their strategic importance remained Indeed, Great Britain, from the very beginning of her political control in the region, was obviously conscious of the importance of this factor, even in the years when the commercial side was apparently overwhelming. The possession of Jamaica, Trinidad and other islands gave Great Britain a predominant position in the Caribbean sea, and during the years of Spanish decadence, no rival at all held any other strategic position there.

In 1849, the discovery of gold in California, newly acquired by the United States as a result of the Mexican War, created a demand for short and comfortable transport from the Atlantic seaboard to the Pacific As a substitute for the long trek across the plains, fast packets on the Atlantic and others on the Pacific began to offer comfortable journeys, with land transport facilities across the Isthmus of Panama and also across Nicaragua, via the San Juan river and Lake Nicaragua and with only short land journeys around the rapids in the river and across the 12 miles from Lake Nicaragua to the Pacific. Thither was drawn commercial attention in the United States. Talk of an isthmian canal became more active than at any time in the previous 400 years, and the position of Great Britain in the Caribbean became a subject of American observation and negotiation. In the Clayton-Bulwer Treaty, signed in Washington on April 19, 1850, by John M Clayton, secretary of State of the United States and Sir Henry Bulwer, H M minister in Washington, the British holdings in Belize were not discussed, but the treaty as signed and ratified provided (as finally interpreted) that the British withdraw the Mosquito protectorate, and that the United States and Great Britain agree, as a principle, that neither would obtain or maintain any exclusive control over any ship canal to be built through the isthmus.

The construction of the canal proved impossible on these terms, owing to public opinion in the United States on the matter, and this treaty was finally replaced by the Hay-Pauncefote Treaty of Nov. 18, 1901, signed by John Hay, secretary of State of the United States, and Lord Pauncefote, H.M. special ambassador in Washington. It was there provided that the United States should build and fortify the canal, but should make no discrimination as to tolls and facilities in favour of American ships as against British ships. The canal was finally completed in 1914 and opened to traffic in 1920.

COAST LINE FRINGED WITH TROPICAL PALMS, CHARACTERISTIC OF THE ISLANDS OF THE CARIBBEAN SEA

The possession and fortification of the Panama canal has, as a much-quoted phrase expresses it, extended the southern border of the United States to the canal. In addition, the Spanish-American War, while it left Cuba a free and independent country, reserved, under the Platt amendment, the right of supervision over foreign treaties and alliances made by Cuba, and gave to the United States naval bases at Bahia Honda on the northern and Guantanamo bay on the southern coast of the island. By these provisions, the United States stepped into strategic control of Cuba, the true "key" position of the whole Caribbean area. At the same time, the acquisition of Porto Rico placed the United States in the second most important strategic spot in the Caribbean, a position consolidated completely with the purchase of the Danish West Indies or Virgin islands (*q.v.*) in 1916, as St. Thomas, the largest of these islands, holds the key position on the Anegada passage, the shortest route from Europe to the Panama canal.

The strategy of the Caribbean sea is linked with that of the Gulf of Mexico, and the comparison with the Mediterranean sea is instinctive The Mediterranean, however, is controlled by Gibraltar, the Bosporus and Suez, and the Caribbean has but one position comparable to any of these—the Panama canal as compared with that of Suez. On the other hand in place of the single strategic entry of the Strait of Gibraltar, there are a hundred possible entries into the Caribbean and the Gulf of Mexico, half a dozen of them of prime importance Commencing with the Straits of Florida (with the Yucatan channel completing the access to the Caribbean) there are, in addition, the Windward passage around the eastern point of Cuba, the Mona passage between Haiti and Porto Rico, the Anegada passage eastward of St. Thomas, the routes between Martinique and Santa Lucia, and that north of Trinidad. Between all the Windward isles, indeed, passage is easy though unimportant

The strategic importance of the Caribbean positions is due however, primarily to the fact that the control of the northern passages must be held by the United States to ensure access to the canal and defence of her coast-line around the Gulf of Mexico. With the chief positions on Cuba and Porto Rico in the hands of the United States, the question of strategy virtually disappears, but their loss in case of war would quickly change the whole strategic problem. With Cuba allied in war so closely as it is with the United States, the Straits of Florida become virtually an inland means of communication, and the resources of the continent stand behind the naval base at Guantanamo bay on the southern side of Cuba. Thus Guantanamo bay takes precedence as a military position over Jamaica, because it is based on a continent instead of on an island, yet before Spain lost Cuba, the possession of Jamaica by Great Britain, a great naval power, made any ports and naval bases that the British might build and supply on the island of Jamaica of vastly greater military importance than anything Spain, a weak power, might build in Cuba.

In recent years, two little Dutch islands, Curaçao and Aruba, off the coast of Venezuela, have acquired a new naval importance that greatly increases the strategic value of the British positions on Trinidad and in British Guiana: this is due to the location of great storage of oil from Venezuela in the refineries of important British, Dutch and American companies on these two Dutch islands. The United States has no actual or potential base on the islands or mainland of northern South America so that the strategic importance of Curaçao and of the port of Cartagena in Colombia are enhanced both for this reason and for their supply of oil, Cartagena now having oil coming via a 700m. pipe-line from the interior to loading stations close to the Colombian sea-coast. These two positions were, moreover, of considerable importance since earliest times, the one, Cartagena, as a Spanish fortified city with an excellent harbour for the small Spanish merchantships and warships, and Curaçao as one of the few literally perfect harbours of the world, and the rendezvous of the pirates and buccaneers of the early colonial period.

The Panama canal is of course the dominating strategic spot of the entire Caribbean region. The possession of this outstanding position by the United States has thus been the result of the developments following the Spanish-American War of 1898, prior to which time the only important base in the entire region that was in the hands of the United States was Key West. The British domination of the Caribbean was shared at once with the United States on the conclusion of the Spanish-American War and its terms of peace, and relinquished to her on her acquisition of the Canal Zone and the construction of the canal and its defences. The importance of the Hay-Pauncefote Treaty must not be overlooked in this connection, however, as without that voluntary cession of her right to build the canal in conjunction with the United States, Great Britain might still be in strategic control of many of the key positions of the Caribbean.

The United States had, however, been gradually growing in a consciousness of the importance of the Caribbean region to her national safety. The development of routes to the Pacific coast after 1840, mentioned above, was the first of many steps. That was followed by the effort to limit British possessions on the islands and the littoral of the Caribbean in 1850, and was manifested almost violently in the controversy with Great Britain over the arbitration of the boundary between British Guiana and Venezuela in 1896. In the years since the Hay-Pauncefote Treaty, the so-called "doctrine of the paramount interest" of the United States in the region of the Caribbean has become one of the most vigorous offsprings of the Monroe Doctrine (*q.v.*).

The dominating position of the United States in the Caribbean region has been accepted there with relatively little protest, although it was challenged by Mexico in 1927, when the Government of President Calles gave moral and financial support to the movement of the Liberal revolutionists in Nicaragua (*q.v.*).

The policy of paramount interest in the Caribbean has resulted from time to time in direct intervention by American official elements in the life of the islands and smaller continental republics. The financial and military interventions in Santo Domingo (*q.v.*) in 1907 and 1911 and in Haiti (*q.v.*) in 1915, all of which were undertaken on the ground that had the United States failed to act European Governments might have sought to do so, are the outstanding examples. The two interventions in Nicaragua, 1912–25 and in 1927, the landing of marines in Honduras in 1924, and the purchase of the Danish West Indies (Virgin islands [*q.v.*]) in 1917 are among the other examples. The incidents surrounding the separation of Panama (*q.v.*) from Colombia, including the settlement of the Colombian claims for damages for the revolution by the payment of $25,000,000 by vote of the United States Congress in 1921, furnish additional indications of this policy. The statements made at that time by President Roosevelt furnish the text for much of the trenchant literature on the subject of American predominance in the Caribbean

The value of the holdings of any nation in the Caribbean region has been so greatly enhanced by the building of the Panama canal that the questions of strategy and paramount interest are in no sense the sole determinants of desirability. The growth of the traffic through the Panama Canal began, before 1927 (when the Nicaraguan difficulties caused new official enunciations of it) to bring forward the question of the possible building of a second canal, through Nicaragua, to which the United States holds option by treaty. In his Minneapolis address, Charles Hughes, while secretary of State, declared:

"So far as the region of the Caribbean sea is concerned, if there were no Monroe Doctrine, one would have to be created for it. . . . By building the Panama canal we have not only established a new and convenient highway of commerce, but we have created new exigencies and new conditions of strategy and defence. It is for us to protect that highway. It may also be necessary for us at some time to build another canal between the Atlantic and Pacific oceans and to protect that."

In general, the policy of the United States toward the countries of the Caribbean (chiefly manifested in the smaller and more turbulent republics of the islands and of Central America) has been to encourage their development into good neighbours for the canal, to assist them in economic and financial matters, and where trouble threatens, to forestall this well in advance of its becoming a crisis. Landings of American marines have invariably been in relatively small numbers, and on the ground of protection of American lives and property, the only ground on which the President of the United States as commander-in-chief of the army and navy can use the armed forces abroad without specific authorization of Congress. The officers and crews of the so called "special service" squadron of a dozen small cruisers and gunboats based at the Panama canal make periodic friendly visits to the ports and capitals of the Central American and Caribbean countries, and the admiral of the United States fleet appears similarly at times in these capitals, while fully accredited ministers are posted in every country, whereas other World Powers maintain only legations accredited to two or more of the countries. These ministers, appealed to in time of crisis, aid in solving problems brought to their attention and furnish or invite professional aid from the United States in more complicated difficulties.

The system has been declared to be paternalistic, but the standing of the United States officials is always maintained in the most rigorous etiquette, and the position of decision and the immense power wielded by these representatives of Washington are entirely the gift of the countries themselves, although it should be added that the situation is not frowned upon by the Department of State. The whole state of balance in the Caribbean, with military position, naval strength and political "paramount interest" in the hands of the United States, furnishes not only a definite protection to the United States and her sister republics in the region, but renders the Panama canal safe from surprise and largely so from any real danger to its communications in time of war. The strategic as well as the commercial importance of a second canal, and the political value of such a construction in Nicaragua, unite in making this development, with its vast increase in the importance of all the elements considered, a not unlikely extension of the future history of the Caribbean region.

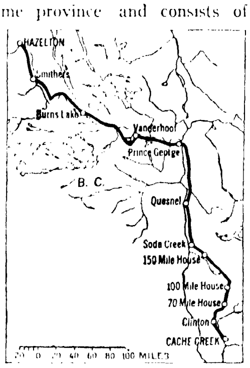
BIBLIOGRAPHY.—Alfred T. Mahan, *The Interest of America in Sea-power* (1906); Stephen Bonsal, *The American Mediterranean* (1912). *Cf.* also, Charles Evans Hughes, "Observations on the Monroe Doctrine," an address before the American Bar Association, August 30, 1923; and Wallace Thompson, "The Origins of the Doctrine of the Paramount Interest of the United States in the Region of the Caribbean Sea," an address before the Academy of Political and Social

Science, Philadelphia, reprinted in the *Annals* of the Academy, July, 1927. *See* also Theodore Roosevelt, *Fear God and Take Your Own Part*. The subject has not been developed, and source material remains to be studied in *Foreign Relations of the United States* at periods of crises and in the unpublished files of the Department of State in Washington. A summary of some of the diplomatic developments is contained in John Bassett Moore, *Digest of International Law* (1906). A large literature of newspaper and magazine articles and pamphlets has sprung up in the course of discussions of the activities of the United States in Central America, some of which are mentioned in the bibliographies under the articles Central America, Monroe Doctrine and Panama Canal. (W. Tho.)

CARIBBEE ISLANDS, a name chiefly of historical importance, sometimes applied to the whole of the West Indies, but strictly comprehending only the chain of islands stretching from Puerto Rico to the coast of South America. These are also known as the Lesser Antilles, and the bulk of them are divided into the two groups of the Leeward and Windward islands. *See* Caribbean Sea.

CARIBOU, the name of the North American reindeer. There are two species, the larger "woodland caribou" and the "barren-ground caribou." (*See* Reindeer.)

CARIBOU HIGHWAY extends from Cache Creek, B.C., Canada, to Hazelton in the same province and consists of about 500m. of improved roadway. This scenic route follows the Frazer river, crosses the great lake country to the headwaters of the Skeena river near Hazelton and passes through regions abounding in mountains, lakes, rivers and valleys that are rich in game, fishing and camping facilities. Cache creek, Clinton, Soda creek, Prince George, Vanderhoof, Burns lake and Smithers lie in its path.



CARIBOU HIGHWAY

CARICATURE, a general term, adopted from the French, for the art of pictorial ridicule or satire of any kind, whether personal, social or political, derived from the Italian word *caricatura* in the sense of a portrait in which characteristic features are ludicrously exaggerated.

The practice of personal caricature is at least as old as to be recorded by Aristotle and Aristophanes, both of whom tell us something of an artist named Pauson who made pictorial fun of people, and was made to suffer for it. Again, Pliny mentions two sculptors, Bupalus and Athenis, who, by way of a joke, exhibited a portrait of the poet Hipponax, who was very ugly, for public ridicule: the poet is said to have retaliated in satirical verse with such effect that the sculptors hanged themselves in despair. That none of these three appears to have benefited by his activities in this direction very possibly accounts for the fact that the line of their successors, if they had any, is not traceable, and that among all the stories related by Vasari there are none that point to any survival of their baneful influence. Leonardo da Vinci made many wonderful drawings of distorted heads, but these we are told were life-like portraits carefully studied from actual freaks, and it is not until the close of the 16th century that we can begin to trace a regular unbroken pedigree for the art of *Caricatura* (the "ritratto ridicolo di cui siansi esagerati i difetti" as it is defined in the *Nuova Enciclopedia*) from the Carracci and their school in Bologna, through Ghezzi, Townshend, Daumier, Dighton, "Ape" and "Spy," to its supreme living practitioner Max, and the very numerous brood of stinging birds whom his revival of the art in the closing years of the last century undoubtedly did much to encourage.

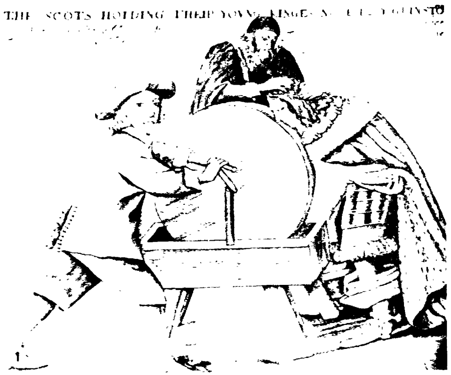
RISE OF CARICATURE

Early Italian School.—In Bologna *caricatura* was the natural result of its artistic and popular "atmosphere." So at least says Count Malaguzzi-Valeri in a recent brochure, and he quotes with approval the opinion of Ludovico Frati (from an article in *La Villa Cittadina*, Nov. 1919) that when the history of caricature in Italy is studied as it has been in England, France and Germany, Bologna will have one of the first places in it. The foundation of the vivacious *Papagallo* in the '80s of the last century proved that the old spirit was not extinguished, and a glance at its activities in the 17th and 18th centuries reveals a considerable amount of material for such a history, which has somehow escaped the attention both of the historians of caricaturists and of the Magnasco society. So far from being *tenebroso*, the school—the actual studio of the Carracci—appears to have sparkled with continuous outbursts of artistic humour. "I Carracci stessi amavan lo scherzo," says Malaguzzi, and they habitually indulged in artistic frivolities in the intervals of serious work. They began by introducing the use of linear symbols and asking their friends to guess what they represented—a practice possibly foreshadowing those of some of the modernists—and visitors to the studio were regarded as fair game for caricature, and saw themselves portrayed under the guise of dogs, pigs, beasts of burden, and even of inanimate objects like jugs or loaves of bread. Annibale Carracci himself was responsible for some of these, and his followers included Pietro Facini, Lionello Spada, Giuseppe Maria Crespi and, most prolific of all, Giuseppe Maria Mitelli. Eight large volumes of Mitelli's drawings, many of them caricatures, are in the library at Bologna, and a pair presented to the British Museum by Laurence Binyon are of a quality that induces a strong desire to see some of the others.

None of these names is familiar—at least as a caricaturist—but thanks to the English engraver, Arthur Pond, who published a series of 24 prints in 1743, we have examples from drawings in private collections by Guercino, Francesco Mola and Carlo Maratti. Most of Pond's subjects, however, are by the then "famoso cavaliere delle caricature," namely, Pietro Leone Ghezzi, who was renowned in Rome, not only among his fellow-countrymen, but also among foreigners for his caricature portraits.

To Pond we are also indebted for what is possibly the earliest example of pure caricature in Great Britain, a drawing made by Antoine Watteau when he was in London in 1720, of Dr. Misaubin, a French refugee who was so successful in his profession as to be branded by posterity as a quack. This drawing is said by Mariette to have been made in a coffee house, and it is not straining probability to suggest that the place may have been Button's, where Hogarth in his younger days made portrait sketches from the life. None of the work mentioned so far, it should be noted, was intended for publication, for *caricatura* was essentially personal, and it was only the vogue created by Ghezzi that led to the publication by Pond of his portraits of this class, and by Oesterreich of another series of about 40 at Potsdam in 1766. There is little if any malice in them, and they seem to have been done simply for the amusement of the subjects and their friends.

Rise of Political Caricature.—For the employment of this gentle art as an adjunct to political satire, it is not so easy as it may sound to find any absolute authority earlier than the middle of the 18th century. There may be one or two examples, but the prints of Chancellor Finch with a pair of wings behind him, in allusion to his flight from the country, or of Bishop Williams with a large blunderbuss, etc., and indeed of whole packs of cards representing individuals, in the 17th century, are purely symbolical in their satire, and cannot be said to attack the personal appearance of the victim. This wicked practice would appear to have been introduced by George (afterwards Marquis) Townshend, and even if he cannot be discredited with the sole responsibility for such a monstrous extension of a private artistic diversion, we can at any rate produce illuminating evidence of it in his case. In June 1765 a letter appeared in *The Public Advertiser* dealing banteringly with Townshend's activities of this kind. After referring to the use of the rolling-press in producing satirical prints, the writer proceeds thus: "He has dealt his grotesque cards from house to house, from Town's End to Town's End. Is there a great general of the highest rank and most eminent military abilities . . . ? If the size of his person as well as fame should be


THE SCOTS HOLDING THEIR YOUNG KINGES NOSE TO YE GRINSTONE

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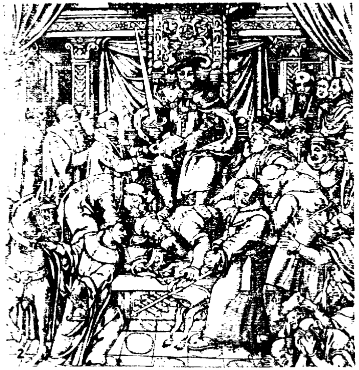

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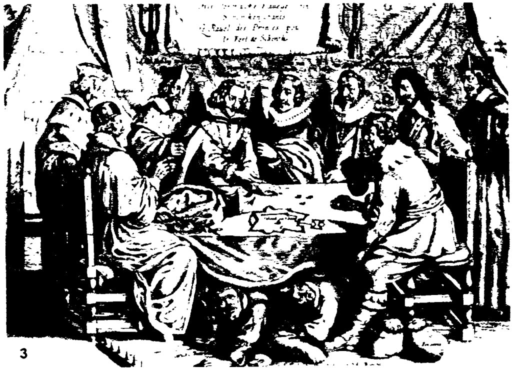

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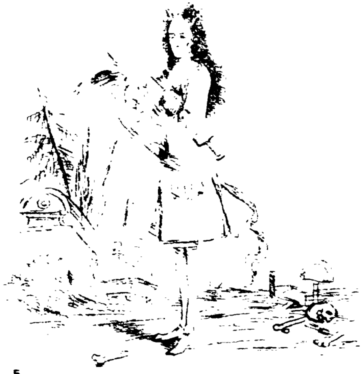

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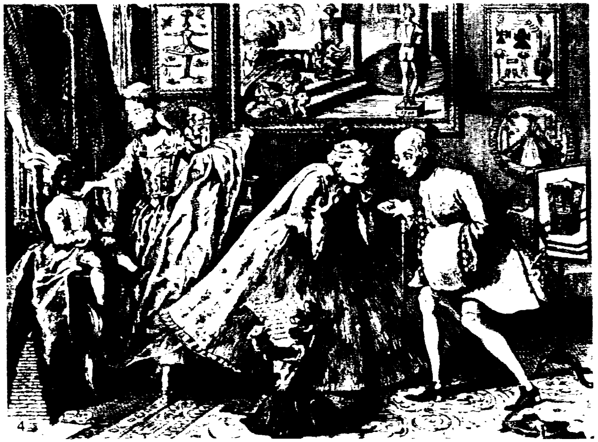

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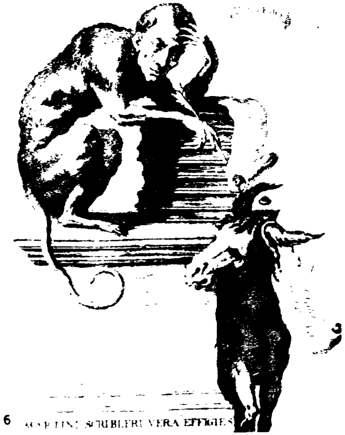

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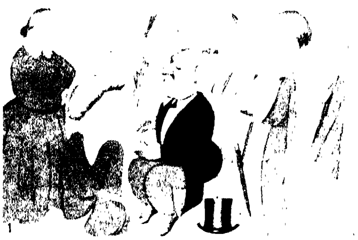
BY COURTESY OF (1) THE TRUSTEES OF THE BRITISH MUSEUM (5) THE DIRECTOR OF THE VICTORIA AND ALBERT MUSEUM

POLITICAL AND HISTORICAL SATIRE, 16TH–18TH CENTURIES

1. "The Scots Holding Their Young Kinges Nose to Ye Grinstone," a print from a broadside in prose, July 14, 1651, ridiculing the severe conditions exacted by the Scotch before offering Charles Stuart (later Charles II) the crown. The central figure, Jack Presbyter, represents the church; Jockie (left), the laity. 2. Presentation of the Bible to Henry VIII; from a woodcut, 1570. Henry (1491–1547), on his throne, is receiving the Bible from Thomas Cranmer, archbishop of Canterbury, and Lord Cromwell, and is trampling on Pope Clement VII., who denounced him. Cardinals Pole and Fisher are endeavouring to raise the Pope. 3. The European Powers throwing dice for the fort of Schencken, Holland; Dutch caricature, 1636. It represents the enemies and allies of the United Provinces, the gamblers being Prince Frederick Henry of Orange, Protestant leader, and Prince Cardinal Ferdinand, governor of Spain. Standing are Richelieu and Louis XIII. of France, supporting Frederick; Emperor Ferdinand II., Philip IV. of Spain, the Pope and the Bishops of Cologne and Mayence support the governor. The peasants await the result in terror. 4. "Taste in High Life," one of William Hogarth's (1697–1764) satires on London society in the 18th century. 5. "Prenez des Pilules, Prenez des Pilules"—"Dr. Misabin." This French caricature by Antoine Watteau (1684–1721), engraved by Arthur Pond, 1739, shows "Dr. Misabin," a Huguenot in London, who prescribed his pills with disastrous result. 6. "The True Portrait of Martin Scribbler," by George Duckett. The ape represents Alexander Pope (1688–1744), who was small and deformed; the donkey his friend William Cleland, who signed Pope's "Letter to the Publisher," in defence of "The Dunciad" (1729)

PLATE IV

CARICATURE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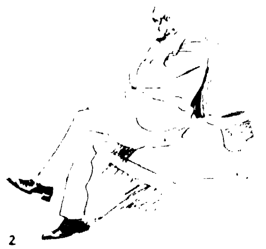
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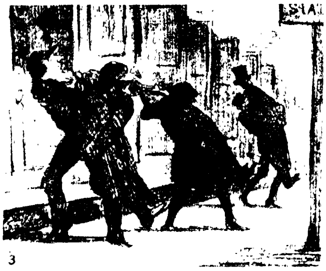
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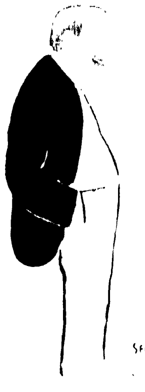

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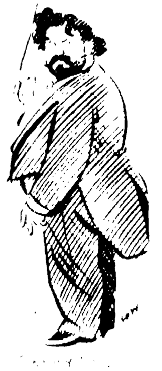

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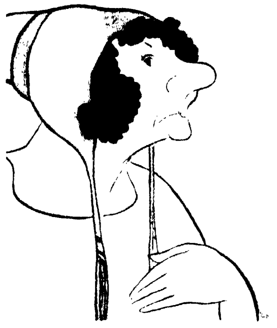
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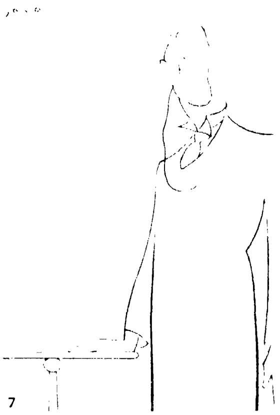
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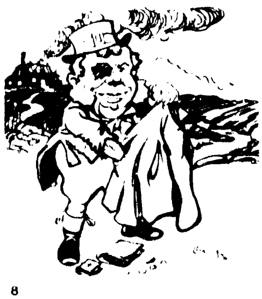
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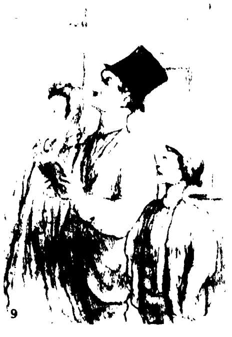
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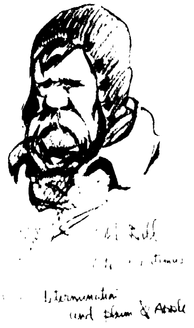

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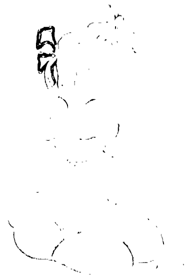
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LATE NINETEENTH AND EARLY TWENTIETH CENTURY CARICATURE

1. "Robert Browning taking tea with the Browning Society" by Sir Max Beerbohm, one of the first satirical artists to break away from the conventional Victorian style of caricature
2. "Gladstone" from "The Phil May Folio"
3. "The Railways" by Honore Daumier, showing third-class passengers frozen during a train trip
4. "Jules Renard" by "Sem" (George Goursat)
5. "S'r 'enry" (Sir Henry Wood) "refusing an encore" by Low
6. Yvette Guilbert, from "Stage Folks" by Alfred J. Frueh, an American born in Lima, Ohio
7. "Austen Chamberlain" by A. B. Sava
8. "Kruger and John Bull" by Caran d'Ache (Emmanuel Poiré), a satire on the Boer War. John Bull is rifling the pockets of President Kruger
9. Drawing by Daumier, published in *Charivari*. "Why the devil should this great red creature only half-dressed, too, be called Olympia?" "But, my dear, it is the black cat they mean by that!"
10. "Old Bill. Full of determination and plum & apple." Central figure in a series of World War cartoons created by Bruce Bairnsfather
11. Cecile Sorel, by Andre Rouveyre

larger than ordinary, this malicious libeller at three strokes of his pencil scratches out his figure in all the ridiculous attitudes imaginable (duke of Cumberland). Is there a nobleman distinguished for wit, eloquence and learning? If his person be long and lank, lean and bony, he also is in the like manner exposed to ridicule (Lord Lyttleton). If the name of a Scotch peer bears the least resemblance of Boot, and his Christian name be John, a huge jack-boot serves for him on copperplate (Lord Bute). And if another lord bears the name of some animal (a fox, for instance) his features are assimilated perforce to those of the animal, and aggravated or distorted in the most ludicrous manner in order to produce a likeness between them."

The personal note has made "caricature" in the broader, modern sense, a living thing. The older satirists merely personified institutions. The papacy was figured as a monster with the trunk of a woman, the head of a donkey, and a different symbol lurking in every limb. The Dutch prints that were so effective against Louis XIV. show us merely dolls representing the various crowned and coroneted heads of the period, and the English ones simply dummies with labels issuing from their mouths, inscribed with the right thing. There is no human interest in any of these designs, valuable as they are to the student and the collector.

Pictorial Satire.—For pictorial satire in general, claims have been advanced to an even greater antiquity than for *caricatura*, which cannot be lightly dismissed, although they must necessarily be accepted with considerable reserve. With the very old as with the very new, it is not always obvious to the spectator whether a joke is intended or not, and it is a dangerous subject on which to be too positive. Champfleury, who ransacked every corner of antiquity for materials for his *Histoire de la Caricature antique*, turned away in despair from the Assyrian bas-reliefs; but are they a whit less solemn than those on the Albert Memorial? Man, as he declares, has laughed, as he has wept, in every age; so why should we deny the possibility of the existence of Assyrian satirists who worked in less enduring materials than granite or marble?

As it happens, the oldest example of pictorial humour put forward by Thomas Wright in his *History of Caricature* is of a religious, not a political, subject and, what is still more interesting, there is good *a posteriori* evidence for accepting it for inclusion in the gallery of the satirical. For, whatever difficulties the extension of the term "caricature" in modern times has occasioned in deciding what is and what is not to be properly included within its limits, there is one strain constantly recurring in the modern family which is also prominent in antiquity, and which may therefore be accounted as of some genealogical significance, namely the representation of human beings with the heads of animals, or, more generally, investing them with animal characteristics.

It is in Egypt that we find the example in question, a painting in the tomb of King Rameses V., presumably as early as 1100 B.C. It represents a soul condemned by Osiris to return to earth in the form of a pig, accompanied by two dog-headed monkeys. It may be that this is simply religious symbolism, but that need not exclude it from consideration here, for there is a definite historical, or, at least, traditional link between it and the famous Roman *graffito* of the Crucifixion, of the 3rd or 4th century A.D. In this the figure on the cross has the head of an ass, and a man contemplates it in an attitude which is interpreted by the legend in Greek characters "Alexamenos worships God." At first sight this might seem to be a scoff directed against the Saviour Himself, but it probably has a more general significance. There was a definite belief among some of the Gentiles that the Jews secretly worshipped the image of an ass, or of an ass's head, but the Gnostics, who were possibly nearer the mark, maintained that the Jewish God Sabaoth was figured in the form of a man with the head of an ass.

Little less than religious belief was the Roman tradition of descent from Aeneas, and at Herculaneum we find something very similar to the Crucifixion *graffito* in an exact parody of a well-known group of Aeneas carrying Anchises and leading Ascanius from Troy, in which the figures are drawn with the heads and extremities of animals. Titian, some 1,200 years later, went even further than this in converting "the Laocöon" into a group of monkeys. In the animal strain, James Goupy satirized Handel "with a snout of a hog playing on an organ, with many symbols of gluttony round him," and Newton drew Wilton, the sculptor, with the head of an ass. None of these examples answers to the definition of *caricatura*—all are symbolic.

Conversely, Tenniel put the British Lion into trousers, while Landseer invested dogs of all sorts with every variety of human sentiment, whether he meant to or not. For this also there is good historical precedent, though hardly as ancient as the days of Rameses V. In some later Egyptian papyri are whole groups of animals performing human actions—notably a lion and a gazelle playing chess together, who are doubtless intended to typify a king and one of his ladies. The fox and the goose were taken to satirize monks and their dupes in the middle ages, and in later times apes for the admonition of humanity at large. Claude Gillot, and his more famous pupil, Antoine Watteau, festooned the way for the Victorian scientists with orgies of artistic anthropoids. "La Grande Singerie" and "La Petite Singerie" at Chantilly are developments of Gillot's numerous engravings, and Watteau, whether or not he actually painted these, has left us two simian satires, "La Peinture" and "La Sculpture." Christophe Huet, J. Gueland and Le Mire followed the lead, and even Chardin in 1740 exhibited "Le Singe Peintre" and "Le Singe Antiquaire." Seeing how many and how obvious are the resemblances between certain types of humanity and animal creation in general, it is no wonder if satirists of all ages have availed themselves freely of these opportunities. It is the same in literature, from Aesop to Gulliver, and on to Dr. Dolittle, while in conversation it is so common as to escape notice altogether. Is there any social circle that does not include a goose, an ass or a cow?

The Effect of Printing.—But whether or not caricature and pictorial satire had even a single ancestor in common in remote ages, it is certain that the latter, unlike the former, depends chiefly for its existence on circulation; and so we have to wait for the invention of the art of block printing on wood and of engraving and etching on copper before we can begin to trace its history with any success. The earliest example mentioned in the British Museum catalogue of Italian engraving, which dates from about 1460, is neither religious nor political, being known as "The battle for the hose." It represents a group of richly attired ladies scuffling for the possession of a pair of trunk hose held aloft in a garland by two winged genii. Dr. Warburg has suggested that the specific idea is a popular illustration of the text of Isaiah iv. 1, thus bringing the prophets of Israel again within our range. Somewhat similar in subject is a slightly later German woodcut of a duel between a man and a woman, which is supposed to symbolize the eternal marital question: "Who shall wear the breeches?" Less abstruse are one or two satires against the Jews; but the surviving examples of the 15th century (probably a mere percentage of such perishable and ephemeral material) are very few, and it is not until the Reformation, when Luther organized whole arsenals of pictorial artillery for his campaign against Rome, that we speak of it as fairly established.

Once the Reformation was established there may have been a less regular demand for satirical prints, though there was still intermittent firing; a contemporary Italian print of Diana and Calisto was altered by Peter Miricenys to represent the young Queen Elizabeth and the pope, the latter "uncovered by Time and Truth." Not until the end of the 17th century, when the Dutch followed Luther's example and employed Romeyn de Hooghe to satirize Louis XIV., did the stream begin to flow regularly and to swell into the great river it became in the time of the Georges.

EARLY BRITISH CARICATURE

17th and Early 18th Century.—The catalogue of satirical prints in the British Museum, compiled by F. G. Stephens, is unfortunately only carried down to the year 1770. Its contents, numbering over 4,000 items, with copious notes, are an indispensable commentary on the history of the period they cover, and a veritable museum of literary and social curiosities. In his preface to the second volume Stephens emphasizes the importance attached to political satire in the time of William III., when Romeyn de Hooghe and his school were producing print after print directed against Louis XIV. One of the most famous of these was "The Reported Death of William III.," occasioned by the public rejoicings in Paris over the false news of William having been shot in 1690. Of this there were four editions, two of them made in Paris, in order to show the "folies extravagantes" of those who produced the original; and in a later print, "Pantagruel agonisant," one of the most elaborate and interesting satires connected with the history of England, the "Reported Death" is introduced as an accessory to the mortification of the French king. These prints continued into the next reign, another effective piece being "Vacarme au Trianon," occasioned by the battle of Ramillies.

British royalties had, up to this time, escaped personal attack in prints, but with the advent of the house of Hanover any restraint in that direction soon melted away. As Stephens observed in commenting on a print entitled "Aeneas in a Storm," not only is George I. hinted at without much respect, but the personal habits of his successor are vividly described, and his peculiar practice of kicking hats, if not larger and living objects, is laughed at. "The Festival of the Golden Rump" deals vigorously with this subject, and has wider bearings of very great importance, social as well as political and personal; it shows that royalty had become an object of stage satire, and indicates the parliamentary origin of the restraints on theatrical representations which were then newly imposed, and have been maintained.

Hogarth, whose period of activity coincides almost exactly with the reigns of the first two Georges, stands alone in the history of caricature. Champfleury calls him "le premier roi" and "le véritable père de la caricature," while Fielding, as we shall see, distinguishes his "comic painting" from *caricatura*, as, save for a few notable examples, he was quite right in doing. Hogarth rarely availed himself of personalities in his satires, and the identification of any of his characters with actual people must be taken with the greatest reserve. Nor did he, as a rule, take any particular event as a subject, looking much more widely over the whole range of human frailties, and selecting and staging them like a theatrical manager. Hogarth's great serial works were "not of an age, but for all time," whereas the satirical prints of the 18th century are merely squibs which light up some ephemeral extravagance or political brawl, brightly enough, but without any permanent illumination of the world's stage.

By the time George III. had ascended the throne the issue of satirical prints had become a regular institution. As already mentioned, a new species now first appeared, invented by George Townshend; they were caricatures on cards. The original one, which had an amazing success, was of Newcastle and Fox looking at each other, and crying, with Peachum in *The Beggar's Opera*, "Brother, brother, we are both in the wrong." Another of Townshend's masterpieces, published in 1762, was "The Scotch Hurdy-Gurdy or The Musical Boot," signed "D. Rhezzio inv., G. Oh! Garth scratchavit." Further activities against Bute are reflected in another advertisement of a Political and Satirical History.

Stephens claims rather too much for Townshend in saying that he may fairly be styled the inventor of the most modern form of artistic satire, but it may be allowed that he raised the tone of it, and that his skill, though often mercilessly employed and subject to political passion, was not disgraced by the unscrupulous frankness and licence of some of his predecessors or successors

Later 18th Century Caricature.—In his fourth volume, which deals with the years 1761–70, Stephens writes that a very striking attestation of the growing importance of artistic satire which, by this time, was partly personal, partly political, is afforded by the fact that many magazines, illustrated by satirical prints, were published during this period. Previous to this date such work could hardly be said to exist. These publications were essentially arsenals of satirical weapons of which the cuts enriching them were the most efficient. The *London Museum* was one of the more prominent. The *Political Register* supplied a considerable number of satirical prints, notably one of Bute as Colossus with Pitt between his feet (1767). The *Oxford Magazine* was enriched by a series of very cleverly designed prints such as "The Siege of Warwick Castle," a satire on physicians (1768) and "The Rape of the Petti-coat." Even the decorous *Gentlemen's Magazine*, which in 1746 had published a version of Hogarth's portrait of Lord Lovat, issued among its few illustrations with figures the satirical print of "John Wilkes Esq. before the Court of King's Bench." The *Universal Museum* printed "The Present State of Surgery or Modern Practice" (1769). The *Town and Country Magazine*, the most prolific of satire-bearing works, had numerous illustrations, many of which were directed against men of note, and women of ill-fame. The former were nearly all politicians opposed to the popular leaders, and these prints may fairly be called the arrows of their party directed against the king and his court. These weapons showed that the dignified and honourable modes of English political warfare had given place to a coarser and meaner system of attack; the *Town and Country Magazine* spared neither the public nor the private lives of the courtiers, and their wives and daughters, living and dead, chaste or unchaste, had no more mercy at the hands of the satirists than was vouchsafed to their mistresses or the harlotry of the stage and opera. The common object of attack in these cases was that order of society which hung like a fringe about the court, and of which the most extravagant front comprised those "*macaronies*" whose vagaries occupied the *Universal Magazine* and other publications.

If Stephens could say as much as this of social satire down to 1770, one wonders how he would have expressed himself had he continued till the end of the century, the last quarter of which was enriched by a steadily growing production of caricatures of every sort, and not always of the nicest. But the establishment of the Royal Academy had certainly raised both the quantity and the standard of artistic work in Great Britain, and until the Regency there is much more in the comic part of it to be praised than blamed Gillray and Rowlandson, in the work of their early prime, had no rival but each other, though the field was a large one, and included such men as Henry William Bunbury, Paul Sandby, P. J. de Loutherbourg, James Sayer, John Raphael Smith, James Hamilton Mortimer and others less known but hardly less worthy. The demand for caricatures continued to increase, and on some of the prints issued by S. W. Fores—the founder of the still extant firm in Piccadilly—it was advertised that folios of caricatures were lent out for the evening, and that his gallery might be inspected for one shilling. The range of subjects also increased, and while politics continued to take first place, social subjects became much more numerous and more absurd. Rowlandson drew every class of society, in every sort of occupation, and as there was little or no "mixture" of the social classes in his time, his variety is enormous.

Disappearance of the 18th Century School.—By the end of the 18th century the rose had become somewhat overblown, and during the first quarter of the 19th, caricature sank into exceeding coarseness. The artistic reputation of its two gifted exponents, Rowlandson and Gillray, has suffered irreparable damage from the atrocious and often revolting quality both of their subjects and their interpretation of them; it is only in recent years that the former has been recognized from his immense output of beautiful drawings as one of our finest artists, while the latter, surviving only in his caricature prints, has still to wait for a recognition of his true powers which were so grossly employed in disgusting satire. Isaac Cruikshank, who with his still more gifted son, George, forms a link between the older order and what was to come, was never offensively coarse, though like Newton, Heath and one or two more, he was too fond of being funny to have much regard to artistic excellence. The extravagances of this school may be excused to some extent by the opportunities offered them in the ridiculous fashions, both sartorial and social, of their time, and they may very possibly be more appreciated in time to come than they are at the moment.

FRENCH CARICATURE

Effect of Censorship.—Meanwhile, our attention may conveniently be turned to France, where personal caricature, even if it had established itself as soon as in England, was hardly likely to be allowed the same liberty in connection with political satire. The rarity of satirical prints of the earlier part of the 18th century is due rather to the extreme rigour with which they were suppressed than to their numbers, and apart from politics there was a large and varied supply of very interesting material for Grand-Carteret's volume *L'Estampe Satirique*, etc., and the more recent and fuller works of André Blum on the same subject. Among the earliest examples is another medical satire by poor Watteau who, in the short interval between his return from England and his death in 1721, burlesqued the whole faculty in a drawing which was engraved by Comte de Caylus. Caylus himself appears to have caught the infection of pure caricature from Ghezzi, and he made some very curious *portrait-chargés* of the frequenters of Madame Doublet's salon. Of more public interest were the satires against literary and artistic personages; in 1728 the *Almanac de Parnasse* had a frontispiece introducing portraits of Rousseau, Voltaire, Racine le jeune, Crébillon and other figures, which was suppressed by the police and the *Almanac* sold without it. Voltaire in later years was bombarded with caricatures, one of which had the interest for us of showing Urania offering him a pair of spectacles to help him in reading Newton's *Principia*. Jacques Saly produced a series of caricatures when he was at the French Academy in Rome in 1750, thus carrying on the true Carraccian tradition. The lighter side of social satire is represented by Jeurat, J. B. Huet and Gabriel St. Aubin, all of whom had a kindly eye for *les filles de joie*, and later by Duboucourt, some of whose works have more than a little in common with the best of Rowlandson's. With *Vauxhall Gardens* and *La Promenade de la Galerie du Palais Royal*, published in 1785 and 1787, England and France, the only two countries in which a continuous development of caricature is traceable, were within measurable distance of each other. In the years of the Revolution and Napoleonic Wars such an approach could hardly be expected to be continued, no later than 1791 the rift was wide enough for the following legend beneath a very telling print:—"La grande aiguiserie royale des poignards anglais: Le fameux ministre Pitt aiguisant les poignards . . . Le gros Georges Dandin tournant le roule en haletant de fatigue." The very numerous satires of these years are of the greatest interest historically, but are not of an attractive nature. It is, however, all the more interesting on this account to note that when the two countries were, so to speak, starting afresh in the second quarter of the next century, they did so on remarkably similar lines. Let us, therefore, continue with France.

The Reign of Louis Philippe.—Champfleury begins his *History of Modern Caricature* with the reign of Louis Philippe in 1830. In his preface he remarks that the book might well be styled "The demolishers of the *bourgeoisie*," for they had no more determined adversaries than Daumier, Traviés and Henri Monnier; and that whatever satirical characters might be created in the future to succeed those of Mayeux, Robert Macaire and Monsieur Prudhomme, those three types would subsist as the most faithful representatives of the *bourgeoisie* from 1830 to 1850. The king himself, he adds, was the first *bourgeois* in the realm, and seemed to think that he could govern it with an umbrella for a sceptre, and that he only had to open it to protect himself from political storms. Certainly that strikes the dominant note of modern caricature, which henceforth, not only in France and England, but generally everywhere, became gradually less rude and savage, and more "refined" and domesticated. As both politically and socially the world settled down after the Revolution and the Napoleonic Wars, so caricature, save for occasional necessities, assumed a more polite, if more sarcastic, tone, and monsters and deformities gave place to subtler rendering of human weaknesses or excesses. In France, at first, the satire was none the less biting, the ridicule none the less stinging for its artistic excellence, and personal, physical caricature was used by Daumier and others with terrific effect. The king's heavy physiognomy was transformed into a symbol—*la poire*—and there was no public character who escaped merciless caricature of his features, gestures and habits. At the same time, however, the artistic sense predominated, and when the bitterness had somewhat abated, survived as an example to be followed, a standard to be maintained. Even if this improvement was, so to speak, in the air, it was actually precipitated by one man, namely Charles Philipon. Whether or not he influenced John Doyle in the course of their lithographic studies, who, as we shall see, was doing something of the same sort for English caricature, he was certainly the great general who organized and led to glory the noble army of French satirical artists, and thereby furnished an example which has been followed more or less closely in every country in the world.

Philipon's Career.—Philipon was born at Lyons in 1800 and settled in Paris in 1825, where he took to lithography for a living and produced some very charming caricatures; but he soon realized his ambition to found a paper. This was *La Caricature*, which made its appearance on Nov. 4, 1830, and after braving a continuous deluge of legal actions, was suppressed in 1835. Its chief artists were Honoré Daumier, Henri Monnier and J. T. Traviés, above mentioned.

On Dec. 1, 1832, was born Philipon's second child, *Le Charivari*, which still survives in a new series, having only temporarily succumbed to the World War in 1915. This was a daily paper, "publiant chaque jour un nouveau dessin." Its birthday vignette, designed by Tony Johannot, the public were informed, required such special preparation that it could not appear in time. When no more than eight years old, it stood godfather to another lusty, and still thriving paper, *Punch, or the London Charivari*. In 1838, on Nov. 1, *La Caricature Provisoire* donned the shoes of its deceased brother, dedicated "aux amis de l'ancienne Caricature politique," and adorned by its artists Daumier, Grandville, Forest, Bouchot, etc.; and when asked about the adjective *provisoire*, Philipon replied: "Si elle n'est pas politique, elle sera non politique . . . elle sera morale, littéraire, théatrale, artistique, sociale, medicale, chirurgicale, agricole, somnambuliste, anabaptiste, etc." In the following June it received a new sub-title, "revue morale, judiciaire littéraire, artistique, fashionable et scénique," having abdicated its title of *provisoire*, "désormais trop sûre de vivre longtemps, et bien, pour ne pas se proclamer définitive." In Jan. 1842 its subtitle was further modified, and it broke out into coloured plates of a most distressing brilliance.

Philipon's third child to attain public importance was *Le Journal pour Rire*, a specimen number of which was issued in Dec. 1847, and No. 1 on Feb. 5 following. This was on large newspaper sheets and full of wood-cut illustrations by some of the older artists, and also some new ones. Among these one of the most brilliant was Gustave Doré, who furnished *Punch* with the idea for at least two of his most successful features, namely, the "Bird's Eye Views of Society" and "The Royal Academy Guyed." Besides these, Philipon was responsible for *Le Musée Philipon* and was also the godfather of a great many occasional publications. In No. 5 of *Le Journal pour Rire* is a list of "Caricatures par les principaux dessinateurs du *Musée Philipon*, du *Charivari*, du *Journal pour Rire*, et de la maison Aubert," some of them consisting of as many as 70 or 80 plates, a glance at which will give us a fair idea of what purely social caricature had become under the fostering influence of Philipon. First place is given to Gavarni, with "Le Carnaval," "Le Carnaval à Paris," "La Boite aux Lettres," "Les Maris vengés," "Les Artistes," "Les Impressions de Ménage," "Les Lorettes," "Les Enfants terribles." Next is Daumier with "Les Beaux Jours de la Vie" (80 plates), "Les Croquis d'Expression" and "Les Robert Macaire" (with Philipon). Then Bouchot's 70 "Bonnes Fêtes Musicales"; Jacques's "Militariana"; Behr's "L'Amour à Paris"; "Croquis parisiens" and "L'Opéra au 19e siècle" by E. de Beaumont; "Au Bal de l'Opéra," "Les Troupiers Français," "Croquis militaires," "Les Grisettes," and "Physiologie des bals publics" by Vernier. The anonymous remainder is not long, and is necessary to complete the survey:—"Nos Gentilshommes," "Turlupiniades," "Souvenirs de Garnison," "À la Guerre comme à la Guerre," "Moeurs Algériennes," "Moeurs britanniques," "Les Chargés parisiens," "Le Conservatoire de danse," "Ces bons Parisiens," "Prophètes charivfiques."

For one man such an achievement, of which the above is the barest outline, was prodigious, and its effect on caricature, both in France and other countries, has been decisive. He raised caricature from the precarious issue of occasional prints to the regular position of an indispensable auxiliary to journalism. To his recognition of the practical and artistic possibilities of lithography combined, we owe the magnificent series of drawings that await resurrection in the forgotten or neglected volumes above mentioned, and his undying ardour in political ridicule is still traceable in these days of milder expression.

Among the brilliant and very numerous band of his artists, three names only are familiar to the public in Great Britain or the U.S.A. Daumier, who stands head and shoulders above the rest; Doré, who might have rivalled him had he been prevented, as Daumier was, from evaporating into popular painting; and Gavarni. The first has now been recognized, like Rowlandson, as a serious factor in the history of art; the second had his popular triumph and must wait for reinstatement until the effects of it have cleared off. The third is still hovering. But none of the three can be fairly appreciated, until much more of their work is brought out into the light. Of the rest, Traviès and Monnier stand out conspicuously as the creators of two almost historical characters—the hunchback Mayeux and Monsieur Prudhomme—characters like Philipon's and Daumier's Robert Macaire and Bertrand (feebly imitated in "Ally Sloper" and "Ikey Mo"); and Grandville, who is best known for his ornithological whims, though they were but a part of his excellent works, deserves equal rank.

WORLDWIDE SPREAD OF CARICATURE

Doyle and Seymour.—In England, as in France, modern caricature may be fairly dated from 1830, when McLean, the printseller, commenced the issue of his *Monthly Caricature Sheets*, a series which outlasted Philipon's first venture by a year. These sheets were entirely covered with lithographs, mostly by Robert Seymour, but also by John Doyle who in the previous year had begun the famous series of political cartoons, also in lithograph, over the mysterious signature "H B." These, too, were published by McLean, and although it would be paying him too high a compliment to style him the English Philipon, he is certainly to be congratulated on having brought out two such notable caricaturists as Doyle and Seymour, and also on having realized the practical and artistic possibilities of lithography for the purpose. Doyle was an Irishman who came to London to paint portraits, but turning his attention to lithography, like Philipon, found it an equally efficient and delightful means of improving and refining the artistic qualities of political caricature. George Cruikshank, not content to follow in his father's footsteps, but still using the needle, was also a great, and certainly a wider, influence in the general refinement upon the monstrous and extravagant fancies of the older school which is apparent in the work of John Leech, Richard Doyle, Hablot Browne and the rest. But there is a softness and a gentle spirit of raillery in the elder Doyle's political sheets—numbering in all over 900—and at least equally discernible in the work of his son, that inclines one to place Doyle as high as Cruikshank among those to whom the spirit of modern caricature is most indebted for its high tone and gentle demeanour, no less than for its artistic excellence.

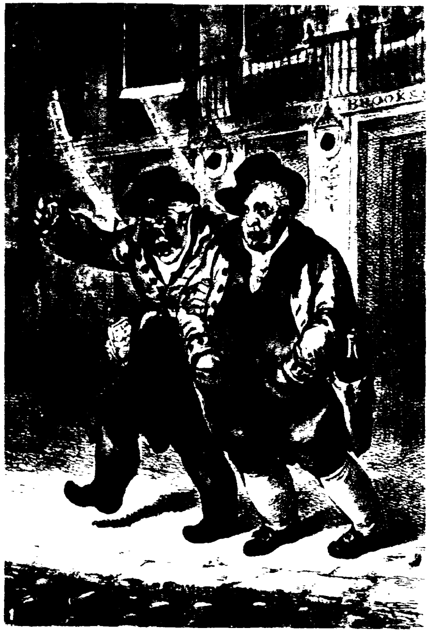
Robert Seymour, whose name and work are now entirely forgotten, was really one of the older school. Like Woodward and Bunbury, he was a born caricaturist. It was his suggestion of *Cockney Sporting Plates* to be issued monthly that was altered by Charles Dickens, whom he asked to supply the letterpress, into *The Pickwick Papers*, and he was their first illustrator. His art was not of the highest order, or he might not have achieved such a wide popularity in his inartistic period. It was in *Figaro in London*, edited by Gilbert à Beckett, that Seymour was described, in 1833, as the Shakespeare of caricature, and in the same year was announced *The Terrific Penny Magazine* with cuts by Seymour and other artists of celebrity, and later, *The Wag*, and a new supply of Figaro's caricature gallery. In this sort of company one might observe, like Dr. Primrose, that if there was not more wit than usual, there was certainly more laughter. But the dominating figure of this period was, undoubtedly, George Cruikshank, who, if we allow for the difference in time and circumstances, occupied very much the same place in the 19th century as Hogarth did in the 18th.

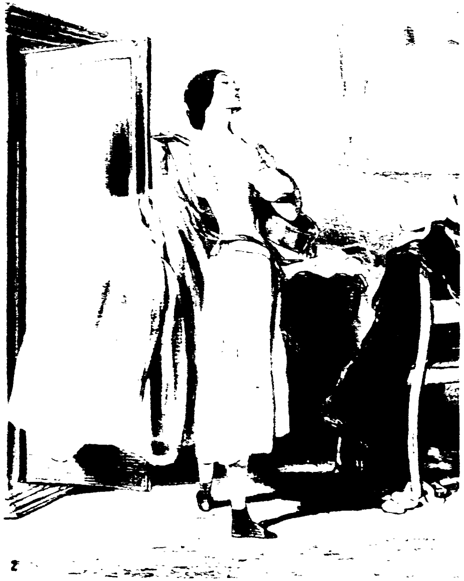
The untimely death of Seymour, by his own hand, in 1836, and a diminishing output of H. B.'s lithographs, may possibly have accelerated the foundation in 1840 of *Punch or the London Charivari*. Certainly the time was ripe for such an event, thanks to the efforts of the preceding decade, and although neither the elder Doyle nor George Cruikshank had any hand in it, and its origins were of the humblest, it soon established itself, and only needed Richard Doyle and John Leech to make its success the more sure and more glorious.

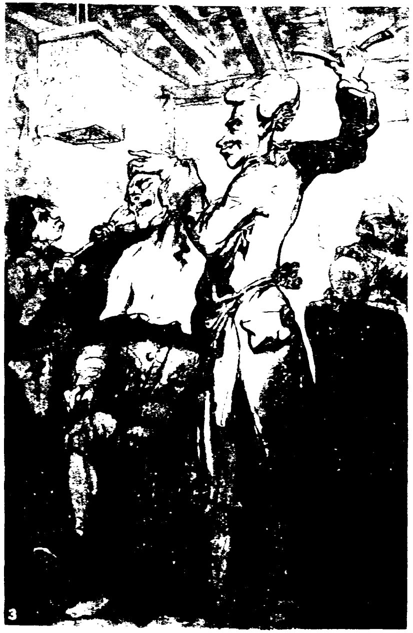
But the success of Philipon's papers in Paris was bound to be attempted, sooner or later, in other countries than England, and for even a glance at the history of caricature during the second half of the 19th century we must look all over Europe—to say nothing of America, north and south—where in every capital the press was being requisitioned to provide a regular weekly service of vehicles for comical and satirical expression of feeling, which had hitherto had to go on foot or hire a conveyance for any particular occasion.

Bismarck in Caricature.—Such a consummation was, perhaps, dimly foreshadowed by the publication, in 1890, in Paris, of a little volume entitled *Bismarck en Caricatures*, illustrated by 140 cartoons, etc. from the more important periodicals since 1862. Its author, J. Grand-Carteret, was already well known for his work on caricatures in earlier periods, and he followed it some years later with volumes dealing similarly with Leopold II., Nicholas II., Alphonse XIII. and Edward VII., which bring us nearer to present days. But the first volume, in itself marking a distinct advance in the importance of caricature as an aid to history, and also emphasizing, as it happened, the beginning of a new epoch with the dismissal of the great Chancellor, is for many reasons the most valuable. Allowing for Bismarck being its only subject, with the stage all to himself, one cannot fail to see how clearly the mirror of caricature reflects the events, and the subtleties with which they are developed, throughout the whole quarter of a century in which Bismarck was violently, yet always respectfully attacked, both in his own country and in many other States. A French author might be pardoned for a little bias in dealing with such a subject, but throughout the volume there is hardly a cartoon which Bismarck himself could not have regarded with pleasure or pride. All are tributes to his incessant activity and efficiency, even those of the little Munich *Punsch*, which never ceased to sting him till it ceased to appear in 1870. The occasional issue of single caricatures to a very limited clientèle was now superseded by the regular publication of illustrated periodicals which were read by thousands, and the foundations of a permanent and world-wide alliance between caricature and journalism were firmly laid. On its social side this alliance was no less fruitful in its developments than in politics, and the gain to both parties to it became more and more apparent as the century advanced to its close. To posterity the gain is immeasurably greater, in having a live record of manners and customs in place of the haphazard fragments from which its knowledge of earlier periods is alone derivable. Astronomers contemplate the heavens in a pool of mercury, and the reflections of human action in the mercurial element, though the gaiety of nations may ripple the surface, are not so distorted as to impair their interest or their value. Rather do the ripples add that relish to matter of fact which, as we presently shall see, is at the root of the derivation of the word caricature, and, we may almost say, of a really spiritual understanding of anything human.

Eastern Europe.—Beginning with the remotest and least prolific of the nations, we find in Russia *Strekoza* and *Palimet*, in Cracow *Djabel* and in Warsaw *Mucha*. None of these is available for perusal in England, but the Buda-Pest *Borsszem Janko*, by some strange chance, though not mentioned by Grand-Carteret, is in the British Museum library. It began with the New Year in 1868, and had an excellent artist in Karl Klič. It is amusing to find scraps of English here and there; there is "Lord Jockeymor-





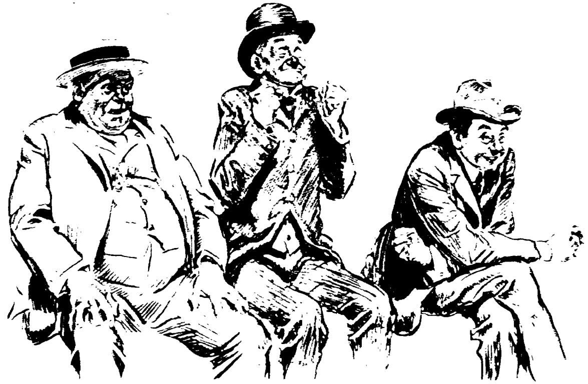


ENGLISH AND FRENCH CARICATURE, 19TH CENTURY

1. "Pillars of the Constitution—Three o'clock and a Cloudy Morning," by James Gillray (1757–1815). Gillray, one of the best known satirists of the 18th and early 19th centuries, made Georgian politics and manners the target of his scathing humour. Here Sheridan and the Duke of Norfolk are shown reeling out of Brooks's. (The Duke is stammering, "And now for the Majesty of the People," while Sheridan calls out, "And now have at the Ministry, Damme!")

2. "*Rien n'est si joli que la fa-a-a-a-ble-e-e, si triste que la vérité!*" This is one of a series of 79 sketches, "Les Lorettes," by Gavarni (1804–66), *nom de plume* of the French caricaturist, Hippolyte Sulpice Guillaume Chevalier

3. "A Sufferer for Decency," by Thomas Rowlandson (1756–1834). Rowlandson, a contemporary of Gillray, produced landscape paintings as well as drawings and etchings of many types of subject, the fine quality of which gave to them a definite place of importance in English art. He was a keen satirist of the social life of his era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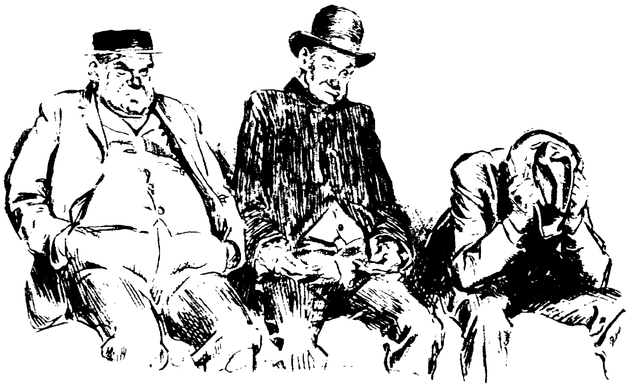
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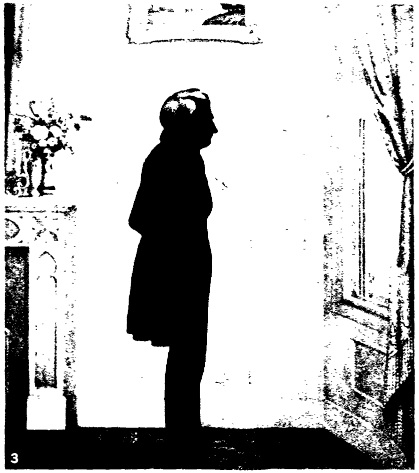
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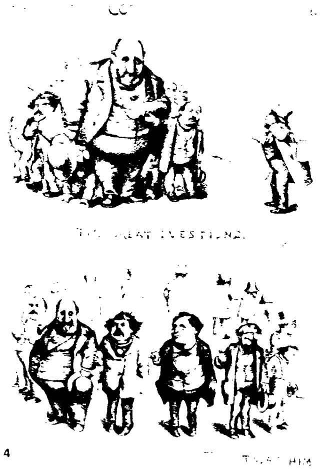

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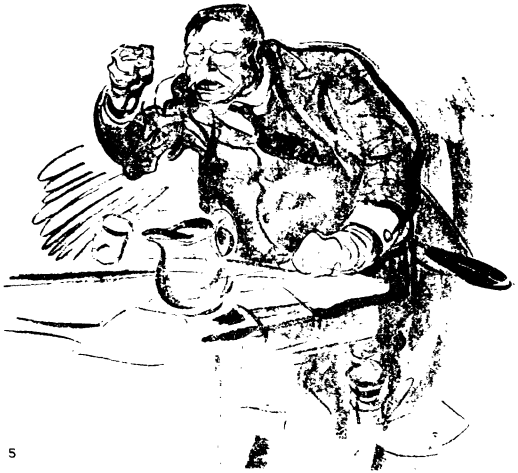
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BY COURTESY OF (1, 2) COLLIER'S WEEKLY, (4) HARPER AND BROTHERS, (5) THE SUN, NEW YORK

CARICATURE IN THE UNITED STATES

1, 2. "Two Strikes and the Bases Full," and "Fanned Out," two caricatures by Charles Dana Gibson of types among the spectators at a base-ball game

3. Silhouette of William Henry Harrison, by W. H. Brown

4. One of the caricatures by Thomas Nast (published August 19, 1871, in *Harper's Weekly*) in the long series in which he attacked "Boss" Tweed and the Tweed Ring. The firm of J. H. Ingersoll and Co. was used by Tweed to cover fraudulent transactions

5. "The Boss" by Oscar Cesare, caricature of Theodore Roosevelt, published in May 1912. The legend was "'I typify and embody'—T. R."

land" in Janko's *Museum*, remarking on a bottled specimen "indeed very curious," while outside Queen Victoria is sitting attended by a Scotch piper. In 1887 the paper was still well illustrated, by Klosz and others unnamed, a really fine cartoon being a grim rendering of "Cholera," and a more amusing one showing Bismarck in the prompter's box dismissing the old year down a stage trap, and calling on the new, armed to the teeth. More surprising is a group of politicians in the disguise of Gilbert and Sullivan's *Mikado* and the "Three Little Maids from School." *Caviar*, another Hungarian paper, had a good caricaturist in C. Sieben.

Vienna, as might be expected, was far more prolific. *Kikeriki*, founded in 1861, is still crowing; *Figaro*, a name adopted by numerous papers and in all lands—there was even a *Sheffield Figaro*—was most famous in Vienna; and there were also *Der Floh*, *Lucifer*, *Die Bombe*, *Die Auste*, *Wiener Caricaturen* and *Die Muskete*. At Innsbruck, too, was *Der Scherer*, and at Prague *Humoristiche Listy*.

Spain and Portugal.—In Lisbon, *Os Puntos nos ii* (the dots on the i's) had a notable cartoonist in Raphael Pinheiro. In Madrid the only considerable illustrated paper in the last century was *El Motin*, and the work of Spanish caricaturists must be looked for in North and South America. But there is now quite a long list including *El Liberal*, *España*, *Gil Blas*, *Gedeconcito*, *Blanca e Nera*, *La Espera*, *Gedéon*, *El Mundo Humoristico*. In Barcelona two excellent caricaturists, Bracons ("Apa") and Inglada, work for *Iberia*, and Picarol for *La Campana de Gracia*.

Switzerland, Belgium, Holland.—Switzerland was fortunate in having two caricaturists at a much earlier date, Rudolf Topffer and Martin Bisteli. Both were dead before 1850; but their influence may have contributed to the success of the Geneva *Carillon* and the Zurich *Postheiri* and *Nebelspalter*, the last of which attained first rate importance in political caricature and is still flourishing.

In Belgium, the grotesque and somewhat fearful expressions of Breughel, Bosch, Wierz and Jan van Beers found a remarkable exponent in Felicien Rops, whose contributions to the Brussels *Uylenspiegel* in the '50s and '60s are among the *rariora* of modern prints. On one occasion, in 1863, he paid Grandville the compliment of a new version of that artist's famous cartoon of 1831, "Order is established in Warsaw." In the '80s, the eccentricities of "Popold" had begun to afford opportunity for the caricaturists which were not neglected. At Liège, there were Lemaître in *Le Rasoir* and Lapièrre in *Le Frondeur;* and in Brussels, Boum-Kelkou in *Le Clairon*, Sebranc in the *Moniteur du Congo*, Levy in *Le Gourdin*, and Zarib in *Clair de Lune*. With the new century appeared G. Julio in *Le Cri du Peuple* and *La Réforme*, C. de Busschera in *Le Flirt*, Sicambre in *Le Zwanzeur*, besides others in *Le Sifflet*, *La Trique* and *Les Corbeaux*.

From the colder genius of Holland, where Romeyn de Hooghe established pictorial satire as a serious contribution to politics, we need not expect very much on the lighter side of caricature, but can appreciate all the better the extraordinary manifestation of the old spirit in Louis Raemackers' War cartoons; and even forgive the Amsterdam *Weekblad von Nederland* and *De Kroniek* for their sharpest hits at the British Government in the Boer War. The magnificent conception of Cecil Rhodes in his coach, in 1897, needs no forgiveness. *De Notenkraker*, Amsterdam, and *De Nederlandische Spectator* at The Hague are also to be remembered.

Scandinavia, Greece, Italy.—Scandinavia, in an atmosphere comparatively free from the political smoke or social scents of its neighbouring countries, has produced numerous caricaturists whose delightfully fresh and simple touch proclaims their kinship with Grieg and Ibsen. With the exception of Olaf Gulbranson and "Blix" who became famous on *Simplizissimus*, their names and their works are little known abroad. Among the earliest were Wilhelm Marstrand, Constantin Harrisen and Fritz Jürgensen in Copenhagen and Wilhelm Petersen, the illustrator of Hans Andersen. In the Danish *Punch* we find excellent work of Hans Tegner and Knud Gamborg, in *Blacksprutten* and *Klods-Hans* of Alfred Schmidt, and in *Vort Land* of Axel Thiess.

In Norway and Sweden the principal artists were Th. Kittlesen in *Tyrilhaus*, E. Schwart in *Sondags Nisse*, Knud Stangenberg in *Strix*, and Albert Engelström.

At the present time Copenhagen maintains a good display but of no special merit. "Blix" contributes on Sundays to the venerable *Berlingske Tidende* (no connection with Berlin), now in its 180th year. *Politiken*, approaching its jubilee, is wonderfully vivid and varied, as are the morning *Dagens Nyheder*, the noonday *B.T.* and the weekly *Hjemmet*.

If Greece was somewhat outside the European circle in the last century, and if her language and written character are still beyond the casual intelligence, her recent contributions to our subject are fuller and more certain than in the days of Pauson. *Romeos*, the most famous of all Greek comic papers, which first appeared in 1883 and was read by every Greek from Marseille to Trebizond, was the work of one man, Soures, the Aristophanes of modern Greece, who wrote the whole of it (including the advertisements) in verse. It ceased, with his death, in 1918. *Asty* was more remarkable for its caricatures (a volume of which has been published) by its editor Themistocles Anninos (d. 1906) *Eleutheron Bema*, the present leading morning paper, exhibits a daily cartoon (*Γελοιογραφία*) by Ph. Demetriades; and *Proia*, another daily, rivals it in the productions of El. Koumetakes and N. Kastanakes. *Gatos* (the Cat), a weekly paper, supplies the only coloured caricatures in this country.

In Italy, modern caricature began with the establishment of *Il Fischietto* in 1848, at Turin, as a very small paper with one or two crude woodcuts. But it soon enlarged itself, and early in the '60s it was admirably, one is almost tempted to say superbly, illustrated by three artists, Virginio, Teja and Redenti. If Virginio's lithographs lacked the genius of Daumier, as any but Daumier's must, they lacked little else to recommend them both to the collector and to the historian. Had Grand-Carteret included Napoleon III. in his series, the Italian artists would have had a preponderating share of the illustrations, for as he points out in his *Bismarck*, French influence was predominant in Italy right up to 1870, and it seemed that the caricaturists were violently protesting against it. After 1870, he adds, there is a complete change; the kingdom of Italy, having now attained her unity and territorial integrity, began to look abroad, and the press admirably reflected the new state of affairs. Italian comic papers might be those of a neutral country with cosmopolitan ideas, and *Papagallo*, soon afterwards established in Bologna, was a veritable European picture gallery, unfolding week by week in a succession of coloured cartoons the broadest outlines and most important questions of European politics. So great was the success of *Papagallo* that it was soon imitated by *Il Trottola* and *Il Rana*. *Il Pasquino* was already established at Turin and *Il Pulchinella* in Naples. *Il Fischietto* was later managed and illustrated by Camillo Marietti, who signalized the retirement of Bismarck in 1890 by a cartoon which may take rank with Tenniel's "Dropping the Pilot." It was entitled "L'Armoire aux retraites," and showed Tisza and Bismarck each occupying a cupboard, and the hand of history pointing out a third to Crispi. *Il Travaso* in Rome, *Il 420* in Florence, *L'Uomo di Pietra* and *Guerin Meschino* in Milan, are lively younger brothers of the still flourishing *Pasquino* Among the modern caricaturists none is finer than Musacchio, and none more effective than Sacchetti.

Germany, France.—The extent and diversity of modern Germany, apart from her great place in Europe, precludes more than a very scanty tribute in our space to the very large and accomplished family descended from Luther and Cranach as also from Gutenberg and the early block printers. Between the homeliness of Adolf Oberlander and the mordancy of Th. H. Heine there is a wide gulf, but it is by no means a void; and from *Fliegende Blätter* of 1845 to *Des Junggeselle* of 1928 one cannot step as through a desert. Berlin and Munich were naturally the two most prolific centres, and they were not long in following England in Philipon's train with *Kladderadatsch* (1848) and *Fliegende Blätter* (1845). Munich was first in point of time, and has certainly never been eclipsed by Berlin in point of quality. The miniature cartoons of E. Schleich from 1862 to 1870 in the Munich ***Punsch***

are a most valuable commentary on the story of the rise of Prussia under the influence of Bismarck. *Jugend* and *Simplizissimus* in later times have developed the artistic possibilities of caricature, and if with more vigour than charm, it may be added that even their most cruel and brutal satire has something about it which compels laughter. In Berlin, besides *Kladderadatsch*, there were soon *Der Ulk* in 1868, *Wespen* in 1870, *Lustige Blätter*, and *Humoristiche Blätter*. The Frankfurt *Latern*, the Stuttgart *Wahre Jacob*, the Dusseldorf *Monatschafte*, the Danzig *Bunte Blätter* are all of them to be reckoned with the Berlin and Munich papers.

In France, the school of Philipon continued to flourish, and also to expand. Daumier lived on to 1879, and his cartoon after Sedan was one of his most impressive. Doré had abandoned caricature, or "Cham" would not have been Daumier's next of kin. The foremost names or pseudonyms of the next generation were Nadar, André Gill, Draner, Sahib, Stop, Luque, Félix Regamey, Alfred le Petit, Moloch and Pilotell. Of the many new papers before 1800 were *L'Eclipse*, *Le Trombinoscope*, *La Chronique Parisienne* and *La Chronique Amusante* (all containing cartoons by Moloch), *Le Journal Amusant*, *Le Cri de Paris*, *La Lune*, *La Charge*, *Triboulet*, *La Journée*, *Le Figaro Illustré*, *La Silhouette*, *Le Carillon* and *Le Sifflet*. The last named, which began in 1872, was peculiarly vivacious, and its large coloured cartoons by Le Mare and others though of little artistic merit, and vulgar in their extravagant outlines, were still very amusing and informing. It was thoroughly radical, and the ex-emperor, the royalists and the church cut very sorry figures in it. Certainly there was a decline in artistic illustration, not in France alone, towards and during the '80s; and though we can hardly drag in Bismarck here, it is noticeable that after 1890 there were signs of a very potent revival The appearance of *Gil Blas* in the kiosques in 1891, and of *Le Courrier Français*, if not a challenge to the inanities of "Mars" in *La Vie Parisienne*, was truly a relief. Though Steinlen was even less a caricaturist than Gavarni, and Forain little more, both were great artists, and it was a pity that so much of their subject matter being "the unmentionable," their really fine qualities, like those of Rowlandson and Gillray, had to wait to be discovered.

The first appearance of *Le Rire* on Nov. 10, 1894, may fairly be regarded as an event of some importance in the history of caricature, at any rate as to its lighter side, and its opening number, with a coloured plate by J. L. Forain, is a document of considerable interest In the first place, there is its list of artists, which, even without the further promise "d'autres noms, aimés du public, et d'autres encore qui seront des surprises," is surprising enough:—J. L. Forain, Willette, Caran d'Ache, Fernand Frau, Dépaquit, Paule Crampel, Courboin, Jossot, Georges Delaw, G. Darbour, D'Espagnet, Gyp, Heidbruck, Jean Veber, Léandre, Louis Anquetin, Ch. Maurin, H. de Toulouse-Lautrec, P. Bonnard, Hermann-Paul, Marc Mouclier, Vallotton, Rupert-Carabin, Roedel, Louis Morin, A. Schlaich, Alphonse Lévy ("Said"), Grellet, Gumery, Verbeck, Vavasseur, Guydo, Charly, Lebègue Even without Steinlen, Guillaume, Gerbault, Abel Faivre and many more, there are names in this list to which none of the previous generation, with the great Cham, Moloch, Sahib, Bac, etc., can deny at least equal places in the niches of fame. Of no less interest, and of considerable historical significance, is the introduction of two features, "Le Rire d'Autrefois" and "Le Rire à l'Étranger," the latter still continuing. The former was distinctly homage to Philipon, the first item being a double page reproduction of Daumier's famous "Le Ventre Legislatif," with the mischievous parenthesis added "Ça n'a pas beaucoup changé depuis 1834." Later numbers reproduced still older caricatures, by Isabey and others. The foreign section had a distinctly English flavour, being introduced by a note signed "Globe-Trotter," and two out of its three items (nowadays it contains a dozen) were English—one by Sambourne from *Punch*, and the other by Phil May from *The Sketch*. The third was from the Vienna *Floh*, but still with a Gladstonian allusion—Bismarck as "The Grand Old Man" trying to fell Capriva personified as a tree. Of more recent date were *L'Assiette au Beurre*, *Le Canard sauvage* (subsequently *Le Canard enchainé*), *L'Intransigeant*, *L'Indiscret*, *Mon Dimanche*, *D'Artagnan*, *Fantasio* and many others.

Great Britain.—Returning at last to England, it is interesting to observe that *Punch*, though dominating the realm of caricature from its very inception, and for over a quarter of a century almost alone in its glory, was always equal to the occasion, sustaining with dignity and charm the whole responsibility of an ancient and most honourable inheritance. Victorian conditions inflated the popular love of monarchy, and the public at large came more and more to regard established institutions like the Royal Academy, Covent Garden theatre or the Langham hotel as all-sufficient, and to look askance at any attempt to supplement them with new ones. So that when *Judy*, *Fun*, *Moonshine* and *Ally Sloper's Half Holiday* were successfully established, they were never in any sense rivals to the legitimate monarch. It is rather surprising that half-a-dozen artists in a single journal, of so small a size, and with no coloured illustrations, should for half a century more or less have been the only representatives of the great family with its ramifications that flourished in former days. But *autres temps*, *autres moeurs* and the extraordinary vulgarities with which the domestic life of the young queen and her consort was made fun of soon gave place to the refinement introduced by the Doyles and established by their successors, Leech, Tenniel, Keene, Du Maurier and Sambourne. For Victorian England this must be allowed to have sufficed, and Dr. Primrose might now have observed that if there was not more laughter than of yore there was certainly as much wit At the same time it must be admitted that the Victorian climate was not suitable for the development of rude health in caricature. Heavy academical foliage absorbed the sun, and the pungent undergrowth of Pre-Raphaelitism only succeeded in forcing its way up by virtue of its deadly earnestness. *Punch* alone enjoyed the free air.

One plant, however, appeared in 1869, which by its fruits we know must have been from a seed of the original tree, namely *Vanity Fair*. Here, at last, was a revival, and in its pleasantest form, of personal caricature. Though "Ape" and "Spy" (Carlo Pellegrini and Leslie Ward) were the only two of its artists whose names are familiar to the general public, it is significant that many of the finest portraits in the earliest numbers were by J. J. Tissot, so that the success of the paper was really established by Italian and French artists. Historically this is quite as it should be, just as "Punch" is named after the mythical "Polchinello" whose characteristics were illustrated by Ghezzi, and one of its most successful artists, Du Maurier, was of French extraction. Not until the last decade—*la fin du siècle*—did the Victorian glaciation give any sign of loosening. Among the first, in 1890, and of itself insignificant, was a little paper called *The Whirlwind* edited by Herbert Vivian and Stewart Erskine and illustrated by some of the founders of the New English Art club—another sign. A little later *Pick me up* made a gallant bid for popular favour, but was before its time. In 1894 there was a more decided crack, and *The Yellow Book*, published by Mathews & Lane, threw up two volcanoes in the shape of Aubrey Beardsley and Sir Max Beerbohm, whose molten streams combined to flow with increasing effect on the artistic and literary climate. Widely different as they were, both these young men achieved the same result in bursting the shackles that were cramping the arts of illustration and caricature. Reed's caricature in *Punch*, "Britannia à la Beardsley," was far too witty and too clever to have been designed in derision of so fine an artist; but there was something so entirely new to the Victorian in Beardsley's uncanny grotesque, that he was for long looked at askance. His influence on "black and white" in general was enormous, and in caricature it is traceable everywhere. Sir Max, on his part, being a caricaturist in the Carraccian tradition, loosened the buttons, shook out the folds and generally disorganized the growing trimness of personal caricature as exemplified in the *Vanity Fair* cartoons, which in the '80s were becoming more and more suitable for *The Tailor and Cutter*. The most baffling thing about his marvellous gift of spiritual portraiture seems to be that the farther he gets from actuality the nearer he gets to truth

Recent Developments.—With the most recent developments of caricature it is impossible for the staid historian to keep pace. He can only shout after the caricaturists, not to stop, but to wish them still more activity in still wider fields. As it is they have rushed in at the studio doors opened to them by the cubists, vorticists, post-impressionists and their imitators, and rushed out again with their arms full of fancies which they have twisted up and thrown, like confetti, into the most unexpected places. Some have stuck to the hoardings, others have got into the circulars of the most respectable and stately commercial firms, and the least humorous of the weekly papers. This great and surprising expansion is due, in no small measure, to the World War, when they were employed with Lutheran vigour and insistence, both as propaganda and as a relief to the feelings. Posterity may perhaps decide which were the most successful (for either purpose) among such as King George reviewing the British fleet in a diving suit (German), the Bolsheviks at the telephone (Musacchio), or "What did *you* do in the Great War, Daddy?" (English); but there is no doubt that all of them contributed something to the very general extension of the employment of caricature for artistic and commercial, no less than for satirical purposes, in these present days. Instead of being destroyed, or reserved for private circulation, as in the old times, the careless rapture of the modern artist now finds a place on the hoardings. These modern artists are a determined lot of fellows, a large and exceedingly fierce tribe, and they are doing much more for caricature than any one before them. Adopting the most advanced and highly artistic tenets, they have imposed significant form alike on the commonest objects of the ideal home and the rarest flowers in the garden of public affairs. They know to a hair's breadth how far a statesman's face can be stretched without snapping, they have the bursting strain of every bulge in his figure calculated to a decimal point. With a few strokes of the pen they can visualize an international situation or a social tendency in a manner that saves us reading whole columns of print. Finally, notwithstanding every excess, they have shown themselves equal to the delicate task of sustaining the traditions of the very oldest of the comic papers under the double disadvantage of the devastations of the World War and the complete change of outlook on many subjects resulting therefrom. *Charivari*, now in its 87th year, has in Soupault, Bib and Cyl, cartoonists as lively as ever, and if an artistic comparison with their earliest predecessors is impossible now, it is probably only because it is too soon to make it. *Punch*, the next oldest, having enjoyed uninterrupted prosperity with a sound constitution and no incitement to change, is still an old friend with a young face. *Kladderadatsch* and *Fliegende Blätter* are oftener quoted by *Le Rire* than any others, and side by side with them we find *Nebelspalter, Simplizissimus, Mucha, Ulk, Jugend, Pasquino, Lustige Blätter* and *Wahre Jacob*, most of them past their jubilee and all well up to date. If the tight-lacing of the '80s was finally abolished by the War, and if the reaction seems a little too startling just at the moment, it must be accepted nevertheless as a very healthy symptom in an art which to be an art at all, must always be allowed its own way.

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United States.—Political caricature in the United States began with William Charles, a Scotsman who, forced to leave Great Britain, emigrated to America, and, in the War of 1812, used his pencil and invention with great bitterness against his renounced country. Pencil and invention were both crude. Charles was an imitator of James Gillray, and his most widely-circulated cartoon, "John Bull Making a New Batch of Ships to Send to the Lakes," bore a close resemblance, in conception and detail, to Gillray's "Tiddy-Doll (Napoleon) Making a New Batch of Kings." Gillray, influencing Charles, also influenced the work of Charles's successors for several decades. The basis of the early American cartoon was the Gillray group of many figures. A school of distinctively American caricature came in with the first administration of President Jackson. These lithographs told their stories by means of legends enclosed in balloon-like loops issuing from the lips of the various members of the groups. The anonymous artists were most productive in the heat of political campaigns, during the Mexican War, and with the rising slavery agitation. The Civil War naturally let loose a flood of cartoons; among them the early work of Nast.

Thomas Nast (1840–1902) remains the dominant figure in the history of American caricature. Lincoln called Nast's cartoons the best recruiting sergeants on the Union side. His picture "Peace," originally called "Compromise with the South," first made his reputation. It appeared just after the election of 1862, and was circulated by the million as a campaign document. Nast's later influence was both national and local. He was the inventor of the "donkey" used as the symbol of the Democratic Party, the Tammany "Tiger," the "rag-baby" of inflation, and the cap and dinner pail emblematic of labour. More than any other man he was responsible for the overthrow of the notorious Tweed Ring that long held New York city in its clutches. Such cartoons as "The Brains of Tammany" and "The Tammany Tiger in the Arena" proved the siege guns in the battle for civic reform. Finally it was a Nast picture that led to the capture, in Spain, of the fugitive Tweed. The traditions of Nast were carried on in the late '70s, '80s and '90s by Keppler and Gillam. The series of "Tattooed Man" cartoons, depicting James G. Blaine in the title rôle, contributed to Cleveland's victory in 1884. They were the work of Bernhard Gillam, who, upon leaving *Puck*, drew equally vindictive caricatures of Cleveland and the Democratic Party on the rival pages of *Judge*. A cartoon with a story was Gillam's "Where Am I At?" of 1892. It was originally drawn to commemorate an expected smashing Republican victory. When the election returns showed that Cleveland had won it was too late to prepare another cartoon, so Gillam set to work making the necessary changes in the plate, capping his labour with a likeness of himself in the form of a monkey turning an uncomfortable somersault. Two outstanding cartoons of the later '90s, "Don Quixote Bryan Meets Disaster in his Encounter with the Full Dinner Pail," and "Be Careful: It's Loaded!" a warning to Spain just before the outbreak of the Spanish-American War, were the work of Victor Gillam.

American caricature of the present century is abundant and of a high order. Syndicate service has brought the work of the most efficient and highly paid cartoonists to the readers of the most rural communities. There is a Pulitzer prize annually awarded for the cartoon deemed the most effective. Conspicuous among contemporary caricaturists are Rollin Kirby of *The New York World-Telegram*, J. N. ("Ding") Darling of *The Des Moines Register*, Daniel R. Fitzpatrick of *The St. Louis Post-Dispatch*, Nelson Harding of *The New York Journal*, and Herbert Johnson of *The Saturday Evening Post*. (A. B. M., X.)

See the articles on related subjects, as CARTOON; COMIC STRIP; PEN DRAWING; PENCIL DRAWING; ILLUSTRATION; POSTER; etc.

CARIGARA, a municipality (with administrative centre and 30 *barrios* or districts) of the province and island of Leyte, Philippine Islands, on Carigara bay, 22 mi. W. of Tacloban, the provincial capital. Pop. (1939) 23,236 (a gain of 5,678 since 1918), of whom 11,359 were males, and no whites. Coastwise vessels touch there and carry large exports of abacá (Manila hemp), from which fabrics are manufactured, as well as from cotton. Palay (rice) and maize (corn) are produced; fisheries are important, and there are mineral springs. The vernacular is a dialect of Bisayan, and of those inhabitants 10 years old and over 41.2% were reported as literate, while of those aged 6 to 19, inclusive, 23.2% were reported as attending school. (C. S. L.)

CARIGNANO, a town of Piedmont, Italy, in the province of Turin, 11 mi. S. by tramway from the town of Turin. Pop. (1936) 4,992 (town); 7,392 (commune). It has a handsome church (S. Giovanni Battista) erected in 1756–66 by the architect Benedetto Alfieri di Sostegno (1700–1767), uncle of the poet Alfieri. S. Maria delle Grazie contains the tomb of Bianca Palaeologus, wife of Duke Charles I of Savoy, at whose court Bayard was brought up. The town passed into the hands of the counts of Savoy in 1418. Carignano was erected by Charles Emmanuel I of Savoy into a principality as an appanage for his third son, Thomas Francis (1596–1656), whose descendant, Charles Albert, prince of Carignano, became king of Sardinia on the extinction of the elder line of the house of Savoy at the death of Charles Felix in 1831.

CARILLON, an arrangement for playing tunes upon a set of bells by mechanical means. The word is said to be a Fr. form of late Lat. or Ital. *quadriglio*, a simple dance measure on four notes or for four persons (Lat. *quattuor*); and is used sometimes for the tune played, sometimes (and more commonly in England) for the set of bells used in playing it. The earliest mediaeval attempts at bell music, as distinct from mere noise, seem to have consisted in striking a row of small bells by hand with a hammer, and illustrations in mss. of the 12th and 13th centuries show this process on three, four or even eight bells. The introduction of mechanism in the form either of a barrel (*see* BARREL-ORGAN) set with pegs or studs and revolving in connection with the machinery of a clock, or of a keyboard struck by hand (*carillon à clavier*), made it possible largely to increase the number of bells and the range of harmonies. In Belgium, the home of the *carillon*, the art of the *carillonneur* has been brought to its greatest perfection, and here, and in Holland and France, the number of carillons, great and small, runs into hundreds. (*See* BELL.)

In Britain the system of ringing bells by peal, known as the change-ringing, has always been preferred. But carillons and keyboards on the Continental model exist here and there, *e.g.*, at the Manchester town hall, at Armagh and Cobh cathedrals, Bournville, Cattistock and elsewhere, while British made carillons have been set up in America. Among the latter are that of the Houses of Parliament at Ottawa (53 bells, the largest weighing 10 tons), and that of Riverside Drive church, New York, containing 72 bells, of which the deepest-toned, weighing 18¼ tons, is the fourth largest bell in existence. Some of the most important improvements in bell-ringing mechanism, as well as in methods of tuning, have had their origin in Britain.

This mechanism is very similar in general to that employed in the case of organs, one difference, however, being that light wooden levers take the place of the ivory keys. These levers are attached by means of wires and cranks to the clappers, which strike the bell on the inside surface at a point near its largest diameter. The travel of the clapper is about one inch, which is sufficient to bring out the full volume of sound required for carillon playing, while still permitting the delicacy of touch necessary to the obtaining of the best effects.

Pedals are attached to the levers connected with the heavier bells, so that these can be played by foot or by hand, their performance being further facilitated in some cases by the employment of "assistance pistons." These provide that directly the player begins to depress the pedal, electrical contact brings into operation an electro-pneumatic motor, the piston of which is coupled to the clapper and its force thereby added to that of the performer. This device, the invention of Gillett and Johnston, was employed first in the case of the fine carillon of 48 bells made by this firm and presented to Louvain university library by the American engineering societies. As regards the compass of carillons, the smallest usually have a range of at least two octaves, in semi-tones, while the largest may have a compass of as much as four-and-a-half octaves, or 53 bells.

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CARINA, one of the three constellations (*see* CONSTELLATION) into which the large southern Ptolemaic constellation Argo (*q.v.*) was subdivided. It contains several variable stars (*see* STAR).

CARINATAE, the name once given in contradistinction to Ratitae (*q.v.*) to a large superorder of birds, including all the modern flying forms except the tinamous, on account of the keel-like process on the breast-bone. The terms are now commonly replaced by Palaeognathae (=Ratitae) and Neognathae (=Carinatae).

CARINI, a town in the province of Palermo, Sicily, 13 mi. by rail W.N.W. of Palermo. Pop. (1936) 13,782 (town); 14,762 (commune). On the coast lay the ancient *Hyccara*, said to be the only Sican settlement on the coast. It was stormed and taken by the Athenians in 415 B.C., and the inhabitants, among them the famous courtesan Lais, were sold as slaves.

CARINTHIA, formerly an Alpine province of Austria and later a *gau* of "greater Germany," occupies the drainage area of the upper Drava. Area, 4,583 sq.mi.; pop. (1939) 459,957.

Within the province two distinct regions exist, viz., Upper Carinthia, west of the confluence of the Gail and the Drava, and Lower Carinthia, east of that junction. The former is very mountainous and is divided into two sharply contrasted types of country by the west-east flowing Drava. North of the river lies a belt of crystalline rock highly dissected into blocks by the numerous left-bank tributaries of the main stream, *e.g.*, the Isel, the Moll, etc. Here, though the heights are well-watered and clothed with forests and high pastures, settlement is sparse; scattered dwellings and hamlets concerned with cattle-raising predominate, for the valleys are narrow and rise steeply to the glaciated summits of the Hohe Tauern. There are, however, great possibilities for the development of electricity from the numerous falls, and the trend of Austria in this direction before 1938 reacted favourably upon the prosperity of this region. South of the Drava the southern limestone zone of the Alps is entered. Although several thousand feet lower in general level than the crystalline zone this region offers few attractions to human occupation. The prevalence of faulting and steep scarps, the lack of good passes, the absence of surface drainage and the marshy nature of the valley floors combine to restrict settlement which, with agriculture, favours the sunny northern slopes and the occasional alluvial fans, particularly in the valley of the Gail which divides the mass of the Carnic Alps into two groups. In both a decrease in height and difficulty towards the east is accompanied by an increase in cultivation and by a growth in the number and size of the villages.

BY COURTESY OF THE AUSTRIAN TOURIST OFFICE

MAN AND WOMAN OF THE ALPINE PROVINCE, CARINTHIA, DRESSED IN THEIR NATIVE GALA COSTUME

Lower Carinthia centres on the nucleus of the busy Klagenfurt basin, an undulating area, between 1,300 ft. and 1,650 ft. above sea-level, floored with Tertiary sediments and morainic debris. Its fertility is in great contrast to that of the crystalline Gurktal Alps and Saualpe to the north and of the Karawanken limestone belt of the south, for suitable soil and the high summer temperatures favour the growth of cereals and fruit while the surrounding mountain pastures aid the breeding of horses and cattle. In addition leather, paper, cement and mineral products are extensively manufactured, the latter particularly in the south-east near Bleiburg where lead ores are extracted. These, with the iron of the Saualpe and local lignite are the bases of small but important metallurgical industries at many places, among which Ferlach, Klagenfurt and St. Veit are the best known. The development of Carinthia was hindered in every direction by its remoteness and internal difficulties of communication. The old longitudinal route from Innichen to Bleiburg, followed by a railway, carried little through trade because of frontier difficulties at either end, while only two transverse railways exist. One of these, however, the eastern, leads to the important Semmering pass and brought prosperity to the important route junctions of Klagenfurt (pop. 1939: 61,956) and Villach (26,537). The other, crossing the Hohe Tauern by tunnel, handles a large proportion of the local trade in timber and wood products while both carry increasing numbers of tourists to the numerous small bathing resorts that line the shores of the remarkably warm Carinthian lakes which lie in the longitudinal valleys, *e.g.*, the Wörther-see, the Millstätter-see, the Ossiach-see, etc.

The population is predominantly Roman Catholic in religion and German in speech. Only in the southeast, where access is most easy, has a foreign element succeeded in penetrating along the main valleys and here alterations in customs, language and architecture herald the passage to Slovene territory.

See also AUSTRIA; V. Paschinger, M. Wutte, *Landeskunde von Kärnten* (Klagenfurt, 1923); Hans Retzlaff and Clotildis Thiede, *Kaernten: Grenzland im Sueden* (Berlin, 1938). (W. S. L.)

CARINUS, MARCUS AURELIUS, Roman emperor, A.D. 283–85, was the elder son of the Emperor Carus, on whose accession he was appointed governor of the western portion of the empire. He fought with success against the German tribes, but soon left the defense of the Upper Rhine to his legates and returned to Rome, where he abandoned himself to dissipation. He also celebrated the *ludi Romani* on a magnificent scale. After the death of Carus, the army in the east demanded to be led back to Europe; Numerianus, the younger son of Carus, was forced to comply, but was murdered on the way, and Diocletian, commander of the body-guards, was proclaimed emperor by the soldiers. Carinus at once marched against Diocletian, whom he met in Moesia. Carinus was successful in several engagements, but at the battle on the Margus (Morava), according to one account, he was assassinated in the hour of victory; another tradition represents the battle as a complete victory for Diocletian.

See Vopiscus, *Carinus* (mainly the recital of his crimes); Aurelius Victor, *De Caesaribus*, 38, Epit. 38; Eutropius ix. 18–20; Zonaras xii. 30; Orosius vii. 25; Pauly-Wissowa, *Realencyklopädie*, ii. 24 ff. (Henze).

CARISBROOKE, a village in the Isle of Wight, England, 1 mi. S.W. of Newport. The valley of the Lugley brook separates it from the steep conical hill on which stands the famous castle. There are remains of a Roman villa in the valley, but no reliable mention of Carisbrooke occurs in Saxon times, nor does the name appear in the Domesday survey. The castle is mentioned in the survey under Alvington, but it is unlikely that there was much stonework until the advent of the Redvers lords. From early times the lordship of the island has been associated with ownership of the castle, which thus became the seat of government. Henry I bestowed it on Richard de Redvers, in whose family it continued until Isabella de Fortibus sold it to Edward I. Thereafter, when the castle was in the hands of the crown, the government was entrusted to wardens. The keep was added in the time of Henry I, and in the reign of Elizabeth, when the Spanish Armada was expected, it was surrounded by an elaborate pentagonal fortification. The castle was garrisoned for Maud in 1136, but was captured by Stephen. In the reign of Richard II it was unsuccessfully attacked by the French; Charles I was imprisoned here for 14 months before his execution. In 1904 the chapel of St. Nicholas in the castle was reopened and reconsecrated, having been rebuilt as a memorial of Charles I. The remains of the castle are imposing; parts are inhabited, but the king's apartments are in ruins. The church of St. Mary has a beautiful Perpendicular tower and transitional Norman portions. Only the site can be traced of the Cistercian priory to which it belonged. This was founded shortly after the conquest and originated from the endowment which the monks of Lyre near Evreux held in Bowcombe, including church, mill, houses, land and tithes of the manor. Richard II bestowed it on the abbey of Mountgrace in Yorkshire. It was restored by Henry IV, but was dissolved by act of parliament in the reign of Henry V, who bestowed it on his newly-founded charterhouse at Sheen. Carisbrooke formerly had a considerable market, several mills, and valuable fisheries, but it never acquired municipal or representative rights, and was important only as the site of the castle. The parish was transferred to the borough of Newport in 1933.

CARISSIMI, GIACOMO (*c.* 1604–1674), one of the most celebrated masters of the Italian school of music, was born about 1604 in Marino, near Rome. Of his life almost nothing is known. At the age of twenty he became chapel-master at Assisi, and in 1628 he obtained the same position at the church of St. Apollinaris belonging to the Collegium Germanicum in Rome, which he held till his death on Jan. 12, 1674, at Rome. He seems never to have left Italy. The two great achievements generally ascribed to him are the further development of the recitative, previously introduced by Monteverde, and of infinite importance in the history of dramatic music; and the invention of the chamber-cantata by which he superseded the madrigals formerly in use. It is impossible to say who was really the inventor of the chamber-cantata; but Carissimi and Luigi Rossi were the composers who first made this form the vehicle for the higher kind of chamber-music, a function which it continued to perform until after the time of Alessandro Scarlatti, Astorga and Marcello. His oratorios in turn were of the first importance as having definitely established the form and style of that class of work.

CARLÉN, EMILIA SMITH FLYGARE (1807–1892), Swedish novelist, was born at Strömstad on Aug. 8, 1807, and died at Stockholm on Feb. 5, 1892. Her first husband, a doctor, A. Flygare, died in 1833, and in 1841 she married a poet, Johan Gabriel Carlén, and went to live in Stockholm, where she formed a literary salon. Among her numerous novels, some of which depicted the life of fishermen and sailors, others the manners of the middle classes of her time, were *Waldemar Klein* (1838), *Gustaf Lindorm* (1839, Eng. trans. 1853); *Professorn och hans skyddslingar* (1840, Eng. trans. *Professor's favourites*, 1843), *The Rose of Tistelön* (1842, Eng. trans. 1844); *Jungfrutornet* (1848, Eng. trans. *The Maiden's Tower*, 1853); *Enslingen på Johannesskäret* (1846, Eng. trans. *The Hermit*, 1853); *Ett Köpmanshus i skärgården* (1859, *The Merchant's House on the Cliffs*). In 1878 she published an autobiography, *Reminiscences of Swedish Literary Life*. Her novels were collected in 31 vols., *Samlade romaner* (Stockholm, 1869–75).

CARLETON, WILL (WILLIAM MCKENDREE) (1845–1912), American poet, was born in Hudson, Mich., on Oct. 12, 1845. After graduating at Hillsdale college in 1869 he made extensive lecture tours through the western states, Canada and Great Britain. He then engaged in editorial work for local Michigan papers and in Jan. 1872 became editor of the *Detroit Weekly Tribune*. From 1873–78, he was editor of the *Detroit Tribune*. He had early shown a taste for poetry, and his "Betsey and I Are Out" (1871) won for him immediate recognition. He was a frequent contributor to *Harper's Weekly*. In 1883 he published *City Ballads*. He died in Brooklyn, N.Y., on Dec. 18, 1912.

His published works include: *Farm Ballads* (1873); *Farm Legend* (1876); *City Ballads* (1883); *City Legends* (1890); *City Festivals* (1892); *Songs of Two Centuries* (1902); *Poems for Young American* (1906); *A Thousand More Verses* (1912); *Over the Hill to the Poor House* (1927).

See A. E. Corning, *Will Carleton; A Biographical Sketch* (1917).

CARLETON, WILLIAM (1794–1869), Irish novelist, was born at Prillisk, Clogher, Co. Tyrone, on March 4, 1794.

As his father removed from one small farm to another, William attended at various places the hedge-schools, which used to be a notable feature of Irish life. Most of his learning was gained from a curate named Keenan, who taught a classical school at Donagh (Co. Monaghan), which Carleton attended from 1814 to 1816 with the intention of becoming a priest. After various experiments in earning his living he set out for Dublin, and arrived in the metropolis with 2*s* 9*d* in his pocket. He first sought occupation as a bird-stuffer, but a proposal to use potatoes and meal as stuffing failed to recommend him. He then determined to become a soldier, but the colonel of the regiment in which he desired to enlist persuaded him (Carleton had applied in Latin) to give up the idea. He obtained some teaching and a clerkship in a Sunday school office, began to contribute to the journals, and his paper "The Pilgrimage to Lough Derg," which was published in the *Christian Examiner*, excited great attention. In 1830 appeared the first series of *Traits and Stories of the Irish Peasantry*, which at once placed the author in the first rank of Irish novelists. A second series, containing, among other stories, "Tubber Derg, or the Red Well," appeared in 1833, and *Tales of Ireland* in 1834. From that time till within a few years of his death Carleton's literary activity was incessant. *Fardorougha the Miser, or the Convicts of Lisnamona* appeared in 1837–38 in the *Dublin University Magazine*. Among his other famous novels are: *Valentine McClutchy, the Irish Agent, or Chronicles of the Castle Cumber Property* (1845); *The Black Prophet, a Tale of the Famine*, in the *Dublin University Magazine* (1846), printed separately in the next year; *The Emigrants of Ahadarra* (1847); *Willy Reilly and his dear Colleen Bawn*, in *The Independent* (London, 1850); and *The Tithe Proctor* (1849), the violence of which did his reputation harm among his own countrymen. Some of his later stories, *The Squanders of Castle Squander* (1852) for instance, are defaced by the mass of political matter with which they are overloaded. Carleton remained poor, but in 1848 a pension of £200 a year was granted by Lord John Russell in response to a memorial on Carleton's behalf, signed by numbers of distinguished persons in Ireland. He died at Sandford, Co. Dublin, on Jan. 30, 1869.

Carleton's best work is contained in the *Traits and Stories of the Irish Peasantry*. He wrote from intimate acquaintance with the scenes he described; and he drew with a sure hand a series of pictures of peasant life, unsurpassed for their appreciation of the passionate tenderness of Irish home life, of the buoyant humour and the domestic virtues, which would, under better circumstances, bring prosperity and happiness. He alienated the sympathies of many Irishmen, however, by his unsparing criticism and occasional exaggeration of the darker side of Irish character.

During the last months of his life Carleton began an autobiography which he brought down to the beginning of his literary career. This forms the first part of *The Life of William Carleton* . . . (1896), by D. J. O'Donoghue, which contains full information.

CARLETON PLACE, a town and port of entry of Lanark county, Ontario, Canada, 28m. S.W. of Ottawa, on the Mississippi river, and at the junction of the main line and Brockville branch of the Canadian Pacific railway. It has abundant water-power privileges, and extensive railway-repair shops and woollen mills. Pop. (1941) 4,305

CARLILE, RICHARD (1790–1843), English reformer and freethinker, was born on Dec. 8, 1790, at Ashburton, Devonshire, the son of a shoemaker. He was educated in the village school and, after apprenticeship to a tinman, obtained occupation, in 1813, in London as a journeyman tinman. Influenced by Paine's *Rights of Man*, he became an uncompromising radical, and in 1817 started pushing the sale of the *Black Dwarf*, a new weekly paper, edited by Thomas Wooler, all over London, and in his zeal to secure the dissemination of its doctrines frequently walked 30m a day. In the same year he also printed and sold 25,000 copies of Southey's *Wat Tyler*, reprinted the suppressed *Parodies* of Hone, and wrote himself, in imitation of them, the *Political Litany*. This work cost him 18 weeks' imprisonment. In 1818 he published Paine's works, for which and for other publications of a like character he was fined £1500, and sentenced to three years' imprisonment in Dorchester gaol. Here he published the first 12 volumes of his periodical the *Republican* (1820, etc.). The publication was continued by his wife, who was accordingly sentenced to two years' imprisonment in 1821. A public subscription, headed by the duke of Wellington, was now raised to prosecute Carlile's assistants. At the same time Carlile's furniture and stock-in-trade in London were seized, three years were added to his imprisonment in lieu of payment of his fine, his sister was fined £500 and imprisoned for a year for publishing an address by him, and nine of his shopmen received terms of imprisonment varying from six months to three years. In 1825 the government decided to discontinue the prosecutions. After his release in that year Carlile edited the *Gorgon*, a weekly paper, and conducted free discussions in the London Rotunda. For refusing to give sureties for good behaviour after a prosecution arising out of a refusal to pay church rates, he was again imprisoned for three years, and a similar resistance cost him ten weeks' more imprisonment in 1834–35. He died on Feb. 10, 1843, after having spent in all nine years and four months in prison.

See G. J. Holyoake, *The Life and Character of Richard Carlile* (1870); T. C. Campbell, *The Battle of the Press, as told in the life of R. Carlile* (1899); G. A. Aldred, *Richard Carlile, Agitator* (1923).

CARLINGFORD, CHICHESTER SAMUEL FORTESCUE, Baron (1823–1898), British statesman, belonged to a family long settled in Ireland, and became Liberal M.P. for Louth in 1847. He was junior lord of the treasury (1854), chief secretary for Ireland (1865) under Lord Russell and (1867) under Gladstone, president of the board of trade (1871–74), lord privy seal (1881–83), and president of the council (1883–85). He received a peerage in 1874. At first a warm supporter of Gladstone's Irish policy, he parted from him in 1885 on the Home Rule question.

CARLINGFORD, market town and port, Co. Louth, Eire. Pop. (1936) 488. King John's castle dates from 1210. There are remains of castellated houses built during Elizabethan and previous wars. A Dominican monastery was founded in 1305. The town received several charters between the reigns of Edward II. and James II., and was represented in the Irish parliament until the Union. Carlingford Lough is a rock basin hollowed out by glacial action. The oyster beds have long been valuable.

CARLINVILLE, a city of western Illinois, U.S.A., on the Chicago and Alton railroad, 60m. N. by E. of Saint Louis; the county seat of Macoupin county. Population in 1940 was 4,965. Natural gas is found in the vicinity, and in a normal year the county mines over 6,000,000 tons of coal. The city manufactures brick, tile and monuments. It was settled about 1828 and incorporated as a city in 1865. A new 250-ac. lake supplies water.

CARLI-RUBBI, GIOVANNI RINALDO, Count of (1720–1795), Italian economist and antiquarian, was born at Capo d'Istria. At the age of 24 he was appointed professor of astronomy and navigation in the University of Padua, and entrusted with the superintendence of the Venetian marine. After filling these offices for seven years he resigned them in order to devote himself to the study of antiquities and political economy. Among his principal works are his *Dell' origine e del commercio della moneta, e dell' instituzione delle zecche d'Italia*, published in four parts between 1751 and 1759; his *Ragionamento sopra i bilanci economici delle nazioni* (1759); his *Sul libero commercio dei grani* (1771), and his *Antichità Italiche* (1771).

CARLISLE, EARLS OF. This English title has been held by two families, being created for James Hay in 1622, and being extinct in that line on the death of his son in 1660, and then being given in 1661 to Charles Howard, and descending to the present day in the Howard family.

James Hay, 1st earl of Carlisle (d. 1636), the son of Sir James Hay of Kingask (a member of a younger branch of the Erroll family), was knighted and taken into favour by James VI. of Scotland, brought into England in 1603, treated as a "prime favourite" and made a gentleman of the bedchamber. He received many titles and honours, was created Lord Hay of Sawley (1615), Viscount Doncaster (1618), and earl of Carlisle (1622). James employed him on many important diplomatic missions to France, Germany and Spain. On July 2, 1627, Lord Carlisle obtained from the king a grant of all the Caribbean Islands, including Barbados, this being a confirmation of a former concession given by James I. He was also a patentee and councillor of the plantation of New England, and showed great zeal and interest in the colonies. He became gentleman of the bedchamber to King Charles I. after his accession. In 1628, after the failure of the expedition to Rhé, he was sent to make a diversion against Richelieu in Lorraine and Piedmont; he counselled peace with Spain and the vigorous prosecution of the war with France, but on his return home found his advice neglected. He took no further part in public life, and died in March 1636. "He left behind him," says Clarendon, "a reputation of a very fine gentleman and a most accomplished courtier, and after having spent, in a very jovial life, above £400,000, which upon a strict computation he received from the crown, he left not a house or acre of land to be remembered by."

The charms and wit of his second wife, Lucy, countess of Carlisle *née* Percy (1599–1660) which were celebrated in verse by all the poets of the day, including Carew, Cartwright, Herrick and Suckling, and by Sir Toby Matthew in prose, made her a conspicuous figure at the court of Charles I. There appears no foundation for the scandal which made her the mistress successively of Strafford and of Pym. Strafford valued highly her sincerity and services, but after his death, possibly in consequence of a revulsion of feeling at his abandonment by the court, she devoted herself to Pym and to the interests of the parliamentary leaders, to whom she communicated the king's most secret plans and counsels. Her greatest achievement was the timely disclosure to Lord Essex of the king's intended arrest of the five members, which enabled them to escape. But she appears to have served both parties simultaneously, betraying communications on both sides, and doing considerable mischief in inflaming political animosities. In 1647 she attached herself to the interests of the moderate Presbyterian party, which assembled at her house, and in the second Civil War showed great zeal and activity in the royal cause, pawned her pearl necklace for £1,500 to raise money for Lord Holland's troops, established communications with Prince Charles during his blockade of the Thames, and made herself the intermediary between the scattered bands of royalists and the queen. In consequence her arrest was ordered on March 21, 1649, and she was imprisoned in the Tower, whence she maintained a correspondence in cipher with the king through her brother, Lord Percy, till Charles went to Scotland. According to a royalist newsletter, while in the Tower she was threatened with the rack to extort information. She was released on bail on Sept. 25, 1650, but appears never to have regained her former influence in the royalist counsels, and died soon after the Restoration, on Nov. 5, 1660.

The first earl was succeeded by JAMES, his only surviving son by his first wife, at whose death in 1660 without issue, the peerage became extinct in the Hay family.

Charles Howard, 1st earl of Carlisle in the Howard line (1629–85), was the son and heir of Sir William Howard, of Naworth in Cumberland. In 1645 he became a Protestant and supported the government of the commonwealth, being appointed high sheriff of Cumberland in 1650. He bought Carlisle Castle and became governor of the town. He distinguished himself at the battle of Worcester on Cromwell's side, was made a member of the council of state in 1653, chosen captain of the protector's body-guard and selected to carry out various public duties. In 1655 he was given a regiment, was appointed a commissioner to try the northern rebels, and a deputy major-general of Cumberland, Westmorland and Northumberland. In the parliament of 1653 he sat for Westmorland, in those of 1654 and 1656 for Cumberland. In 1657 he was included in Cromwell's House of Lords and voted for the protector's assumption of the royal title the same year. In 1659 he urged Richard Cromwell to defend his government by force against the army leaders, but his advice being refused he used his influence in favour of a restoration of the monarchy, and after Richard's fall he was imprisoned. In April 1660 he sat again in parliament for Cumberland, and at the Restoration was made *custos rotulorum* of Essex and lord-lieutenant of Cumberland and Westmorland. On April 20, 1661, he was created Baron Dacre of Gillesland, Viscount Howard of Morpeth, and earl of Carlisle; the same year he was made vice-admiral of Northumberland, Cumberland and Durham, and in 1662 joint commissioner for the office of earl marshal. In 1663 he was appointed ambassador to Russia, Sweden and Denmark, and in 1668 he carried the Garter to Charles XI. of Sweden. In 1667 he was made lieutenant-general of the forces and joint commander-in-chief of the four northernmost counties. In 1672 he became lord-lieutenant of Durham, and in 1673 deputy earl marshal. In 1678 he was appointed governor of Jamaica and reappointed governor of Carlisle. He died on Feb. 24, 1685, and was buried in York Minster.

Frederick Howard, 5th earl (1748–1825), was a member of a commission sent out by Lord North to attempt a reconciliation with the American colonies. In 1780 he became viceroy of Ireland. The two years of Carlisle's rule passed in quietness and prosperity, and the institution of a national bank and other measures which he effected left permanently beneficial results upon the commerce of the island. In 1789, in the discussions as to the regency, Carlisle took a prominent part on the side of the prince of Wales. In 1791 he opposed Pitt's policy of resistance to the dismemberment of Turkey by Russia; but on the outbreak of the French Revolution he left the opposition and vigorously maintained the cause of war. In 1815 he opposed the enactment of the Corn Laws; but from this time till his death, in 1825, he took no important part in public life. Carlisle was the author of some political tracts, a number of poems, and two tragedies, *The Father's Revenge* and *The Stepmother*, which received high praise from his contemporaries. His mother was a daughter of the 4th Lord Byron, and in 1798 he was appointed guardian to Lord Byron, the poet, who lampooned him in *English Bards and Scotch Reviewers*.

George Howard, 6th earl (1773–1848), eldest son of the 5th earl, entered parliament as Lord Morpeth in 1795 as a Whig. He was appointed to the Indian board in 1806, when the "Ministry of all the Talents" took office, but resigned in 1807, though he remained prominent in the House of Commons. After his elevation to the House of Lords (1825), he held various cabinet offices under Canning and Grey. He made some minor contributions to literature and left the reputation of an amiable scholar.

George William Frederick Howard, 7th earl (1802–64), was born in London on April 18, 1802, eldest son of the 6th earl by his wife Lady Georgiana Cavendish. He was educated at Eton and Christ Church, Oxford, where (as Lord Morpeth) he earned a reputation as a scholar and writer of graceful verse. He sat in parliament for Morpeth (1826–32), and subsequently for the West Riding. In the agitation for parliamentary reform he took the side of Earl Grey. In 1835 he was appointed by Lord Melbourne chief secretary for Ireland. This post he held for about six years (being included in the cabinet in 1839), winning great popularity by his amiable manners and kindly disposition. Losing his seat at the election of 1841, he visited the United States, but in 1846 he was again returned for the West Riding, and was made chief commissioner of woods and forests in Lord John Russell's cabinet. Succeeding to the peerage in 1848, he became chancellor of the duchy of Lancaster in 1850. The great event of his life, however, was his appointment by Lord Palmerston to the lord-lieutenancy of Ireland in 1855. This office he continued to hold till Feb. 1858, and again from June 1859 till within a few months of his death. Among his writings may be mentioned a lecture on *The Life and Writings of Pope* (1851); *The Last of the Greeks*, a tragedy (1828); a *Diary in Turkish and Greek Waters* (1854), the fruit of travels in the East in 1853 and 1854; and a volume of *Poems*, published after his death. In 1866 appeared his *Viceregal Speeches*, collected and edited by J. Gaskin. He took warm interest in the reformation of juvenile criminals, and established on his own estate one of the best conducted reformatories in the country. Lord Carlisle died at Castle Howard on Dec 5, 1864. He never married, and was succeeded in the peerage by his brother, the REV. WILLIAM GEORGE HOWARD (d. 1889), as 8th earl.

George James Howard, 9th earl (1843–1911), was the son of Charles, 4th son of the 6th earl. He was educated at Eton and Trinity and Cambridge and married in 1864 Rosalind, daughter of the 2nd Lord Stanley of Alderley. Howard sat in parliament as a Liberal in 1879–80, and again from 1881 to 1885; and succeeded his uncle in the peerage in 1889. In the split in the Liberal party over Home Rule Carlisle joined the Liberal Unionists, but did not again sit in the Commons. In the House of Lords he rarely spoke, except on licensing questions, in which, as a lifelong temperance advocate, he took a keen interest. His real distinction lay in his knowledge and practice of art. He was a pupil of Legros and Giovanni Costa, and was an excellent landscape painter. For 30 years he was a trustee of the National gallery, London, and a great connoisseur. The Mabuse "Adoration of the Magi" in the National gallery was sold from the Carlisle collection to the National gallery at a figure far below its market price. He died at Hindhead, Surrey, on April 16, 1911.

His wife, Rosalind Frances (1845–1921), youngest daughter of the 2nd Lord Stanley of Alderley, was married in 1864. Her mother was one of the founders of Girton college, Cambridge, and Lady Carlisle took a keen interest in the advancement of women's education. Up to 1885 the Howards' house in Kensington was a centre for Liberal politicians, as well as for the artists who gathered round George Howard. When the Home Rule split came Lady Carlisle remained a staunch friend of Gladstone, and she moved gradually further and further to the Left. Most of her life was spent in the north on her husband's estates, the management of which was left to her. She was an even more enthusiastic temperance advocate than her husband, and was president from 1903 onwards of the National British Women's Temperance movement. She was president also of the Women's Liberal Federation from 1896 to 1901, then from 1906 to 1914, and worked with her group for a democratic franchise for women, when many Liberal women were prepared to accept a narrower measure. She died in London on Aug. 12, 1921.

Charles James Stanley Howard, 10th earl (1867–1912), son of the 9th earl and his wife Rosalind noticed above, was an active member of the London School board (1894–1902) and Unionist M.P. for Birmingham (1904–11). Viscount Morpeth succeeded his father in 1911, and died the January following. He was succeeded by his son GEORGE JOSELYN, 11th earl (b. 1895), who was educated at Osborne and Dartmouth, and served in the navy until 1920.

CARLISLE, a city, municipal and parliamentary borough, and the county town of Cumberland, England, 299 mi. N.N.W. of London and 8 mi. S. of the Scottish border. Pop. (1938), 60,220. Area 7 sq mi. It lies on the south bank of the river Eden, a little below the point where it debouches upon the Solway plain, 8 mi. above its mouth in the Solway firth, at the junction of two tributaries from the south, the Caldew and the Petteril, which leave a small strip of land between them. The city grew up originally about two slight eminences on this peninsula, crowned respectively by cathedral and castle. Silloth, on the Irish sea, is the nearest port (21 miles). Carlisle is one of the principal railway centres in Great Britain, the chief lines being those of the L.M.S. and L.N.E. railways. Through connections with Scotland are maintained past the head of the Solway firth. The Romano-British *Luguvallium* occupied the site of the city. It lay a mile south of Hadrian's wall and seems to have been a town rather than a fort. Its position near the small ports on the Solway firth brought it much intercourse with Ireland and the Isle of Man.

Carlisle (*Caer Luel, Karliol*) is first mentioned in 685, when under the name of Luel it was bestowed by Egfrith on St. Cuthbert to form part of his see of Lindisfarne. It was then a thriving and populous city, and when St. Cuthbert visited it in 686 he was shown with pride the ancient walls and a Roman fountain. In the 9th century it was destroyed by the Danes and vanishes completely from history until in 1092 it was re-established by William Rufus, who built the castle. During the centuries of border strife which followed, the history of Carlisle centres round that of the castle, which formed the chief bulwark against the Scots on the western border and played an important part in the history of the country down to the rebellion of the Young Pretender in 1745. At the time of the Scottish wars two parliaments were held at Carlisle, in 1300 and in 1307. A charter from Edward I, dated 1293, exemplifies two earlier grants. The first, from Henry II, confirmed the liberties and customs which the city had theretofore enjoyed, granting in addition a free gild merchant, with other privileges. This grant is exemplified in the second charter, from Henry III, dated 1251. A charter from Edward II, dated 1316, grants to the citizens the city, the king's mills in the city and the fishery in the Eden. A charter from Edward III in 1352 enumerates the privileges and liberties hitherto enjoyed by the citizens, including a market twice a week, on Wednesday and Saturday; a fair for 16 days at the feast of the Assumption of the Virgin (Aug. 15); free election of a mayor, bailiffs and two coroners; and the right to hold their markets in the place called "Battailholm." It also mentions that the city was greatly impoverished by reason of the devastations of the Scots and by pestilence. Confirmations of former privileges were issued by Richard II, Henry IV, Henry VI and later sovereigns. Although the city had been under the jurisdiction of a mayor and bailiffs at least as early as 1290, the first charter of incorporation was granted by Elizabeth in 1566. A charter of James I confirmed former liberties, and in 1638 Charles I granted a charter under which the town continued to be governed until 1835. It declared Carlisle a city by itself.

The Cathedral.—Bede named a monastery which seems to have had close connections with Irish and Scottish churches until its destruction by the Danes. William Rufus is given the credit for its rehabilitation. The bishopric of Carlisle was created by Henry I in 1133, out of the house of Augustinian canons, founded in 1102. This was the sole episcopal chapter of regular canons of St. Augustine in England. It was dissolved in 1540. Between 1156 and 1204 the bishop's throne was unoccupied, but thereafter there was a continuous succession. The diocese covers the counties of Cumberland (except Alston parish) and Westmorland (except Firbank parish) and part of Lancashire. The cathedral, a fine cruciform building with a central tower, is incomplete. Of the Norman nave, built by Aethelwold, the first prior and bishop, only two bays are standing, the remainder having been destroyed by the Parliamentarians in 1646. The south transept and the lower part of the tower piers are also of the period. Remarkable distortion is seen in the nave arches, owing to the sinking of the foundations. The thinness of the aisle walls, and the rude masonry of the foundations of the original apse which have been discovered, point to native, not Norman, workmanship. The choir is ornate and beautiful, and the huge decorated east window, with its elaborate tracery, is perhaps the finest of its kind extant. The present tower, erected with some difficulty on the weak foundations of the Norman period, dates from 1400–19. Of the conventual buildings, little more than a Perpendicular gateway and refectory remain.

The moated castle, now used as barracks, has been so far altered that only the keep is of special interest. Fragments of the old city walls are seen on the western side. Notable public buildings are the city hall, the courthouses, museum and art gallery. The Cumberland infirmary serves an area reaching to Northumberland and Dumfriesshire. The grammar school, of very early foundation, received endowment from Henry VIII. Much valuable information relating to the early history and customs of Carlisle is furnished both by the Dormont Book, which contains an elaborate set of by-laws dated 1561, and by the records of the eight craft gilds—weavers, smiths, tailors, tanners, shoemakers, skinners, butchers and merchants. The corporation plate includes two 16th-century racing bells, which are the oldest racing prizes in England. The constant wars until the union of the crowns of England and Scotland impeded commerce; and Fuller, writing in the 17th century, says that the sole manufacture was that of fustian. In 1750 the manufacture of coarse linen cloth was established and was followed in a few years by the introduction of calico stamperies. The commercial prosperity of Carlisle, however, began with the railway development of the 19th century. The main industries are lithography, engineering, iron working, brewing, tanning and biscuit making; there are large locomotive and carriage works. In 1916 the Liquor Control board took over the supply of intoxicants in Carlisle and district, acquiring five breweries and 321 licensed businesses, as a result of a wave of drunkenness, and in 1921 the management of the trade was transferred to the home secretary. The number of licensed houses in the borough was reduced by 50% between 1916 and 1938 as the cases of drunkenness fell from 964 to 87. Much work was done in widening streets and bridges, and a municipal airport has been established. The parliamentary borough returns one member.

See *Victoria County History, Cumberland;* R. S. Ferguson, *Some Municipal Records of the City of Carlisle* (Cumberland and Westm. Antiq. and Archaeol. Soc., Carlisle and London, 1887), and *Royal Charters of Carlisle* (1894); Mandell Creighton, *Carlisle* in "Historic Towns" series (London, 1889).

CARLISLE, a borough of Cumberland county, Pennsylvania, U.S.A., in the pleasant and fertile Cumberland valley, 18 mi. W. by S. of Harrisburg. It is the eastern gateway of the Pennsylvania Turnpike, all-weather express highway, tunnelled through the Alleghenies to Pittsburgh; and is also served by the Pennsylvania and Reading railways. The population in 1940 was 13,984. The county seat, it is an industrial centre, producing rugs, carpets, shoes. Factory output in 1940 was valued at $12,217,000.

Dickinson college, founded there in 1773 by John Dickinson (*q.v.*) and Dr. Benjamin Rush (*q.v.*), is the second oldest in the state. Its oldest building (West college), designed by Latrobe, is a fine example of classic colonial architecture. Enrolment is restricted to 600, one-fourth being women. The medical field service school of the U.S. army occupies Carlisle barracks, a pre-revolutionary army post, used successively as a munitions factory in the Revolution, as an artillery school, a cavalry school, for the famous Carlisle Indian school (1879) and an army hospital in 1917–18. A guardhouse built by Hessians captured at the battle of Trenton still stands. Carlisle was laid out in 1751, and its stockade (Ft. Lowther) was a refuge for pioneers from the western frontiers. County and borough were named for Cumberland, England, and its county town. In 1794 Washington made Carlisle his headquarters during the "whisky rebellion" in western Pennsylvania. It was the home of "Molly Pitcher," heroine of the battle of Monmouth. On the night of July 1, 1863, it was bombarded by Confederate troops.

The borough was incorporated in 1872 and in 1921 adopted a commission-manager form of government.

CARLOFORTE, a town of Sardinia, in the province of Cagliari, the capital of the small island (6 m. by 5 m.) of San Pietro (anc. *Accipitrum* or *'Ιερακοννῆσος*, *i.e.*, the hawk's island) off the west coast of Sardinia. Pop. (1936) 8,030. It lies on the east coast of the island, 6 m. west by sea from Porto Vesme, which is 15 m. S.W. by road from Iglesias. It was founded in 1737 by Charles Emmanuel III. of Savoy, who planted a colony of Genoese whose dialect and costume still prevail. In 1798 it was attacked by the Tunisians and 933 inhabitants were taken away as slaves. They were ransomed after five years and the place fortified. It is now a centre of the tunny fishery, and there are manganese mines, while most of the ore from the mines of the Iglesias district is shipped here. Three miles to the south-east is the island of S. Antioco (*see* SULCI).

CARLOMAN (828–880), king of Bavaria and Italy, was the eldest son of Louis the German, king of the East Franks. He married a daughter of Ernest, count of the Bohemian mark, and in conjunction with his father-in-law resisted the authority of his father in 861. In 865 an arrangement was made by which he became possessed of Bavaria and Carinthia as his expectant share of the kingdom of Louis. During the troubles between Louis and his two younger sons Carloman remained faithful to his father, and carried on the war with the Moravians so successfully that when peace was made at Forchheim in 874 they recognized the Frankish supremacy. In 875 the emperor Louis II. died, having named his cousin Carloman as his successor in Italy. Carloman crossed the Alps to claim his inheritance, but was cajoled into returning by the king of the West Franks, Charles the Bald. In 876, on his father's death, Carloman became actually king of Bavaria, and after a short campaign against the Moravians he went again to Italy in 877 and was crowned king of the Lombards at Pavia; but his negotiations with Pope John VIII. for the imperial crown were fruitless. Stricken with paralysis, he bequeathed the whole of his lands to Louis. He died on Sept. 22, 880, at Öttingen, where he was buried, leaving an illegitimate son, afterwards the emperor Arnulf.

See Regino von Prum's "Chronicon" and "Annales Bertiniani" in *Monumenta Germaniae Historica. Scriptores,* Bd. i. (ed. G. H. Pertz, Hanover, 1826–92); E. Dümmler, "Geschichte des Ostfränkischen Reiches," in *Jahrbücher der Deutschen Geschichte* (Leipzig, 1887–88); J. F. Böhmer, *Die Regesten des Kaiserreichs unter den Karolingern,* vol. i. (ed. E. Mühlbacher, Innsbruck, 1908).

CARLOMAN, the name of three Frankish princes.

CARLOMAN (d. 754), mayor of the palace under the Merovingian kings, was a son of Charles Martel, and, together with his brother, Pippin the Short, became mayor on his father's death in 741, administering the eastern part of the Frankish kingdom. He extended the power of the Franks in various wars, and strengthened the church in the lands under his rule. In 747 Carloman retired to a monastery which he founded on Monte Soracte, but subsequently entered a monastery on Monte Casino. He died at Vienne on Aug. 17, 754.

CARLOMAN (751–771), king of the Franks, was a son of King Pippin the Short, and consequently a brother of Charlemagne. The brothers became joint kings of the Franks on Pippin's death in 768. Trouble between them arising out of the conduct of the war in Aquitaine was followed by Carloman's death at Samoussy on Dec. 4, 771. He married Gerberga, daughter of Desiderius, king of the Lombards.

CARLOMAN (d. 884), king of France, was the eldest son of King Louis II., the Stammerer, and became king, together with his brother Louis III., on his father's death in 879. Although some doubts were cast upon their legitimacy, the brothers obtained recognition and in 880 made a division of the kingdom, Carloman receiving Burgundy and the southern part of France. In 882 he became sole king owing to his brother's death Carloman met his death while hunting on Dec. 12, 884.

See E. Lavisse, *Histoire de France,* tome ii. (1903).

CARLOS I. (1863–1908), king of Portugal, the third sovereign of Portugal of the line of Braganza-Coburg, son of King Louis I. and Maria Pia, daughter of King Victor Emmanuel of Italy, was born at Lisbon on Sept. 28, 1863. On May 22, 1886, he married Marie Amélie, daughter of Philippe, duc d'Orléans, comte de Paris, and on the death of his father (Oct. 19, 1889) he succeeded to the throne of Portugal. In that year the British Government remonstrated against Portuguese encroachments in South Africa, and relations between the two countries were greatly strained for some time. The king's attitude at this crisis was conciliatory, and aided peaceful relations. King Carlos was an artist of some repute, and a keen student of oceanography. In May 1907 he suspended the constitution of Portugal and temporarily appointed Senhor Franco as dictator for the execution of necessary reforms. Some discontent was aroused by this proceeding; this was increased by Franco's drastic measures, and on Feb. 1, 1908, King Carlos and his elder son, Louis, duke of Braganza (1887–1908), were assassinated whilst driving through the streets of Lisbon. The king was succeeded by his only surviving son, Manoel, duke of Beja (1889–1932), who took the title of Manoel II.

See L. de Colleville, *Carlos Ier intime* (1906).

CARLOS, DON (1545–1568), prince of Asturias, the son of Philip II., king of Spain, by his first wife Maria, daughter of John III. of Portugal, was born at Valladolid on July 8, 1545. In 1560 he was recognized as heir to the throne of Castile, and three years later to that of Aragon, but his mental derangement became so acute that in his morbidness he even contemplated the murder of his father. At length, in Jan. 1568, when he had made preparations for flight from Spain, he was placed in confinement by order of Philip, and on July 24 he died. He had not married, though Elizabeth and Margaret, daughters of Henry II. of France, Mary, queen of Scots, and Anne, daughter of the emperor Maximilian II. had been suggested for him. The marriage of his father and Elizabeth, to whom Carlos had once been betrothed, is believed by some writers to have hastened his death. Schiller and Alfieri, J. G. de Campistron in *Andronic,* and Lord John Russell have made the relations between Don Carlos and his father the subject of dramas; and other dramas based upon the life of Don Carlos have been written by Thomas Otway, M. A. Chénier, J. P. de Montalvan, and D. X. de Enciso.

See L. von Ranke, *Zur Geschichte des don Carlos* (1829); W. H. Prescott, *History of the Reign of Philip II.,* vol. ii. (1855, 1859);

L. P. Gachard, *Don Carlos et Philippe II.* (1863); C. de Moüy, *Don Carlos et Philippe II.* (1863); L. A. Warnkönig, *Don Carlos, Leben, Verhaftung und Tod* (Stuttgart, 1864); W. Maurenbrecher, *Don Carlos* (1876); M. Büdinger, *Don Carlos, Haft und Tod* (1891); F. Rachfahl, *Don Carlos Kritische Untersuchungen* (Freiburg, 1921).

CARLOS, DON (CARLOS MARIA ISIDRO) (1788–1855), the first of the Carlist claimants of the throne of Spain, was the second surviving son of King Charles IV. and his wife, Louisa Maria of Parma. He was born on Mar. 29, 1788. From 1808 till 1814, he was a prisoner of Napoleon in France. Returning to Madrid, he married, in 1816, Maria Francesca de Asis, daughter of King John VI. of Portugal, and sister of the second wife of his elder brother King Ferdinand VII. Though he took no part in the Government, except to hold a few formal offices, Don Carlos was known for his religious orthodoxy and his firm belief in the divine right of kings. During the revolutionary troubles of 1820–23 he was threatened by the extreme radicals, but no attack was made on him. Towards the close of Ferdinand's reign Don Carlos was forced into the position of a party leader, for when Ferdinand endeavoured to alter the law of succession in order to secure the crown for his daughter Isabella, the Spanish clericals banded to protect the rights of Don Carlos, and he might easily have placed himself at the head of an insurrection had he not considered rebellion a sin. In Mar. 1833, Don Carlos went to Portugal to support Don Miguel, then regent. While there he was called upon by Ferdinand to swear allegiance to the infanta Isabella, afterwards queen, but he refused to renounce his rights and those of his sons. On the death of his brother in Sept. 1833, he was shut off from Spain by the civil war in Portugal, and could do nothing to direct the Spaniards who rose on his behalf and proclaimed him king as Charles V. When the Miguelite party was beaten in Portugal, Don Carlos escaped in a British warship to England in June 1834, and, crossing to France, joined his partisans at Elizondo in the valley of Bastan, in the western Pyrenees. On Oct. 27, 1834, he was deprived of his rights as infante by a royal decree, confirmed by the Cortes on Jan. 15, 1837. Don Carlos remained in Spain till the defeat of his party, and then escaped to France in Sept. 1839. The defeat of his cause, which had many chances of success, was due to his want of capacity and apathy. His first wife having died in England, Don Carlos married her elder sister, the princess of Beira, in Oct. 1837. He abdicated his pretensions in May 1845, took the title of count of Molina, and died at Trieste on Mar. 10, 1855.

By his first marriage, Don Carlos had three sons, Charles (1818–61), John (1822–87) and Ferdinand (1824–61). Charles succeeded to the claims of his father, and was known to his partisans as Don Carlos VI., but more commonly as the count of Montemolin. In 1846, when the marriage of queen Isabella was being negotiated, the Austrian Government endeavoured to arrange an alliance between the two, but as Charles insisted on the complete recognition of his rights, the Spanish Government refused the alliance. In April 1860 he and his brother Ferdinand landed at San-Carlos de la Rápita, at the mouth of the Ebro, but no Carlist rising took place, and the princes only saved their lives by an abject surrender of their claims. Later at Cologne, the count of Montemolin publicly retracted his renunciation on June 15 on the ignominious ground that it had been extorted by fear. Both princes died in Jan. 1861 without issue.

The third brother, John, who had advanced his own claims before his brother's retraction, now came forward as the representative of the Carlist cause. On Oct. 3, 1868, he made a formal renunciation in favour of his son Charles, Don Carlos VII. (*q.v.*).

See H. Baumgarten, *Geschichte Spaniens* (Leipzig, 1861); H. Butler Clarke, *Modern Spain* (Cambridge, 1906), which contains a useful bibliography.

CARLOS, DON (CHARLES MARIA DE LOS DOLORES) (1848–1909), prince of Bourbon, claimant, as Don Carlos VII., to the throne of Spain, was born at Laibach on March 30, 1848, the son of Don Juan (John) of Bourbon and the archduchess Maria Beatrix, daughter of Francis IV., duke of Modena. Don Carlos was the grandson of the first pretender. He married in 1867, Princess Marguerite, daughter of the duke of Parma, and niece of the comte de Chambord, who bore him a son, Don Jaime, in 1870, and three daughters. Don Carlos boldly asserted his pretensions to the throne two years after the revolution of 1868 had driven Queen Isabella II. and the other branch of the Bourbons into exile, but his supporters were routed at Oroquista by the troops of King Amadeus in 1872, and Don Carlos himself became a fugitive in the French Pyrenees. When the Federal republic was proclaimed on the abdication of King Amadeus, the Carlists, organized in guerrilla bands, many of them led by priests, had overrun Spain to such an extent that they held the interior of Navarre, the three Basque provinces, and a great part of Catalonia, Lower Aragon, and Valencia, and had made raids into Old Castile and Estremadura. Don Carlos re-entered Spain in July, 1873, and was present at the siege of Bilbao and at the battle near Estella on June 27, 1874, in which Marshal Concha was killed and the liberals were repulsed with loss. Twice he lost golden opportunities of making a rush for the capital in 1873, during the Federal republic, and after Concha's death. His cousin, Alphonso XII. being proclaimed king, the tide of war turned against him, and in 1875, the Carlist bands were swept out of central Spain and Catalonia and in March 1876 from the Navarre district. From that date Don Carlos became a wanderer residing successively in England, Paris, Austria, and Italy. Two further chances of testing the power of his party in Spain came to him, but he failed to profit by them because of his lack of decision. The first was when he was invited to unfurl his flag on the death of Alphonso XII., when the perplexities of Castilian politics reached a climax during the first year of a long minority under a foreign queen-regent. The second was at the close of the war with the United States and after the loss of the colonies, when the discontent was so widespread that the Carlists were able to assure their prince that many Spaniards looked upon his cause as the solution of the national difficulties. After the death of his first wife in 1893, Don Carlos married, in 1894, Princess Marie Bertha of Rohan. He died at Varese, in Italy, on July 18, 1909.

CARLOW, a county of Eire in the province of Leinster, bounded north by the counties Kildare and Wicklow, east by Wicklow and Wexford, south by Wexford, and west by Laoighis Co. (formerly Queen's Co.) and Kilkenny. Excepting Louth, it is the smallest county in Ireland, having an area of 346 sq.mi. Pop. (1936), 34,452.

In the south-east is a range of barren granitic mountains, the chief peaks being Knockroe (1,746 ft.) and Mt. Leinster (2,610 ft.). This range is flanked on the east by mica-schists and Silurian slates and on the west by Carboniferous limestone, the level expanse of which covers the greater portion of the county. On the west side, the Barrow affords means of communication with Waterford whilst to the east the drainage is chiefly to the Slaney. Beyond the Barrow is the elevated tract of land known as the ridge of Old Leighlin (Gallows hill bog, 974 ft.), forming the beginning of the coal-measures of Leinster. Glacial deposits cover much of the lower land and many eskers may be seen near Bagenalstown.

Carlow, under the name of Catherlogh, is among the counties generally considered to have been created in the reign of John. Leinster was confirmed as a liberty to William Marshal, earl of Pembroke, by John, and Carlow, among other counties in this area, had the privileges of a palatinate on descending to one of the earl's heiresses. The relics of antiquity in the county comprise large dolmens, some relics of ecclesiastical and monastic buildings, and the remains of several castles built after the English settlement. Old Leighlin, where the 12th century cathedral of St. Lazerian is situated, is merely a village, although until the Union it returned two members to the Irish parliament. The soil is rich but stock-raising has become the most important rural activity.

Sheep, poultry and dairy cattle are kept and the farms are often large. The staple trade of the county is in corn, flour, meal, beet sugar, butter and provisions, which are exported in large quantities. The sandstone of the county is frequently of such a nature as to split easily into layers, known in commerce as Carlow flags. Porcelain clay exists in the neighbourhood of Tullow, but no attempt is made to turn this product to use.

The Great Southern railway from Kildare to Wexford follows the river Barrow through the county, with a branch from Bagenalstown to Kilkenny, while another branch from the north terminates at Tullow. Co. Carlow and Co. Kildare together form one constituency returning four members to the Dáil Eireann.

CARLOW, county town, Co. Carlow, Eire, on the river Barrow. Population of urban district (1936) 7,649. Little of the castle now remains. In the reign of Edward III the king's exchequer was removed thither and money applied to building town walls. Early in Elizabeth's reign Rory Oge O'More burned the town. Carlow submitted to Ireton in 1641 and was attacked in the insurrection of 1798. It obtained a charter of incorporation in the 13th century and was reincorporated by James I, returning two members to the Irish parliament. Two miles northeast of the town is an important dolmen and 3 mi. W. is the church of Killeshin of Norman and pre-Norman date. Brewing, flour milling, dairying and the manufacture of beet sugar are important.

CARLSBAD, a celebrated spa of Bohemia, Czechoslovakia (Czech, Karlovy Vary), lies about 1,225 ft. above sea level at the junction of the Tepl and the Eger. Surrounded by the precipitous pine-forested foothills of the Erzgebirge, it is squeezed along the valleys of both streams and rises picturesquely tier above tier on the slopes of the hills around. Legend ascribes its origin to an accidental discovery of its famous springs by the emperor Charles IV., but there was certainly an old pre-existent settlement, Vary, which derived enhanced prosperity and an addition to its name from his interest. His experience of the medicinal qualities of its waters caused him to build a castle near by and to confer many privileges upon the town. Its function as a curative spa tends to obscure other important activities of the district. The 17 warm mineral springs are believed to rise from a common reservoir, known as the Sprudelkessel, and range in temperature from 107·7° to 164° F. While they vary in temperature the chemical composition is constant and the following figures per thousand parts of water for the largest, the Sprudel, delivering 405 gallons per minute, are typical:—2·405 sulphate of soda, 1·298 bicarbonate of soda, 1·042 sodium chloride, 0·186 sulphate of potash, 0·166 bicarbonate of magnesia, 0·012 bicarbonate of lithium, 0·966 carbon dioxide, with traces of arsenic, antimony, rubidium, selenium, tin and organic substances. Free from colour and odour, the waters are slightly acid and saline and are used for drinking and bathing with beneficial effects in liver diseases and troubles due to uric acid. Owing to their powerful action they require to be used under careful medical direction regarding diet and exercise, and there are many elaborate curative establishments supplemented by several hospitals and hospices for poorer patients. Though the waters were first used for bathing in 1520 the rapid growth of the town as an international health resort dates from the middle of the 19th century, after which many of its imposing buildings, *e.g.*, the Kurhaus, the Kaiserbad, the Mühlbrunnen and Sprudel colonnades were erected. Concurrently, the porcelain and stoneware industries developed in range of markets and in character of products, concentrating upon luxury articles. The industries have a long record of prosperity based upon rich local supplies of high grade kaolin and ornamental stone with easy access to the coal of the Falkenau basin, some miles west of Carlsbad. There is a flourishing trade in fine leather goods, confectionery and the preparation of evaporated salts and bottled waters for export. During winter the town is dominated by the manufactures but with the advent of the season, which reaches its height in June and July, everything is subordinated to catering for visitors; the normal population (1930) of 23,901 is trebled by the influx and the town assumes a cosmopolitan appearance, reflected in the number of its churches and the variety of their denominations. There are charming wooded heights, *e.g.*, the Aberg (1,980 ft.), the König Otto's Höhe (1,960 ft.), the Dreikreuzberg (1,805 ft.) and many others. After 1933 the town became one of the active centres of national socialist propaganda in Czechoslovakia; in 1938, together with the Sudetenland, Carlsbad was occupied by Germany.

(W. S. L.; X.)

CARLSBAD, a city in southeastern New Mexico, U.S.A., on the Pecos river; the county seat of Eddy county. The population in 1940 was 7,116. It is served by the Santa Fe railway, and is a shipping point for quantities of potash, cotton, livestock, alfalfa, wool and oil. The Carlsbad irrigation project of the federal government comprises 25,045 ac., of which over 90% is under crops. The city has one of the few potash mines in the United States; it also has cotton gins, a cotton-seed oil mill and a bat guano fertilizer plant. There are five large lakes and mineral springs in the vicinity. In the Guadalupe mountains, 27 mi. S.W., is Carlsbad Caverns national park. The cavern there has lofty chambers, with limestone formations of extraordinary beauty and impressiveness. The Big Room is over ½ mi. long and has a maximum width of more than 600 ft. and a maximum height of 250 ft.

CARLSBAD CAVERNS NATIONAL PARK, a tract of about 9,960 ac. in southeast New Mexico, U.S.A., set apart in 1923 as a government reservation. The series of caverns from which it is named was formed by the dissolvent action of water on original beds of rock salt, limestone and gypsum in the predominating shale. Its total extent is not known, but is probably much greater than that of the present area of the reservation. One of the most notable discoveries is the Big Room, a cavern over ½ mi in length with a maximum width of 600 ft. and 250 ft. in height, containing a great variety of stalactites and stalagmites and portions of white limestone and onyx marble.

CARLSBAD DECREES, the name usually given to a series of resolutions (*Beschlüsse*) passed by a conference of the ministers of the more important German States, held at Carlsbad Aug. 6–31 1819. The occasion of the meeting was the desire of Prince Metternich to take advantage of the consternation caused by recent revolutionary outrages (especially the murder of the dramatist Kotzebue) to persuade the German Governments to combine in a system for the suppression of the Liberal agitation in Germany. The business to be discussed, as announced in Metternich's opening address, was twofold: (1) Matters of urgent importance necessitating immediate action; (2) Questions affecting the fundamental constitution of the German Confederation, demanding more careful and prolonged discussion.

These questions were debated in 23 formal conferences. On the issues raised by the first class there was practical unanimity. All were agreed that the state of Germany demanded disciplinary measures, and it was decided to lay before the Federal Diet definite proposals for (1) a uniform press censorship of all periodical publications; (2) a system of "curators" to supervise education in universities and schools; and (3) the erection of a central commission at Mainz, armed with inquisitorial powers, for the purpose of unmasking the widespread revolutionary conspiracy assumed to exist.

On the questions raised under the second class there was more fundamental difference of opinion, especially on the burning question of the due interpretation of Article XIII. of the Federal act. The controversy raged round the distinction between "assemblies of estates," as laid down in the article, and "representative assemblies," such as had been already established in several German States. Gentz, in an elaborate memorandum, laid down that representation by estates was the only system compatible with the conservative principle, whereas representative assemblies were based on "the sovereignty of the people." In answer Count Wintzingerode, on behalf of the king of Württemberg, placed on record a protest, in which he urged that insistence upon the system of estates would be to stereotype caste distinctions foreign to the whole spirit of the age, would alienate public opinion from the Governments, and—if enforced by the central power—would violate the sovereign independence of those States which, like Württemberg, had already established representative constitutions. Though the majority of those present favoured the Austrian interpretation of Article XIII. as elaborated by Gentz, they were as little prepared as the representative of Württemberg to agree to any measures for strengthening the Federal Government at the expense of the prerogatives of the minor sovereignties. The result was that constitutional questions were reserved for further discussion at a general conference of German ministers to be summoned to Vienna later in the year. The effective Carlsbad resolutions, subsequently issued as laws by the Federal Diet, were therefore only those dealing with the curbing of the "revolutionary" agitation.

See GERMANY: *History*. The acts, protocols and resolutions of the conference of Carlsbad are given in M. de Martens's *Nouveau Recueil général de traités*, etc., t. 4, pp. 8–166 (Göttingen, 1846).

(W. A. P.)

CARLSTADT, KARLSTADT or KAROLOSTADT, **ANDREAS RUDOLF BODENSTEIN** (1480–1541), German reformer, was born at Carlstadt, Bavaria. He studied at the universities of Erfurt (1499–1503), Cologne and Wittenberg, where he acquired fame as a champion of the scholasticism of Thomas Aquinas. In 1513 he became professor of theology. In 1515 he went to Rome to take a degree in law. He returned to Germany as an ardent opponent of Thomism and as a champion of the Augustinian doctrine of the impotence of the human will and salvation through Divine grace alone. The 151 theses of Carlstadt, dated Sept. 16, 1516, discovered by T. Kolde (*"Wittenberger Disputationsthesen"* in *Zeitschrift für Kirchengeschichte*, xi), prove that Carlstadt was at this time actually in advance of Luther.

In 1518, in reply to Eck's *Obelisci*, an attack on Luther's 95 theses, Carlstadt published a series of theses, maintaining the supremacy of the Holy Scriptures over the authority of the fathers, and asserting the liability of general councils to error. A public disputation with Eck, in which Luther also took part, led to three polemical treatises against Eck in which he proclaimed the doctrine of the exclusive operation of grace in the justification of believers.

In 1520 he appeared as the first of modern biblical critics, denying the Mosaic authorship of the Pentateuch and classifying the Scriptures into three categories of different value in accordance with the degrees of certainty as to their traditional origin. He still, however, held their verbal inspiration, and attacked Luther for rejecting the epistle of James. The inclusion of Carlstadt's name in the papal bull excommunicating Luther resulted in his attack upon the papacy in *Von päpstlicher Heiligkeit*, (Oct. 1520).

In 1521 Carlstadt went to Denmark, on the invitation of Christian II., to assist in the reform of the church; but he was forced, by the hostility of nobles and clerics alike, to leave after a few weeks. In June he was back in Wittenberg, busy with tracts on the Holy Sacrament (he still believed in the corporeal presence) and against monasticism and the celibacy of the clergy. He was accepted as the leader of Protestantism in Wittenberg; and, at his instance, auricular confession, the elevation of the Host communion under one species, and the rules for fasting were abolished. In January he was married.

The return of Luther early in March, however, ended Carlstadt's supremacy, and communion in one kind and the elevation of the Host was restored. Carlstadt himself, though still professor, was deprived of all influence in practical affairs, and devoted himself to theological speculation. He now denied the necessity for a clerical order and retiring to Orlamünde abolished the Mass and even preached against the necessity for any sacraments. He occasionally lectured at Wittenberg and fulminated against Luther's policy of compromise.

All this brought him into conflict with the elector, Frederick the Wise, the university and Luther himself. His professorship and living were confiscated and in 1524 he went into exile. He was exposed to great privations, but found opportunity for polemical writing, proclaiming for the first time his disbelief in the "Real Presence." He visited Strasbourg, Heidelberg, Zürich, Basel, Schweinfurth, Kitzingen, Nördlingen and Rothenburg on the Tauber, from whence he had to fly for his life after the Peasants' War. His spirit was now broken, and from Frankfort he wrote to Luther humbly praying him to intercede for him with the elector. Luther agreed to do so, on receiving from Carlstadt a recantation of his heterodox views on the Lord's Supper, and as a result, the latter was permitted to return to Wittenberg (1525), but not to lecture. His refusal to take up the cudgels against Zwingli and Oecolampadius ended in his flight to avoid imprisonment. Taking refuge in Holstein and later in East Friesland, he ultimately reached Zürich, where Bucer and Oecolampadius secured him a friendly reception by Zwingli, who procured him employment. After Zwingli's death he remained in close intercourse with the Zürich preachers, who defended him against Luther's attacks; and finally, in 1534, on Bullinger's recommendation, he was called to Basel as preacher at the church of St. Peter and professor at the university He died there on Dec. 24, 1541.

During these latter years Carlstadt's attitude became more moderate. Despatched to Strasbourg in 1536, to discuss a proposed compromise in the matter of the Lord's Supper between the theologians of Strasbourg and Wittenberg, he displayed a conciliatory attitude which earned him the praise of Bucer. Carlstadt's historical significance lies in the fact that he was one of the pioneers of the Reformation; but he was a thinker and dreamer rather than a man of affairs. He lacked the balance of mind and sturdy common sense that inspired Luther's policy of consideration for "the weaker brethren." In reply to Luther's attack in *Wider die himmlischen Propheten*, he issued his *Anzeig etlicher Hauptartikel christlicher Lehre*, a compendious exposition of his views.

Besides the above mentioned works, Carlstadt's chief writings are *De Canonicis Scripturis* (1520), *Von Gelübden Unterrichtung* (1521), *De legis litera sive carne et spiritu* (1521), *Priestertum u. Opfer Christi* (1524), *Ob man gemach faren soll* (1524). His disputations with Eck were reprinted in 1903.

See C. F. Jaeger, *A. Bodenstein von Karlstadt* (Stuttgart, 1856); H Barge, *A. Bodenstein von Karlstadt*, 2 vols. (Leipzig, 1905); K. Müller, *Luther und Karlstadt* (Tübingen, 1907); Von Ranke, *Hist. of the Reformation in Germany* (Eng. trs., 1905) and J. Janssen, *Hist. of the German people*.

CARLSTADT, a borough of Bergen county, New Jersey, U.S.A., 5 mi north of Jersey city, on the Erie railroad. The population was 4,472 in 1920 (25% foreign-born white), and was 5,644 in 1940 by the federal census. The numerous and varied manufactures include silk, wire gauges, dynamos, candles, wax, cigars, safety razors, buttons, embroidery, marble, chemicals and petroleum products. The borough was incorporated in 1894.

CARLYLE, ALEXANDER (1722–1805), Scottish divine, was born on Jan. 26, 1722, at Commertrees Manse, Dumfriesshire, and passed his youth and early manhood at Prestonpans, where he witnessed the battle of 1745. He was educated at Edinburgh (M.A. 1743), Glasgow, and Leyden. From 1748 until his death, on Aug. 28, 1805, he was minister at Inveresk in Midlothian and became the leader of the moderate or "broad" Church section in the Scottish church. His personal appearance earned him the name of "Jupiter Carlyle," and Sir Walter Scott called him "the greatest demigod I ever saw."

See his *Autobiography* (published 1860; new ed., 1910).

CARLYLE, JOSEPH DACRE (1759–1804), British orientalist, was born at Carlisle. He was appointed, in 1795, professor of Arabic in Cambridge university. His translation from the Arabic of Yusuf ibn Taghri Birdi, the *Rerum Egypticarum Annales*, appeared in 1792, and in 1796 a volume of *Specimens of Arabic Poetry*, from the earliest times to the fall of the caliphate, with some account of the authors. Carlyle was appointed chaplain by Lord Elgin to the embassy at Constantinople in 1799, and in a tour through Asia Minor, Palestine, Greece and Italy, collected several valuable Greek and Syriac mss. for a projected critical edition of the New Testament, collated with the Syriac and other versions—a work, however, which he did not live to complete. On his return to England in 1801 he was presented to the living of Newcastle-on-Tyne, where he died April 12 1804.

CARLYLE, THOMAS (1795–1881), British essayist, historian and philosopher, born on Dec. 4, 1795, at Ecclefechan, in Annandale, was the eldest of the nine children of James Carlyle by his second wife, Margaret Aitken. The father was by trade a mason, and then a small farmer. He had joined a sect of seceders from the kirk, and had all the characteristics of the typical Scottish Calvinist. He was respected for his integrity and independence, and a stern outside covered warm affections. The family tie between all the Carlyles was unusually strong, and Thomas regarded his father with a reverence which found forcible expression in his *Reminiscences*. He always showed the tenderest love for his mother, and was the best of brothers. The narrow means of his parents were made sufficient by strict frugality. He was sent to school when he was about five and to Annan grammar-school when ten years old, and soon showed an appetite for learning which induced his father to decide to educate him for the ministry. He walked to Edinburgh in Nov., 1809, and entered the university. Of the professors, he liked Sir John Leslie the best and distinguished himself in mathematics. But he benefited most by his reading of books obtained from the University library and the Advocates' Library. A few lads in positions similar to his own began to look up to him as an intellectual leader, and their correspondence with him shows remarkable interest in literary matters. In 1814 Carlyle, still looking forward to the career of a minister, obtained the mathematical mastership at Annan. The salary of £60 or £70 a year enabled him to save a little money. He went to Edinburgh twice to deliver the discourses required from students of divinity, but the main occupation of his leisure time was wide reading in French and English literature and the study of mathematics. In 1816 he was appointed, through the recommendation of Leslie, to a school at Kirkcaldy, where Edward Irving, Carlyle's senior by three years, was also master of a school. Irving's severity as a teacher had offended some of the parents, who set up Carlyle to be his rival A previous meeting with Irving, also a native of Annan, had led to a little passage of arms, but Irving now welcomed Carlyle with a generosity which entirely won his heart, and the rivals soon became the closest of friends The intimacy, affectionately commemorated in the *Reminiscences*, was of great importance to Carlyle's whole career. "But for Irving," he says, "I had never known what the communion of man with man means." Irving had a library, in which Carlyle devoured Gibbon and much French literature, and they made various excursions together. Carlyle did his duties as a schoolmaster punctiliously, but found the life thoroughly uncongenial. No man was less fitted by temperament for the necessary drudgery and worry. His admiration for a Miss Gordon there seems to have suggested the "Blumine" of *Sartor Resartus;* but he made no new friendships, and when Irving left at the end of 1818 Carlyle also resigned his post.

He had by this time given up the ministry and altogether ceased to believe in Christianity in the winter of 1817–18, though he was and always remained in profound sympathy with its moral teaching. A period of severe struggle followed. He studied law for a time, but liked it no better than schoolmastering. He took a pupil or two, and wrote articles for the *Edinburgh Encyclopaedia* under the editorship of Brewster. He occasionally visited his family, and their unfailing confidence helped to keep up his courage. Meanwhile he was going through a spiritual crisis Atheism was profoundly repugnant to him. At last, one day in July or Aug., 1822, after three weeks' total sleeplessness, he went through the crisis afterwards described quite "literally" in *Sartor Resartus*. He cast out the spirit of negation, and henceforth the temper of his misery was changed to one, not of "whining," but of "indignation and grim fire-eyed defiance." That, he says, was his spiritual new-birth, though certainly not into a life of serenity. The conversion was coincident with Carlyle's submission to a new and very potent influence. In 1819 he had begun to read German, with which he soon acquired a very remarkable familiarity. Many of his contemporaries were awakening to the importance of German thought, and Carlyle's knowledge enabled him before long to take a conspicuous part in diffusing the new intellectual light. The chief object of his reverence was Goethe. In many most important respects no two men could be more unlike; but, for the present, Carlyle seems to have seen in Goethe a proof that it was possible to reject outworn dogmas without sinking into materialism. Goethe, by singularly different methods, had emerged from a merely negative position into a lofty and coherent conception of the universe. Meanwhile, Carlyle's various anxieties were beginning to be complicated by physical derangement. A rat, he declared, was gnawing at the pit of his stomach. He was already suffering from the agonies of indigestion from which he continued to suffer all his life.

Irving's friendship now became serviceable. Carlyle's confession of the radical difference of religious opinion had not alienated his friend, who was settling in London, and used his opportunities for promoting Carlyle's interest. In Jan. 1822 Carlyle, through Irving's recommendation, became tutor to Charles and Arthur Buller, who were to be students at Edinburgh. Carlyle's salary was £200 a year, and this, with the proceeds of some literary work, enabled him at once to help his brother John to study medicine and his brother Alexander to take up a farm. Carlyle was tutor to the young Bullers till July, 1824, when it was decided to send them to Cambridge and both Charles Buller and his parents continued to be his friends as long as they lived It was through Charles Buller that he later became acquainted with the Barings. Meanwhile he was employed upon a life of Schiller and a translation of *Wilhelm Meister*. He received £50 for a translation of Legendre's *Geometry;* and an introduction, explaining the theory of proportion, is said by De Morgan to show that he could have gained distinction as an expounder of mathematical principles. The impressions made upon him by London men of letters in 1824 were most unfavourable. Carlyle felt by this time conscious of having a message to deliver to mankind, and the men of letters, he thought, were making literature a trade instead of a vocation, and prostituting their talents to frivolous journalism. He went once to see Coleridge, who was then delivering his oracular utterances at Highgate, and the only result was the singularly vivid portrait given in a famous chapter in his life of Sterling. Coleridge seemed to him to be ineffectual as a philosopher, and personally to be a melancholy instance of genius running to waste. Carlyle, conscious of great abilities, and impressed by such instances of the deleterious effects of the social atmosphere of London, resolved to settle in his native district. There he could live frugally and achieve some real work. He could for one thing, be the interpreter of Germany to England A friendly letter from Goethe, acknowledging the translation of *Wilhelm Meister*, reached him towards the end of 1824 and greatly encouraged him. Goethe afterwards spoke warmly of the life of Schiller, and it was translated into German. Letters occasionally passed between them in later years, which were edited by Charles Eliot Norton in 1887. Goethe received Carlyle's homage with kind complacency. The gift of a seal to Goethe on his birthday in 1831 "from fifteen English friends," including Scott and Wordsworth, was suggested and carried out by Carlyle. Carlyle did much to promote interest in German literature during the next few years, and made some preparations for a history of German literature. British curiosity, however, about such matters seems to have been soon satisfied, and the demand for such work slackened.

Carlyle meanwhile was passing through the most important crisis of his personal history. Jane Baillie Welsh, born 1801, was the only child of Dr. Welsh of Haddington. She had shown precocious talent, and was sent to the school at Haddington where Edward Irving *(q.v.)* was a master. After her father's death in 1819 she lived with her mother, and her wit and money attracted many admirers. Her father had bequeathed to her all his property which was worth about £200 a year.

Her old tutor, Irving, was now at Kirkcaldy, where he became engaged to a Miss Martin. He visited Haddington occasionally in the following years, and a strong mutual regard arose between him and Miss Welsh. They contemplated a marriage, and Irving endeavoured to obtain a release from his previous engagement The Martin family held him to his word, and he took a final leave of Miss Welsh in 1822. Meanwhile he had brought Carlyle from Edinburgh and introduced him to the Welshes. Carlyle was attracted by the brilliant abilities of the young lady, procured books for her and wrote letters to her as an intellectual guide. The two were to perform a new variation upon the theme of Abelard and Héloïse. (A good deal of uncertainty long covered the precise character of their relations. Until 1909, when Mr. Alexander Carlyle published his edition of the "love-letters," the full material was not accessible; they had been read by Carlyle's biographer, Froude, and also by Charles Norton, and Norton [in his edition of Carlyle's *Early Letters*, 1886] declared that Froude had distorted the significance of this correspondence in a sense injurious to the writers. The publication of the letters certainly seems to justify Norton's view.) Miss Welsh's previous affair with Irving had far less importance than Froude ascribes to it; and she soon came to regard her past love as a childish fancy. She recognized Carlyle's vast intellectual superiority, and the respect gradually deepened into genuine love. The process, however, took some time. By 1825 Carlyle and she were planning marriage, and at Carlyle's instance she conveyed to her mother the house at Haddington, and everything in it, and gave her the life rent of Craigenputtock estate. She also made her will and bequeathed the fee-simple of the estate to Carlyle. She had been brought up in a station superior to that of the Carlyles, and could not accept the life of hardship which would be necessary in his present circumstances. Carlyle, accustomed to his father's household, was less frightened by the prospect of poverty. He was determined not to abandon his vocation as a man of genius by following the lower though more profitable paths to literary success, and expected that his wife should share the necessary sacrifice of comfort. The natural result of such discussions followed. The attraction became stronger on both sides, in spite of occasional spasms of doubt.

About the same time, July 1825, a friend of Irving's, Mrs Basil Montague, wrote to Miss Welsh, to exhort her to suppress her love for Irving, who had married Miss Martin in 1823. Miss Welsh replied by announcing her intention to marry Carlyle; and then told him the whole story, of which he had previously been ignorant. He properly begged her not to yield to the impulse without due consideration. She answered by coming at once to his father's house, where he was staying; and the marriage was finally settled. It took place on Oct. 17, 1826.

Carlyle had now to arrange the mode of life which should enable him to fulfil his aspiration. His wife had made over her income to her mother, but he had saved a small sum upon which to begin housekeeping. A passing suggestion from Mrs. Carlyle that they might live with her mother was judiciously abandoned. Carlyle had thought of occupying Craigenputtock, a remote and dreary farm belonging to Mrs. Welsh. His wife objected to his utter incapacity as a farmer; and they finally took a small house at Comely Bank, Edinburgh, where they could live on a humble scale. The brilliant conversation of both attracted some notice in the literary society of Edinburgh. The most important connection was with Francis, Lord Jeffrey, still editor of the *Edinburgh Review*. Though Jeffrey had no intellectual sympathy with Carlyle, he accepted some articles for the *Review* and became warmly attached to Mrs Carlyle. Carlyle began to be known as leader of a new "mystic" school, and his earnings enabled him to send his brother John to study in Germany. The public appetite, however, for "mysticism" was not keen. In spite of support from Jeffrey and other friends, Carlyle failed in a candidature for a professorship at St. Andrews. His brother, Alexander, had now taken the farm at Craigenputtock, and the Carlyles decided to settle at the separate dwelling-house there, which would bring them nearer to Mrs Welsh. They went there in 1828, and began a hard struggle. Carlyle, indomitably determined to make no concessions for immediate profit, wrote slowly and carefully, and turned out some of his most finished work. He laboured "passionately" at *Sartor Resartus*, and made articles out of fragments originally intended for the history of German literature. The money difficulty soon became more pressing. John, whom he was still helping, was trying unsuccessfully to set up as a doctor in London; and Alexander's farming failed. In spite of such drawbacks, Carlyle in later years looked back upon the life at Craigenputtock as on the whole a comparatively healthy and even happy period, as it was certainly one of most strenuous and courageous endeavour. Though absorbed in his work, he found relief in rides with his wife, and occasionally visiting their relations. Their letters during temporary separations are most affectionate. The bleak climate, however, the solitude, and the necessity of managing a household with a single servant, were trying to a delicate woman. In the autumn of 1831 Carlyle accepted a loan of £50 from Jeffrey, and went in search of work to London, whither his wife followed him. He made some engagements with publishers, though no one would take *Sartor Resartus*, and he returned to Craigenputtock in the spring of 1832. Jeffrey, stimulated perhaps by his sympathy for Mrs. Carlyle, was characteristically generous. Besides pressing loans upon both Thomas and John Carlyle, he offered to settle an annuity of £100 upon Thomas, and finally enabled John to support himself by recommending him to a medical position.[1] Carlyle's proud spirit of independence made him reject Jeffrey's help as long as possible; and even his acknowledgment of the generosity (in the *Reminiscences*) is not so cordial as might have been expected. In 1834 he applied to Jeffrey for a post at the Edinburgh Observatory, for which his knowledge of mathematics and astronomy made him specially well qualified. But Jeffrey preferred to give the job to a man who had been clerk in his service, which led to a break between Carlyle and Jeffrey which lasted some years.

In the beginning of 1833 the Carlyles made another trial of Edinburgh. There he found materials in the Advocate's Library for the article on the *Diamond Necklace*, one of his most perfect writings, and he began to study the history of the French Revolution. *Sartor Resartus* was at last appearing in *Fraser's Magazine*, though the rate of payment was cut down, and the publisher reported that it was received with "unqualified dissatisfaction." Both Carlyle and his wife liked Edinburgh, but on the whole preferred London. Besides, the materials for the history of the French Revolution which he had decided to write were more accessible in London; so they went there in the summer of 1834, and took the house at 5 (now 24) Cheyne row, Chelsea, which Carlyle inhabited till his death; the house has since been bought for the public. Irving, who had welcomed him on former occasions, was just dying—a victim, as Carlyle thought, to fashionable cajoleries. A few young men were beginning to show appreciation. J. S. Mill had made Carlyle's acquaintance in the previous visit to London, and had corresponded with him. Mill had introduced Ralph Waldo Emerson, who visited Craigenputtock in 1833. Carlyle was charmed with Emerson, and their letters published by Norton show that his regard never cooled. Emerson's interest showed that Carlyle's fame was already spreading in America. Carlyle's connection with Charles Buller, a zealous utilitarian, introduced him to the circle of "philosophical radicals."

Carlyle called himself in some sense a radical; and J. S. Mill, though not an intellectual disciple, was a very warm admirer of his friend's genius. Carlyle had some expectation of the editorship of the *London Review*, started by Sir W. Molesworth at this time as an organ of philosophical radicalism. The combination would clearly have been explosive. Meanwhile Mill, who had collected many books upon the French Revolution, was eager to help Carlyle in the history which he was now beginning. He set to work at once and finished the first volume in five months, and lent the ms. to J. S. Mill, who left it at the house of a Mrs. Taylor, who had separated from her husband on account of her intimacy with Mill. There it was burned accidentally, according to Mrs. Taylor, and Carlyle who had no copy and few notes had to write it afresh. Mill sent a cheque for £200 as compensation. Carlyle accepted only £100, the actual cost of living while he was writing what had been burned. On Jan. 12, 1837, the writing of the history was finished, and Carlyle said to his wife: "What they will do with this book, none knows, my Jeannie, lass; but they have not had, for a two hundred years, any book that came more truly from a man's very heart; and so let them trample it under foot and hoof as they see best." "Pooh, pooh! they cannot trample that," was her answer.

The publication, six months later, of the *French Revolution* marks the turning-point of Carlyle's career. Many readers hold it to be the best, as it is certainly the most characteristic, of Carlyle's books. The failure of *Sartor Resartus* to attract average readers is quite intelligible. It contains, indeed, some of the most impressive expositions of his philosophical position, and some of his most beautiful and perfectly written passages. But there is something forced and clumsy, in spite of the flashes of grim

[1] John Aitken Carlyle (1801–70) finally settled near the Carlyles in Chelsea. He began an English prose version of Dante's *Divine Comedy*—which has earned him the name of "Dante Carlyle"—but only completed the translation of the *Inferno* (1840). The work included a critical edition of the text and a valuable introduction and notes.

humour, in the machinery of the *Clothes Philosophy*. The mannerism, which has been attributed to an imitation of Jean Paul, appeared to Carlyle himself to be derived rather from the phrases current in his father's house, and in any case gave an appropriate dialect for the expression of his peculiar idiosyncrasy. But it could not be appreciated by readers who would not take the trouble to learn a new language. In the *French Revolution* Carlyle had discovered his real strength. He was always at his best when his imagination was set to work upon a solid framework of fact. The book shows a unique combination: on the one hand is the singularly shrewd insight into character and the vivid realization of the picturesque; on the other is the "mysticism" or poetical philosophy which relieves the events against a background of mystery. The contrast is marked by the humour which seems to combine a cynical view of human folly with a deeply pathetic sense of the sadness and suffering of life. The convictions, whatever their value, came, as he said, "flamingly from the heart." It was, of course, impossible for Carlyle to satisfy modern requirements of matter-of-fact accuracy in details. He could not in the time have assimilated all the materials even then extant, and later accumulations would necessitate a complete revision. Considered as a "prose epic," or a vivid utterance of the thought of the period, it has a permanent and unique value.

The book was speedily successful. It was reviewed by Mill in the *Westminster* and by Thackeray in *The Times*, and Carlyle, after a heroic struggle, was at last touching land. In each of the years 1837 to 1840 he gave a course of lectures, of which the last only (upon "Hero Worship") was published by himself; they materially helped his finances. By Emerson's management he also received something during the same period from American publishers. At the age of 45 he had thus become independent. He had also established a position among the chief writers of the day. Young disciples, among whom John Sterling was the most accepted, were gathering round him, and he became an object of social curiosity. Monckton Milnes (Lord Houghton), who won universal popularity by the most genuine kindliness of nature, became a cordial friend. Another important intimacy was with the Barings, afterwards Lord and Lady Ashburton. Carlyle's conversational powers were extraordinary; though, as he won greater recognition as a prophet, he indulged too freely in didactic monologue. In his prophetic capacity he published two remarkable books: *Chartism* (1839), enlarged from an article which Lockhart, though personally approving, was afraid to take for the [illegible]

the doctrine implicitly set forth in the *French Revolution*. Carlyle was a "radical" as sharing the sentiments of the class in which he was born. He had been profoundly moved by the widely-spread distresses in his earlier years. When the yeomanry were called out to suppress riots after the Peace, his sympathies were with the people rather than with the authorities. So far he was in harmony with Mill and the "philosophical radicals." A fundamental divergence of principle, however, existed and was soon indicated by his speedy separation from the party and alienation from Mill himself. The Revolution, according to him, meant the sweeping away of effete beliefs and institutions, but implied also the necessity of a reconstructive process. *Chartism* begins with a fierce attack upon the *laissez faire* theory, which showed blindness to this necessity. The prevalent political economy, in which that theory was embodied, made a principle of neglecting the very evils which it should be the great function of government to remedy. Carlyle's doctrines, entirely opposed to the ordinary opinions of Whigs and Radicals, found afterwards an expositor in his ardent disciple Ruskin, and inspired Keir Hardie and other leaders of the labour movement. At the time he was as one crying in the wilderness to little practical purpose. Liberals were scandalized by his apparent identification of "right" with "might," implied in the demand for a strong government; and though he often declared the true interpretation to be that the right would ultimately become might, his desire for strong government seemed too often to sanction the inverse view. He came into collision with philanthropists, and was supposed to approve of despotism for its own sake.

His religious position was equally unintelligible to the average mind. While unequivocally rejecting the accepted creeds, and so scandalizing even liberal theologians, he was still more hostile to simply sceptical and materialist tendencies. He accepted the nickname of "mystic," which had been applied to him by critics The God he revered and held up for worship was the living God of Nature—inspiring all human effort, revealed by all reality, and speaking in the hearts of men and women. Any philosophy of history which emphasized the importance of general causes seemed to him to imply a simply mechanical doctrine and to deny the efficacy of the great spiritual forces. He met it by making biography the essence of history, or attributing all great events to the "heroes," who are the successive embodiments of divine revelations. This belief was implied in his next great work, the *Life and Letters of Oliver Cromwell*, published in 1845. The great Puritan hero was a man after his own heart, and the portrait drawn by so sympathetic a writer is not only intensely vivid, but a very effective rehabilitation of misrepresented character. He was the first to make plain the greatness of Oliver Cromwell as one of the makers of the modern British empire. The "biographical" view of history, however, implies the weakness, not only of unqualified approval of all Cromwell's actions, but of omitting any attempt to estimate the Protector's real relation to the social and political development of the time. The question, what was Cromwell's real and permanent achievement, is not answered nor distinctly considered. The effect may be partly due to the peculiar form of the book as a detached series of documents and comments. The composition introduced Carlyle to the "Dryasdust" rubbish heaps of which he here and ever afterwards bitterly complained A conscientious desire to unearth the facts, and the effort of extracting from the dullest records the materials for graphic pictures, made the process of production excessively painful. For some years after *Cromwell* Carlyle wrote little His growing acceptance by publishers, and the inheritance of her property by Mrs. Carlyle on her mother's death in 1842, finally removed the stimulus of money pressure. He visited Ireland in 1846 and again in 1849, when he made a long tour in company with Sir C. Gavan Duffy, then a young member of the Nationalist party (*see* Sir C. G. Duffy's *Conversations with Carlyle*, 1892, for an interesting narrative). Carlyle's strong convictions as to the misery and misgovernment of Ireland recommended him to men who had taken part in the rising of 1848. Although the remedies acceptable to a eulogist of Cromwell could not be to their taste, they admired his moral teaching; and he received their attentions, as Sir C. G. Duffy testifies, with conspicuous courtesy. His aversion from the ordinary radicalism led to an article upon slavery in 1849 to which Mill replied, and which caused their final alienation It was followed in 1850 by the *Latterday Pamphlets*, containing "sulphurous" denunciations of the do-nothing principle. They gave general offence, and the disapproval, according to Froude, stopped the sale for years. The *Life* of Sterling (d. 1844), which appeared in 1851, was intended to correct the life by Julius Hare, which had given too much prominence to theological questions The subject roused Carlyle's tenderest mood, and the *Life* is one of the most perfect in the language.

Carlyle meanwhile was suffering domestic troubles, unfortunately not exceptional in their nature, though the exceptional intellect and characters of the persons concerned have given them unusual prominence. Carlyle's constitutional irritability made him intensely sensitive to petty annoyances. He suffered the torments of dyspepsia; he was often sleepless, and the crowing of "demon-fowls" in neighbours' yards drove him wild He would gladly have retired to the country again for the sake of quiet; but his wife's love of London kept him there. What helped to decide him to humour her by remaining there was the state of her health. For many years she was in danger of a mental breakdown, from which she was delivered mainly by his continual care and attentions.

In 1851 Carlyle commenced work on his *History of Frederick the Great*. He shut himself up in his study to wrestle with the

Prussian Dryasdusts, whom he discovered to be as wearisome as their Puritan predecessors and more voluminous. He went to Scotland to see his mother, to whom he had always shown the tenderest affection, on her deathbed at the end of 1853. He returned to shut himself up in the "sound-proof room," a study built on the top of his house and designed to be as free as possible from noises. He twice visited Germany (1852 and 1858) to see Frederick's battlefields and obtain materials; and he occasionally went to the Ashburtons and his relations in Scotland. The first two volumes of *Frederick the Great* appeared in 1858, and succeeding volumes in 1862, 1864 and 1865. The success was great from the first. The book is in some respects his masterpiece, and its merits are beyond question. Carlyle had spared no pains in research. The descriptions of the campaigns are admirably vivid, and show his singular eye for scenery. These narratives are said to have been used by military students in Germany, and at least convince the non-military student that he can understand the story. The book was declared by Emerson to be the wittiest ever written. Many episodes, describing the society at the Prussian court and the relations of Frederick to Voltaire, are unsurpassable as humorous portraiture. The effort to fuse the masses of raw material into a well-proportioned whole is perhaps not quite successful; and Carlyle had not the full sympathy with Frederick which had given interest to the *Cromwell*. Carlyle's general conception of history made him comparatively blind to aspects of the subject which would, to writers of other schools, have a great importance, but the extraordinary power of the book is undeniable, though it does not show the fire which animated the *French Revolution*. A certain depression and weariness of spirit darken the general tone.

Mrs. Carlyle had apparently recovered from an almost hopeless illness, when at the end of 1865 Carlyle was elected to the rectorship of the University of Edinburgh. He delivered an address there on April 2, 1866, unusually mild in tone, and received with general applause. He was still detained in Scotland when Mrs. Carlyle died suddenly while driving in her carriage. The immediate cause was the shock of an accident to her dog. She had once hurt her mother's feelings by refusing to use some wax candles. She had preserved them ever since, and by her direction they were now lighted in the chamber of death. Carlyle was overpowered by her loss. His life thenceforward became more and more secluded. He went to Mentone in the winter of 1866 and began the *Reminiscences*. He afterwards annotated the letters from his wife, published (1883) as *Letters and Memorials*. He was impressed by the story of Johnson's "penance" at Uttoxeter, and desired to make a posthumous confession of his shortcomings in his relations to his wife, according to Froude, whose statements to this effect, however, are not generally accepted. A few later utterances made known his opinions of current affairs. He joined the committee for the defence of Governor Eyre in 1866, he also wrote in 1867 an article upon "shooting Niagara," that is, upon the tendency of the Reform Bill of that year; and in 1870 he wrote a letter defending the German case against France. The worth of his *Frederick* was acknowledged by the Prussian Order of Merit in 1874. In the same year Disraeli offered him the Grand Cross of the Bath and a pension. He declined very courteously, and felt some regret for previous remarks upon the minister. The length of his literary career was now softening old antipathies, and he was the object of general respect. His infirmities enforced a very retired life, but he was constantly visited by Froude, Ruskin, and many others. Many friends paid him constant attention. A niece, Miss Aitken afterwards Mrs. Alexander Carlyle, became his housekeeper and ministered to him like a daughter till the end of his life. His conversation was still interesting, especially when it turned upon his recollections, and though his judgments were sometimes severe enough, he never condescended to the scandalous. His views of the future were gloomy. The world seemed to be going from bad to worse, with little heed to his warnings. He would sometimes regret that it was no longer permissible to leave it in the old Roman fashion. He sank gradually, and died on Feb. 4, 1881. A place in Westminster Abbey was offered, but he was buried, according to his own desire, by the side of his parents at Ecclefechan. He left Craigenputtock, which had become his own property, to found bursaries at the University of Edinburgh. He gave his books to Harvard college.

Carlyle's appearance has been made familiar by many portraits. The statue by Boehm on the Chelsea Embankment is characteristic; and there is a fine painting by Watts in the National Portrait Gallery, London. J. McNeill Whistler's portrait of him is in the possession of the Glasgow corporation.

During Carlyle's later years the antagonism roused by his attacks upon popular opinions had subsided; and upon his death general expression was given to the emotions natural upon the loss of a remarkable man of genius. The rapid publication of the *Reminiscences* by Froude produced a sudden revulsion of feeling. Carlyle became the object of general condemnation. Froude's biography, and the *Memorials* of Mrs. Carlyle, published soon afterwards, strengthened the hostile feeling. Carlyle had appended to the *Reminiscences* an injunction to his friends not to publish them as they stood, and added that no part could ever be published without the strictest editing. Afterwards, when he had almost forgotten what he had written, he verbally empowered Froude to use his own judgment; Froude accordingly published the book at once, without any editing, and with many inaccuracies. Omissions of a few passages written from memory at a time of profound nervous depression would have altered the whole character of the book. Froude in this and the later publications held that he was giving effect to Carlyle's wish to imitate Johnson's "penance." No one, said Boswell, should persuade him to make his lion into a cat. Froude intended, in the same spirit, to give the shades as well as the lights in the portrait of his hero. His admiration for Carlyle probably led him to assume too easily that his readers would approach the story from the same point of view, that is, with an admiration too warm to be repelled by the admissions. Moreover, Froude's characteristic desire for picturesque effect, unchecked by any painstaking accuracy, led to his reading preconceived impressions into his documents. The result was that Carlyle was too often judged by his defects, and regarded as a selfish and eccentric misanthrope with flashes of genius, rather than as a man with many of the highest qualities of mind and character clouded by constitutional infirmities. Yet it would be difficult to speak too strongly of the great qualities which underlay the superficial defects. Through long years of poverty and obscurity Carlyle showed unsurpassed fidelity to his vocation and superiority to the lower temptations which have ruined so many literary careers. His ambition might be interpreted as selfishness, but certainly showed no coldness of heart. His unstinted generosity to his brothers during his worst times is only one proof of the singular strength of his family affections. No one was more devoted to such congenial friends as Irving and Sterling. He gave away a great deal of money when the sale of his books made him rich in the later years of his life, but he was careful to hide his benefactions as much as possible.

The harsh judgments of individuals in the *Reminiscences* had no parallel in his own writings. He scarcely ever mentions a contemporary, and was never involved in a personal controversy. But the harshness certainly reflects a characteristic attitude of mind. Carlyle was throughout a pessimist or a prophet denouncing a backsliding world. His most popular contemporaries seemed to him to be false guides, and charlatans had ousted the heroes. The general condemnation of "shams" and cant had, of course, particular applications, though he left them to be inferred by his readers. Carlyle was the exponent of many of the deepest convictions of his time. Nobody could be more in sympathy with aspirations for a spiritual religion and for a lofty idealism in political and social life. To most minds, however, which cherish such aspirations the gentler optimism of men like Emerson was more congenial. They believed in the progress of the race and the triumph of the nobler elements. Though Carlyle, especially in his earlier years, could deliver an invigorating and encouraging, if not a sanguine doctrine, his utterances were more generally couched in the key of denunciation, and betrayed a growing despondency. Materialism and low moral principles seemed to him to be gaining the upper hand; and the hope that religion might survive the "old clothes" in which it had been draped seemed to grow fainter. The ordinary mind complained that he had no specific remedy to propose for the growing evils of the time; and the more cultivated idealist was alienated by the gloom and the tendency to despair. To a later generation it will probably appear that, whatever the exaggerations and the misconceptions to which he was led, his vehement attacks at least called attention to rather grave limitations and defects in the current beliefs and social tendencies of the time. The mannerisms and grotesque exaggerations of his writings annoyed persons of refinement, and suggested Matthew Arnold's advice to flee "Carlylese" as you would flee the devil. Yet the shrewd common sense, the biting humour, the power of graphic description and the imaginative "mysticism" give them a unique attraction for many even who do not fully sympathize with the implied philosophy or with the Puritanical code of ethics. The letters and autobiographical writings, whether they attract or repel sympathy, are at least a series of documents of profound interest for any one who cares to study character, and display an almost unique idiosyncrasy.

(L. S.; D. A. W.)

The materials for the Life of Carlyle consist of his *Reminiscences* and his own and his wife's correspondence and the reports of many disciples and other witnesses. The best edition of the *Reminiscences* is that of C. E. Norton (1887), who has also edited the correspondence with Goethe (1887) and with Emerson (1883) and four volumes of other letters (1888). Alexander Carlyle has edited his *Love Letters* (1909), *Letters of Carlyle to Mill, Sterling and Browning* (1923) and two more volumes, *New Letters* (1904) and *Carlyle intime* (1907). A book published in 1892, *Last Words of Thomas Carlyle*, is mainly letters. The correspondence of Mrs. Carlyle is in her *Letters and Memorials*, three volumes edited by Froude (1883), supplemented by two more edited by Alexander Carlyle (1903), and her *Early Letters*, edited by David G. Ritchie (1889), and *Letters to her Kinsfolk*, edited by Leonard Huxley (1924). The reports by disciples and others are numerous. Among the best are *Conversations with Carlyle*, by Sir Charles Gavan Duffy (1892); *Literary Recollections*, by F. Espinasse (1893); "Carlyle in Society and at Home," by G. S. Venables (*Fortnightly Review*, 1883–84); *William Allingham, A Diary*, edited by H. Allingham and D. Radford (1907); *Personal Reminiscences of Carlyle*, by A. J. Symington (1886); "Conversations with Carlyle," by William Knighton (*Contemporary Review*, 1881), and *Carlyle Personally and in his Writings*, by David Masson (1885).

There have been many short biographies. That by Richard Garnett (1887) is one of the best, but many others are also good, and so is Augustus Ralli's *Guide to Carlyle* (1920) in two volumes. The four-volume life by J. A. Froude (1882–84) was riddled by many critics, and in the posthumously published book, *My Relations with Carlyle* (1903), Froude at last confessed how he had shaped his work in complete reliance on the truth of what he had been told by Geraldine Jewsbury, that "Carlyle was one of those persons who ought never to have married." This led to a controversy, the upshot of which is that Miss Jewsbury and Mr. Froude, who believed her, were both mistaken. See *The Nemesis of Froude*, by Sir James Crichton-Browne and A. Carlyle (1903) and *The Truth about Carlyle*, by D. A. Wilson (1913), with a preface by Sir James Crichton-Browne. Thanks mainly to Crichton-Browne, there is now no room left for doubt in the medical profession and among people of sense about a matter of peculiar importance in the case of a great moralist.

Of a new *Life of Carlyle*, by D. A. Wilson, in which Carlyle is reported like Dr. Johnson or Confucius, the first volume, *Carlyle till Marriage*, appeared in 1923, and was followed by *Carlyle to the French Revolution* in 1924, *Carlyle on Cromwell and Others* (1925) and *Carlyle at his Zenith* in 1927. Later volumes are entitled *Carlyle to Threescore-and-ten* and *Carlyle in Old Age*. (D. A. W.)

CARMAGNOLA, FRANCESCO BUSSONE, COUNT OF (1390–1432), a *condottiere*, won back Gian Galeazzo Visconti's divided territories for Gian's son and heir Filippo Maria Visconti, duke of Milan. In 1425, feeling that he had not been sufficiently rewarded by Visconti, Carmagnola sold his services to the Venetians. In the ensuing war with Milan, he was so dilatory in his actions that the republic became suspicious of his intentions; and indeed Carmagnola was in treaty with his former master. Summoned to Venice by the doge, he was seized, tried for treason, condemned to death and beheaded on May 5, 1432.

See Horatio Brown, *Studies in Venetian History* (1907). A. Manzoni made this episode the subject of a poetical drama, *Il Conte di Carmagnola* (1826).

CARMAGNOLA, a town of Italy, in the province of Turin, 18 mi. by rail S. of Turin. Pop. (1936) 3,982 (town), 12,737 (commune). It is the junction where the lines for Savona and Cuneo diverge; it is also connected with Turin by a steam tramway via Carignano. It was captured by the French in 1796.

CARMAGNOLE, a word first applied to a Piedmontese peasant costume (from Carmagnola, the town in Italy) well known in the south of France, and brought to Paris by the revolutionaries of Marseilles in 1793. It consisted of a short skirted coat with rows of metal buttons, a tricoloured waistcoat and red cap, and became the popular dress of the Jacobins. The name was then given to the famous revolutionary song, composed in 1792. Each verse of this ends with the refrain:

Vive le son, vive le son,
Dansons la Carmagnole,
Vive le son
Du Canon.

CARMAN, WILLIAM BLISS (1861–1929), Canadian poet and journalist, was born at Fredericton, New Brunswick, on April 15, 1861, and was educated at the universities of New Brunswick, Edinburgh (1882–83), and Harvard (1886–88) From 1890 to 1892 he was literary editor of the New York *Independent*, afterwards working on the staffs of *Current Literature* and the *Atlantic Monthly*. The keynote of Carman's poetry is a pagan love of nature. He is a self-acknowledged disciple of Robert Browning, and in a lesser degree, of Matthew Arnold His numerous volumes of verse include: *Low Tide on Grand Pré* (1893); *Songs from Vagabondia* (Boston, 1894); *More Songs from Vagabondia* (Boston, 1896); and *Last Songs from Vagabondia* (Boston, 1901); these last three containing lyrics by Richard Hovey; *Ballads of Lost Haven* (1897); *By the Aurelian Wall* (1898); *Sappho* (1902); *Pipes of Pan* (1903–05); *Daughters of Dawn* (1912); *April Airs* (1916, repr. 1922); and *Later Poems* (1921). Some of Carman's prose essays have been collected in *Kinship of Nature* (1904); *Friendship of Art*; and *The Poetry of Life* (1905.) He died in New Canaan, Conn., June 8, 1929

See O. Shepard, *Bliss Carman* (1923); and H. D. C. Lee, *Bliss Carman* (1912), which contains a bibliography.

CARMARTHEN, the capital town of the county of that name, on the right bank of the Towy, where the river straightens out after meandering, and turns seawards (pop. 1938, 10,860) Area 8.3 sq.mi. Its site on the historic south Wales coast road also commands the main Towy route into central Wales from the south and is the focus of roads from hill-lands to the north. The main part of the town is situated on a hillock with the ruins of a Norman castle (converted into a gaol in the 18th century and now disused) on the south-west side; with the fine parish church of St. Peter, founded in the 12th century but largely of 14th-century construction on the north-east side.

The castle site is undoubtedly of great antiquity and was certainly the Roman station of Maridunum. In the post-Roman centuries Carmarthen became the focus of activity for the Welsh chieftains of south Wales and was associated with the name of Merlin as well. After the town passed into Norman hands in 1123 it became subject to many attacks from the people of the hills around. The castle and church were the nucleus of the mediaeval town and in their neighbourhood there are still traces of the old town wall. Carmarthen was granted its first charter by Edward I in 1313, a privilege which was renewed and augmented by subsequent sovereigns. The mediaeval history of the town in virtue of its key position, is a record of attacks, sieges and burnings into which enter the names of Llewellyn, Glendower, Edward, John and Sir Rhys ap Thomas. On the lower ground to the east of the town near the banks of the river was the Benedictine priory famous for its literary tastes and the *Black Book of Carmarthen;* while on the western side of the town was the house of the Black Friars. In the middle ages Carmarthen was important for its wool trade, being declared by Edward III in 1353 the sole "staple" for Wales. As a result of the social changes in Tudor times a guild hall was built in 1583 near the centre of the town The town grew in size and importance. It had associations with the early Protestants among whom were Bishop Ferrar of St. David's (burned in the market place, 1555) and John Penry (1559–1593). During the great Rebellion the castle was held for the king, but soon changed hands on the appearance of Cromwell and his men. Situated at the highest navigable point of the tide, the town became a busy river port as coastal trade grew during the subsequent centuries. Carmarthen became the social centre for the neighbourhood and was associated with Sir Richard Steele, Bishop Thirlevall, David Williams, Dr. Richard Price, Sir Thomas Picton, etc. It became a printing and literary centre as well. Its importance was further enhanced in 1747 by the building of one of the earliest iron-smelting works in Wales, which later manufactured tinplates. The advent of the railway in 1856 helped the local trade of the town and made it an important railway junction. With the development of the seaboard and the changes that followed the industrial revolution Carmarthen's prosperity declined, although the tinworks continued until 1900.

Carmarthen, together with Lichfield, Poole and Haverfordwest, is one of the old boroughs that remain counties of themselves, a privilege granted to Carmarthen by James I. in 1604. It was created a parliamentary borough in 1536 and after 1832 returned a member jointly with Llanelly, but in 1918 it was merged in the Carmarthenshire parliamentary division.

CARMARTHENSHIRE, South Wales county, is bounded north by Cardigan, east by Brecon and Glamorgan, west by Pembroke, south by Carmarthen Bay and the Bristol Channel (area 919.5 sq.mi.; the largest Welsh county). It consists essentially of the plain of the Towy, with its continuation into the Tâf Valley. This line of lowland curving from a south-west to a west direction is a worn anticline mainly floored by black shales of Tremadoc (Cambrian Age) covered at the sides by conglomerates, sandstones and shales, with beds of volcanic ash and lava of Arenig (Ordovician Age). Above these are shales, flags and limestones named from Llandilo where they are remarkably developed. North of the Towy lowland the hills are formed of Ordovician and Silurian shales and mudstones, deeply dissected and divided into two zones, one south of Brechfa with a maximum height of 900 ft., and one north of Brechfa and the Cothi reaching above 1,300 ft. South and southeast of the Towy the Silurian sandstones and mudstones form the first hills; behind and above them comes Old Red Sandstone followed by Carboniferous Limestone and Coal Measures. The Old Red Sandstone gives to the south-east the Black Mountains of Carmarthenshire rising to 2,026 ft., while south of this the scarps and moorlands of the Carboniferous Limestone and "Farewell rock" (Millstone Grit) form the north-west rim of the South Wales coalfield, the rich coal measures of the Gwendraeth Valley and Llanelly district being within the county. The Old Red Sandstone rocks on the south side of the main Towy lowland form only very subordinate hill lines westward from the Black Mountains and the Towy makes its way through the Old Red Sandstone zone to an estuary formed by coastal sinking.

The main drainage follows the line of the denuded anticline occupied by the Towy which is fed by streams dissecting especially the northern uplands; these include the Sawdde, Cothi and Gwili. The Gwendraeth Fach and Gwendraeth Fawr and the Loughor follow north-east to south-west lines which are characteristic of the region and the Loughor divides the county from Glamorganshire on the east. The line of the middle Towy is continued by the Tâf on the west boundary of the county and after passing Whitland it turns south-east to the sea near Laugharne. Most of the hills have been rounded by ice action and deposits of boulder clay are frequent on the lower valley sides, especially west of Carmarthen Town on the lowland area which shows evidences of having been a lake probably in late-glacial times. With the exception of Llyn y fan in the Black Mountains the lakes of the county are inconsiderable in size, the Bishop's Pond, two miles East of Carmarthen is a good example of an ox-bow lake.

The region above the 600 ft. contour is dotted with tumuli and cairns and, especially in the north-west section, with menhirs and other great stone monuments. The distribution of Bronze Age finds seems to indicate the use of the coast and rivers or valley ways at the time. Bronze objects are found especially along the South Coast, and at Conwil in the Gwili Valley. The hill top camps of Romano-British age cap spurs of the high ground and seem to be situated at defensible points that guard ways up from the sea and communications along the valleys. Garn Goch (5 m. north-east of Llandilo) covers some 15 acres and is enclosed by a stone rampart. The Roman focus of ways across the country lay at Maridunum, later Carmarthen, the present capital of the county. The post Roman centuries saw the civilizing and Christianizing influence of the Celtic Saints on the one hand, leaving its mark to this day in dedications of rural churches, and on the other the numerous raids from the sea and by land of Irish and Scandinavians. The strong reign of Rhodri Mawr (*c.* 870) is said to have brought a measure of peace and his grandson Howel the Good (Howel Dda) was the first to codify the ancient laws of Wales at his palace of Ty Gwyn Ar Dâf near modern Whitland The period subsequent to 1080 saw the beginnings of the Norman intrusion. The Normans first built castles along the coast at Kidwelly, Llanstephan, Laugharne, etc., and then penetrated up the valley ways to Carmarthen, Llandilo, etc. It is interesting to find that many of these castles occupy sites previously chosen for defence by earlier rulers of the country, *e.g.*, the castle at Dinefawr. This had been the seat of the princes of South Wales, the central point of Ystrad Tywi the nucleus of the future county. The campaigns of Edward I. gave the Normans a more unified control of the principality and by the Statutes of Rhuddlan (1284) the counties of Cardigan and Carmarthen were formed out of the districts of Ceredigion and Ystrad Tywi. Nearly a third of the present county, however, still remained under the jurisdiction of the Lords Marchers and it was not until the Act of 27 Henry VIII. that these districts, including the commots of Kidwelly, Iscennen and Carnwillion were added to Edward I.'s original shire. The surrounding hill county made Carmarthenshire famous for its wool in the later Middle Ages. Edward III. by the statute staple of 1353 declared Carmarthen town the sole staple for Wales, ordering every bale of wool to be sealed here before it left the Principality. There are few remains of the mediaeval monastic houses: Talley Abbey (north of Llandilo), founded by Rhys ap Griffith prince of South Wales (late 12th century), for Benedictine monks; Whitland, or Albalanda, also a Benedictine house, probably founded by Bishop Bernard of St. David's (early 12th century), on a site long associated with Welsh monastic life and the celebrated Augustinian Priory of St. John at Carmarthen (12th century). Connections with the house of Tudor through Sir Rhys ap Thomas were important in the 16th century. At Abergwili the then new palace of the Bishops of St. David's Bishop Richard Davies (*c.* 1501–1581) and William Salesbury of Llanrwst translated the New Testament and the Prayer Book into Welsh and in the early part of the 17th century Rhys Prichard (d. 1644), the Puritan Vicar of Llandovery published his famous "Canwyll y Cymry" (the Welshman's Candle). The castles of Carmarthenshire, especially the southern ones, made a very half hearted resistance to the parliamentarian forces. Griffith Jones (1684–1761), vicar of Llanddowror founded Welsh circulating schools, the effective beginning of the modern educational movement in Wales. William Williams of Pantycelyn (1717–91) was the chief hymnologist of the Welsh Methodist revival. Dr. Richard Price, the friend of Priestley, also belonged to the shire. Carmarthen was deeply implicated in the Rebecca riots (1842–43). The markets of Carmarthen, Llandilo and Llandovery received cattle driven on foot in pre-railway days, and Llandovery seems to have been an important focus for cattle being driven to the English Midlands. Old lead mines at Llangunnor (2 mi. S.E. of Carmarthen) and Rhandirmwyn (8 mi. N. of Llandilo) are derelict Stock-marts using the railway still continue. The anthracite coalfield in Carmarthenshire led to growth of Ammanford, Llanelly, Pontardulais, etc., and it has tended to develop industries such as tin-plate and copper smelting. The increasing modern demand for anthracite favours the county and the collieries are now nearly all in a large combine with interests in outside fields as well. Some migration from the Glamorganshire coalfield has taken place. The G.W.R. runs from Loughor, in the south-east, along the coast to the Towy estuary which it follows up to Carmarthen and then leaves, going west via Whitland. Branches go from Llanelly to Ammanford and Llandilo, from Pembrey to the Gwendraeth valley, from Carmarthen to Pencader and Newcastle Emlyn, and from Whitland to Cardigan. The L.M.S.R. running from Shrewsbury via

Craven Arms enters the north-east of the county and runs to Llandovery and Llandilo, with branches thence to Swansea and to Carmarthen, partly conjoint with the G.W.R. Carmarthen has recently become a considerable centre for road-motors.

Pop. (est. 1938) 172,700. Wartime movements caused a population increase of 4% between Sept. 1939 and Feb. 1941. The shire is divided into 9 hundreds. The municipal boroughs are Carmarthen (styled county borough), Kidwelly, Llandovery and Llanelly. There are 5 urban districts, 4 rural districts, 71 civil parishes. The county is in the South Wales circuit, and assizes are held at Carmarthen. There is one court of quarter sessions and there are 9 petty sessional divisions. The borough of Carmarthen has a commission of the peace and separate quarter sessions. The county is divided into two parliamentary divisions, the Llanelly (industrial) and the Carmarthen (rural), each returning one member to parliament. The county is wholly in the diocese of St. David's The National Trust owned 2,074 ac. in the county in 1942.

CARMATHIANS, a Muhammadan sect named after Hamdān Qarmat, who accepted the teaching of the Ismā'ilites (*see* ISLAM) from Husayn al-Ahwāzī, a missionary of Ahmad, son of the Persian 'Abdallāh ibn Maimūn, toward the close of the 9th century. For the political history of the Carmathians, their conquests, and their decay, *see* ARABIA: *History;* CALIPHATE and EGYPT: *History* (*Mohammedan Period*).

In their religious teaching they claimed to be Shi'ites; *i.e.*, they asserted that the imamate belonged by right to the descendants of Ali. Further, they were of the Ismā'īlite branch of these, *i.e.*, they acknowledged the claim to the imamate of Ismā'īl the eldest son of the sixth imam. 'Abdallāh taught that from the creation of man there had always been an imam sometimes known, sometimes hidden. Ismā'īl was the last known; a new one was to be looked for. But while the imam was hidden, his doctrines were to be taught by his missionaries (*dā'īs*). Hamdān Qarmat was one of these, Ahmad ibn 'Abdallāh being nominally the chief. The adherents of this party were initiated by degrees into the secrets of its doctrines and were divided into seven (afterwards nine) classes. In the first stage the convert was taught the existence of mystery in the Qur'ān and made to feel the necessity of a teacher who could explain it. In the second stage the earlier teachers of Islam were shown to be wrong in doctrine and the imams alone were proved to be infallible. In the third it was taught that there were only seven imams and that the other sects of the Shi'ites were in error. In the fourth the disciple learnt that each of the seven imams had a prophet, who was to be obeyed in all things. The prophet of the last imam was 'Abdallāh. In the fifth stage the uselessness of tradition and the temporary nature of the precepts and practices of Muhammad were taught, while in the sixth the believer was induced to give up these practices (prayer, fasting, pilgrimage, etc.). At this point the Carmathian had completely ceased to be a Muslim. In the remaining degrees there was more liberty of opinion allowed and much variety of belief and teaching existed.

The last contemporary mention of the Carmathians is that of Nāsir ibn Khusrau, who visited them in A.D. 1050. In Arabia they ceased to exercise influence. In Persia and Syria their work was taken up by the Assassins (*q.v.*). Their doctrines are said, however, to exist still in parts of Syria, Persia, Arabia and India, and to be still propagated in Zanzibar.

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CARMAUX, a town of southern France, in the department of Tarn, on the left bank of the Cérou, 10m. N. of Albi, under the south-western slopes of the central plateau. Pop. (1936), 8,363. The town gives its name to a coal-basin and has important glass-works.

CARMEL. In Palestine, a well-defined mountain ridge ("garden orchard"; Arab *Jebel Mār Elyās*, Elijah's Mount), wedge-shaped, running north-west-south-east, with a length of some 15 m. and an extreme breadth of about 8½ m. where it meets the Samarian hills, its thin end projecting into the sea to form a headland south of the Bay of Acre. Of the same limestone formation as the central range of Palestine it suggests a buttress thrust forth to the Mediterranean plain. In the middle it attains an altitude of about 1,800 feet. On its south-west side it subsides gently in ridges and valleys to the plain of Sharon whilst above Haifa and Esdraelon the descent is more rapid. The line of its ridge against the sky can be seen from sea and land over a wide radius. Carmel is covered with a wild and luxuriant vegetation. Forests of oak, groves of olive trees and extensive vineyards flourished there of old. The hill was a sanctuary and its many caves and thick undergrowth afforded security to robbers and outcasts (Strabo xvi. 759). The mountain is mentioned in the conquest lists of Thutmose III. and in the Amarna letters but its place in history is small. Throughout the ages the waves of innumerable military enterprises have surged past its base to break elsewhere. The route naturally followed led along the sea coast or through the defiles in the lower slopes at its southern end, linking the plains of Sharon and Esdraelon. In 1479 B.C. Thutmose III led his chariots and horsemen to Megiddo by the same defile through which Lord Allenby thrust cavalry and armoured cars in 1918.

The territories of Asher, Zebulun, Issachar and Manasseh met at Carmel but the possession of the mount was never apparently determined. Somewhere on Carmel's top was the scene of Elijah's dramatic challenge resulting in Yahweh's vindication and the complete discomfiture of Baal and his prophets (I Kings 18). Tradition and a consensus of enlightened opinion have fixed the site at *El-Muhraka* ("the burning") on the southern half of the ridge a short distance south-east of *Esfīya.*

Carmel was evidently sacred both to Yahweh and Baal and according to Scylax (*Periplus*, 42) it was sacred to Jupiter in the days of Darius (6th century B.C.). Tacitus (*Hist.* ii., 78) speaks of its oracle beside an altar and remarks on the absence of any divine image. The philosopher Pythagoras went to "the sacred place of Carmel" to meditate (Iamblichus *Vit. Pyth.* iii. 5); Vespasian when nourishing secret designs before his aggrandisement was confirmed in his hopes by consulting its oracle (Suetonius, *Vesp.* 5). An ideal retreat, the mount attracted Christian anchorites from early times. As early as 570 there is record of a "Monastery of Elisha the Prophet." The Order of Carmelites was founded in 1156 and the monastery then built, situated at the north-west extremity of the ridge, suffered many changes of fortune during the Crusades. A new monastery to "Our Lady of Mount Carmel" was erected in 1767 and used by Napoleon as a hospital for his soldiers. On his retirement (1799) it was burned down. The present building was erected in 1827. The graveyard, with its memorial to Napoleon's soldiers who died there, was desecrated by the Turks during the World War but a new monument was set up by the French navy in 1919. The Turks posted guns there for the defence of Haifa. They were taken in a charge along the ridge by the Mysore Lancers and the Sherwood Rangers (Sept. 22, 1918). Carmel is included in the re-afforestation scheme of the Palestine Government.

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CARMELITES, in England called White Friars (from the white mantle over a brown habit), one of the four mendicant orders. The stories concerning the origin of this order seriously put forward and believed in the 17th and 18th centuries, are one of the curiosities of history. It was asserted that Elias established a community of hermits on Mount Carmel, and that this community existed without break until the Christian era and was nothing else than a Jewish Carmelite order, to which belonged the Sons of the Prophets and the Essenes. Members of it were present at St. Peter's first sermon on Pentecost and were converted, and built a chapel on Mount Carmel in honour of the Blessed Virgin Mary, who, as well as the apostles, enrolled herself in the order. In 1668 the Bollandist (*q.v.*) Daniel Papenbroek (1628–1714), in the March volumes of the *Acta Sanctorum*, rejected these stories as fables. A controversy arose and the Carmelites had recourse to the Inquisition. In Spain they succeeded in getting the offending volumes of the *Acta* censured, but in Rome they were less successful, and so hot did the controversy become that in 1698 a decree was issued imposing silence upon both parties, until a formal decision should be promulgated—which has not yet been done.

The historical origin of the Carmelites must be placed at the middle of the 12th century, when a crusader from Calabria, named Berthold, and ten companions established themselves as hermits near the cave of Elias on Mount Carmel. About 1210 the hermits on Carmel received from Albert, Latin patriarch of Jerusalem, a rule comprising sixteen articles. This was the primitive Carmelite rule. The life prescribed was strictly eremitical: the monks were to live in separate cells or huts, devoted to prayer and work; they met only in the oratory for the liturgical services, and were to live a life of great silence, seclusion, abstinence and austerity. This rule received papal approbation in 1226. Soon, however, the losses of the Christian arms in Palestine made Carmel an unsafe place of residence for western hermits, and so, *c.* 1240, they migrated first to Cyprus and thence to Sicily, France and England. In England the first establishment was at Alnwick and the second at Aylesford, where the first general chapter of the order was held in 1247, and the institute was adapted to the conditions of the western lands to which it had been transplanted, and for this purpose the original rule had to be in many ways altered: the austerities were mitigated, and the life was turned from eremitical into cenobitical, but on the mendicant rather than the monastic model. The polity and government were also organized on the same lines, and the Carmelites were turned into mendicants and became one of the four great orders of Mendicant Friars, in England distinguished as the "White Friars" from the white mantle worn over the dark brown habit. This change was made and the new rule approved in 1247, and under this form the Carmelites spread all over western Europe and became exceedingly popular, as an order closely analogous to the Dominicans and Franciscans. In the course of time, further relaxations of the rule were introduced, and during the Great Schism the Carmelites were divided between the two papal obediences, rival generals being elected,—a state of things that caused still further relaxations. To cope with existing evils Eugenius IV. approved in 1431 of a rule notably milder than that of 1247, but many houses clung to the earlier rule; thus arose among the Carmelites the same division into "observants" and "conventuals" that wrought such mischief among the Franciscans.

Of all movements in the Carmelite order by far the most important and far-reaching in its results has been the reform initiated by St. Teresa. After nearly thirty years passed in a Carmelite convent in Avila under the mitigated rule of 1431, she founded in the same city a small convent wherein a rule stricter than that of 1247 was to be observed. This was in 1562. In spite of opposition and difficulties of all kinds, she succeeded in establishing a number, not only of nunneries, but (with the co-operation of St. John of the Cross, *q.v.*) also of friaries of the strict observance. The interesting and dramatic story of the movement should be sought for in the biographies of the two protagonists. The idea of the reform was to go behind the settlement of 1247 and to restore and emphasize the austerity and the purely contemplative character of primitive Carmelite life. From the fact that those of the reform wore sandals in place of shoes and stockings, they have come to be called the Discalced, or bare-footed, Carmelites, in distinction to the Calced or older branch of the order. In 1580 the reformed monasteries were made a separate province under the general of the order, and in 1593 this province was made by papal act an independent order with its own general and government, so that there are now two distinct orders of Carmelites. The Discalced Carmelites spread rapidly all over Catholic Europe, and then to Spanish America and the East, especially India and Persia, in which lands they have carried on to this day extensive missionary undertakings. Both observances suffered severely from the various revolutions, but they both still exist, the Discalced being by far the most numerous and thriving. There are in all some 2,000 Carmelite friars, and the nuns are much more numerous. In England and Ireland there are houses, both of men and of women, belonging to each observance.

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CARMEN SYLVA: *see* Elizabeth, Queen of Rumania.

CARMINATIVES are drugs which aid the expulsion of gas from the stomach and intestines. They act chiefly by producing a mild irritation and increased vascularity in the stomach, thus stimulating the gastro-intestinal movements or by diminishing spasm. Probably some effect is due to suggestion and to the pleasant sensation they cause in the stomach. Some of the commonest are certain volatile oils or substances containing them, such as capsicum, ginger, oil of cloves, peppermint, chamomile, caraway, aniseed and dill. The last two are very frequently used for children. Other carminatives are chalk, lime water, sodium carbonate and the vegetable bitters such as gentian, orange-peel, etc. Valerian and asafetida are both occasionally used as carminatives, but the smell of both is unpleasant; camphor is used especially in neurotic persons. Tincture of nux vomica being a bitter, has a carminative action, but it also appears to stimulate the plain muscle in the stomach wall; this enhances its action.

CARMINE, a rich crimson-red pigment prepared from cochineal (*q.v.*), the dried bodies of the Coccus cacti insects indigenous to Mexico and Central America. The powdered cochineal is digested with a dilute solution of carbonate of soda through which live steam is passed; after boiling for two hours the solution is filtered and the colouring matter precipitated by the addition of a requisite amount of alum and cream of tartar. The "crimson lake" thus formed is brought to the required shade by the addition of freshly prepared hydrate of alumina and the lake is washed, filtered and dried at a low temperature. Scarlet shades are obtained by the addition of genuine vermilion along with the hydrate of alumina, whilst the addition of lime produces lakes possessing a deep purple tone. The use of carmine in water colours is giving way to the aniline dyes.

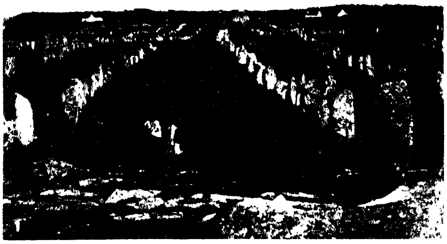
Chemically, carmine may be said to be an aluminum-calcium compound of carminic acid. As a lake it is used in water colours, in cosmetics and in the preparation of fine coach-body colours, though in this it is being gradually superseded by the more permanent lakes obtained from aniline dyestuffs. (*See* Paints, Chemistry of.) (R. S. M.; W. E W.)

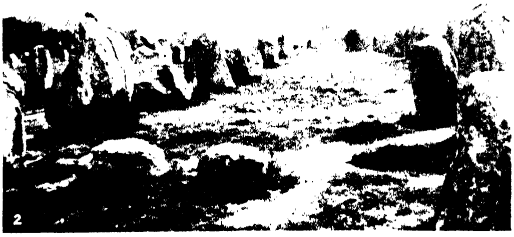
CARMONA, ANTONIO OSCAR DE FRAGOSA (1869–), Portuguese general and statesman, was made prime minister and minister of war in June 1926 by a military pronunciamento. He was virtually dictator of Portugal. Whatever may be said of the irregularity of his accession to power, he undoubtedly commanded general respect. His administration did not make effective the great changes expected in the administration. On Nov. 30 Carmona assumed by decree the position of head of the State, pending the election of a constitutional president. A military revolt against the dictator broke out in Oporto on Feb. 2, 1927, followed by a more serious outbreak at Lisbon. Both were suppressed, Carmona receiving assistance from the monarchical parties. On Aug 26, 1927, he reconstructed his cabinet. He sought to consolidate his power by breaking up the party system, but his attempt to organize a party of national union, on the lines of the Spanish Patriotic Union, met with only partial success. Nevertheless, in April 1928, he was elected president of the republic by a plebiscite, and reconstituted his Government, including civilian elements. He declined a loan, to be arranged by the League of Nations, for the reconstruction of Portuguese finance, deciding that the terms were too onerous.

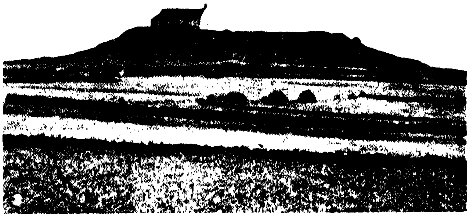
CARMONA, a city of south-west Spain, in the province of Seville, 27 mi. N.E. of Seville by rail. It is on a ridge overlooking the plain of Andalusia from the Sierra Morena, on the north, to the peak of San Cristobal on the south. Pop. (1940) 21,037 (mun., 24,876). The district round Carmona produces the best type of olives (*gordales*) and the town trades in oil, wine, grain, fruit and cattle, and makes soap, rough cloth and pottery.

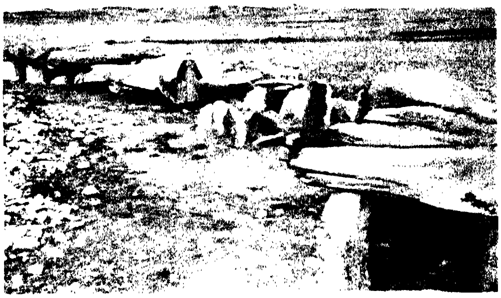
Carmona (Roman Carmo) was the strongest city of Further Spain under Julius Caesar (100–44 B.C.) and a large necropolis

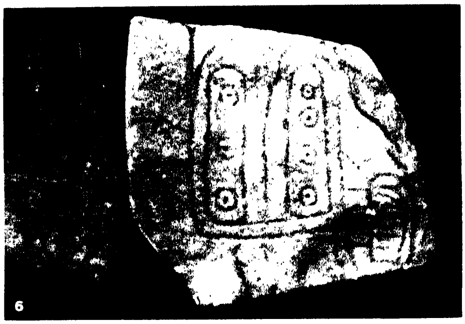
CARNAC

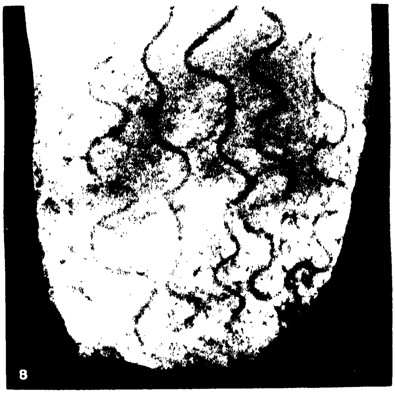








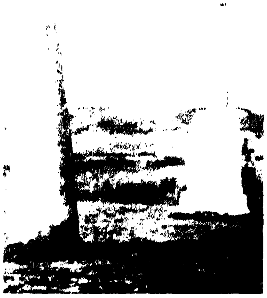




BY COURTESY OF (1, 5, 7) ZACHARIE LE ROUZIC, (2, 3, 4, 6, 8) V. C. C. COLLUM

1. The Menec alignments, containing 1,099 stones in 11 lines, oriented E.N.E. 2. The Kermario (place of the dead) alignments. Here are 10 lines of 982 stones, some more than 18 feet high. 3. Mont-Saint-Michel barrow. This mound, 125 métres long and 10 metres high, covers a beehived burial vault, a dolmen, 19 kists and a galleried dolmen. Bones, vases, axeheads, callais beads and bronze bells were found in the chambers. 4. The Tumiac chambered barrow, a circular mound constructed of sea-mud. 5. The Pierres Plates, bent allée couverte, Locmariaquer. Thirteen of these stones bear shield-like devices resembling an octopus. 6. Sculptured stones from Pierres Plates, stone alley, Locmariaquer. The device suggests the local octopus, still exported by Breton fishermen. 7. Mound of Le Manio, during excavation. A kist with an axe sign on it and pottery of a type usually associated with bronze implements was found at the foot of the menhir. 8. Sculptures from buried foot of menhir, Le Manio (from cast). This mound covers many funeral hearths

CARNAC



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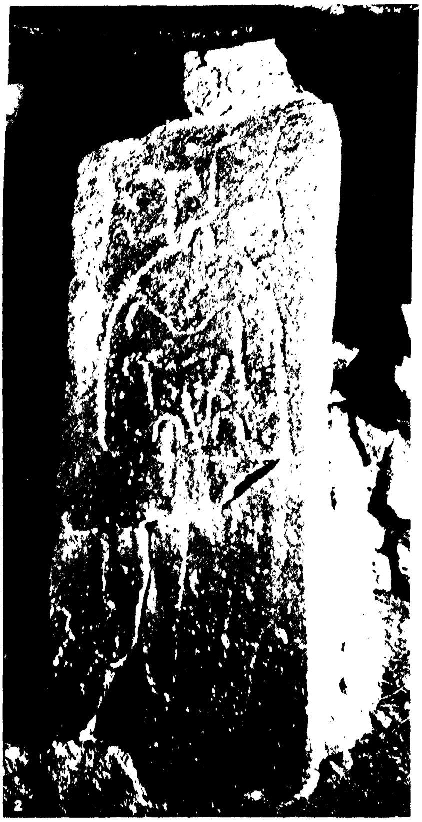

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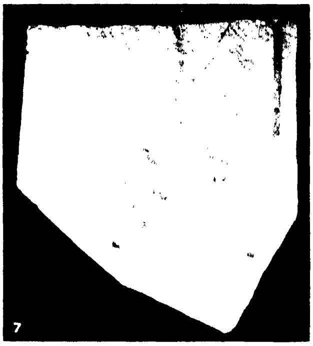

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BY COURTESY OF (1, 3, 8) V. C. C. COLLUM [illegible] ZACHARIE LE ROUZIC

STONE MONUMENTS OF CARNAC, BRITTANY

1. Symbol of Hermes, with a runic inscription, and a Christian cross
2. Sculptured slab in chambered mound of the Mane-er-H'roek, Locmariaquer
3. The isolated menhir Gouhar'h, Conguel, Quiberon, near burial chamber. This pillar is 18 ft. high
4. One of 27 stone kists and graves at Inis-Tilleuc, Portivy, Quiberon
5. Human feet sculptured in relief on the wall of the chamber of Petit Mont
6. Sculptured stone (from cast) in megalithic chamber, Mané-Lud, Locmariaquer. In this mound human bones, beaker pottery, gold ornaments and flint arrow heads were found
7. Sculptured stone (from cast), Mané-Lud, Locmariaquer, with signs representing sacred horns, or boats
8. Sculptured stone, part of denuded dolmen, from hill-top camp at Le Lizo. This stone is now in the Carnac Museum

with rock-hewn graves; some with vestibules provided with triclinia, an amphitheatre and a rock-hewn temple have been excavated. The finds have been arranged in the local museum.

Carmona was greatly strengthened by the Moors and the present Seville gate was built by them. The parish church, with its Moorish court, is a converted mosque. In 1247 Ferdinand III. of Castile took the town and Peter the Cruel (1350–69) built the lofty citadel with its palace, now in ruins.

CARNAC, a village of N.W. France, in the department of Morbihan and arrondissement of Lorient, 9 mi. S.W. of Auray. Pop. (1936) 798. It has a church in the Renaissance style of Brittany, but owes its celebrity to the stone monuments in its vicinity. (*See* STONE MONUMENTS, PRIMITIVE.) The most remarkable consists of long avenues of menhirs or standing stones; but there are also dolmens and barrows, throughout the whole district. About half a mile to the north-west of the village is the Ménec system, which consists of eleven lines and extends a distance of 3,376 ft. The terminal circle is broken by the houses and gardens of a little hamlet. To the east-north-east there is another system at Kermario (Place of the Dead), which consists of ten lines about 4,000 ft. in length. Still further in the same direction is a third system at Kerlescan (Place of Burning), composed of thirteen lines, about ½ m. in length, terminated by an irregular circle. These three systems seem once to have formed a continuous series; the menhirs, many of which have been broken up for road-mending and other purposes, have diminished in number by some thousands in modern times. The alignment of Kermario points to the dolmen of Kercado (Place of St. Cado), where there is also a barrow, explored in 1863; and to the south-east of Ménec stands the great tumulus of Mont St. Michel, which measures 377 ft. in length, and has a height of 65 ft. The tumulus, which is crowned with a chapel, was excavated by René Galles in 1862; and the contents of the sepulchral chambers, which include several jadeite and fibrolite axes and Callais beads, are preserved in the museum at Vannes. About a mile east of the village is a small piece of moorland called the Bossenno, from the *bocenieu* or mounds with which it is covered; and here, in 1874, the explorations of James Miln, a Scottish antiquary, brought to light the remains of a Gallo-Roman town. The tradition of Carnac is that there was once a convent of the Templars or Red Cross Knights on the spot; but this, it seems, is not supported by history. Similar traces were also discovered at Mané Bras, a height about 3 miles to the east. The rocks of which these various monuments are composed is the ordinary granite of the district, and most of them present a strange appearance from their coating of white lichens. Carnac has an important museum of antiquities (Musée Miln).

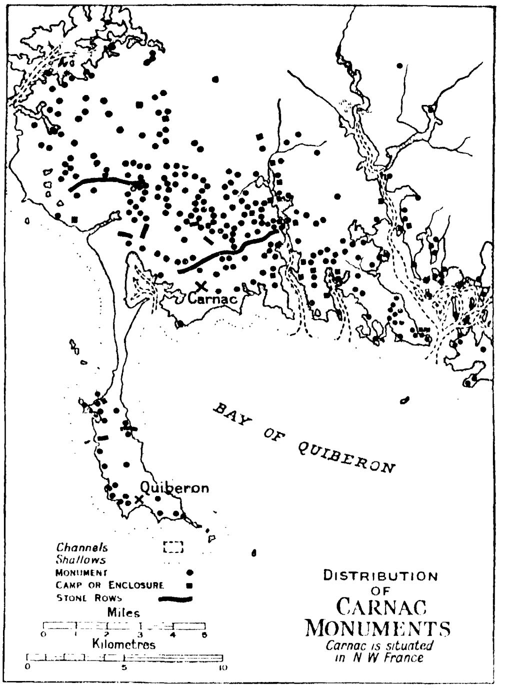
See W. C. Lukis, *Guide to the Principal Chambered Barrows and other Prehistoric Monuments in the Islands of the Morbihan, etc.* (Ripon, 1875); René Galles, *Fouilles du Mont Saint Michel en Carnac* (Vannes, 1864); A. Fouquet, *Des monuments celtiques et des ruines romaines dans le Morbihan* (Vannes, 1853); James Miln, *Archaeological Researches at Carnac in Brittany: Kermario* (1881); and *Excavations at Carnac: The Bossenno and the Mont St. Michel* (1877); Z. Le Rouzic, *The Megalithic Monuments of Carnac and Locmariaquer* (1908); *Bulletin de la Société polymathique du Morbihan.*

(X.)

MEGALITHIC MONUMENTS

Alignments of standing stones, isolated menhirs, chambered mounds, and "dolmens" denuded of their mounds, survive in the Carnac district in greater number and variety than anywhere else. (*See* figure for relationship to sea-coast and deep water inlets.)

The Société Polymathique du Morbihan (Museum at Vannes) started excavating in the 19th century. W. C. Lukis of Guernsey (finds in the British museum) and James Miln of Scotland also studied them. Miln bequeathed his finds to Carnac. He had for a pupil a Carnac boy, Zacharie Le Rouzic, afterwards conservator of the Miln-Le Rouzic museum. Archaeology owes most of its knowledge of the monuments to his re-excavations and restorations, beginning in the last quarter of the 19th century. (Selections of finds from Carnac are also exhibited in the museum of National Antiquities, St. Germain-en-Laye.) The theoretical chronology of the monuments, deduced from an ideal typology starting with the "stone age" slab-kist and evolving into chambered mounds of the Petit Mont (G. xxvi. 14) and Ile Longue (H. xxix. 23) type, has been undermined no less by Le Rouzic's patient collection and juxtaposition of his finds than by the re-examination of the early excavators' original reports and the subsequent methodical analysis of all the association data available, a task that has occupied the writer for nine years. The evidence demonstrates that the monuments were built by a mixed population trading with the megalithic centres of Grand-Pressigny (Touraine), the Iberian peninsula, and northwest Britain and Ireland, influenced culturally by the Aegean and the nomads of northern Eurasia. The native maritime people were slightly-built and very long-headed. They lived largely by fishing and shell-fish collecting, used roughly-fashioned flint, bone and horn implements, and microlithic flakes, and commonly buried their dead crouched, in walled-up rock-shelters or graves made box-wise of slabs or dug out and lined with boulders; but they also had domestic animals and grain. Their pottery and polished stone implements included styles contemporaneous with the knowledge of metal. Intermingled and interbred with them was the sturdily-built broad-headed race everywhere associated with a metal-using culture.



BY COURTESY OF V. C. C. COLLUM

Members of a taller race, which is conspicuous for its large bones, prominent nose and big teeth associated with certain primitive anatomical features, also dwelt among them. Alongside of the crouched inhumation rite of the long-headed slender race, characterizing chambered mound and slab-kists alike, existed that of incineration and urn burial in association with similar objects; this rite again overlapped that of extended inhumation. In the megalithic tombs the principal burial was beneath the floor of the main chamber, but other bodies were disposed on the chamber floors in circumstances suggesting a voluntary holocaust. Horses and cattle were slaughtered as part of the funeral rite; sometimes they were ceremonially buried, as horses at Mané Lud (A. ii. 9) and oxen at Mont St. Michel (F. xix. 2). Certain data point to a ritual burning consistent with roasting at a funeral fire followed by a feast and the carrying away by guests of surplus meat. Rough pottery was ritually made and flints knapped on the spot, and votive objects, including wheel-turned vessels and exquisite jade axeheads, were deposited in the chambers. The constructors of these monuments enjoyed a basic civilisation that had spread all over inhabited Europe in an age when the natives were still in the transition stage from a hunting and fishing existence (when they were ignorant of metal) to the sedentary culture-complex of which pottery, agriculture and stock-raising (with its wood-working and tillage implements), spinning, weaving and, probably, felting, metallurgy, trade, and organized religion formed part. Superposed on this was a sophisticated imported culture, more particularly concentrated around natural harbours and river inlets, and limited to the dominant and wealthy, who possessed gold, jadeite and callaïs ornaments, had a knowledge of the processes of metallurgy (including iron smelting and casting), and technically advanced potting (including glazes, casting in moulds and brick-and-tesserae-making), used hollow-cast bronze and lead axes as a weight-currency, and imitated at their own potteries the wares of Greece and Italy. The wide gap between the two cultural extremes, hitherto regarded as chronological, is revealed as economic and social.

The long, low, extensive mounds covering numerous funeral hearths and multiple kists enclosed by a rough kerb, while overlapping, appear somewhat to antedate the higher chambered mounds with entrance corridors and the technically degenerate *allées couvertes*. They definitely antedate the alignments.

Kist burial is contemporaneous with every local type of megalithic monument, persisting, modified to contain extended bodies, into the 6th century A.D. Zacharie Le Rouzic conservatively dates the long, low mounds from 2500 to 2000, and the chambered and corridored mounds and *allées couvertes*, together with alignments and cromlechs, from 2000 to 1200 B.C. The writer's researches, confirmed by the excavations, carried out for Sir Robert Mond, of the previously unexcavated *allée couverte* of Tressé, North Brittany (1st cent. A.D.), and, in Guernsey—a colony of ancient Armorica—of the classic Déhus chambered mound (roughly contemporary), indicate that the Carnac megalithic monuments were erected at some date between 300 B.C. and 200 A.D.

Beaker pottery in Britain, attributed to a hypothetical "Bronze age," is technically inferior to the highly characterised Armorican caliciform beaker of Spanish facies, associated with "dolmens." Analysis of the 49 recorded instances in which such beakers have been found in megalithic monuments included in the *Corpus* of South Morbihan monuments in preparation by the writer (based on Le Rouzic's MS. inventory for the region) brings out the variation in the contemporary architectural models and illustrates this telescoping of hypothetical "ages." Five were *allées couvertes*, in 2 cases bent and in 1 having a porthole. Six of the chambers were corbelled, in 3 cases being enclosed in the same mound with a "dolmen"-style chamber built of massive stone uprights with coverstones. (Dry masonry is always associated with megaliths in unruined chambers; multi-chambered mounds are common.) In one case one wall was natural rock outcrop. The ground plans of these 49 monuments include almost all known European types. In them characterless flint chips and quartzite hammer-stones are general, associated (a) with unused polished local fibrolite, diorite, jadeite and chloromelanite axes, some being obvious copies of metal models; (b) with unused scrapers, blades and barbed and tanged and also leaf-shaped arrowheads in Grand-Pressigny or other imported flint; (c) with evenly-bored cylindrical callaïs beads, and rougher beads in serpentine and talc; (d) with rock-crystals, and (e) with hammered gold ornaments decorated with repoussé dots. With the recorded beakers were associated, in 7 cases, black handmade Gaulish pottery (associated with gold twice, with a copper dagger once, with wheel-turned ware thrice); in 4 cases handmade "black-leaded," and in 5 cases, wheel-turned "black-leaded" ware (these associated, respectively, with gold and iron in 1 instance, with a bronze tinkle-bell in 1; with gold in 1, and in another with a corrugated cylindrical bead, apparently of metal with an enamel copper-based glaze on the exterior surface only, a yellow glass bead, and a scrap of bronze); in 8 cases with wheel-turned Gaulish pottery of Roman Occupation date (associated with iron and a bronze awl in 1 case, Gaulish coins, glass and pipe-clay Gaulish statuettes in another, and with similar statuettes in 2 further cases, and in yet another with bronze and lead and Gaulish brick-tiles). In 6 instances the beakers were associated with pottery of "Iron age" facies (in 1 instance associated with bronze riveted swords and beaten gold collars), and in 2 with the peculiar pedestal offering stands of highly-fired ware manufactured at the Er-Lannic site (G. xxvi. 15), these stands themselves associated in 1 case with the before-mentioned statuettes and glass.

In 2 cases the beakers were associated with potter's clay, in 4 further cases with gold ornaments (in 1 instance associated with a fragment of tortoise-shell and in another with a schist wrist-guard), and in 1 case with a Gallo-Roman glass phial. Thus in 26 instances out of the 49 there were other objects dating the monument to Gaulish times.

This analysis is limited to beaker associations and takes no account of the numerous instances in which datable Gaulish objects were found associated with other types of handmade pottery, flints and votive stone axes. Le Rouzic's excavations have demonstrated that the horse-shoe cromlechs enclosed human habitations, and that, at the Er-Lannic cromlechs, were produced hard-stone votive axes and cylindrical offering-stands like those found *in situ* in the Hougue Bie chamber in Jersey, and in fragments in some Carnac monuments. Folklore associates these enclosures with assemblies and dancing. The alignments, by no means straight, usually lead up to such enclosures (some of them vast in area), the taller stones, up to 5 metres high, nearest the enclosure. The Kerlescan group (13 lines and 880 m. long) still contains 540 stones, the Kermario group 982, and the Menec group 1,099 (not to mention others). Possibly they were social memorials set up along the route from a settlement to a boat landing.

Excavations have revealed several habitation sites in which Gaulish and "Iron age" pottery is associated with objects found in the megalithic tombs. Hill-top and promontory refuge "camps," adjacent to channels, yield similar objects.

The seemingly anomalous Carnac data are all susceptible of a logical explanation if we assume that the Veneti of Armorica, whose great sailing ships, iron anchors and chains, and far-flung trade so impressed Caesar, were an off-shoot from their namesakes sited on the Adriatic where sea-routes from the Aegean met continental trade routes from the Black Sea. The signs sculptured on the megaliths of the tombs suggest by their symbolism a cult derived from an Oriental cosmic theosophy spread far and wide during the period 600 B.C. to 400 A.D., in which Hermes and his emblem—to whose frequency in Gaul Caesar called attention—played a propagative part.

In Roman times the megalithic chambers were doubtless still enveloped in their mounds which would excite little comment among a people familiar with funeral tumuli at home. Their violation was probably begun by the Northern pirates who devastated Armorica and they appear to have proved a lucrative source of "hidden gold" to the enterprising, pirates or others all down the centuries from that time to this.

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CARNARVON, EARLDOM OF. The earldom of Carnarvon was created in 1628 for Robert Dormer, Baron Dormer of Wyng (*c.* 1610–1643), who was killed at the first battle of Newbury while fighting for Charles I, and it became extinct on the death of his son Charles, the 2nd earl, in 1709. From 1714 to 1789 it was held by the family of Brydges, dukes of Chandos and marquesses of Carnarvon, and in 1793 Henry Herbert, Baron Porchester (1741–1811), was created earl of Carnarvon.

His great-grandson, HENRY HOWARD MOLYNEUX HERBERT, 4th earl of Carnarvon (1831–1890), was born on June 24, 1831. He was educated at Eton and Christ Church, Oxford, and succeeded to the title in 1849, on the death of his father, Henry John George, the 3rd earl (1800–1849). In 1858 he was undersecretary for the colonies, and in 1866 secretary of state, and he introduced in 1867 the bill for the federation of the British North American provinces; but before the measure became law he had resigned, owing to his distaste for Disraeli's reform bill. Resuming office in 1874, he endeavoured to confer a similar boon on South Africa, but the times were not ripe. In 1878 he again resigned, out of opposition to Lord Beaconsfield's policy on the eastern question; but on his party's return to power in 1885 he became lord-lieutenant of Ireland. He resigned on a question of personal veracity raised by Parnell. He never returned to office, and died on June 29, 1890. He was high steward of the University of Oxford, and president of the Society of Antiquaries. The 4th earl was succeeded by his son, George Edward Stanhope Molyneux (1866–1923), *see* the following article.

CARNARVON, GEORGE EDWARD STANHOPE MOLYNEUX HERBERT, 5TH EARL OF (1866–1923), English Egyptologist, was born at Highclere, Berkshire, June 26, 1866, and educated at Eton and Trinity college, Cambridge. He began excavations near Thebes with Howard Carter in 1906 and discovered tombs of the XII and XVIII Egyptian dynasties in the Valley of the Kings. A further concession having been obtained in 1914, operations in another part of the valley were conducted after World War I, resulting in the discovery by Mr. Carter in Nov. 1922 of the antechamber of the tomb of Tutenkhamon (*q.v.*) of the XVIII dynasty. On Feb. 16, 1923, the sepulchral chamber was opened, the actual sarcophagus being discovered on Jan. 3, 1924. Meanwhile Lord Carnarvon had died in Egypt on April 5, 1923, from the results of a mosquito bite and pneumonia. See *The Tomb of Tut-ankh-Amen* by Howard Carter and A. C. Mace (1923).

CARNARVON, CARNARVONSHIRE, WALES: *see* CAERNARVON; CAERNARVONSHIRE.

CARNATIC, a name given by Europeans to a region of southern India, between the Eastern Ghats and the Coromandel coast, in the presidency of Madras. Properly the name applies only to the country of the Kanarese extending between the Eastern and Western Ghats, over an irregular area narrowing northwards, from Palghat in the south to Bidar in the north, and including Mysore. Administratively the name Carnatic (or rather Karnatak) is now applied only to the Bombay portion of the original Karnata, viz., the districts of Belgaum, Dharwar and Bijapur, and the native states of the southern Mahratta agency, Jath and Kolhapur..

History.—The Carnatic was of great importance historically. It extended along the eastern coast of India about 600 mi. in length, and 50–100 mi. in breadth. It was bounded on the north by the Guntur circar, and thence it stretched southward to Cape Comorin. The region south of the river Coleroon, which passes the town of Trichinopoly, was called the southern Carnatic. The central Carnatic extended from the Coleroon river to the river Pennar. The northern Carnatic extended from the river Pennar to the northern limit of the country. The Carnatic, as defined, comprehended within its limits the maritime provinces of Nellore, Chingleput, South Arcot, Tanjore, Madura and Tinnevelly, besides the inland districts of North Arcot and Trichinopoly.

At the earliest period of which any records exist the Carnatic was divided between the Pandya and Chola kingdoms, which with that of Chera or Kerala (*q.v.*) formed the three Tamil kingdoms of southern India. The Pandya kingdom practically coincided in extent with the districts of Madura and Tinnevelly; that of the Cholas extended along the Coromandel coast from Nellore to Pudukottai, being bounded on the north by the Pennar river and on the south by the southern Vellaru. The government of the country was shared for centuries with these dynasties by numerous independent or semi-independent chiefs, evidence of whose perennial internecine conflicts is preserved in the multitudes of forts and fortresses the deserted ruins of which crown almost all the elevated points. In spite, however, of this passion of the military classes for war the Tamil civilization developed in the country was of a high type. This was largely due to the wealth of the country, famous in the earliest times as now for its pearl fisheries. Of this fishery Korkai (the Greek Kolchoi), now a village on the Tambraparni river in Tinnevelly, but once the Pandya capital, was the centre long before the Christian era. In Pliny's day, owing to the silting up of the harbour, its glory had already decayed and the Pandya capital had been removed to Madura (*Hist. Nat.* vi. cap. xxiii. 26), famous later as a centre of Tamil literature. The Chola kingdom, which four centuries before Christ had been recognized as independent by the great Maurya king Asoka, had for its chief port Kaviripaddinam at the mouth of the Cauvery, every vestige of which is now buried in sand. For the first two centuries after Christ a large sea-borne trade was carried on between the Roman empire and the Tamil kingdoms; but after Caracalla's massacre at Alexandria in A.D. 215 this ceased, and with it all intercourse with Europe for centuries. Henceforward, until the 9th century, the history of the country is illustrated only by occasional and broken lights. The 4th century saw the rise of the Pallava power, which for some 400 years encroached on, without extinguishing, the Tamil kingdoms. When in A.D. 640 the Chinese traveller Hsüan Tsang visited Kanchi (Conjevaram), the capital of the Pallava king, he learned that the kingdom of Chola (Chu-li-ya) embraced but a small territory, wild, and inhabited by a scanty and fierce population; in the Pandya kingdom (Malakuta), which was under Pallava suzerainty, literature was dead, Buddhism all but extinct, while Hinduism and the naked Jain saints divided the religious allegiance of the people. The power of the Pallava kings was shaken by the victory of Vikramaditya Chalukya in A.D. 740, and shattered by Aditya Chola at the close of the 9th century. From this time onward the inscriptional records are abundant. The Chola kingdom, which in the 9th century had been weak, now revived, its power culminating in the victories of Rajaraja the Great, who defeated the Chalukyas after a four years' war, and, about A.D. 994, forced the Pandya kings to become his tributaries. A magnificent temple at Tanjore, once his capital, preserves the records of his victories engraved upon its walls. His career of conquest was continued by his son Rajendra Choladeva I, self-styled Gangaikonda owing to his victorious advance to the Ganges, who succeeded to the throne in A.D. 1018. The ruins of the new capital which he built, called Gangaikonda Cholapuram, still stand in a desolate region of the Trichinopoly district. His successors continued the eternal wars with the Chalukyas and other dynasties, and the Chola power continued in the ascendant until the death of Kulottunga Chola III in 1278, when a disputed succession caused its downfall and gave the Pandyas the opportunity of gaining for a few years the upper hand in the south. In 1310, however, the Mohammedan invasion under Malik Kafur overwhelmed the Hindu states of southern India in a common ruin. But though crushed, they were not extinguished; a period of anarchy followed, the struggle between the Chola kings and the Muslims issuing in the establishment at Kanchi of a usurping Hindu dynasty which ruled till the end of the 14th century, while in 1365 a branch of the Pandyas succeeded in re-establishing itself in part of the kingdom of Madura, where it survived till 1623. At the beginning of the 15th century the whole country had come under the rule of the kings of Vijayanagar; but in the anarchy that followed the overthrow of the Vijayanagar empire by the Muslims in the 16th century, the Hindu viceroys (*nayakkas*) established in Madura, Tanjore and Kanchi made themselves independent, only in their turn to become tributary to the kings of Golconda and Bijapur, who divided the Carnatic between them. Towards the close of the 17th century the country was reduced by the armies of Aurangzeb, who in 1692 appointed Zulfikar Ali nawab of the Carnatic, with his seat at Arcot. The collapse of the Delhi power after the death of Aurangzeb produced further changes. The nawab Saadetallah of Arcot (1710–32) established his independence; his successor Dost Ali (1732–40) conquered and annexed Madura in 1736, and his successors were confirmed in their position as nawabs of the Carnatic by the nizam of Hyderabad after that potentate had established his power in southern India.

After the death of the nawab Mohammed Anwar-ud-din (1744–49), the succession was disputed between Mohammed Ali and Husein Dost. In this quarrel the French and English, then competing for influence in the Carnatic, took opposite sides. The victory of the British established Mohammed Ali in power over part of the Carnatic till his death in 1795. Meanwhile, however, the country had been exposed to other troubles. In 1741 Madura, which the nawab Dost Ali (1732–40) had added to his dominions in 1736 was conquered by the Mahrattas; and in 1743 Hyder Ali of Mysore overran and ravaged the central Carnatic. The latter was reconquered by the British to whom Madura had fallen in 1758; and, finally, in 1801 all the possessions of the nawab of the Carnatic were transferred to them by a treaty which stipulated that a large annual revenue should be reserved to the nawab, and that the British should undertake to support a sufficient civil and military force for the protection of the country and the collection of the revenue. On the death of the nawab in 1855 it was determined to put an end to the nominal sovereignty, a liberal establishment being provided for the family.

The southern Carnatic, when it came into the possession of the British was occupied, with doubtful right, by military chieftains called poligars. They were unquestionably a disorderly race; and the country, by their incessant feuds and plunderings, was the scene of continued strife and violence. Under British rule they were subdued and their military establishments destroyed.

See INDIA: *History.* For the various applications of the name Carnatic *see* the *Imperial Gazetteer of India* (1908), *s.v.*; for the early history of the country *see* V. A. Smith, *Early History of India* revised by S. M. Edwardes (1924); Robert Sewell, *A Forgotten Empire* (Vijayanagar) (1900); *The Cambridge History of India*, ed. Prof. E. J. Rapson (1922 *et seq.*).

CARNATION, A HIGHLY PERFUMED FLOWER GROWN EXTENSIVELY IN THE UNITED STATES

The flower has various forms and colours, its stem supporting grasslike leaves

CARNATION (*Dianthus caryophyllus*, family Caryophyllaceae), a garden flower, a native of southern Europe, but occasionally found in an apparently wild state in England. It is held in high estimation for the beauty and the delightful fragrance of its blossoms. The varieties are numerous, and are ranged under three groups, called bizarres, flakes and picotees. The true carnations, as distinguished from picotees, are those which have the colours arranged in longitudinal stripes or bars of variable width on each petal, the ground colour being white. The bizarres are those in which stripes of two distinct colours occur on the white ground, and it is on the purity of the white ground and the clearness and evenness of the striping that the technical merit of each variety rests. The flakes have stripes of only one colour on the white ground. The selfs, those showing one colour only, as white, yellow, crimson, purple, etc., are commonly called cloves. The picotee has the petals laced instead of striped with a distinct colour. The winter flowering or perpetual race is remarkable for the charming delicacy and colouring of the blossoms and for the length of the flower stalks. Marguerite carnations are remarkable for their beautifully fringed blossoms. They are little known in America, where the summers are too hot for them. Jacks are seedling carnations with single flowers of no great value. Carnations are sometimes grown outdoors in mild climates, but their chief use in America is as cut flowers, forced in the greenhouse for winter blooming. For this purpose they are propagated by cuttings made from greenhouse plants in November-December, which are grown during the winter and planted outdoors, where if blooms appear they must be pinched off. Before frost appears they are replanted in the cool greenhouse and later forced into bloom by judicious management of temperature and the amount of shade on the glasshouse roof.

CARNEADES (214–129 B.C.), Greek philosopher, founder of the Third or New Academy, was born at Cyrene. Little is known of his life. He learned dialectics under Diogenes the Stoic, and under Hegesinus, leader of the academy. The chief objects of his study, however, were the works of Chrysippus, opposition to whose views is the mainspring of his philosophy. In 155, together with Diogenes the Stoic and Critolaus the Peripatetic, he was sent on an embassy to Rome to justify certain depredations committed by the Athenians in the territory of Oropus. On this occasion he delivered two speeches on successive days, one in favour of justice, the other against it. His powerful reasoning excited among the Roman youth an enthusiasm for philosophical speculations, and the elder Cato insisted on Carneades and his companions being dismissed from the city.

Carneades, practically a 5th-century Sophist, is the most important of the ancient sceptics. Negatively, his philosophy is a polemic against the Stoic theory of knowledge in all its aspects. All our sensations are relative, and acquaint us, not with things as they are, but only with the impressions that things produce upon us; it is impossible to distinguish between false and true impressions; therefore the Stoic φαντασία, καταληπτική (*See* STOICS) must be given up. There is no criterion of truth. In answer to the Stoic doctrine of design in nature, he points to the existence of evil; and against the theory of a divine providence he argues that the world cannot be shown to be anything but the product of natural forces. While against Stoic theology he points out that individuality is not consonant with infinity, with Aristotle he argues that virtue, as relative, cannot be ascribed to God; and further that neither intelligence, corporeality nor incorporeality, nor in fact anything can be regarded as attributes of God; thus anticipating much in modern thought.

The positive side of his teaching resembles in all essentials that of Arcesilaus (*q.v.*). Knowledge being impossible, a wise man should practice ἐποχή (suspension of judgment). He will not even be sure that he can be sure of nothing. Ideas or notions are never true, but only probable; nevertheless, there are degrees of probability, and hence degrees of belief, leading to action, according as the impression is merely probable in itself; probable and uncontradicted; or probable, uncontradicted and confirmed by investigation. Carneades left no written works; his opinions seem to have been systematized by Clitomachus.

See A. Geffers, *De Arcesilae Successoribus* (1845); C. Gouraud, *De Carneadis Vita et Placitis* (1848); V. Brochard, *Les Sceptiques grec* (1887); C. Martha, "Le Philosophe Carneade à Rome," in *Revue des deux mondes*, xxix (1878), and the histories of philosophy. F. Alessio, *Carneade* (Mondovi, 1890), also ACADEMY, GREEK.

CARNEGIE, ANDREW (1835–1919), American manufacturer, was born in Dunfermline, Scotland, on Nov. 25, 1835. In 1848 his father emigrated to America, settling in Allegheny City, Pennsylvania. He worked as a bobbin boy in a cotton factory, and then as a telegraph clerk and operator. T. A. Scott of the Pennsylvania Railroad employed him as secretary, and in 1859 made him superintendent of the western division of the line. When the Civil War opened he accompanied Scott, then assistant secretary of war, to the front. He introduced sleeping cars for railways, and purchased (1864) Storey Farm on Oil creek, where much oil was brought in. Foreseeing the extent to which the demand for iron and steel would grow, he started the Keystone Bridge works, built the Edgar Thomson steel rail mill, bought out the Homestead steel works, and by 1888 had under his control an extensive plant served by tributary coal and iron fields, a railway 425 mi. long, and a line of lake steamships. In spite of the depression of 1892, marked by the bloody Homestead strike, the various Carnegie companies, aided by favourable tariff legislation, prospered to such an extent that in 1901 they were incorporated in the United States Steel corporation. Mr. Carnegie himself retired from business.

His views on social subjects and the responsibilities which great wealth involved were already known in a book entitled *Triumphant Democracy*, published in 1886, and in his *Gospel of Wealth* (1900). He devoted himself to the work of providing capital for social and educational advancement. Among these the provision of public libraries in the United States and Great Britain (and similarly in other English-speaking countries) was especially prominent, his method being to build and equip, but on condition that the local authority provided site and maintenance. In 1901 he founded the Carnegie Institute of Technology at Pittsburgh, and in 1902 the Carnegie institution at Washington. In Scotland he established a trust for assisting education at the Scottish universities, a benefaction which resulted in his being elected lord rector of St. Andrews university. He was a large benefactor of the Tuskegee institute under Booker Washington for Negro education. He also established large pension funds—in 1901 for his former employees at Homestead, and in 1905 for American college professors. His benefactions in the shape of buildings and endowment for education and research are too numerous for detailed enumeration and are noted in this work under the headings of the various localities. But mention must also be made of his founding of Carnegie Hero Funds, in America (1904) and in the United Kingdom (1908), for the recognition of deeds of heroism; his contribution in 1903 for the erection of a Temple of Peace at The Hague, and for a Pan-American palace in Washington as a home for the International Bureau of American Republics. In 1911 he established the Carnegie corporation and endowed it liberally for the furtherance of civilization. By the close of 1918 he had erected 2,505 library buildings. He supported the movement for spelling reform. He died at Lenox (Mass.), on Aug. 11, 1919.

Among publications by him are *An American Four-in-hand in Britain* (1883), *Round the World* (1884), *The Empire of Business* (1902), a *Life of James Watt* (1905) and *Problems of To-day* (1908).

CARNEGIE, a borough of Allegheny Co., Pennsylvania, U.S.A., 6 mi. S.W. of Pittsburgh, in the valley of Chartiers creek. It is served by the Pennsylvania, the Pittsburgh, Chartiers and Youghiogheny and the Pittsburgh and West Virginia railways. Pop. (1940) 12,663. Principal industries are coal mining and the manufacture of steel and steel products, lead, glass, structural iron and enamelled ware. The borough was formed in 1894 by uniting Chartiers and Mansfield. A few miles south is Bower Hill, chief scene of violence in the "whisky rebellion" of 1794.

CARNEGIE TRUSTS, the second largest, and in some respects the most remarkable, group of charitable foundations in the world. Andrew Carnegie's theory of wealth is summed up in the following sentence. "This, then, is held to be the duty of the man of wealth, to set an example of modest, unostentatious living, shunning display or extravagance; to provide moderately for the wants of those dependent upon him; and after doing so, to consider all surplus revenues which come to him simply as trust funds, which he is called upon to administer . . . the man of wealth thus becoming the mere trustee and agent for his poorer brethren." In this spirit he founded the following trusts in the United Kingdom and in America.

I. TRUSTS IN THE UNITED KINGDOM

Carnegie Trust for the Universities of Scotland (Edinburgh).—Founded in 1901 this has a capital of £2,000,000. One half of the income is to be applied to the improvement and expansion of the four Scottish universities, chiefly in the field of research; one half to the payment of the whole or part of the fees of university students of Scottish birth or extraction.

Carnegie Dunfermline Trust.—Founded in 1903 with £750,000, this is the counterpart, to some extent, of the Carnegie Institute of Pittsburgh (*see* below). This trust is limited to the founder's native city of Dunfermline, but the income may be spent on anything which may improve the community. The trustees are, however, charged to maintain the beautiful park known as Pittencrieff Glen, which was presented by the founder separately. They have established a number of institutes, a clinic, a craft school, a school of music and a physical training college, and have substantially assisted the public library, the baths, and a large number of local societies, educational, literary and artistic.

Carnegie Hero Fund Trust.—This fund is administered from Dunfermline by the trustees of the Carnegie Dunfermline Trust.

Carnegie United Kingdom Trust (Dunfermline).—Founded in 1913 with a capital of £2,000,000, this is the analogue of the Carnegie Corporation of New York "for the improvement of the well-being of the masses of the people of Great Britain and Ireland by such means as are comprehended within the meaning of the word charitable." This trust has carried on the founder's library policy, having erected a number of public libraries, established more than 100 county libraries and assisted many special libraries. It has published an edition of Elizabethan music and a number of modern compositions. Grants have been made for the erection of six child welfare model centres, to the Old Vic and Sadler's Wells theatres, London, as the nucleus of a national theatre for England, and to many musical and dramatic enterprises. The trust has also taken a prominent part in rural development by founding county community councils, and in 1927 it set aside the sum of £200,000 over four years to encourage the provision of public playing fields. (J. M. M.)

II. TRUSTS IN THE UNITED STATES

Carnegie Institute of Pittsburgh.—This consists of a group of cultural and educational departments primarily for the people of Pittsburgh: free public library, concert hall, institute of technology, museum and art gallery. The foundation dates from 1881 when Carnegie offered to provide a public library; the offer was accepted in 1886. The idea expanded until the Institute was constituted as such in 1896. It has a capital of $36,000,000.

Carnegie Institution of Washington.—Founded in 1902, with a present capital of $35,000,000, this is a great combination of research departments, working in collaboration and including geophysical laboratory (1906); Mount Wilson Observatory (1904); terrestrial magnetism (1904); plant biology (1903); animal biology (1935), including embryology, genetics, nutrition and Tortugas laboratory; historical research (1903). The published reports of the Institution constitute a highly valuable library of research and are widely distributed.

Carnegie Hero Fund Commission (Pittsburgh).—This foundation was established in 1904, and was designed for the purpose of giving suitable recognition to persons engaged in peaceful occupations who risk their lives in heroic efforts to save others. Recognition takes the form of medals, pecuniary grants, pensions, educational help for children, etc. The fund for the U.S., Canada and Newfoundland has assets totalling $9,000,000. Funds were set up as follows: British Isles, $1,250,000 (1908); France, $1,000,000 (1909); Germany, $1,500,000 (1910); Norway, $125,000 (1911); Switzerland, $130,000 (1911); Netherlands, $200,000 (1911); Sweden, $230,000 (1911); Denmark $125,000 (1911); Belgium, $230,000 (1911); Italy, $750,000 (1911).

Carnegie Foundation for the Advancement of Teaching (New York).—This was founded in 1905 to provide free pensions for college professors. The Foundation system is non-contributory; but after difficulties and elaborate revisions, a new system was made possible, through funds granted by Carnegie corporation, by the establishment of the Teachers Insurance and Annuity association in which colleges and teachers both contribute on a soundly calculated actuarial basis to the building up of contractual retiring annuities. The foundation itself has paid out more than $35,000,000 in free pensions. Its list of prospective pensioners has long been closed. The foundation, through its Division of Educational Enquiry, endowed by Carnegie corporation, has undertaken many sweeping inquiries in the field of education, and issued important reports. Its assets amount to more than $28,000,000.

Carnegie Endowment for International Peace.—Founded in 1910 with a view to "the speedy abolition of international war between the so-called civilized nations," this has a capital of $10,000,000. It is divided into three sections concerned respectively with "intercourse and education," "economics and history" and "international law." The endowment is very broad in its scope, being free to work in any way for the promotion of good feeling and understanding between the nations. After World War I, one important project was a series of volumes on European economics in connection with the war and its aftermath. The Division of Economics and History of the Carnegie Endowment is responsible for the Economic and Social History of World War I, in 150 volumes, prepared under the direction of Dr. James T. Shotwell and divisional editors in 16 countries, through funds made available by Carnegie Corporation of New York. A 44-volume study of the history of Canadian-American relations was being completed in 1940.

Carnegie Corporation of New York.—Founded in 1911 this is the largest in size and scope of all the Carnegie foundations, its capital being $135,000,000. It exists for "the advancement and diffusion of knowledge and understanding among the people of the United States." In 1917 its scope was extended to include Canada and the British colonies, $10,000,000 of its capital being devoted for this purpose. It may spend its revenue through the other five American Carnegie trusts or through any other suitable channels. Its policy is in fact fluid, the founder having said in the deed, "Conditions upon the earth inevitably change . . . I give my trustees full authority to change policy or causes hitherto aided when this, in their opinion, has become necessary or desirable." The corporation has aided American colleges and universities by grants for endowments and buildings, has made large appropriations in the interests of library training and service, has carried on a program including encouragement of adult education, fine arts, modern languages, and engineering education. Forty-one per cent of its income has been devoted to other institutions founded by Andrew Carnegie; its largest outside appropriations have been to the National Academy of Sciences ($5,000,000); American Library association ($3,300,000); Vanderbilt university ($3,500,000). It has also encouraged research in law, economics and medicine.

All the above foundations, except the Carnegie Corporation of New York and the United Kingdom Trust, have functional or local limitations. The two general trusts work largely on the same lines, seeking to promote education in the widest sense of the term, to make accessible to the public at large the cultural resources of the community, and especially to finance carefully devised pioneer experiments for which, without practical demonstration, public or private liberality can hardly be expected.

See the *Annual Reports* issued by the various Trusts; *Manual of the Public Benefactions of A. Carnegie* (1920); Burton Hendrick, *The Life of Andrew Carnegie,* 2 vols. *See* also LIBRARIES. (R. M. Li.)

CARNEIA, an important Dorian festival (Sparta, Cos, etc.) While many details of it are obscure, the following are the main features, and are tolerably certain. (1) It was held in the month *Karneios* (roughly August). (2) The name is connected with *Karnos* or *Karneios* (probably = Ram), said to have been a favourite of Apollo, unjustly killed by the Heracleidae, and therefore commemorated to appease the god's anger; perhaps an old god of fertility displaced by Apollo (*cf.* HYACINTHUS). (3) It contained an agrarian element. Five young men called *καρνεᾶται* were chosen out of each tribe; one man, decked with garlands, ran away and the rest followed him; they were called *σταφυλοδρόμοι*, *i.e.*, "grape-cluster-runners," hence they very likely carried bunches of grapes. It was a good omen if they caught the fugitive, bad if they did not. They were under the direction of a priest called ἀγητής, or leader. It seems reasonable to suppose that the person they chased was the temporary incarnation of some spirit of vegetation; perhaps to catch him signified that fertility was not allowed to go away, but was secured, to be used for the next year's crops. (4) It contained an element apparently military, since a feast was held by nine groups, each consisting of nine citizens, representing the *ὠβαί* or divisions.

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CARNELIAN or **CORNELIAN,** a variety of chalcedony (*q.v.*), is most generally of a blood-red colour, though included under this name are specimens of a reddish tint varying in colour from yellow to brown. The colouring matter is probably iron oxide in various stages of hydration, though the particles are so small that only in thin sections under the microscope can they be distinguished from the colourless silica in which they are embedded. Though carnelians are recognized in all shades of red, it is convenient to distinguish three varieties; (1) that coloured flesh-red or burnt-brick—the typical carnelian, (2) the honey coloured and (3) that usually called the sard, which is brown by reflected and deep red by transmitted light and was formerly the most valued, because of its greater transparency and depth of colour.

Among the Greeks and Romans the carnelian was one of the most treasured stones and used especially for intaglios of all kinds, examples of which have retained their high polish to a greater extent than many harder stones. The carnelian was also widely used for signets because, as Pliny says (*Nat. Hist.*, xxxvii; trans. P. Holland, 1634), "it signeth very faire without any of the wax sticking to it." Carnelians are embellished by various processes, notably burning and dyeing with salts of iron, and for trade purposes the natural colour is of little importance.

The chief localities are Ratanpur, India; Campo de Maia, Brazil; Dutch Guiana; Siberia; Warwick, Queensland; Tampa Bay, Fla., U.S.A., and Chesil Bank, South Dorset. (W. A. W.)

CARNESECCHI, PIETRO (1508–1567), Italian humanist, was the son of a Florentine merchant, who enjoyed the patronage of the Medici. At 25 he held several rich livings, had been notary and protonotary to the Curia, and was first secretary to the pope. He accepted Luther's doctrine of justification by faith, though he repudiated a policy of schism. When the movement of suppression began, Carnesecchi found shelter with his friends in Paris. On the accession of Pius IV (1559) he came to live in Rome. With the accession of Pius V in 1565 the Inquisition renewed its activities, and Carnesecchi went to Florence, where he was betrayed by Cosimo, the duke, who wished to curry favour with the pope. He was beheaded and burned on Oct. 1, 1567.

CARNIOLA, a former duchy and crownland of Austria which centred round the town of Laibach (Ljubljana), on a feeder of the Save and in a fertile basin. With the foundation of the Serb, Croat and Slovene State, Carniola ceased to exist as a territorial unit, being merged in Slovenia. (*See* YUGOSLAVIA.)

CARNIVAL, the last three days preceding Lent, which in Roman Catholic countries are given up to feasting and merrymaking. Anciently the carnival began on the morrow of Epiphany (Jan. 7) and lasted till Shrove Tuesday. It probably represents the Roman Saturnalia. Rome has ever been the headquarters of carnival, and though some popes made efforts to stem the tide of Bacchanalian revelry, many of the others were great patrons and promoters of carnival keeping; notably Paul II, who instituted a great variety of races. Under Julius III we have long and vivid accounts of bull-baits in the Forum. Even the austere and rigid Paul IV (d. 1559) used to keep carnival by inviting all the Sacred college to dine with him. Sixtus V (1585–1590) set himself to the restraint of excesses and the repression of lawlessness. For the warning of offenders he set up gibbets in conspicuous places. The later popes mostly restricted the carnival to the last six or seven days before Ash Wednesday. The municipal authorities of the city now allow ten days. The carnival sports at Rome anciently consisted of (1) the races in the Corso (hence its present name, formerly Via Lata); (2) the spectacular pageant of the Agona; (3) that of the Testaccio.

Of other Italian cities, Venice was the principal home, after Rome, of carnival. Later Turin, Milan, Florence, Naples, all put forth competing programs. In old times Florence was conspicuous for the licentiousness of its carnival. The carnival in Spain lasts four days, including Ash Wednesday. In France the merrymaking is restricted almost entirely to Shrove Tuesday (*mardi gras*) and to the *mi-carême*, Thursday of the third week in Lent.

CARNIVORA, or the carnivores, comprise the members of the order of flesh-eating mammals which includes the most powerful beasts of prey, as the lion, tiger, leopard and jaguar, numerous fur-bearers, as the seal, fox and sable, the domesticated cat and dog and other well-known animals. In general, their teeth, especially the four long, piercing canine teeth, are adapted for tearing flesh, and the toes of many species are provided with strong sharp claws for seizing prey. For the most part, the carnivores are very active, intelligent and courageous animals, with a keen sense of sight and smell. In size carnivores vary greatly, ranging from small weasels to huge bears, which may weigh ¾ of a ton. There are about 300 species which in their relationships form three groups: the catlike, doglike and seallike carnivores. Besides the cats—lion, tiger, leopard, puma, wildcat and domestic cat—the civets, mongooses and hyenas are comprised in the catlike group. In the doglike group are found in addition to the dogs, wolves and foxes, such unlike types as the bears, the raccoons, cacomistls, kinkajous, pandas, the weasels, badgers, skunks and otters. Far removed from these typical carnivores is the fin-footed seal group, which in addition to true seals, includes the sea lions and the walruses. The carnivores are well represented in all parts of the world except the Australian region, which contains only the dingo, a dog brought there by man. The polar bear and the polar fox range farther north than all other land mammals, while sea lions are found in both arctic and antarctic waters. However, some important groups are restricted in their distribution. The numerous civets, for example, are confined to the old world; the raccoons, except the panda, occur only in America, while in most of Africa none of the true bears is found. Though some carnivores are destructive to domestic animals, and even to human life, many are valuable fur-bearers, as the sable, otter, marten, mink, fox and fur-seal, and they also hold in check various animals, as rodents, which, if unrestricted in numbers, would become exceedingly injurious to agriculture. Besides the dog and the cat, which have been household animals since ancient times, the cheeta or hunting leopard, the ferret and the mongoose are domesticated. The black fox and the mink, successfully raised for their fur, may also be mentioned.

The term Carnivora, suggesting that all the animals so designated are flesh-eaters, is not entirely appropriate. Certain highly organized species of the cat, wolf and weasel kind live almost wholly upon the flesh of warm-blooded animals, for the capture of which their habits and structure are admirably adapted; but others, like most bears, are almost wholly vegetable feeders and quite unfitted for the chase. The great variation in diet and mode of life exhibited by the order is accompanied by a corresponding variation in the limbs and other external organs and by the teeth and skeleton. No single character absolutely distinctive of the group can be named; but by the combination of a number of structural features, it may be distinguished from other orders of mammals. There are never fewer than four toes on each foot; and the first is never opposable to the rest; the digits are typically armed with compressed claws, never with nails or hoofs; there are typically two tufts of tactile vibrissae on each cheek; the tail is never absent; the anus and genital organs open by separate apertures, and the mammae are never wholly pectoral. The cranial portion of the skull is always tolerably capacious as compared with the facial portion and the brain is well or moderately well convoluted. There are two sets of teeth, milk and permanent, differentiated into incisors, canines and cheek-teeth. The incisors are typically six in number above and below, the centrals never being larger than the laterals. The canines are almost always long and piercing in both jaws. The cheek-teeth are rooted, never of persistent growth, and the enamelled crown is raised into simple or bladelike cusps. The two halves of the uterus are separate and the placenta is deciduate and generally zonary.

CHARACTERS USED IN CLASSIFICATION

Soft Parts.—The *facial vibrissae* consist of a tuft above each eye (superciliary), two tufts on each cheek (genal), half a dozen or more rows on the upper lip (mystacial), a few isolated on the chin and a median tuft (interramal) on the throat. As a rule they are well developed both in number and length in predatory species, especially those which hunt in foliage or undergrowth. In vegetable feeders like the typical bears they are, on the contrary, greatly reduced and apparently functionless.

Rhinarium.—The nostrils are typically surrounded by a conspicuous area of naked, glandular skin, the rhinarium, continued in front to the edge of the upper lip as a strip of grooved skin, the philtrum. It is subject, however, to considerable variation with habits.

Ear.—There is typically a well-developed erect external ear, or pinna, attached by a broad hollowed base of which the walls are strengthened by cartilaginous ridges. One of these, the supratragus, is sometimes valvular, helping to close the ear orifice. Another character of importance is the bursa, a pocket formed by a supplementary flap low down on the posterior margin of the ear.

Feet.—In the generalized, and probably primitive, type there are five digits tolerably evenly spaced and forming with their tips a strongly and fairly evenly curved series, the third and fourth being the longest, the second and fifth shorter and subequal, and the first the shortest. Each is supplied with an inferior digital pad behind the claw; and they are united by a flap of integument, or web, which extends nearly to the digital pads. The sole is provided with a plantar pad composed of four united lobes. Behind the plantar pad there is on the forefoot a pair of large, lobate carpal pads; and on the hind foot there is a pair of elongated metatarsal pads, which extend nearly to the heel. This type of foot, called subplantigrade, passes by imperceptible gradations into feet contrasted as digitigrade and plantigrade. The typical plantigrade foot is broad and short, the plantar pad is considerably wider than long, the digits are nearly equal in length and their pads form a lightly curved row. The typical digitigrade foot is longer and narrower than the subplantigrade foot and has the first digit short and raised off the ground or absent; the plantar is three-lobed and the area above it is hairy.

There are two types of claw in the digitigrade foot, the short blunt claw of the dogs and hyenas and the sharp, retractile claw, found in some civets and most cats, which is modified for laceration of prey. The terminal bone of the digit is retracted by an elastic ligament and the sharp point of the curved claw is protected from wear by lobes of skin which ensheathe it. In the seals the feet are converted into paddles, but their structure suggests that they also are modifications of the subplantigrade foot.

Anal Glands.—The rectum is typically provided with a pair of glands opening, usually by a single aperture, just within the anal orifice. The secretion probably acts in normal cases as a lubricant or disinfectant; but in some genera, especially of Mustelidae, like the skunks, the secretion is abundant and nauseous and its forcible discharge is an important means of defense. In the bears (Ursidae) the glands are developed to a negligible extent; and they are quite absent in the seals.

External Genitalia.—The perinaeal area, lying between anus and generative orifice, varies greatly in extent, especially in the males. It may be small, the penis being short and close to the scrotum. But in most families the perinaeal area is large, the penis being long, with the prepuce remote from the scrotum.

Skull.—The skull is very variable in the length, breadth and height of muzzle and brain case. The length of the muzzle is correlated with the number and size of the teeth. Its nasal chambers are filled with delicate scroll-like bones, the *turbinals*. Of these there are two main groups, the *maxillo-turbinals*, rising from the sides of the inner surface of the maxillae, in front, and the *ethmo-turbinals* behind.

On the palate there is a pair of orifices, the *posterior palatine foramina*, which are typically situated on the maxillo-palatine suture but may be in advance of it.

The bone containing the ear capsule is covered by the *auditory bulla*, composed either wholly or partly of the tympanic bone, which alw [illegible] fo [illegible] The po [illegible] sionally cartilaginous, but it may be ossified from a separate centre, the entotympanic. In this type of bulla its cavity is always divided into two chambers by a bony partition, which passes from the line of junction of the two bones.

Behind the bulla there is an expansion of the occipital bone, the ***paroccipital process***, and behind the auditory orifice another process, called the mastoid. Low down on the inner wall of the temporal fossa there is frequently a bony channel, the ***alisphenoid canal***, through which passes a branch of the carotid artery. Its incidence is remarkable, and it has been much used in classification.

Teeth.—These vary in number and structure in accordance with diet. The primitive number was 44; three incisors, one canine, four premolars and three molars above and below on each side, expressed by the formula i.$\frac{3}{3}$, c.$\frac{1}{1}$, p.$\frac{4}{4}$, m.$\frac{3}{3}$. Very seldom, however, is the full complement retained, the numerical reduction takes place mostly from the suppression of one or more of the front and back cheek teeth. It reaches its extreme in predatory forms like the cats and weasels where the formula may be p.$\frac{2}{2}$, m.$\frac{1}{1}$. The number, arrangement and shape of the cusps are also subject to great variation, but the extreme types of dentition are derivable from a more generalized intermediate type in which there is a gradual transition in size, shape and cusp-armature throughout the series. In the upper jaw the cheek-teeth increase in size and complexity from the first to the fourth premolar and decrease from the latter to the last molar. The fourth premolar is triangular in shape and the inner portion or lobe is as broad at the base as the three-cusped bladelike outer portion of the crown. The third premolar and the first molar are also triangular and tolerably similar to the fourth premolar. In the lower jaw the teeth gradually increase in size and complexity from the first premolar to the first molar. The first three premolars have compressed three-cusped blades, with the median cusp the biggest. The fourth premolar is broader than those in front and has supplementary cusps on the inner side of the three-cusped blade, the shape of the tooth and the arrangement of the cusps clearly foreshadowing those of the first molar, in which the crown is differentiated into two subequal portions, an anterior armed with three cusps arranged in a triangle, and a posterior lower portion with an outer and an inner cusp. A first lower molar of this type is found in many genera of Carnivora.

In this type of dentition the fourth upper premolar and the first lower molar, which are opposed in mastication, are approximately similar to the teeth immediately before and behind them in the series, but they are larger, thus attesting the concentration of biting power in the posterior half of the jaw. This difference in size, often accentuated, is found in many terrestrial species and as a very general rule, these two teeth also differ considerably in shape from the others; and since this modification is an adaptation for shearing raw flesh and is particularly manifest in predatory forms, the teeth in question have been distinguished as the carnassials. In the upper carnassial, or the fourth premolar, the modification is brought about by the reduction in size of the inner portion of the crown to a comparatively small lobe and the increase in size and compression of the median and posterior cusps of the outer portion to form a sharp-edged cutting blade. The lower carnassial, or first molar, is still more altered and may, as in the cats, be wholly converted into a cutting blade formed by the enlargement and compression of the anterior median and the adjoining external cusp of the front portion of the primitive type of lower carnassial. High specialization of both carnassials as shearers, seen in the cats, hyenas, some weasels and others is accompanied by shortening of the jaws, suppression of the second upper molar and reduction in size of the first, and loss of the second lower molar.

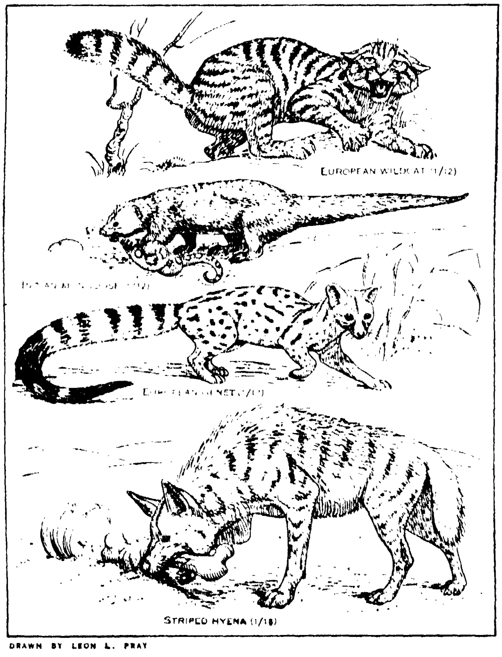
CLASSIFICATION

The existing Carnivora may be divided into two suborders: the Pinnipedia or seal group, with paddlelike feet and cheek-teeth all alike, and the Fissipedia or typical carnivores, with pawlike feet and cheek-teeth of several kinds. A third suborder, the Creodonta (*q.v.*), from which the two existing suborders have been derived, is a primitive stock, extinct since early in the Tertiary era. Many authorities consider these groups full orders.

The fissiped carnivores are divided into two superfamilies: the Canoidea, comprising the dog, bear, raccoon and weasel families with their various branches, and the Feloidea, including the cat, hyena and civet families. This arrangement puts together animals that appear superficially very different but it takes into account the fossil record and evolution of these groups.

Feloidea.—Although the cats are highly specialized, their relatives the civets include some of the most primitive living carnivores. In the Feloidea the ethmo-turbinal bones are extremely large and occupy the greater part of the nasal chambers, extending forwards between and over the smaller maxillo-turbinals almost to the anterior orifice of the chambers. The auditory bulla is composed of two elements, the tympanic and entotympanic, and when completely ossified, its cavity is divided by a partition springing from the line of junction of the two bones that compose its wall. Cowper's glands connected with the generative organs of the male are absent. The Feloidea are divisible into three families.

Family Viverridae, civets, genets and mongooses, are divided into four subfamilies. The Nandiniinae contains the African tree civet, *Nandinia*, which differs from other Viverridae in having the cavity of the auditory bulla undivided and the wall of its posterior portion permanently cartilaginous; in the large size and shelflike form of the mastoid portion of the skull and the backward direction of the paroccipital away from the bulla, two characters in which it resembles many of the typical Canoidea. In other characters it shows kinship with the Oriental palm civets, Paradoxurini, with which it has been affiliated. The body and tail are long, the muzzle elongate and narrow; the full complement of facial vibrissae is retained; the ear has the bursa and a ridgelike supratragus, the legs are short, with the feet subplantigrade, and with short, curved, partially retractile claws, evenly spaced digits, a four-lobed plantar pad, continuous on the forefoot with the bilobed carpal pad and on the hind foot with the metatarsal area which is naked and has two ridgelike pads. Also, in the skull the palatine foramina are in front of the suture, and the cheek-teeth are p. $\frac{4}{4}$, m. $\frac{2}{2}$ and moderately trenchant. But it differs from the Paradoxurini in having abdominal scent glands in front of the genital organs and especially in the shortness of the penis and its close proximity to the scrotum.



DRAWN BY LEON L. PRAY

FIG. 1—CATLIKE (FELOID) CARNIVORES. REDUCTION FROM LIFE SIZE IS INDICATED IN PARENTHESES

The single species of this genus, *N. binotata*, sometimes called the two-spotted palm civet, is a spotted, omnivorous, arboreal animal the size of a small cat, restricted to the forest region of west Africa. It is an extremely interesting primitive type, resembling in many cranial and dental characters, especially in the structure of the bulla, the extinct Miacidae of the Eocene.

The subfamily Viverrinae, comprising the civets, genets and their allies, differ from the Nandiniinae in having the auditory bulla divided by a partition, the wall of its posterior chamber completely ossified and its posterior surface applied to the paroccipital process, which projects downwards, and in the relatively small size of the mastoid process. Also the scent glands, when present, are either wholly or partly perinaeal, never entirely abdominal in position. The subfamily exhibits great range in structural variation and is divisible into several tribes.

The Paradoxurinii, the palm civets (*q.v.*), resemble *Nandinia* in external form and habits, but in the male the prepuce is far in advance of the scrotum, the intervening area being usually occupied by a large but simple scent pouch, and in the female the vulva is surrounded by the scent gland. This group, ranging from India to the Philippines and Celebes, is represented by the genera *Paradoxurus*, *Paguma* and *Macrogalidia*. In a related form, *Arctogalidia*, the scent gland is absent in the male, and in the binturong (*Arctictis*) the tail is prehensile and the teeth, as in *Arctogalidia*, are not so trenchant as in the typical palm civets.

In the three Oriental genera of Hemigalini (*Hemigalus*, *Diplogale*, *Chrotogale*) the teeth are sharper cusped than in the last, the feet are more digitigrade and the scent pouch is reduced in size in both sexes.

The otter-civet (*Cynogale*), the type of the Cynogalini, is a fish-eater adapted for aquatic life. The vibrissae are numerous and rigid, the rhinarium is on the summit of the muzzle, which is very wide, and the tail is short. The scent gland is reduced and the teeth are modified for holding fish and crushing the shells of crabs and mussels. The genus ranges from the Malay States to Borneo.

The Viverrini, represented in tropical Asia by the civets (*Viverra*, *Viverricula*) and in Africa by the typical civet cat (*Civettictis*) and the genets (*Genetta*, *Poiana*), differ from the Paradoxurini in being digitigrade, generally with retractile claws, in having more elaborate scent glands and more trenchant teeth.

In the Galidictini or Madagascar mongooses (*Galidia*, *Galidictis*, *Hemigalidia*), the scent gland is restricted to the female, the feet are narrow with nonretractile claws, the jaws are short, the teeth sectorial and the bulla has a bony tubular meatus not found in the other tribes.

In the preceding groups the scent gland is present in one or both sexes. In the following three it is absent: the genus *Fossa*, sole representative of the *Fossini*, is a civetlike animal inhabiting Madagascar; digitigrade but with nonretractile claws; *Eupleres*, the only known form of the *Euplerini*, also comes from Madagascar, is remarkable for the degenerate character of the teeth and feeble jaws, and the feet are subplantigrade and fossorial; and the linsangs (*Prionodon* and *Pardictis*), representing the Prionodontini, elegant genetlike animals found in southeastern Asia, with digitigrade feet and retractile claws, are the only members of the Viverridae in which the penis is small and close to the scrotum.

The subfamily Herpestinae, the mongooses, differs from the Viverrinae in having a glandular circumanal sac into which the anus and anal glands open by separate orifices, and in the absence of the bursa on the ear. They have no perinaeal glands, the penis is short and close to the scrotum and there is a tubular auditory meatus in the skull. The feet are digitigrade or subplantigrade with fossorial nonretractile claws and the toes may be reduced to four on each foot. The teeth also vary, sometimes being bluntly, sometimes sharply, cusped and trenchant. This group contains a large number of genera and species found mostly in India and Africa. The best known are *Herpestes*, the typical mongoose; *Mungos*, the banded mongoose; *Ichneumia*; *Suricata* and others.

Subfamily Cryptoproctinae contains only the fossa (*Crypto-*

procta) of Madagascar. It resembles externally a large Oriental palm civet, but differs in the absence of perinaeal scent glands, the possession of a capacious circumanal sac and of a large bone in the penis, this organ being highly complex in structure. The jaws of the skull are short and the teeth are sectorial, closely resembling those of the Felidae.

Hyaenidae.—Subfamily Hyaenidae includes the hyenas (*Hyaena, Crocuta*). They differ from other Feloidea in the large size of the tympanic bone, which composes nearly the whole of the bulla, the partition of the cavity lying far back. The feet are digitigrade, like those of a dog, but there is no pollex. The anal glands open into a capacious subcaudal pouch. There are no perinaeal glands and the prepuce is far in advance of the scrotum. The skull is massive and the teeth which are sectorial in type are very powerful. The genus *Hyaena* is represented by the striped hyena of southwestern Asia and northern Africa and by the brown hyena of southwestern Africa. *Crocuta*, the spotted hyena, which differs in the structure of the teeth and genital organs, is restricted to Africa. Hyenas are mostly scavengers, feeding upon the carcasses of big game. Subfamily Protelinae contains only the aard-wolf (*Proteles*), found on the savannas and veldt of tropical and southern Africa. It resembles a small striped hyena externally except for the presence of a pollex on the forefoot. It differs, however, from the hyenas in the normal structure of the bulla and from all the land carnivores in its remarkable dentition, the cheek-teeth being widely spaced, all alike and peglike, with the jaws correspondingly weak. It eats carrion and white ants.

Family Felidae contains the cats, distinguished by the position of the posterior palatine foramina on the maxillo-palatal suture and the absence of the interramal tuft of vibrissae. As in the linsangs (Viverridae), the penis is small and close to the scrotum, the vulva close to the anus, and there are no perinaeal glands or glandular pouch above or around the anus; but although the feet have retractile claws, they are more digitigrade than in the linsangs, the pollex being more elevated, the hallux absent and the plantar pad three-lobed. In the skull the jaws are short and the teeth highly sectorial the important cheek-teeth being the two-bladed carnassials. Recent cats are all closely allied and represent surviving members of a single group. Until recently all except the cheeta were generally considered to belong to a single genus, but at least five genera can be recognized. *Felis*, the typical cats, including the domestic cat and a number of near relatives, is characterized by fully ossified hyoid, well-developed claw-sheaths and long tail. *Lynx* differs from other cats in the absence of an upper premolar, and has short tail and tufted ears. *Neofelis nebulosa*, the clouded leopard of southern Asia and the Greater Sunda Islands, is characterized by very long upper canines. *Panthera* contains the lion (*P. leo*), the tiger (*P. tigris*), the leopard (*P. pardus*), the jaguar (*P. onca*) and the snow leopard (*P. uncia*), which have the larynx (voice box) loosely attached to the skull by the long ligamentous suspensorium of the hyoid. The cheeta (*Acinonyx*) is distinguished from other cats by the absence of the integumentary sheaths to the claws; the hyoid is as it is in the typical cats.

Canoidea.—In this superfamily, containing the dogs, bears, and raccoons, the ethmo-turbinals are excluded from the anterior orifice of the nasal chambers by the enlarged maxillo-turbinals. The wall of the auditory bulla is composed entirely of the tympanic bone and its cavity is typically undivided. Cowper's glands are present in the male.

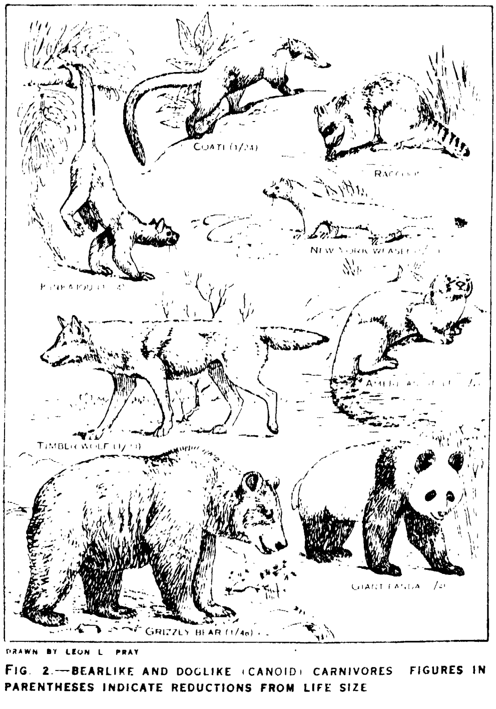
The families fall into three series: the dogs with their close relatives, the bears; the raccoons and their allies; and the weasel-like carnivores.

Canidae.—The dogs, wolves and foxes differ from the rest of the Canoids in possessing a caecum and a duodeno-jejunal flexure in the intestine, as in the Feloids. Also they are completely digitigrade and typically the formula of the cheek-teeth is p.$\frac{4}{4}$, m.$\frac{2}{3}$, with the carnassials large and secant. The teeth, however, vary. The genus *Canis*, containing the dogs, wolves and jackals, many related genera from South America, and the foxes (*Vulpes*) have the teeth as recorded above; but the Asiatic dholes (*Cuon*) and the South American bush dog (*Speothos*) have lost the third lower molar. The most aberrant dentition, however, is found in the foxlike African genus *Otocyon*, in which there are not only four lower and three, occasionally four, upper molars, but the carnassial teeth are not differentiated from the rest either in size or function. Another somewhat aberrant type is the African hunting-dog (*Lycaon*) in which the ears are large and rounded and the pollex is absent.

Ursidae.—Although the bears and the dogs are shown by fossil forms to be modified descendants of the same stock, the living representatives of these families are widely divergent. The bears are heavily built, with broad, plantigrade feet, short tails, protrusible lips, reduced vibrissae and no bursa on the ear. The cheek-teeth, although numerically as in the typical Canidae, are widely different in function and form, being adapted primarily for crushing hard vegetable fibre. The first three premolars above and below are practically functionless, closely crowded or widely spaced, and one or more often deciduous. The upper carnassial is small and not trenchant, and the molars have large flat tuberculated crowns. There are several well-defined genera: *Ursus* containing the brown bear (*U. arctos*), the grizzly (*U. horribilis*) and the black bear (*U. americanus*); *Thalarctos*, the polar bear (*Th. maritimus*); *Selenarctos*, the Asiatic black bear (*S. tibetanus*); *Helarctos*, the Malayan sun-bear (*H. malayanus*); *Melursus*, the sloth bear (*M. ursinus*); and *Tremarctos*, the spectacled bear (*T. ornatus*).

Procyonidae.—This family is here considered to include the pandas, the kinkajous and the cacomistles, as well as the raccoons.

Subfamily Ailurinae contains two forms, widely divergent in appearance and in certain anatomical features, the giant panda (*Ailuropoda melanoleuca*) and the common panda (*Ailurus fulgens*). The former inhabits Tibet and western China. It resembles a white bear with black legs, shoulders, ears and eye-spots, but it lacks the alisphenoid canal in the skull and the molars are broad with numerous supplementary cusps The common panda, which occurs in southern China and northeastern



DRAWN BY LEON L. PRAY

FIG. 2.—BEARLIKE AND DOGLIKE (CANOID) CARNIVORES FIGURES IN PARENTHESES INDICATE REDUCTIONS FROM LIFE SIZE

India, is a small, long-tailed, arboreal species, with subplantigrade, sharp-clawed, hairy feet with greatly reduced pads, the supplementary bone on the forefoot being quite small. It also differs from the giant panda in the loss of the third lower molar, in the cheek-teeth forming graduated series and being simpler in pattern and in the presence of the alisphenoid canal. The anus is encircled by a glandular pouch and the penis is small and close to the scrotum, as in some Feloids.

The subfamily Procyoninae, confined to America, differs from the Ailuridae in having the penis long, the prepuce remote from the scrotum and the anal sac and alisphenoid canal absent, in the normally developed pads on the feet and the differentiation of the upper carnassial from the third premolar. There are several tribes.

The Potosini or kinkajous (*Potos*) are arboreal vegetable feeders, with a prehensile tail and ventral scent glands; the jaws are massive and the molars flat-crowned.

The Procyonini or raccoons (*Procyon*) have long unwebbed digits, a shortish tail and a mobile snout; the crowns of the molars are broad and tubercular, recalling those of *Ailurus*.

The Nasuini or coatis (*Nasua*) have webbed feet, with fossorial claws, a very long tail, an exceedingly mobile probing snout, slender jaws and smaller cheek-teeth than the raccoons but larger tusklike canines.

The Bassariscini, the cacomistles (*Bassariscus*), are active, predacious, genetlike animals with small paws, a long tail and trenchant dentition.

The Bassaricyonini (*Bassaricyon*) closely resemble the kinkajous superficially but the tail is not prehensile and the cranial and dental characters are more like those of the raccoons.

Mustelidae.—This family differs from the Procyonidae in the invariable absence of the second upper molar and in the presence, except in the sea otter, of a wide angular emargination, instead of a notch or slit, between the median and posterior cusps of the upper carnassial. The genera of this family exhibit greater range in structural variation and habits than any family of Carnivora. They may be referred to five subfamilies, the Melinae, the Mephitinae, the Melivorinae, the Mustelinae and the Lutrinae.

The subfamily Melinae is characterized by the upper carnassial not larger than the molar, with a large inner lobe and bluntly cusped blade; the feet are fossorial. *Meles*, the true badger, is heavily built, with narrow head, short legs and tail and a glandular subcaudal pouch. The upper molar is larger than the carnassial, the bulla is undivided and does not open into the mastoid. The badgers are found in temperate Europe and Asia. *Arctonyx*, the sand, or hog badger, occurs from northern India and southern China to Sumatra. It resembles *Meles*, but the muzzle is long, mobile and pig-like, while cranially the long palate, continued posteriorly by the pterygoid bones, is unique. *Mydaus*, the teledu or stink badger of Sumatra, Java and Borneo, differs from the preceding forms in the absence of the subcaudal pouch, and in the skunklike development of the anal glands, the disclike rhinarium, divided upper lip, united toe-pads, reduced ear and the bulla opening into the mastoid. It has a short tail and a white stripe runs from the crown to the tail. *Helictis*, the ferret badger, found in southeastern Asia, is long-tailed like the skunks. The upper carnassial is larger than the molar, which has only a slightly broadened talon. There are no special glands. The bulla is divided by a septum. The nose is long, ending in a naked truncated snout; the ear retains a bursa. *Taxidea*, the American badger, is only distantly related to the typical old world species, the resemblances between the two being chiefly convergent. Its broad skull, the carnassial larger than the triangular upper molar, the bulla opening to the mastoid, the metatarsus without pads, the single carpal pad and peculiar glands associated with both male and female genitalia, are distinctive characters.

The Mephitinae, or skunks, restricted to America and represented by three genera (*Mephitis, Conepatus, Spilogale*), have the bony palate short while the mesopterygoid fossa is long. The penis is without a bone. The anal glands are excessively developed and secrete a nauseating fluid, which may be sprayed for a distance of several yards. The conspicuous pattern and fearless behaviour of skunks make them the stock instance of warningly coloured species.

The Mellivorinae includes only one species, *Mellivora capensis*, the ratel or honey badger, which occurs in tropical Asia and Africa. This animal is badgerlike in appearance but the teeth are sectorial, the upper carnassial larger than the molar, with a sharp blade. The anal glands are developed as in the skunks; the anus is sunk in a pouch and the ear is reduced.

The Mustelinae have the upper carnassial long with a small talon. The feet are digitigrade and not fossorial, with short, partly united digits and short, sharp claws. The weasel, stoat, mink and polecat (*Mustela*) of Europe, Asia and America, have thick-walled auditory bullae, which open to the mastoid. The muzzle is short and the dentition especially sectorial. *Vormela*, the tiger polecat of southern Europe and Asia, is characterized by its variegated dorsal coloration and unconstricted upper molar. *Martes*, the martens and sables, have four premolars and thin-walled bullae. The feet have hairy metatarsus, the carpal pads separate from the plantar pad, like *Mustela* and the ear has a well developed marginal bursa. *Gulo*, the Holarctic wolverine, is a large plantigrade relative of the martens, with heavy dentition. The tayra (*Tayra barbara*), of South and Central America, is probably closely allied to the martens, but the ear lacks the bursa and the feet are naked, with confluent pads. The grisons (*Grison* and *Lyncodon*) occur in Central and South America; they are more distinct from the tayra than was formerly thought. The bullae are low, the tympanic ring in contact with their roofs and their cavities are small and undivided. The dorsal coloration is gray or whitish, while the underparts are dark brown or black, and the anal glands are well developed. The African muishonds (*Ictonyx, Poecilictis*) are also skunklike in coloration, being black with white stripes, but they are lighter in build and less fossorial. The cheek-teeth are $\frac{3}{3}$ or $\frac{3}{4}$. The anal glands are highly effective. *Poecilogale albinucha*, the striped African weasel, is short-legged and long-bodied, but otherwise similar to the larger forms.

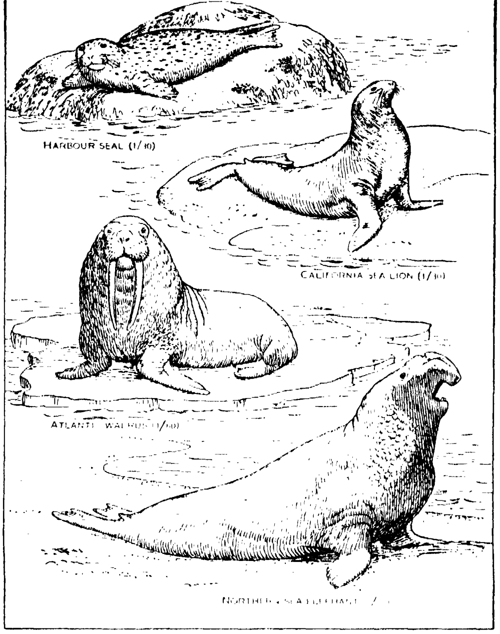
The Lutrinae, or typical otters, represented by many genera (*Lutra, Aonyx, Pteronura*, etc.), differ from the preceding subfamilies mainly in their structural adaptations to aquatic life, and particularly in having the hind feet larger than the fore-feet, with long distensible digits. The kidneys also are lobulate. The skull in shape resembles that of the Mustelinae, but the upper molar is as large as the carnassial. The family ranges all over the world apart from Madagascar and Australia.

The Enhydrini, or sea-otter (*Enhydra*), which is restricted to the north Pacific, differs from the Lutrini in the structure of the feet. The fore feet have the digits very short and tightly fused, and the hind feet very large and paddle-like with the digits progressively increasing in length from the first to the fifth. Also the cusps of the teeth are all bluntly rounded.

SUBORDER PINNIPEDIA

The seallike mammals are often considered a separate order, but they are related to land carnivores. The upper limbs are short, the feet, swimming paddles. The first and fifth toes of the hind feet are larger than the rest. The cheek-teeth are all similar.

Otariidae.—This family comprises the sea lions and fur seals; these have small external ears and progress on land in quadrupedal fashion by applying the naked soles of all four feet to the ground. The incisor teeth are present, the canines are of normal size and the cheek-teeth have compressed crowns with one main cusp. They feed mostly on fish. There are seven well-marked species, each of which has received a generic name based on cranial characters. Steller's sea lion (*Eumetopias jubata*) and the northern fur seal (*Callorhinus ursinus*) are found in the north Pacific; the Californian sea lion (*Zalophus californianus*) ranges from California to Japan; the Australian sea lion (*Neophoca cinerea*) inhabits Australia; the Patagonian sea lion (*Otaria flauescens*) frequents the coasts of South America; the southern fur seal (*Arctocephalus*) occurs in the South American, South African and Australian seas; and Hooker's sea lion (*Phocarctos hookeri*), also in the Australian seas. The family is thus restricted to the Pacific and southern oceans.



DRAWN BY LEON L. PRAY

FIG. 3.—SEALLIKE (PINNIPEDE ARCTOID) CARNIVORES. THE FIGURES IN PARENTHESES INDICATE THE DRAWINGS' REDUCTION FROM LIFE SIZE

Odobenidae.—This family contains the walrus (*Odobenus*), restricted to the northern oceans. Its limbs are like those of the *Otariidae*, but the external ear is absent and the skull is remarkably modified to carry the huge tusklike upper canines, while the cheek-teeth are flat-crowned for crushing the shells of mussels and oysters upon which the walrus mainly feeds.

Phocidae.—This family comprises true seals. They are also without external ears, but the hind-limbs are stretched backward to act as a tail-fin and their soles, which like those of the fore limb are hairy, are incapable of being applied to the ground. The variation in cranial and dental characters is greater than in the *Otariidae*, the common seals (*Phoca*) and the elephant seals (*Mirounga*) exhibiting the extremes. In *Phoca* the claws are all well developed, the digits of the fore flippers are subequal and the first and fifth of the hind flippers only slightly exceed the rest and the integument is not produced beyond their tips; the incisors are $\frac{3}{2}$, the cheek-teeth are cusped and mostly two-rooted, the muzzle is normal, its orifice is small and encircled by the long nasals and premaxillae which are in contact. In *Mirounga* the digits of the fore flippers decrease in length from the first to the fifth, those of the hind flippers have no claws and the fourth and fifth digits greatly exceed the rest and are lengthened by skin-lobes; the muzzle of the male is developed into a distensible proboscis; the incisors are $\frac{2}{1}$, the small cheek-teeth have simple crowns and one root, and the premaxillae and nasals are short and widely separated and do not surround the dilated nasal aperture. *Phoca* and its allies, e.g., *Halichaerus*, the gray seal, are found in the northern oceans. *Mirounga*, the largest of the pinnipedes, reaching a length of 20 ft., ranges from the antarctic to California; but there are many structurally intermediate genera in the northern and southern oceans. (R. I. P.; J. E. HL.)

EXTINCT FORMS

Fossil remains of the majority of the common modern genera of Carnivora are found in the Pleistocene formations along with a number of extinct types which were known to prehistoric man. Among these the most remarkable are the sabre-tooth tigers or machaerodonts (*see* MACHAERODUS), the *Arctotherium* or short-faced bear of North and South America. The cave bear of Europe (*Ursus spelaeus*) and the California lion (*Panthera atrox*) equalled in size the largest living species. The geographic range of hyenas, lions and *Cuon* was then extended to northern Europe, while conversely the wolverine and other northern Carnivora have been found as far south as Arkansas.

All of the families of modern Carnivora are represented in the formations of the later Tertiary epochs, most of them by a wider variety of types than those that survive to-day, and the ancestry of many of the modern genera can be traced back through the Pliocene, Miocene and Oligocene into or toward a common ancestral stock which appears to be fairly represented by the Eocene family Miacidae of the Primitive Carnivora or Creodonta (*see* CREODONTA). The Miacidae, alone among the creodont families, have acquired the true carnassial or shearing teeth of the fissipede Carnivora, p^4 in the upper and m_1 in the lower jaw being enlarged and specialized for this purpose; and on this account they are transferred by some authorities to the Fissipedia. But they have not acquired the consolidated scapholunar bone of the wrist nor the completely ossified auditory bulla of the Fissipedia, and for these and other reasons may be regarded as pro-fissipede creodonts. (*See* Matthew, 1909, *Memoirs Amer. Mus. Nat. Hist.*, vol. ix, part vi, pp. 339–340.)

In the Oligocene numerous genera of primitive fissipede Carnivora are known from Europe, North America and central Asia. They all appear to be rather nearly related, but the beginnings of the distinctions between viverroid, musteloid and cynoid groups can be perceived and the felids are already distinct. The faunas of the three regions have much in common and these Oligocene fissipedes are evidently descended from Holarctic Miacidae of the Eocene. They had apparently not yet reached Africa, although the Creodonta had preceded them into that region, at least as far as Egypt. Neither creodonts nor fissipede Carnivora are found in South America at this time; the Carnivora did not reach the Neotropical region until the Pliocene, their place being taken by carnivorous marsupials in the older Tertiary of South America.

All of these Oligocene Carnivora have the scaphoid and lunar bones united. Most of them have the tympanic ring expanded into a complete bulla, but the bulla is not infrequently loosely articulated to the skull and is then usually lost in the fossil specimens.

The canoid group has the dentition $\frac{3 \cdot 1 \cdot 4 \cdot 3-2}{3 \cdot 1 \cdot 4 \cdot 3}$; the teeth behind the carnassial moderately reduced and of crushing type. *Cynodictis* with only two upper molars leads through a number of intermediate stages (*Nothocyon*, Upper Oligocene, *Cynodesmus*, Lower Miocene, *Galecynus* and *Tephrocyon*, Upper Miocene) into the modern Canidae; while *Daphaenus* with three upper molars leads (through *Daphaenodon* of the Lower Miocene) into the Miocene *Amphicyons* or bear-dogs with enlarged crushing and reduced shearing teeth. These equalled the modern bears in size, but were still largely digitigrade with legs of moderate length and long heavy tail. They are connected with the true bears through *Hemicyon* (Miocene), *Hyaenarctos* and *Indarctos* (Pliocene) in which the teeth progressively assume the fully specialized crushing type of the true bears, the limbs become long and straight, the feet plantigrade and the outer digit of *manus* and *pes* the largest. How near this series comes to being a direct line of ancestry is not yet settled, but it unquestionably indicates that the bears are derived from primitive Oligocene cynoids. The raccoons also appear to be derived from this primitive cynoid stock, through *Cynodon* of the Oligocene and *Phlaocyon* of the Lower Miocene, but it is probable that the modern Procyonidae are several independent parallel branches from this stock rather than a single group.

The Oligocene musteloids have the post-carnassial teeth more reduced than in the cynoids and of more or less cutting type. Their dental formula is $\frac{3 \cdot 1 \cdot 4-3 \cdot 2-1}{3 \cdot 1 \cdot 4-3 \cdot 2}$. None of them have acquired the expansion of the inner half of m^1 nor the flattened tympanic bulla that characterize modern Mustelidae; these characters appear in a very rudimentary stage in most of the Lower Miocene and more fully developed in the Middle and Upper Miocene mustelines, but are assumed independently in a number of separate series that lead up more or less directly into the martens, weasels, wolverines, otters, skunks and badgers.

The viverroid group is hardly distinguishable in the Oligocene by tooth characters, but it shows in contradistinction to the cynoids and musteloids a certain tendency to extend the bulla backward and expand the paroccipital process over its posterior end. The well-developed parastyle on the upper carnassial, characteristic of most modern Viverridae and Felidae, is small and inconstant in their Oligocene ancestors, and is moreover not uncommonly found in Tertiary cynoids and musteloids (*Aelurodon*, etc.). In the Miocene Viverridae the limitation of the post-carnassial teeth to two above and one (the second true molar) below, both well developed, becomes more definite, the bulla more characteristic and the division between viverrine and herpestine genera begins to be distinguishable.

A number of intermediate genera in the Miocene and Lower Pliocene (*Ictitherium*, *Lepthyaena*, *Palhyaena*) are transitional to the hyenas, which are fully developed in the Lower Pliocene and are clearly derivable from primitive civets, although the known species of these intermediate genera are not directly ancestral. Hyenas and civets are found only in the old world Tertiaries, although fragmentary remains of hyenoid Canidae from the Tertiary of North America have several times (*Aelurodon, Borophagus, "Prohyaena," Chasmoporthetes*) been mistakenly referred to these old world families. The Tertiary canids, on the other hand, are chiefly North American, while the Mustelids and ursids are Holarctic.

The Felidae are quite distinct in the Oligocene, and all of them show, but in differing degree, an enlarged and compressed upper canine, reduced lower canine and flanged or angulate chin. They appear to fall into two series: in one these characters and associated special adaptations in skull and skeleton are decidedly more marked and are progressively increased in the Lower and Upper Miocene to culminate in the sabre-tooth tigers of the Pliocene and Pleistocene (*see* MACHAERODUS). In the other series the above noted peculiarities, already much less developed, are progressively reduced to the nearly normal condition of the modern Felidae in which upper and lower canines are nearly equal, and the chin has lost its flange. The clouded leopard (*q.v.*) of Malaysia is the most primitive living species in these as in some other particulars. *Dinictis* of the Oligocene, *Nimravus* and *Archaelurus* of the Lower Miocene, *Pseudaelurus* of tho later Miocene, are the successive stages in the ancestry of the Felidae, while *Hoplophoneus* and *Eusmilus* of the Oligocene and *Machaerodus* of the Miocene lead into the more highly specialized sabre-tooths *Smilodon* and *Megantherceon* of the Pliocene and Pleistocene. In both the feline and machaerodontine series there is also a progressive specialization of the shearing teeth and reduction of the premolars, these teeth in *Dinictis* being not far beyond the stage reached in the modern viverrid genus *Cryptoprocta*. (W. D. M.; X.)

TEMPERAMENTS OF THE CARNIVORES

It is a commonplace observation that cat and dog have characteristic and incompatible temperaments. Groups of cats do not join in chasing a smaller dog, and dogs do not patiently watch a mouse-hole. Little reflection is required to extend such observation to other types of carnivores. Indeed, each of the principal members of the carnivore group, wild as well as domesticated, in so far as it has been familiar to European peoples, has left its stamp on folklore and even in the structure of language. We speak of the gregariousness and loyalty of dogs, of the solitary nature and stealth of cats, of the cunning of foxes and of the ferocity of weasels. The bear has two familiar characters—he is a by-word for surliness, as well as for good-natured inoffensiveness—but these correspond accurately on one hand to his behaviour when annoyed (well known from the mediaeval bear baiting), and on the other to his character when unmolested in the wild. The comparative study of such psychic characters applying to families and genera deserves attention.

While such widespread impressions cannot be very exactly or scientifically formulated, the fact that the mental characteristics of the familiar domestic cat may be seen in its relatives in quite the same way as anatomical peculiarities, such as the sheathed claws or vertical pupil of the eye, has profound philosophic implications. Differences of temperament in other mammalian groups, and characteristic of whole orders, elephants or monkeys for example, may be detected in a still more general way. The topic was referred to by Clarence Day in a clever evolutionary essay, *This Simian World*.

The importation of the giant panda, which represents a distinct subfamily of carnivores, into U.S. and European zoological gardens made observation of this previously unfamiliar creature possible. Its instant popularity, equally with its keepers and with the visiting public, obviously had as its basis a novel and distinctive set of behaviour patterns.

For a person familiar with cats and dogs to undertake the breeding of ferrets means another insight into the family characters of carnivores. The ferret is a typical representative of the weasel family, and though as long domestic as the cat, retains much of the curiously intent ferocity of its wild relatives. The weasel temperament appears to have impressed itself on the behaviour of the smaller rodents and the rabbits that form the principal prey of the smaller members of the weasel tribe. These rodents display an unreasoning and helpless fear of the ferret, as of the weasel. The play of a tame adult ferret with a human being is startlingly different from that of a cat or a dog, and the play of young ferrets with each other is equally characteristic.

The skunks are very distinctive members of the weasel family confined to the Americas. They are still somewhat confused linguistically with the European polecat (the wild relative of the ferret). The skunk characteristic of complete fearlessness is obviously correlated with its conspicuous type of colouration and with its astonishingly effective means of defense by the spray of an overpowering scent from its anal glands. Even the fearlessness of the skunk, however, relates it psychologically to the weasel tribe, in which lack of fear of very much larger animals, even carnivores, is characteristic.

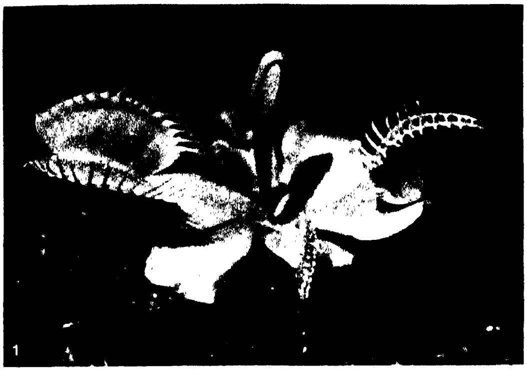
The raccoon represents still another type of carnivore whose peculiar habits and temperament have become familiar. Raccoons are said to exhibit exceptional intelligence in releasing themselves from cages, and intelligence may well be associated with their most highly developed characteristic, insatiable curiosity. It is curiosity, in turn, that makes the raccoon an easy prey to the trapper who baits his trap or snare with some unusual or glittering object.

The coati of tropical America differs radically from the raccoon in gregarious habits but betrays its relationship by an equally evident extreme of curiosity. The arboreal and nocturnal kinkajou, also thought to be a relative of the raccoons, is so distinctive in its habits that it may be expected to have quite as distinctive mental characters.

The observations and impressions of naturalists as to the minds of wild animals, and the frequently prejudiced observations of the keeper of pet animals obviously need critical sifting and experiment before the mental characteristics of animals can be associated properly with the taxonomic categories of orders, families, genera, species, races and individuals. The interrelations of habits, structure and mental characteristics likewise require more, and more critical, observation. There are, however, strong indications of such associations. (K. P. S.)

CARNIVOROUS PLANTS, the better term for insectivorous plants, are, like the parasites, climbers or succulents, a physiological assemblage belonging to a number of distinct families, including some among the fungi. They agree in having the extraordinary habit of adding to the supplies of nitrogenous material and salts, afforded them in common with other plants by the soil and atmosphere, by capturing and consuming by digestion or by the aid of bacteria, insects and other small animal forms (crustacea larvae, nematodes, etc.). The various and curious mechanical arrangements by which these supplies of animal food are ob-

CARNIVOROUS PLANTS



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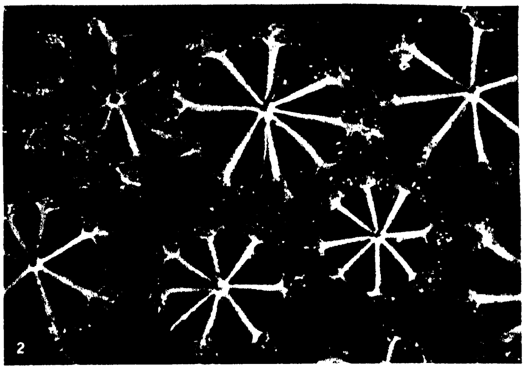

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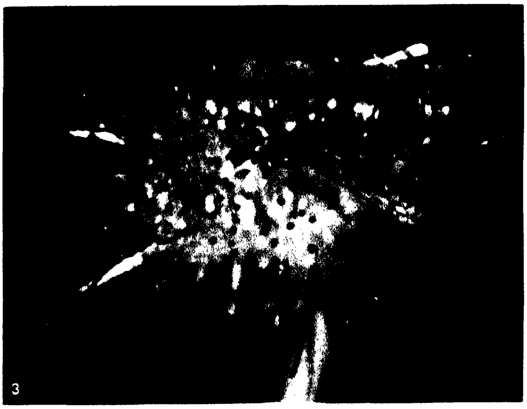

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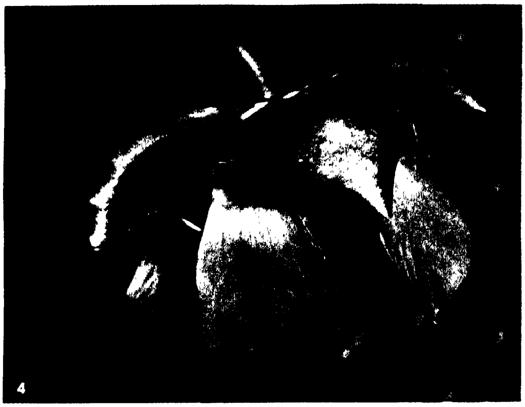

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PHOTOGRAPH RUTHERFORD PLATT

1. Venus's fly trap (*Dionaea muscipula*) The lobe at the left is open, while that at the right, with spikes interlocked, imprisons an insect which the plant is digesting. The lobes close when the insects touch small sensitive bristles on the upper surface

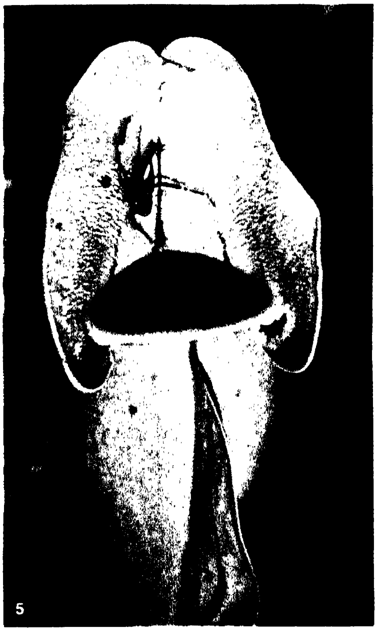
2. Closeup view of the floating leaves of bladderwort (*Utricularia*), a water plant. On the leaves are small bladders with trap doors which open only inward

3. Roundleaf Sundew (*Drosera rotundifolia*) Sticky tentacles on the leaves catch insects, which are passed by other tentacles toward the centre of the leaf and are drowned and digested

4. The parrot pitcher plant (*Sarracenia psittacina*)

5. Common pitcher plant (*Sarracenia*) in late spring, with an insect on the lid The insect slides down the lid into the pitcher's detentive surface, where strong downward pointing bristles trap the victim

6. Butterwort (*Pinguicula planifolia*) Insects are attracted to the sticky surface of the leaves, which then curl inward, crushing the victim



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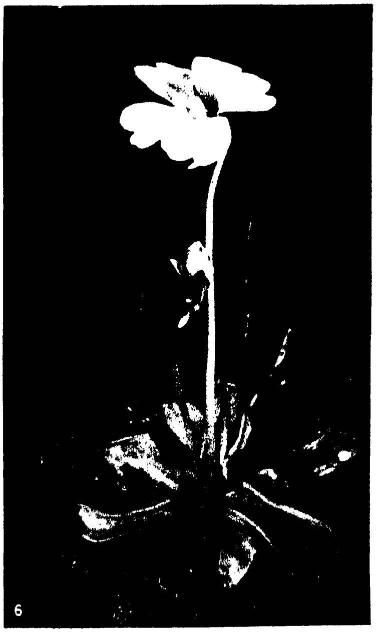

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tained and utilized are described under the headings of the various genera.

Perhaps the most generally known of the carnivorous plants occur in the family Droseraceae, and this is because of the worldwide and common occurrence of the sundews (*Drosera* spp.). The carnivorous genera include *Drosera, Drosophyllum, Aldrovanda* and *Dionaea*. *Byblis,* previously regarded as another genus of this family, has been placed in a separate family, the Byblidaceae, by Domin. *Roridula,* hitherto regarded as carnivorous, has been shown not to be so. It is an insect catcher, but does not make use of them, its secretions being resinous (Lloyd). The Sarraceniaceae contain the genera *Sarracenia* (nine or ten species); *Darlingtonia (Chrysamphora)*, one species; *Heliamphora,* four species. The Nepenthaceae consist of one large genus, *Nepenthes,* with upwards of 60 species. These three families (the Byblidaceae aside) are closely allied and form the series the Sarraceniales of the free-petaled section (Choripetalae) of the Dicotyledons. The curious pitcher plant, *Cephalotus follicularis,* comprises a separate family, the Cephalotaceae, closely allied to the Saxifragaceae. Finally the genera *Pinguicula, Genlisea, Utricularia, Biovularia* and *Polypompholix* are a distinct group belonging to the gamopetalous family Lentibulariaceae.

The large genus *Drosera,* of more than 90 species, are of worldwide distribution, the largest species being found in Australia, viz., *D. gigantea,* growing to a stature of three feet, with adhesive clinging leaves. Its congeners on the other hand are usually confined to restricted and well-defined, comparatively small areas. Thus *Drosophyllum* grows on the dry hills of Portugal and nearby Morocco. Its habitat is in contrast to that of all the other carnivorous plants, which is swampy or wet, acid and infertile soils. The two species of *Byblis* have a wide range from southwestern Australia to its northern tropics. Of the two physiologically closely related monotypic genera, *Aldrovanda* and *Dionaea*. *Aldrovanda* has a very wide range in the old world from the Iberian peninsula to Japan and in Africa certainly as far south as the Chobe Swamp in Portuguese East Africa. Its wide distribution may be partly explained by the fact that it is a floating swamp plant, though it appears rather particular about its immediate surroundings (Ashida). *Dionaea muscipula* on the other hand is found only in North Carolina and to some extent in South Carolina, U.S.A. The four species of *Heliamphora* are to be found on the table mountains of the Guianas and Venezuela, the Mts. Roraima, Duida and Auyan-Tepui being the three known localities. *Darlingtonia* grows in swampy places from sea level to 6000 ft., approximately, in the coastal belt and the nearby Sierra Nevadas of southern Oregon and northern California. Of *Sarracenia* there are nine or ten species, ranging from Labrador to Louisiana along the whole of the Atlantic seaboard and as far west as Winnipeg, and perhaps still farther. The richest congeries of species is in the southeastern U.S. The *ca.*60 species of *Nepenthes* are natives of the wet tropics of the Old World, in the Indian Archipelago, and northern Australia, Cochin-China, Bengal, and the Seychelles and Madagascar. Of the gamopetalous Lentibulariaceae, *Pinguicula* is fairly abundant in the north temperate zone, and ranges down the Andes to Patagonia, always in moist habitats. The 250 species of *Utricularia* are floating aquatics which grow in quiet waters or sandy or muddy soils, moss of rocks or trees, etc., and are circumterrestrial, from Greenland to South Africa in longitude. Their closely related two species of *Biovularia* are tropical American. *Polypompholix* is south and southwestern Australian, and is fairly restricted geographically. *Genlisea* is a small genus of tropical west Africa and the tropical regions of Brazil. It is worthy of remark that, with the above named exception of *Drosophyllum* all the carnivorous plants agree in inhabiting damp heaths, bogs, swamps, very wet soils usually of quartz sand or mud, where water is abundant and where there is a paucity of nitrogenous material and possibly of suitable salts.

There are also carnivorous plants among the fungi, speaking in a strict sense. As Pfeffer long ago pointed out, a great many fungi are carnivorous in that they live on animal food. Here is meant the sort that have special arrangements or traps by which they catch their prey. The first was discovered by Zopf (1888). It was a fungus (*Arthrobotrys oligospora*) already described by Fresenius, but was shown by Zopf to have minute loops by which it caught live nematodes, into the bodies of which it then sent penetrating digesting and absorbing branches (haustoria). Other similar species are now known, in some of which the trapping loops are composed of three cells which immediately swell when an eelworm ventures to insert head or tail, such as *Dactylella bembicoides* (Couch). A fungus which catches armoured rotifers by means of short branches with end cells which on being attacked exude a strong adhesive was discovered and named in 1911 by Sommerstorff as *Zoophagus insidians*. Another similarly acting species is *Sommerstorffia spinosa* described by Arnaudow in 1923. A number of other species with devices of other kinds (sticky discs or patches chiefly) have been described in detail by Drechsler. All these are of course microscopic in dimensions; accordingly there are probably many others awaiting discovery.

See F. E. Lloyd, *The Carnivorous Plants,* 1942. (F. E. L.)

CARNOCK, ARTHUR NICOLSON, 1ST BARON (1849–1928), British diplomatist, was born in London on Sept 19, 1849, the son of Admiral Sir Frederick W. E. H. Nicolson, 10th Bart. (1815–99). He was educated at Rugby and Brasenose College, Oxford, and in 1870 entered the foreign office as assistant private secretary to Lord Granville. In 1874 he was attached to the British embassy in Berlin, and after occupying a succession of minor diplomatic posts became in 1885 *chargé d'affaires* at Tehran. From 1888 to 1904 he held posts in Constantinople, Bulgaria and Morocco, where he was minister. In 1899 he succeeded his father as 11th baronet. In 1906 Sir Arthur Nicolson went as ambassador to Russia, returning in 1910 to the foreign office as undersecretary for foreign affairs. He retired in 1916, when he received a peerage. He published in 1873 a *History of the German Constitution.* He died on Nov. 5, 1928

CARNOT, LAZARE HIPPOLYTE (1801–1888), French statesman, the second son of L. N. M. Carnot (*q.v.*), was born at Saint-Omer on Oct. 6, 1801. Hippolyte Carnot lived at first in exile with his father, returning to France only in 1823. He wrote, in 1830, an *Exposé de la doctrine Saint-Simonienne* and collaborated in the Saint-Simonian journal *Le Producteur.* In March 1839, after the dissolution of the chamber by Louis Philippe, he was elected deputy for Paris (re-elected in 1842 and in 1846) and sat in the group of the radical Left. At the revolution of 1848 he became minister of education in the provisional government. In proposing a law for free and obligatory primary education he declared himself against purely secular schools, holding that "the minister and the schoolmaster are the two columns on which rests the edifice of the republic." By this attitude he alienated both the Right and the republicans of the extreme Left, and was forced to resign on July 5. Under the empire he refused to sit in the *Corps Législatif* until 1864, in order not to have to take the oath. From 1864 to 1869 he was in the republican opposition, taking a very active part. He was a member of the constituent assembly of 1871, and in 1875 was nominated a senator for life He died on March 16, 1888, three months after the election of his elder son, M. F. S. Carnot, to the presidency of the republic. He had published *Le Ministère de l'instruction publique et des cultes du 24ᵉ fevrier au 5ᵉ juillet 1848* (1849), *Mémoires sur Lazare Carnot* (2 vols. 1861–64, new ed., 1907), *Mémoires de Barère* (with David Angers, 4 vols., 1842–43).

A notice by Lefèvre-Portalis in Vol. xxxviii of the *Séances* of the Academy of Moral and Political Sciences.

CARNOT, LAZARE NICOLAS MARGUERITE (1753–1823), French general, was born at Nolay, Côte d'Or, on May 13, 1753. He entered the corps of engineers, becoming captain in 1783, just after the publication of his first work, an *Essai sur les machines en général.* In 1784 he wrote his *Éloge* of Vauban. But as the result of a controversy with Montalembert, Carnot abandoned the official, or Vauban, theories of the art of fortification, and went over to the "perpendicular" school of Montalembert. He was consequently imprisoned, on the pretext of having fought a duel, and only released when selected to accompany Prince Henry of Prussia in a visit to Vauban's fortifications. The Revolution drew him into political life, and he was elected a deputy for the Pas de Calais. Carnot was a stern and sincere republican, and voted for the execution of the king. In the campaigns of 1792 and 1793 he was continually employed as a commissioner in military matters, his greatest service being in April, 1793, on the north-eastern frontier, where the disastrous battle of Neerwinden and the subsequent defection of Dumouriez had thrown everything into confusion.

Carnot was the real organizer of victory for the revolutionary armies. He was a military genius who cast aside the hampering traditions of the Prussian military school, at that time blindly followed by other European armies. He abandoned the idea of seeking to defend all points, and formed the French armies into large masses able to strike deadly blows at the enemy. The successes of Jourdan, Hoche and Pichegru were largely due to the new conceptions of strategy inculcated by Carnot. The changes he made in army tactics were equally important. Deployment in line gave way to the older system of attack in columns formation, under which full use could be made of the superior quality and intelligence of the French soldier. Side by side with these changes in the art of fighting, Carnot carried out other important administrative changes, notably in the organization of the food supply. Under his new system the French soldier was fed, clothed, and supplied with munitions far more efficiently than before.

After his reorganization of the army front Carnot returned to Paris and was made a member of the Committee of Public Safety. He was charged with duties corresponding to those of the modern chief of the general staff and adjutant-general. As a member of the committee he signed its decrees. His whole attention was given to the defence of the frontiers. He organized 14 armies, which included over a million men, in the course of a single year. His labours were incessant; practically every military document in the archives of the committee was Carnot's own work, and he was repeatedly in the field with the armies. His part in Jourdan's great victory at Wattignies was so important that the credit of the day has often been assigned to Carnot. The winter of 1793–94 was spent in new preparations, in instituting a severe discipline in the new and ill-trained troops of the republic, and in improvising means and material of war. He continued to visit the armies at the front, and to inspire them with energy. He acquiesced in the fall of Robespierre in 1794, but later defended Barère and others among his colleagues, declaring that he himself had constantly signed papers without reading them, as it was physically impossible to do so in the press of business. When Carnot's arrest was demanded in May, 1795, a deputy cried "Will you dare to lay hands on the man who has organized victory?"

Carnot was elected one of the five Directors in November, 1795, and continued to direct the war department during the campaign of 1796. Late in 1796 he was made a member (1st class) of the Institute, which he had helped to establish. He was for two periods president of the Directory, but in its later stages found himself at variance with Barras and his adherents. On the *coup d'état* of the 18th Fructidor (1797) he was warned in time and took refuge abroad. The ridiculous accusations of conspiracy against the republic drew from him a *Réponse au rapport de J. C. Bailleul*, which gives an admirable account of the working of the constitution of 1795.

Carnot returned to France after the 18th Brumaire (1799) and was re-elected to the Institute in 1800. Early in 1800 he became minister of war, and he accompanied Moreau in the early part of the Rhine campaign. His chief work was, however, in reducing the expenses of the armies. Contrary to the usual custom he refused to receive presents from contractors, and he effected much-needed reforms in every part of the military administration. He tendered his resignation later in the year, but it was long before the First Consul would accept it. From 1801 he lived in retirement with his family, employing himself chiefly in scientific pursuits. As a senator he consistently opposed the increasing monarchism of Napoleon, who, however, gave him in 1809 a pension and commissioned him to write a work on fortification for the school of Metz. In these years he had published *De la corrélation des figures de géométrie* (1801), *Géométrie de position* (1803), and *Principes fondamentaux de l'équilibre et du mouvement* (1803), all of which were translated into German.

His great work on fortification appeared at Paris in 1810 (*De la défense de places fortes*), and was translated for the use of almost every army in Europe. He took Montalembert as his groundwork. Without sharing Montalembert's antipathy to the bastioned trace, and his predilection for high masonry caponiers, he followed out the principle of retarding the development of the attack, and provided for the most active defence. To facilitate sorties in great force he did away with a counterscarp wall, providing instead a long gentle slope from the bottom of the ditch to the crest of the glacis. This, he imagined, would compel an assailant to maintain large forces in the advanced trenches, which he proposed to attack by vertical fire from mortars. Along the front of his fortress was built a heavy detached wall, loop-holed for fire, and sufficiently high to be a most formidable obstacle. This "Carnot wall," and, in general, Carnot's principle of active defence, played a great part in the rise of modern fortification.

He did not seek employment in the field in the aggressive wars of Napoleon, remaining a sincere republican, but in 1814, when France itself was once more in danger, Carnot at once offered his services. He was made a general of division, and Napoleon sent him to the important fortress of Antwerp as governor. His defence of that place was one of the most brilliant episodes of the campaign of 1814. He joined Napoleon during the Hundred Days, and was made minister of the interior, the office carrying with it the dignity of count, and on June 2, he was made a peer of France. On the second Restoration he was proscribed. He lived thenceforward in Magdeburg, and died there on Aug. 2, 1823. His remains were solemnly removed to the Panthéon in 1889. Long before this, in 1836, Antwerp had erected a statue to its defender of 1814. In 1837 Arago pronounced his *éloge* before the Académie des sciences. The memory of his military career is preserved in the title, given to him in the Assembly, of "The organizer of victory."

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CARNOT, MARIE FRANÇOIS SADI (SADI) (1837–1894), 4th president of the 3rd French Republic, son of L. Hippolyte Carnot, was born at Limoges on Aug. 11, 1837. He was educated at the École Polytechnique and the École des Ponts et Chaussées, and then obtained an appointment in the public service. He was entrusted in 1870 with the task of organizing resistance in the departments of the Eure, Calvados and Seine Inférieure, and made prefect of the last named in Jan. 1871. In the following month he was elected to the National Assembly by the department Côte d'Or. In Sept. 1880 he became minister, and again in April 1885, passing almost immediately to the Ministry of Finance, which he held under both the Ferry and the Freycinet administrations until Dec. 1886. When the Wilson scandals (*see* GRÉVY) occasioned the downfall of Grévy in Dec. 1887, Carnot became a candidate for the presidency, with the support of Clemenceau and others who desired to see a president who had no connection with the politics of the market place. He was elected by 616 votes out of 827. The internal situation was a critical one, the stability of the State being threatened by the Boulangist agitation, but Boulanger was exiled in 1889. Carnot had but one other serious crisis to surmount, the Panama scandals of 1892, which, if they greatly damaged the prestige of the State, increased the respect felt for its head, against whose integrity none could breathe a word. On

June 24, 1894, after speaking at a public banquet at Lyons he was stabbed by an Italian anarchist named Caserio and expired almost immediately. The horror and grief excited by this tragedy were boundless, and the president was honoured with a splendid funeral in the Panthéon, Paris.

See E. Zevort, *Histoire de la Troisième République*, tome iv., "La Présidence de Carnot" (Paris, 1901); A. A. G. Hanotaux, *Histoire de la Troisième République* (1904, etc.).

CARNOT, NICOLAS LÉONHARD SADI (1796–1832), French physicist, elder son of L. N. M. Carnot, was born at Paris. He was admitted to the École Polytechnique in 1812, and late in 1814 he left with a commission in the Engineers and with prospects of rapid advancement in his profession. But Waterloo and the Restoration led to a second and final proscription of his father; and though not himself cashiered, Sadi was purposely told off for the merest drudgeries of his service. In 1819 he presented himself at the examination for admission to the staff corps (*état-major*) and obtained a lieutenancy. He then studied mathematics, chemistry, natural history, technology and even political economy. He was an enthusiast in music and other fine arts, and practised all sorts of athletic sports, including swimming and fencing. He became captain in the Engineers in 1827, but left the service altogether in the following year. He died of cholera in Paris on Aug. 24, 1832. He was an original and profound thinker. The only work he published was his *Réflexions sur la puissance motrice du feu et sur les machines propres à développer cette puissance* (1824). This contains but a fragment of his scientific discoveries, but it is sufficient to put him in the very foremost rank, though its full value was not recognized until pointed out by Lord Kelvin in 1848 and 1849. Fortunately his manuscripts had been preserved, and extracts were appended to a reprint of his *Puissance motrice* by his brother, L. H. Carnot, in 1878. These show that he had not only realized for himself the true nature of heat, but had noted down for trial many of the best modern methods of finding its mechanical equivalent, such as those of J. P. Joule with the perforated piston and with the friction of water and mercury. Lord Kelvin's experiment with a current of gas forced through a porous plug is also given. "Carnot's principle," that the efficiency of a reversible engine depends on the temperatures between which it works, is fundamental in the theory of thermodynamics (*q.v.*).

CARNOUSTIE, small burgh and watering place, Angus (Forfarshire), Scotland. Pop. (est. 1938) 4,801. Area, .9 sq mi. It lies on the North sea, 10¾ mi. E.N.E. of Dundee by the L.N.E.R. Bathing and golfing are good. There is a vegetable preserves factory. Barry Links, a triangular sandy tract occupying the south-eastern corner of the shire, is used as a military ground. Its extreme point is called Buddon Ness, off which are the dangerous shoals locally known as the Roaring Lion. On the ness two lighthouses have been built at different levels.

CARNUNTUM, an important Roman fortress (*Καρνοῦς* in Ptolemy), originally belonging to Noricum, but after the 1st century A.D. to Pannonia. It was a Celtic town, the name, which is nearly always found with K on monuments, being derived from *Kar, Karn* ("rock," "cairn"). Its extensive ruins may still be seen near Hainburg in lower Austria. It was a very old mart for the amber brought to Italy from the north. During the reign of Augustus (A.D. 6), Tiberius made it his base in the campaigns against Maroboduus (Marbod). Later it became the centre of the Roman defences of the Danube from Vindobona (Vienna) to Brigetio (O-Szöny), and (under Trajan or Hadrian) the permanent quarters of the XIV. legion. It was created a *municipium* by Hadrian (*Aelium Carnuntum*). Marcus Aurelius resided there (172–175) during the war against the Marcomanni, and wrote part of his *Meditations*. Septimius Severus, governor of Pannonia, was proclaimed emperor there (193). In the 4th century it was destroyed by the Germans, and though it was partly restored by Valentinian I., Vindobona became now the chief military centre. It was finally destroyed by the Hungarians in the middle ages.

See J. W. Kubitschek and S. Frankfurter, *Führer durch Carnuntum* (3rd ed., 1894); Pauly-Wissowa's *Realencyclopädie s.v.; Corpus Inscriptionum Latinarum*, iii., part i. p. 550.

CARNUTES, a Celtic people of central Gaul, between the Sequana (Seine) and the Liger (Loire). Their territory included the greater part of the modern departments of Eure-et-Loir, Loiret, Loir-et-Cher. The chief towns were Cenabum (Orléans) and Autricum (Chartres). In the time of Caesar they were dependents of the Remi, but joined in the rebellion of Vercingetorix. As a punishment for the treacherous murder of some Roman merchants and one of Caesar's commissariat officers at Cenabum, the town was burnt and the inhabitants put to the sword or sold as slaves. They sent 12,000 men to relieve Alesia, but shared in the defeat of the Gallic army. Having attacked the Bituriges Cubi (*see* BITURIGES), who appealed to Caesar for assistance, they were forced to submit.

Under Augustus, the Carnutes were raised to the rank of *civitas foederata*, retaining their own institutions, and only bound to render military service to the emperor. Up to the 3rd century Autricum was the capital, but in 275 Aurelian changed Cenabum into a *civitas* and named it Aurelianum or Aurelianensis urbs (whence Orléans).

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CARO, ANNIBALE (1507–1566), Italian poet, was born at Civita Nuova, in Ancona, in 1507. He became tutor in the family of Lodovico Gaddi, a rich Florentine, and then secretary to his brother Giovanni, by whom he was presented to a valuable ecclesiastical preferment at Rome. At Gaddi's death, he entered the service of the Farnese family, and became confidential secretary in succession to Pietro Lodovico, duke of Parma, and to his sons, duke Ottavio and cardinals Ranuccio and Alexander. Caro's most important work was his translation of the *Aeneid* (Venice, 1581; Paris, 1760). He is also the author of *Rime* (1569), *Canzone* (1553) and sonnets, a comedy named *Gli Straccioni* (1582), and two clever *jeux d'esprit*, one in praise of figs, *La Ficheide* (1539) and another in eulogy of the big nose of Leoni Ancona, president of the Academia della Vertù. Caro's poetry is distinguished by the freedom and grace of its versification; indeed he may be said to have brought the *verso sciolto* to the highest development it has reached in Italy. His prose works consist of translations from Aristotle, Cyprian and Gregory Nazianzen; and of letters, written in his own name and in those of the cardinals Farnese, which are remarkable both for the baseness they display and for their euphemistic polish and elegance. His fame is defaced by the virulence with which he attacked Lodovico Castelvetro in one of his canzoni, and by his meanness in denouncing him to the Holy Office as translator of some of the writings of Melanchthon. He died at Rome about 1566.

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CARO, ELME MARIE (1826–1887), French philosopher, was born at Poitiers. He was educated at the Stanislas college and the École Normale, where he graduated in 1848. He came to Paris in 1858 as master of conferences at the École Normale. In 1861 he became inspector of the Academy of Paris, in 1864 professor of philosophy to the Faculty of Letters, and in 1874 a member of the French Academy. He married Pauline Cassin, the novelist who wrote the *Péché de Madeleine* and other popular novels. In his philosophy he was mainly concerned to defend Christianity against modern positivism. The philosophy of Cousin influenced him strongly, but his strength lay in exposition and criticism rather than in original thought. Besides important contributions to *La France* and the *Revue des Deux Mondes*, he wrote *Le Mysticisme au XVIIIe siècle* (1852–54), *L'Idée de Dieu* (1864), *Le Matérialisme et la science* (1868), *Jours d'épreuve* (1872), *Le Pessimisme au XIXe siècle* (1878), *La Philosophie de Goethe* (2nd ed., 1880), *M. Littré et le positivisme* (1883), *George Sand* (1887), *Mélanges et portraits* (1888).

See E. V. Maumus, *Les Philosophes Contemporains i. E. M. Caro* (Paris, 1891).

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CARO, NIKODEM (1871–), German chemist, was born May 26, 1871, at Lódz. He studied at Berlin University and at the technical high school, Charlottenburg, and founded a public chemical laboratory. He was engaged in agricultural research work, and experimented on peat as a source of power. He interested himself in the problems of calcium carbide and acetylene, and in the liquefaction of water gas for the production of hydrogen, also in ammonia oxidation. In conjunction with Frank, he devoted himself to the development of a process for the fixation of nitrogen (cyanamide) and organized the cyanamide industry founded thereon. Large works for this industry were also erected at Piesteritz and Chovzow. Dr. Caro made a special study of the question of Bavarian sources of water-power with a view to utilizing them in the chemical industry.

CAROL II. (1893–), king of Rumania, was the eldest son of king Ferdinand and queen Marie of Rumania, and became crown prince on the death of his grandfather, Carol I., in 1914. In 1921, after the dissolution of a morganatic marriage he married the princess Helen, daughter of Constantine, king of the Hellenes; and the issue of this marriage was prince Mihai (b. Oct. 25, 1921). In 1925 crown prince Carol, having eloped with Mme Lupescu, renounced his rights of succession so that on death of king Ferdinand in 1927, the young prince Mihai was proclaimed king under a regency. Prince Carol's marriage with the princess Helen was dissolved in 1928. After a short residence in England and France, prince Carol returned to Rumania and was proclaimed king on June 8, 1930.

King Carol has one brother, prince Nicholas (b. 1903); and three sisters, Elisabeth (b. 1894; m. 1921 to George II., king of the Hellenes from whom divorced in 1935), Marie (b. 1900; m. 1927 to Alexander I., king of Yugoslavia); and Ileana (b. 1909; m. 1931 to the archduke Anton of Austria-Tuscany).

CAROL, a hymn of praise, especially such as is sung at Christmas in the open air. Diez suggests that the word is derived from *chorus*. Others ally it with *corolla*, a garland, circle or coronet, the earliest sense of the word being apparently "a ring" or "circle," "a ring dance." Stonehenge, often called the giants' dance, was also frequently known as the carol. The crib set up in the churches at Christmas was the centre of a dance, and some of the most famous of Latin Christmas hymns were written to dance tunes. These songs were called *Wiegenlieder* in German, *noëls* in French, and carols in English. Strictly speaking the word "carol" should be applied to lyrics written to dance measures, in common acceptation it is applied to the songs written for the Christmas festival. Carolling, *i.e.*, the combined exercise of dance and song, found its way from pagan ritual into the Christian church, and the clergy, however averse they might be from heathen survivals, had to content themselves in this, as in many other cases, with limiting the practice. The third council of Toledo (589) forbade dancing in the churches on the vigils of saints' days, and secular dances in church were forbidden by the council of Auxerre in the next year. Even as late as 1209 it was necessary for the council of Avignon to forbid theatrical dances and secular songs in churches. Religious dances persisted longest on Shrove Tuesday, and a castanet dance by the choristers round the lectern is permitted three times a year in the cathedral of Seville. The Christmas festival, which synchronized with and superseded the Latin and Teutonic feasts of the winter solstice, lent itself especially to gaiety. The "crib" of the Saviour was set up in the churches or in private houses, in the traditional setting of the stable, with earthen figures of the Holy Family, the ox and the ass; and carols were sung and danced around it. The singing of the carol has survived in places where the institutions of the "crib," said to have been originated by St. Francis of Assisi to inculcate the doctrine of the incarnation, has been long in disuse, but in the West Riding of Yorkshire the children who go round carol-singing still carry "milly-boxes" (My Lady boxes) containing figures which represent the Virgin and Child. That carol-singing early became a pretext for the asking of alms is obvious from an Anglo-Norman carol preserved in the British Museum ms. (Reg. 16 E, viii.), *Seigneurs ore entendey à nus*, which is little more than a drinking song.

BY COURTESY OF THE CZECHOSLOVAK LEGATION

WENCESLAS, KING OF BOHEMIA

After statue of "good king Wenceslas," subject of familiar carol, in St. Vitus Cathedral, Prague

There are extant numerous carols dating from the 15th century which have the characteristic features of folksong. The famous cherry-tree carol, "Joseph was an old man," is based on an old legend which is related in the Coventry mystery plays. "I saw three ships come sailing in," and "The Camel and the Crane," though of more modern date, preserve curious legends. Among 18th century religious carols perhaps the most famous is Charles Wesley's "Hark, how all the welkin rings," better known in the variant, "Hark, the herald angels sing." The modern revival of carol-singing has produced new carols, the best of which are perhaps mostly derived from mediaeval Latin Christmas hymns.

The earliest printed collection of carols was issued by Wynkyn de Worde in 1521. It contained the famous Boar's Head carol, *Caput apri defero, Reddens laudes Domino*, which in a slightly altered form is sung at Queen's college, Oxford, on the bringing in of the boar's head. Among the numerous collections of French carols is *Noci Borguignon de Gui Barôzai* (1720) giving the words and the music of 34 *noëls*, many of them very free in character. The term *noël* passed into the English carol as a favourite refrain, "nowell," and seems to have been in common use in France as an equivalent for *vivat*.

In architecture, the term "carol" (also wrongly spelled "carrel" or "carrol") is used, in the sense of an enclosure, of a small chapel or oratory enclosed by screens, and also sometimes of the rails of the screens. It is particularly applied to the separate seats near the windows of a cloister (*q.v.*), used by the monks for purposes of study, etc. The term "carol" has, by a mistake, been sometimes used of a scroll bearing an inscription of a text, etc.

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CAROLINE, WILHELMINA (1683–1737), wife of George II., king of Great Britain and Ireland, was a daughter of John Frederick, margrave of Brandenburg-Ansbach (d. 1686). She married George Augustus, electoral prince of Hanover, in Sept. 1705. In Oct. 1714, when her father-in-law became king George I, Caroline came with her husband to London, where her popularity and tact did much to ease the difficult situation caused by the quarrel between the prince of Wales and his father. During the period of complete estrangement from the royal court (1717–20), the prince and princess attracted most of the distinguished men and women of the day to their residences at Leicester House in London and at Richmond. A formal reconciliation with George I. took place in 1720. In Oct. 1727 George II. and his queen were crowned. Queen Caroline's influence was effective in keeping Sir Robert Walpole in power; and her religious tolerance was reflected in the appointment of bishops remarkable for learning rather than orthodoxy. She was regent of the kingdom during the king's absences from England in 1729, 1732, 1735 and 1736–37. In her relations with her husband, to whom she bore eight children, Caroline proved herself a clever and patient woman, and retained her influence over him up to her death on Nov. 20, 1737.

Caroline appears in Scott's *Heart of Midlothian*; *see* also Lord Hervey, *Memoirs of the Reign of George II.*, ed. by J. W. Croker (1884); W. H. Wilkins, *Caroline the Illustrious* (1904); and A. D. Greenwood, *Lives of the Hanoverian Queens of England*, vol. i. (1909).

CAROLINE AMELIA ELIZABETH (1768–1821), queen of George IV of Great Britain, second daughter of Charles William Ferdinand, duke of Brunswick-Wolfenbüttel, was born on May 17, 1768. In 1795 she was married to the then prince of Wales (*see* GEORGE IV), who disliked her and separated from her after the birth of a daughter, Princess Charlotte Augusta, in Jan. 1796. The princess resided at Blackheath; and as she was thought to have been badly treated by her profligate husband, the sympathies of the people were strongly in her favour. About 1806 reports reflecting on her conduct were circulated so openly that the king appointed a commission to inquire into the circumstances. The princess was acquitted of any serious fault, but improprieties in her conduct were pointed out and censured. In 1814 she left England and travelled on the Continent, residing principally in Italy. On the accession of George IV in 1820, orders were given that the English ambassadors should prevent the recognition of the princess as queen at any foreign court. Her name was also formally omitted from the liturgy. These acts stirred up a strong feeling in favour of the princess among the English people generally, and she at once made arrangements for returning to England and claiming her rights. She rejected a proposal that she should receive an annuity of £50,000 a year on condition of renouncing her title and remaining abroad and arrived in England on June 6. One month later a bill to dissolve her marriage with the king on the ground of adultery with an Italian, Bartolomeo Bergami, whom she had taken into favour in Milan, was brought into the House of Lords. The trial began on Aug. 17, 1820, and on Nov. 10 the bill, after passing the third reading, was abandoned. The public excitement had been intense, the boldness of the queen's counsel, Brougham and Denman, unparalleled, and the ministers felt that the smallness of their majority was virtual defeat. The queen was allowed to assume her title, but she was refused admittance to Westminster Abbey on the coronation day, July 19, 1821. Mortification at this event seems to have hastened her death, which took place on Aug. 7 of the same year.

See *A Queen of Indiscretions, the Tragedy of Caroline of Brunswick, Queen of England*, trans. by F. Chapman from the Italian of Graziano Paolo Clerici (1907), with numerous portraits, etc.; *The Trial at large of Her Majesty . . . containing the evidence . . . speeches . . . etc. . . . printed from the Journals of the House*, 2 vols., 1821. Of contemporary authorities the *Creevey Papers* (1905) throw the most interesting sidelights on the subject.

CAROLINE ISLANDS: *see* PACIFIC ISLANDS (OCEANIA).

CAROLINGIANS, the name of a family (so called from Charlemagne, its most illustrious member) which gained the throne of France A.D. 751. It appeared in history in 613, its origin being traced to Arnulf (Arnoul), bishop of Metz, and Pippin, long called Pippin of Landen, but more correctly Pippin the Old or Pippin I. Albeit of illustrious descent, the genealogies which represent Arnulf as an Aquitanian noble, and his family as connected—by more or less complicated devices—with the saints honoured in Aquitaine, are worthless, dating from the time of Louis the Pious in the 9th century. Arnulf was one of the Austrasian nobles who appealed to Clotaire II., king of Neustria, against Brunhilda, and it was in reward for his services that he received from Clotaire the bishopric of Metz (613). Pippin, also an Austrasian noble, had taken a prominent part in the revolution of 613. These two men Clotaire took as his counsellors; and when he decided in 623 to confer the kingdom of Austrasia upon his son Dagobert, they were appointed mentors to the Austrasian king, Pippin, with the title of mayor of the palace. Before receiving his bishopric, Arnulf had had a son Adalgiselus, afterwards called Anchis; Pippin's daughter, called Begga in later documents, was married to Arnulf's son, and of this union was born Pippin II. Towards the end of the 7th century Pippin II., called incorrectly Pippin of Herisal, secured a preponderant authority in Austrasia, marched at the head of the Austrasians against Neustria, and gained a decisive victory at Testry, near St. Quentin (687). From that date he may be said to have been sole master of the Frankish kingdom, which he governed till his death (714). In Neustria Pippin gave the mayoralty of the palace to his son Grimoald, and afterwards to Grimoald's son Theodebald; the mayoralty in Austrasia he gave to his son Drogo, and subsequently to Drogo's children, Arnulf and Hugh. Charles Martel, however, a son of Pippin by a concubine Chalpaïda, seized the mayoralty in both kingdoms, and he it was who continued the Carolingian dynasty. Charles Martel governed from 714 to 741, and in 751 his son Pippin III. took the title of king. The Carolingian dynasty reigned in France from 751 to 987, when it was ousted by the Capetian dynasty. In Germany descendants of Pippin reigned till the death of Louis the Child in 911; in Italy the Carolingians maintained their position until the deposition of Charles the Fat in 887. Charles, duke of Lower Lorraine, who was thrown into prison by Hugh Capet in 991, left two sons, the last male descendants of the Carolingians, Otto, who was also duke of Lower Lorraine and died without issue, and Louis, who after the year 1000 vanishes from history.

See P. A. F. Gérard and L. A. Warnkönig, *Histoire des Carolingiens* (Brussels, 1862); H. E. Bonnell, *Anfänge des Karoling. Hauses* (1866); J. F. Böhmer and E. Mühlbacher, *Regesten d. Kaiserreichs unter d. Karolingern* (Innsbruck, 1889, *seq.*); E. Mühlbacher, *Deutsche Gesch. unter d. Karolingern* (Stuttgart, 1896); F. Lot, *Les Derniers Carolingiens* (1891). (C. Pf.)

CAROLUS-DURAN, the name adopted by the French painter, CHARLES AUGUSTE EMILE DURAND (1837–1917), who was born at Lille on July 4, 1837, and died in Paris on Feb. 17, 1917. He studied at the Lille Academy and then went to Paris, and in 1861 to Italy and Spain for further study, especially devoting himself to the pictures of Velasquez. His subject picture "Murdered," or "The Assassination" (1866), one of his first successes, is now in the Lille museum; but he became best known afterwards as a portrait-painter and as the head of one of the principal ateliers in Paris, where some of the most brilliant artists of a later generation were his pupils. His "Lady with the Glove" (1869), a portrait of his own wife, was bought for the Luxembourg. In 1905 he was appointed director of the French academy at Rome in succession to Eugène Guillaume.

CARORA, an inland town of the State of Lara, Venezuela, on the Carora, a branch of the Tocuyo river, about 45m. W. by S. of the city of Barquisimeto, and 1,128ft. above sea-level Pop. (1941) 8,214. The town is comparatively well-built and possesses a fine parish church, a Franciscan convent and hermitage It was founded in 1754, and its colonial history shows considerable prosperity, its population at that time numbering 9,000 to 10,000. The neighbouring country is devoted principally to raising horses, mules and cattle; and in addition to hides and leather, it exports coffee, rubber and other forest products.

CAROTO or **CAROTTO, GIOVANNI FRANCESCO** (*c.* 1480–1555), Italian painter of the Veronese school. He was a pupil of Liberale and worked for some time, so Vasari says, under Mantegna at Mantua. His later works betray the influence of Leonardo da Vinci, and of Raphael and the Roman school. In spite of plagiarisms, however, his art is essentially Veronese in colour, in the character of the figures and in the treatment of landscape, in which he was something of an innovator, for he seems to have loved trees and fields and flowing waters for their own sakes, and not merely as a background to human interests. Vasari says that Caroto, after having established a certain reputation at Verona, went to Milan in 1505, and was there engaged on work for Antonio M. Visconti. Between 1513 and 1518 he was employed at Casale Monferrato. But the greater part of his life was spent at Verona, where he decorated the churches with frescoes and painted altar-pieces and smaller pictures, some of which are now in the Pinacoteca Communale.

His early work recalls the style of his masters, Liberale and Mantegna; "The Madonna in a Landscape with Lemon Trees," dated 1501 in the gallery at Modena; the "Madonna" in the Staedel at Frankfurt, and a "Madonna" in the Louvre at Paris. A fresco signed and dated 1508 of the "Annunciation" reveals Caroto as a follower of Leonardo, whose work he must have seen at Milan. Another Leonardesque picture is the fine "Madonna and Child flanked by two Angels carrying Lilies," at Dresden, received at that gallery with a forged signature of Leonardo until Morelli identified it as a work of Caroto. In his later work the artist becomes Raphaelesque in his design. This is the case in the fine frescoes in the church of S. Eufemia at Verona, representing stories of the angel Raphael, and in the altarpiece painted for the same church, of which the central panel, with large figures of three archangels, is now in the Pinacoteca. Another masterpiece is the picture in S. Fermo Maggiore (1528) with the Virgin and St. Anne in the clouds and four saints standing beneath in a fine landscape. "The Raising of Lazarus" (1531) in the Palazzo Arcivescovile and the St. Ursula (1535) in S. Giorgio in Braida, are among his last pictures. Outside Verona there are works by the master at Milan (Castello), Mantua (Chiesa Virgiliana), Florence (Offizi, Pitti), Fiesole (Villa Doccia), Modena, Bergamo, Paris, Dresden and Budapest Caroto also decorated the façades of houses, and it is said that his work can still be seen on one of the houses on the Piazza Erbe. He modelled some medals of fine quality (medal for Bonifazio Palaelogo of Monferrato).

GIOVANNI CAROTO (1488–1555?) the younger brother of Giov. Francesco, was an architect and painter. According to Vasari, who knew him personally, he was a pupil of Liberale. He published a book on the antiquities of Verona, with woodcuts after his own drawings.

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CARP, the typical fish of the family Cyprinidae of the order Ostariophysi, in which the air-bladder is connected with the internal ear by a chain of ossicles. The Cyprinidae are scaly soft-rayed fishes with abdominal pelvic fins, with a toothless protractile mouth, and with falciform lower pharyngeal bones bearing a small number of teeth that bite against a horny plate attached to a process of the basal part of the skull. The form, number and arrangement of these teeth are of great importance in classification.

About 1,500 species are known from the rivers and lakes of Europe, Asia, Africa and North America, but there are no Cyprinidae in South America, in Madagascar, or in the Australian region (including Celebes). Most feed on weeds or on insects, crustaceans, worms, etc The Catostomidae (Suckers) of North America, the Cobitidae (Loaches) of Eurasia, and the Homalopteridae of southern Asia and China are related families. Other Cyprinids than the Carp are described under the headings BARBEL, BITTERLING, BLEAK, BREAM, CHUB, DACE, GOLDFISH, GUDGEON, MAHSEER, MINNOW, ROACH, RUDD, TENCH.

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COMMON CARP INTRODUCED FROM ASIA INTO AMERICA AND EUROPE

The carp (*Cyprinus carpio*) is characterized by large scales, a long dorsal fin, and a mouth with four barbels. It is a native of eastern Asia, but has been introduced into Europe and North America. It inhabits lakes, ponds, and slow-running rivers, especially frequenting weedy places with a muddy bottom; it is mainly a vegetarian. It attains a weight of 25 lb. in England, but is said to reach 100 lb. on the continent of Europe. In Germany varieties wholly or partly scaleless are bred and are esteemed for the table. The Crucian carp is smaller and without barbels; it inhabits Europe, Turkistan, Siberia and Mongolia. The goldfish is closely related to the Crucian carp; it is a native of China and Japan.

CARPACCIO, VITTORIO or **VITTORE** (*c.* 1465–*c.* 1522), Italian painter, was born in Venice, of an old Venetian family The facts of his life are obscure, but his principal works were executed between 1490 and 1519; and he ranks as one of the finest precursors of the great Venetian masters. The date of his birth is conjectural. He is first mentioned in 1472 in a will of his uncle Fra Ilario, and Dr. Ludwig infers from this that he was born *c.* 1455, on the ground that no one could enter into an inheritance under the age of fifteen; but consideration of the youthful style of his earliest dated pictures ("St. Ursula" series, Venice, 1490) makes it improbable that at that time he had reached so mature an age as thirty-five; and he was more probably about 25 in 1490. What is certain is that he was a pupil (not, as sometimes thought, the master) of Lazzaro Bastiani, who, like the Bellini and Vivarini, was the head of a large *atelier* in Venice, and whose own work is seen in such pictures as the "S Veneranda" at Vienna, and the "Doge Mocenigo kneeling before the Virgin" and "Madonna and Child" (formerly attributed to Carpaccio) in the National Gallery, London. In later years Carpaccio appears to have been influenced by Cima da Conegliano (*e.g.* in the "Death of the Virgin," at Ferrara). Apart from the "St. Ursula" series his scattered series of the "Life of the Virgin" and "Life of St. Stephen," and a "Dead Christ" at Berlin, may be specially mentioned.

See Pompeo Molmenti and Gustav Ludwig, *Life and Works of Vittorio Carpaccio,* Eng. trans., R. H. Cust (1907); and Roger Fry, "A Genre Painter and his Critics," in the *Quarterly Review* (April, 1908).

CARPATHIAN MOUNTAINS. These form the eastern wing of the central mountain axis of Europe, though they are not so impressive nor so widely known as the Alps. They begin near Bratislava and extend in a huge arc, concave towards the south-west to Orsova on the Danube with a total length and area nearly equal to that of the Alps, but with a much lower mean height and a maximum height (Gerlsdorfspitze—8,737 ft.) of little more than half that of the Alpine chain. They lack the rugged peaks, the extensive snowfields, the imposing glaciers, the high waterfalls and the numerous lakes characteristic of the Alps though allied to the latter in age and origin. The middle of the arc is marked by a significant decrease in width (from an average of 180 to 60 miles) and height and at this point a number of easy passes connect the headwaters of the Dniester and the Tisza. Here fracture and subsidence have carried the Hungarian plain into the heart of the highlands and it is possible to use this as a convenient division of the system into the Northern and Southern Carpathians. Across this constricted zone have passed many human influences, notably that of the Magyars, from the southern plains of Eastern Europe and Asia while through the passes here contact is made with the climatic and vegetational types of southern Russia.

Ranges.—The Northern Carpathians present the appearance of a very broken mountain mass in which numerous detached blocks are separated by wide and shallow basins. The outer belt, known as the Beskid Mountains, extends from the river Morava to the sources of the river Visó and the Golden Bistritza, in the form of a dissected peneplain of Miocene age and is composed of Cretaceous and early Tertiary sandstones and shales, the so-called Carpathian Sandstone. The surface of this peneplain is dotted with settlements and cultivated tracts but upon it rise parallel lines of monadnock ridges whose steep slopes are heavily wooded, often to the summits though the highest reach several hundred feet above the tree-line and provide summer pastures for the stock of the plateau farms. Among these ridges the best known are the White Carpathians (Javornik, 3,325 ft.), the Beskids proper (Smrk—4,395 ft., and Ossus—5,106 ft.), and the Arva Magura group (Babia Gora—5,650 ft.); east of the river Poprad the ridges are generally lower and more forested with firs and beeches. The inner belt of the Northern Carpathians has a very complicated structure, of which overthrusts are the keynote, and still awaits detailed interpretation. It is seen in its most complex form between the Morava and the Hernad, where, against a core of old crystalline rocks, Carboniferous and older strata have been considerably crushed and folded. On the outer edge of this shattered nucleus rest highly-disturbed Permian and Mesozoic beds but in the inner portion of the belt similar formations show little disturbance. East of the Hernad river the crystalline complex is absent and the Permian and Mesozoic beds are little folded. The southern borderland of the Northern Carpathians is in the region of greatest disturbance where faulting and fracture are complicated by the occurrence of extensive volcanic outpourings of Miocene and later date, whereby the folded character of the ranges is almost entirely obscured. This region has also participated in the subsidence that originated the Hungarian plain. Throughout this inner belt dissected massifs of varying heights alternate with broad, terraced depressions having a general east-west grain. The formation of these basins and the neighbouring peneplains appears to be closely connected with the periodic fluctuations of level associated with the formation of the Hungarian plain. The highest massif, the High Tatra (*see* TATRA MOUNTAINS) has been strongly glaciated and closely resembles the Alpine ranges in its lakes, peaks, cirques and hanging valleys. South of this, the Fatra group and the Low Tatra (Djumbir—6,700 ft.) still show small cirques and minor traces of glaciation. Farther south the ranges decrease in height and continuity and, though still good pasture lands, are more important for their wealth of ores and the fertility of their volcanic soils. Thus the Slovakian Ore Mountains which include the Schemnitz, the Ostrowsky and other groups and the Zips-Gömör Ore Mountains are rich in iron, copper and other metallic ores while the Matra, Bükk and Tokaj groups are famed for their scenery and vineyards.

The structure of the Southern Carpathians is better known. Extending from the neighbourhood of the Jablonica Pass they widen rapidly to surround the Transylvanian Basin, the southern border of which is formed by the Transylvanian Alps, the most decided range of the whole system. In geological build they differ widely from the Northern Carpathians and only the outer *flysch* belt is common to both sections. Three subdivisions may be recognized, viz.:—the Moldavian Carpathians, the Transylvanian Alps and the massifs that fringe the Transylvanian Basin. The Moldavian Carpathians appear to bear a physiographical resemblance to the Beskids in the occurrence of conglomerate relict ridges upon a sandstone peneplain. The Transylvanian Alps extending from Orsova to the Prahova river are broken up by youthful transverse streams above which rise mature flat-topped ridges belonging to three topographical cycles. Here the rocks are mainly schistose in type with small outcrops of Mesozoic strata. Folding, fracturing and overthrust are common and the mode of origin of the present scenery approximates to that of the Alps. Traces of past glaciation are frequent and though the average height is a little less than 6,000 ft. the highest ridges, *e.g.*, the Fagaras, exceed 8,000 ft. The bordering mountains of the Transylvanian Basin are less well understood. Though lower they appear to be closely allied in rock composition and morphology to the Transylvanian Alps and this is especially true of the Bihar Mountains to the west. They differ, however, in one important feature for volcanic masses and debris are widespread, more particularly in the Harghitei complex which forms the eastern boundary of the basin.

Climate.—The climate is transitional from central to eastern European type but varies considerably according to altitude and exposure. The higher-lying ridges have raw winters, coldest on the eastern side where winds from the Russian plain are frequent; on the other hand these act as extraordinary heating influences in the summer, especially in the Bukovina district. The enclosed basins suffer great extremes, *e.g.*, Sibiu 1,360 ft., Jan. 24° F, July, 67° F. Precipitation varies from an average of 24 ins. in the Transylvanian Basin to 56 in. in parts of the Northern Carpathians. Summer is the wettest season when some 40% of the total precipitation occurs while a smaller secondary maximum due to Mediterranean influences appears in October. Vegetation varies with these climatic conditions. The edges of the mountain zone fringing the plains are often treeless but oak and beech soon appear, the latter dominating, to a height of about 4,000 ft., above which fir and pine succeed to 6,000 ft. The loess-covered depressions are generally treeless.

Population.—The contrasts in structure between the Northern and Southern Carpathians are repeated in their human and economic conditions and for this there are three causes, viz:—differences in accessibility, climate and ethnography. The Northern Carpathians are peopled mainly by Slavs, pastoralists and foresters, with, however, a strong penetration of Magyars along the valleys opening southwards where topography, climate and a fertile loess soil favour the cultivation of wheat and vine. Commercial routes of continental importance avoid these highlands so that traffic is limited to local movements along the valleys, notably those of the Waag and Hernad; life is therefore very parochial in nature and outlook. Poor communications and lack of coal have restricted the development of the mineral wealth that exists while agriculture and even pastoral and forestry activities reflect in their backwardness the evils of isolation and the long domination of the Slav peoples and their interests by Magyars. Energetic efforts on the part of the Czechoslovak Government to attract tourists and winter sportsmen to the spas and mountains of Slovakia are breaking down the isolation and increasing the prosperity of the southern slopes of this division of the Carpathians.

The Southern Carpathians, lying in Rumania, are settled mainly by Rumanians and have the advantage of being crossed by railways through several passes, viz.:—at the Iron Gates, the Vulcan Pass, the Roteturm Pass of the Oltu valley, the Predeal Pass, the Gyimes Pass and the Jablonica Pass. Further large minorities of Magyars and Germans, cattle breeders and mixed farmers, have contributed to the development of this region, particularly in its large loess-covered basins and in such mineral areas as that of the Bihar Mountains. The discovery of coal and petroleum, too, have stimulated human progress so that the lowlands are studded with flourishing farms and agricultural villages with occasional large towns engaged in manufactures of local importance. Contrasted with the large, solid Saxon and Magyar villages are the scattered, wooden homesteads of the Rumanian pastoralists. Sheep-rearing is the dominant form of pastoral industry and seasonal movement to high pastures is on a much more extensive scale than in the Northern Carpathians owing to the proximity of the Wallachian plains. So, too, a more genial climate raises the limit of human settlement here about 1,000 ft. higher than in the northern division (*i.e.*, to over 3,000 ft.).

Though in the remote fastnesses of the Carpathians bears, wolves, lynxes and birds of prey still persist and peasant life clings to the dress and habits of past centuries these highlands have never offered a serious obstacle to human movement, which has been especially easy at the point where the great bow is nearly severed through the Lupkow, Uzsok and Vereczе passes, now crossed by railways. By these passes waves of invasion from Asia effected penetration, while during the World War crossings were made with little difficulty by both combatant groups. The spread of Rumanians into Transylvania is another proof of the weakness of the system as a barrier, while only between Czechoslovakia and Poland does it serve as a frontier. Its broad and fertile depressions have rather acted as nuclei for the development of individual peoples and as refuges for the neighbouring plainsmen in times of strife.

Little scientific knowledge of the Carpathians existed until the 19th century when organized survey and mapping was undertaken by the Austrian army. Since then the formation of Carpathian societies in Hungary, Galicia and Transylvania has stimulated investigation while the studies of de Martonne have contributed much to our knowledge of the Southern Carpathians.

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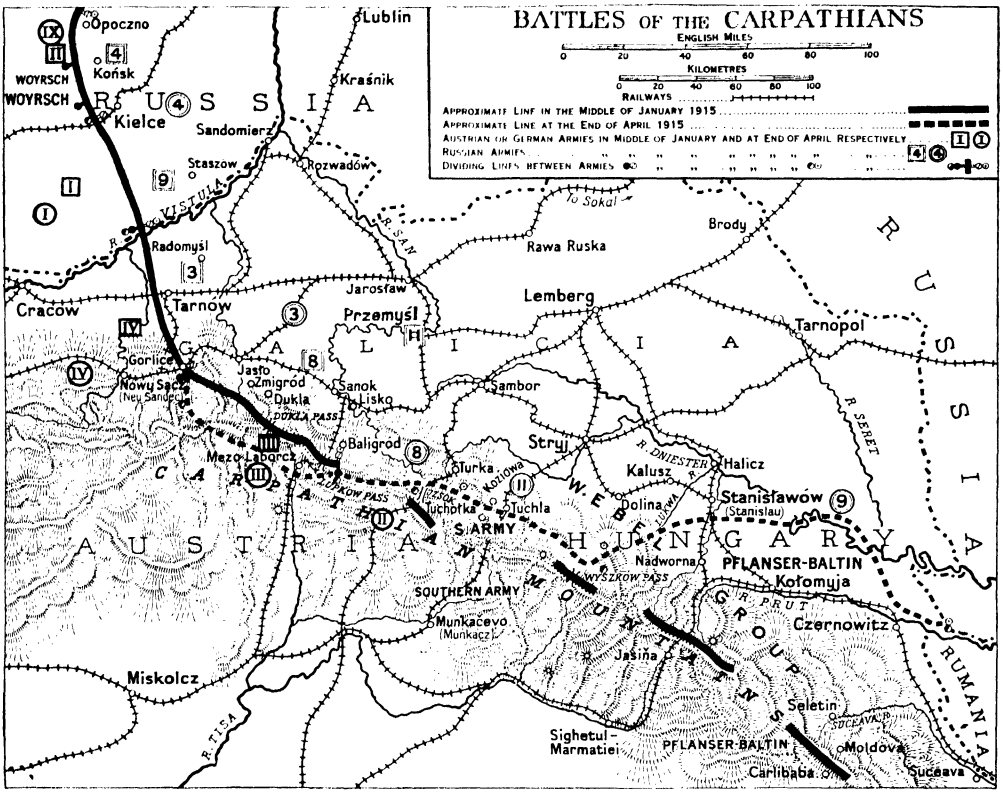
CARPATHIANS, BATTLES OF THE. Under this heading is recorded the fighting of the first four months of 1915 in the wooded Carpathians, from the Dukla pass, south of Jaslo, to the Rumanian border. The average height of the crest of the main ridge in this section of the range is between 2,500 and 3,000 ft. The slopes are steep on the Galician side, gentler on the



Hungarian side. The winter climate is extremely severe, the temperature being often many degrees below zero; snowstorms and blizzards are frequent. Why both sides chose these inhospitable highlands for a winter battle—for each side in turn attacked in great strength—invites some examination.

Object of the Operations.—For Austria-Hungary the main motives were the relief of the fortress of Przemysl and the security of the threatened plains of Hungary. But Conrad von Hotzendorf, Chief of the Austrian General Staff, hoped for more; the attacks, if successful, would develop into a large scale offensive against the southern flank of the whole Russian battle line. On the Russian side, the Grand Duke Nicholas sought during this winter to secure his flanks as the necessary preliminary to a direct advance from the Polish salient aimed at the heart of Germany. The undisputed possession of the Carpathian passes, with freedom to debouch at will into the Hungarian plains below, would go far towards breaking the resistance of Austria-Hungary and so safeguarding the Russian southern flank. The grand duke trusted to the greater endurance of his men under winter conditions to give them the advantage over enemies bred in less rigorous climates. He forgot that the Russian is a plainsman, and that hill fighting requires a special aptitude and training.

By the end of 1914 a continuous front had been established in the Carpathians only as far east as Baligrod. Thence to the Rumanian frontier the conditions were those of open warfare; detachments on either side attacked and defended points of strategic importance, but no solid battle line had been formed.

Disposition of Troops.—The disposition of the opposing forces when the campaign opened in mid-January were approximately as follows: The Russian III. Army (Radko-Dimitriev) extended from the Vistula, north-east of Cracow, by Tarnóv to about Gorlice; on its left came Brusilov's VIII. Army, which stretched from Gorlice to Baligrod and held the important Dukla pass. Farther east, Webel's Dniester group (second-line infantry divisions and Cossacks) had pushed up the slopes of the Eastern Carpathians, capturing the Uzsok and Wyszkow passes and overrunning the Bukovina. The XI. Army was besieging Przemysl. On the Austrian side, the IV. Army (Grand Duke Joseph Ferdinand) faced Radko-Dimitriev, and Boroevich's III. Army was opposed to Brusilov. Farther east, Linsingen's newly formed Southern German Army (four German and two Austrian divisions and two cavalry divisions) had assembled at Munkacs and was moving forward. Farther east still, beyond the Wyszkow pass, the group of Pflanzer-Baltin extended up to Dorna-Vatra on the Rumanian border.

Austrian Offensive.—The Austrian offensive, which opened the campaign, was made by the right of Boroevich's III. Army, by Linsingen's Southern Army and by Pflanzer-Baltin's group. The offensive began on Jan. 23, 1915. The attack of the III. Army, after an initial success which carried it to the line of the Upper San, soon lost its impetus. The Russians retaliated with a counter-offensive which began on Jan. 26 against the left of Boroevich's Army astride the Mezö Laborcz railway; from now to the end of the battle the Russians maintained the initiative in this part of the field, to which both sides began to transfer forces from other sectors of the front. Linsingen's Southern Army recaptured the Uzsok and Wyszkow passes and pushed slowly forward on Tuchla, but with the III. Army on its left falling back before the Russian counter-attacks could accomplish little. Meanwhile, Pflanzer-Baltin, whose group had been reinforced in the last week of January by a fresh corps, drove the Russians out of the Bukovina with his right wing, while his left wing reached in succession Kolomea, Nadworna, and finally, on Feb. 20, Stanislau. He now purposed to wheel to the left, to come in on the flank and rear of the Russian forces facing Linsingen. This move was checked by the assembly to the north and west of Stanislau of Lechitski's IX. Army, which had been transferred from the Russian front in Poland.

Attempt to Relieve Przemysl.—During the first half of February the Austrians transferred the II. Army (Bohm-Ermolli) from the Polish to the Carpathian front, with the intention of making a last attempt to relieve Przemysl. By the end of February, when this II. Army was ready to advance, the situation of the Austrian forces in the Carpathians seemed critical, in spite of their numerical superiority. The left of Boroevich's III. Army had almost reached breaking point under the continual pressure of Brusilov's forces, which had captured Mezö Laborcz and the Lupkow pass; Linsingen's Army held its ground, but could make no headway; Pflanzer-Baltin's Army was threatened by Lechitski's concentration; and Przemysl was in sore straits. The offensive of the II. Army, if it was to restore the situation, required a rapid and striking success. The principal offensive was made in the direction of Baligrod, astride the shortest road to Przemysl. At no time did the attack meet with any great measure of success; and by the middle of March it was stopped as hopeless, the Austrians being completely exhausted by the weather and their heavy losses. The formations which had borne the brunt of the assaults had lost over 50% of their strength. Przemysl was now abandoned to its fate.

Meanwhile, during the first fortnight in March, Lechitski's forces had driven Pflanzer-Baltin some 20m. back from Stanislau and had reached the line of the Prut in northern Bukovina. An opportune reinforcement enabled Pflanzer-Baltin to check the Russian advance. There was some further fighting; but little material change took place in this eastern portion of the battlefield up to the end of April.

Russian Offensive.—On March 20 the Russians, now sure of the fortress of Przemysl (it actually fell on March 22) launched a final great offensive against the Austrian III. and II. Armies. The attack was made by the left wing of Radko-Dimitriev's III. Army, which had been extended eastwards, and by Brusilov's VIII. Army. For a month their effort lasted. Both the Austrian Armies were driven over the crest of the main ridge. But both managed to maintain their positions on the other side of it, though it was only the arrival of fresh German divisions (the Beskiden corps) which saved the III. Army from breaking. Linsingen's Southern Army obstinately withstood all shocks and indeed made some ground forward. It held fast to the important Uzsok pass. By April 20 the Russians paused, breathless. They had appreciably enlarged their gains south of the Dukla pass, but their effort to break through the Austrian front had failed.

Conclusions.—It is a little difficult to arrive at a just balance of profit and loss between the two antagonists in this long drawn-out struggle. The Austrians seem to have attached undue importance to their fortress of Przemysl; their obstinate efforts to relieve it brought them to the verge of collapse and cost them heavier losses in men than did the eventual surrender of the garrison. The Russians, though they secured a "bridge-head" over the barrier of the Carpathians, did not succeed in forcing the obstacle, and squandered valuable resources in men and munitions by their persistence.

The result showed in fact that both commanders had been ill-advised to embark on this winter battle. On the whole the consequences were more disastrous for the Russians, whose obsession with this Carpathian struggle induced them to withdraw two corps from the right wing of their III. Army, and was thus a direct cause of its crushing defeat by Mackensen at the beginning of May (*see* DUNAJEC-SAN). No special lessons of tactics can be drawn from the fighting. The conditions of weather and ground were against elaboration of manoeuvre. Hill fighting requires a degree of individual skill and of tactical leadership which neither side possessed.

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CARPATHUS: *see* KARPATHOS.

CARPEAUX, JEAN BAPTISTE (1827–1875), French sculptor, the son of a mason, was born at Valenciennes, France, on May 11, 1827, and died at the Château de Bécon, near Courbevoie, on Oct. 12, 1875. In 1842 he went to Paris, and after working for two years in a drawing-school was admitted to the École des Beaux-Arts on Sept. 9, 1854, where he was a pupil of Rude. The Grand Prix de Rome was awarded to his statue of "Hector bearing in his arms his son Astyanax." At Rome he was fascinated by Donatello, and yet more influenced by Michelangelo, to whom he owes his feeling for vehement and passionate action. In his last year in Rome he sent home a dramatic group, "Ugolino and his Sons," which made his reputation. It was cast in bronze and erected in the garden of the Tuileries. This work was a reaction against the prevailing pseudo-classicism. Carpeaux received many important commissions from the imperial family and others. He executed in 1869 one of the four groups for the façade of the new opera house, this representing "The Dance."

See Ernest Chesneau, *Carpeaux, sa vie et son oeuvre* (1880); Paul Foucart, *Catalogue du Musée Carpeaux, Valenciennes* (1882); Jules Claretie, *J. Carpeaux* (1882); François Bournand, *J. B. Carpeaux*

CARPENTARIA, GULF OF, a relic, to all appearances, of the inland sea which occupied much of east central Australia in Triassic and Jurassic times, though the Great Artesian Basin appears to have no extensive outlet in this direction and the portion from Cloncurry northwards to the coast may be a separate basin. The gulf occupies a depression in the north-north-east portion of the continental block and is *c.* 480 m. from north to south and *c.* 420 m. (max.) from east to west. Except in the north-west, where the edges of the Arnhem Land plateau have sunk to form a drowned coast with numerous inlets and islands (groote Eylandt: *c.* 36 m. long, max. elev., 520 ft.), the gulf floor shelves up from shallow depths (average 30–40 fathoms) to form an unindented lowland fringe—perhaps a raised sea-floor—50 to 100 m. wide in the south-south-west and 100–150 m. in the south and east, with a few off-lying islands (Sir Edward Pellew Group; Wellesley islands). Behind the often dead-flat plains the land rises gradually to the Barkly Tableland (*c.* 1,000 ft.) in the south and to the highlands of Cape York Peninsula in the east. The plains—the "gulf country" proper—are largely floored with silts and muds washed down by the numerous rivers, some of which (Roper, McArthur, Flinders, Batavia) are fine streams navigable for varying distances inland. They have, however, markedly seasonal régimes: in summer wide areas are flooded and in winter the sea penetrates far up their courses. The soils, except in the alluvial flats and pockets, are perhaps poorer than would be expected and climatic conditions lead to grass-lands—Mitchell grass covers extensive areas—with occasional forest clumps, dense palm groves and mangrove belts near and along the coasts. The rivers abound in crocodiles and game and the gulf waters are said to afford good fishing. The climate is tropical (Mean ann. temp.: 85°–65°; average ann. rainfall 20″–40″) and there are only two seasons—the wet (November to April) and the dry. The gulf country is at present, apart from mining in the Croydon area and a little alluvial gold-washing in the Batavia river, devoted entirely to pastoral farming. There are a good many blacks, but the scanty white population lives mainly in the inland cattle stations, in mission stations (*e.g.*, at some river-mouths) and at such settlements as Normanton (pop. *c.* 500), Burketown and Borroloola. Normanton, 23 m. up the Norman river, is the port for a large and rich pastoral area, as well as for the mining (gold and silver) field of Croydon, with which it is linked by a railway (94 m.). There is also a weekly air-service to Cloncurry (220 m.).

Proposals are entertained for constructing a port on one of the Sir Edward Pellew islands to serve, by means of a railway, the valuable Barkly Tableland pastoral area.

CARPENTER, EDWARD (1844–1929), English author, was born at Brighton on Aug. 29, 1844, the son of Charles Carpenter, a barrister who had begun life in the navy. Edward Carpenter received a conventional education at Brighton college and at Trinity Hall, Cambridge, where he graduated 10th wrangler in 1868, and then became a fellow and lecturer of his college. He took holy orders and acted as curate in a Cambridge church, but the stirrings of revolt against the existing social and religious order were already at work in his mind, and he left Cambridge in 1874, having relinquished both his college appointments and holy orders. The revolutionary change which eventually led to a complete alteration in his conception of life was due to the reading in 1868 or 1869 of Walt Whitman's *Leaves of Grass* and then of his *Democratic Vistas*. From that moment he felt, to use his own words, that "my life deep down was flowing out and away from the surroundings and traditions amid which I lived—a current of sympathy carrying it westward across the Atlantic." A holiday in Italy and the revelation of the significance of Greek art confirmed his desire for a life more in conformity with nature. But when he left Cambridge he was to spend some years in uncongenial surroundings in a series of dingy lodgings before he was able to fulfil his dream. He became a university extension lecturer, and in the course of his visits to the industrial towns of Yorkshire and the Midlands got into touch with working people and with some of the Socialist leaders. His early volumes of verse were still-born, but *Towards Democracy* (1883) and *England's Ideal and other papers on Social Subjects* (1887) found many readers. In 1884 he visited the United States, spent some time with Whitman (*see* his *Days with Walt Whitman*, 1906), and met Lowell, Emerson, Charles Norton and others. Shortly afterwards he relinquished his lecturing to lead the simple life at Bradway, near Sheffield, occupying himself with market-gardening, handicrafts, and his literary work and Socialist propaganda. His Socialism was of the school of William Morris, and he was concerned with a revolution in industrial, social and family life rather than with political issues The second great influence in his life was that of Havelock Ellis, and some of his later writings are concerned with the question of an "intermediate sex." Although he was something of a recluse at Bradway and later in his Surrey home, many people belonging to "advanced" movements sought him out. Among his works are *Love's Coming of Age* (1896); *The Intermediate Sex* (1908); *The Drama of Love and Death* (1912), and *My Days and Dreams*, an autobiography (1916). He died in England on June 28, 1929.

CARPENTER, JOHN ALDEN (1876–), American composer, was born at Park Ridge (Ill.), on Feb. 28, 1876. He was educated at Harvard university, graduating in 1897, and joined his father in business in Chicago. Subsequently he studied music in Europe under Elgar, and in Chicago under Ziehn. His compositions include *Gitanjali*, a song-cycle with words by Tagore (1914); *Adventures in a Perambulator* and *Concertino* for orchestra and piano (1915); a symphony (1917); *The Birthday of the Infanta*, a ballet pantomime, produced by the Chicago Opera Company, Dec. 23, 1919; *Krazy-Kat*, a ballet, produced Dec 23, 1921; and *Skyscrapers*, a ballet produced at the Metropolitan Opera House, New York, Feb. 19, 1926, which was also given five times the following season. His published works also include a sonata for violin and piano and a number of songs As a composer of modern tendencies he has displayed great skill in his handling of the orchestra.

CARPENTER, LANT (1780–1840), English Unitarian minister, was born at Kidderminster on Sept. 2, 1780, the son of a carpet manufacturer. In 1805 he became a pastor of a church in Exeter, removing in 1817 to Bristol. At both Bristol and Exeter he was also engaged in school work, among his Bristol pupils being Harriet and James Martineau. Carpenter did much to broaden the spirit of English Unitarianism. The rite of baptism seemed to him a superstition, and he substituted for it a form of infant dedication. He was drowned on the night of April 5, 1840.

CARPENTER, MARY (1807–1877), educational and social reformer, was born on April 3, 1807, at Exeter, the daughter of Dr. Lant Carpenter. She was educated in her father's school for boys, learning Latin, Greek and mathematics, and other subjects at that time not generally taught to girls. In 1829 she and her sisters opened a school for girls at Bristol, but the life-work of Mary Carpenter began with her activities in organizing, in 1835, a "Working and Visiting Society," of which she was secretary for 20 years. In 1846 she started a school for poor children in Lewin's Mead and a night-school for adults. She published a memoir of Dr. Joseph Tuckerman of Boston, and a series of articles on ragged schools, which appeared in the *Inquirer* and were afterwards collected in book form. This was followed in 1851 by *Reformatory Schools for the Children of the Perishing and Dangerous Classes, and for Juvenile Offenders*, which advocated: (1) good free day-schools; (2) feeding industrial schools; (3) reformatory schools. This book drew public attention to her work. She was consulted in the drafting of educational bills, and invited to give evidence before House of Commons committees. To test her theories, she herself started a reformatory school at Bristol, and in 1852 published *Juvenile Delinquents, their Condition and Treatment*, which largely assisted the passing of the Juvenile Offenders Act (1854). Miss Carpenter now returned to her plea for free day-schools, contending that the ragged schools should receive a parliamentary grant. At the British Association meeting of 1860 she read a paper on this subject, and mainly owing to her instigation, a conference on ragged schools in relation to Government grants for education was held at Birmingham (1861). In 1866 Miss Carpenter made the first of her visits to India, and drew up a memorial to the governor-general dealing with female education, reformatory schools and the state of gaols. With the co-operation of native gentlemen, she established a model school for Hindu girls. At the meeting of the prison congress in 1872 she read a paper on "Women's Work in the Reformation of Women Convicts." Her work now began to attract attention abroad. Princess Alice of Hesse summoned her to Darmstadt to organize a women's congress. Thence she went to Neuchâtel to study the prison system of Dr. Guillaume, and in 1873 to America, where she was enthusiastically received. She died on June 14, 1877.

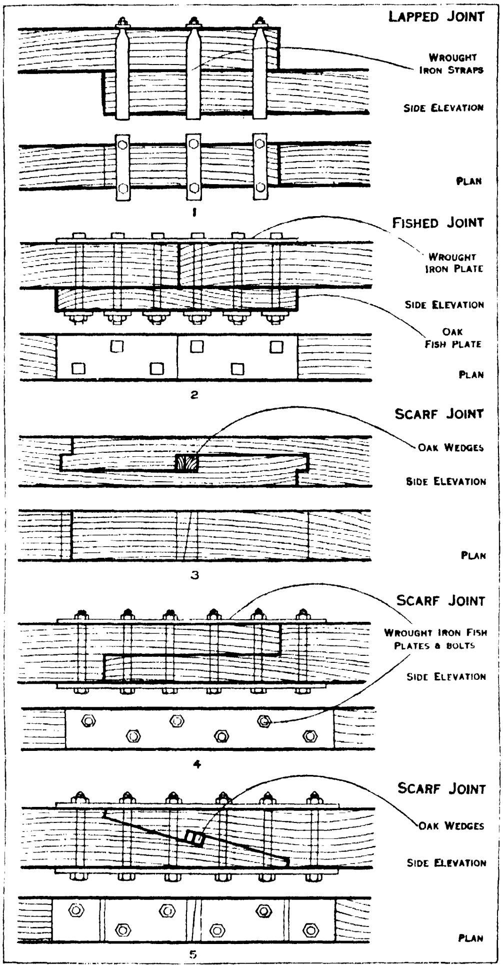
CARPENTER, a worker in wood. Carpenters are commonly classified according to the work which they do, *e.g.*, ships' carpenters, rough carpenters (rough carpentry, an obsolescent phrase, meaning the erection of the framework of a wooden house), cabinet makers, etc. Wood-cutting machinists are more properly classed as mill-sawyers. In the 18th century carpenters, being still chiefly master carpenters or journeymen, worked by the piece, but with the growth of general building firms master carpenter piecework practically ceased. Carpenters are very strongly organized both in the United States, in the United Brotherhood of Carpenters, and in Great Britain, in the Amalgamated Society of Woodworkers, which has also powerful branches in the dominions, where the older name of Amalgamated Society of Carpenters and Joiners (A.S.C.J.) is often retained. (*See* BUILDING.)

CARPENTRAS, a town of south-eastern France, capital of an arrondissement in the department of Vaucluse 16 m. N.E of Avignon Pop. (1936) 8,675. It lies in a hilly region bordering the wide valley of the lower Rhône.

Carpentras is identified with *Carpentoracte*, a town of Gallia Narbonensis mentioned by Pliny. Its mediaeval history is full of vicissitudes; it was captured and plundered by Vandal, Lombard and Saracen. In later times, as capital of the Comtat Venaissin, it was frequently the residence of the popes of Avignon, to whom that province belonged from 1228 till the Revolution. Carpentras was the seat of a bishopric from the 5th century till 1805. The highest part of the town is occupied by the church (and former cathedral) of St. Siffrein, a late Gothic building (1405–1519) which preserves remains of a previous Romanesque church. The richly sculptured Flamboyant south porch is noteworthy. The adjoining law-court, built in 1640 as the bishop's palace, contains in its courtyard a small but well-preserved triumphal arch of the

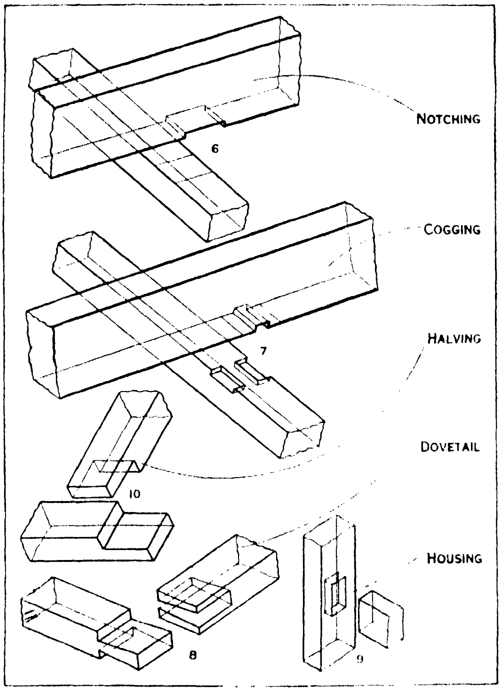
Gallo-Roman period. The former palace of the papal legate dates from 1640. Of the 14th century fortifications the only survival is the Porte d'Orange, a gateway surmounted by a fine machicolated tower. Water is brought to the town by an aqueduct of forty-eight arches, completed in 1734.

Carpentras is the seat of a sub-prefect and of a court of assizes, and has a tribunal of first instance. Confectionery, honey, wax, fruit, preserved fruits, tin-ware and nails are produced, and there are silk-works and tanneries. There is trade in silk, wool, fruit, oil, etc. The irrigation-canal named after the town flows to the east.



FIGS. 1-5.—LAPPED, FISHED AND SCARF JOINTS, THREE OF THE MOST USEFUL EMPLOYED IN CARPENTRY

CARPENTRY, the art and work of a carpenter (from Lat. *carpentum,* a carriage), a workman in wood, especially for building purposes. Carpenters' work has been divided into three principal branches—descriptive, constructive and mechanical. The first shows the lines or method for forming every species of work by the rules of geometry; the second comprises the practice of reducing the timber into particular forms, and joining the forms so produced in such a way as to make a complete whole according to the intention or design; and the third displays the relative strength of the timbers and the strains to which they are subjected by their disposition. Here we have merely to describe the practical details of the carpenter's work in the operations of building. The carpenter differs from the joiner since his skill is directed to the carcass of a building, to things which have reference to structure only. Almost everything that the carpenter does to a building is necessary to its stability and efficiency, whereas the joiner does not begin his operations until the carcass is complete, and every article of joiners' work might at any time be removed from a building without undermining it or affecting its most important qualities.

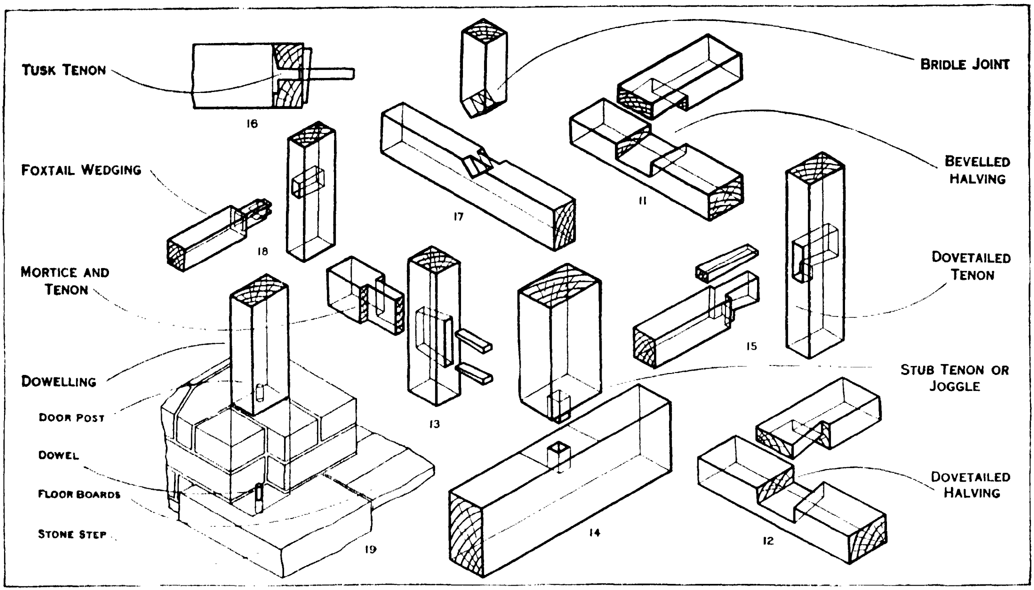


FIGS. 6-10

The carpenter frames or combines separate pieces of timber by scarfing, notching, cogging, tenoning, pinning and wedging, etc. The tools he uses are the rule, axe, adze, saws, mallet, hammers, chisels, gouges, augers, pincers, set squares, bevel, compasses, gauges, level, plumb rule, jack, trying and smoothing planes, rebate and moulding planes, and gimlets and wedges. The carpenter has little labour to put on to the stuff; his chief work consists in fixing and cutting the ends of timbers, the labour in preparing the timber being largely done by machinery.

Joints.—The joints in carpentry are various, and each is designed according to the thrust or strain put upon it. Those principally used are the following: lap, fished, scarf, notching, cogging, dovetailing, housing, halving, mortice and tenon, stub tenon, dovetailed tenon, tusk tenon, joggle, bridle, foxtail wedging, mitre, birdsmouth, built-up, dowel. Illustrations are given of the most useful joints in general use, and these, together with the descriptions, will enable a good idea to be formed of their respective merits and methods of application.

The lapped joint is used for temporary structures in lengthening timbers and is secured with iron straps and bolts; a very



FIGS. 11–19

common use of the lap joint is seen in scaffolding secured with cords and wedges

The fished joint is used for lengthening beams and is constructed by butting the ends of two pieces of timber together with an iron plate on top and bottom, and bolting through the timber; these iron connecting-plates are usually about 3ft long and ¾in and ½in. in thickness. This joint provides a good and cheap method of accomplishing its purpose.

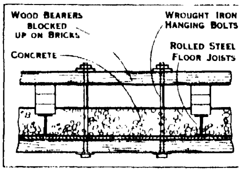

WOOD BEARERS BLOCKED UP ON BRICKS
WROUGHT IRON HANGING BOLTS
ROLLED STEEL FLOOR JOISTS
CONCRETE

FIG. 20—CENTRING FOR CONCRETE

The scarf joint is used for lengthening beams, and is made by cutting and notching the ends of timbers and lapping and fitting and bolting through. This method cuts into the timber, but is very strong and neat.

The ends of floor joints and rafters are usually *notched* over plates to obtain a good bearing and bring them to the required levels Where one timber crosses another as in purlins, rafters, wood floor girders, plates, etc., both timbers are notched so as to fit over each other; this *cogging* serves instead of fastenings The timbers are held together with a spike. In this way they are not weakened, and the joint is a very good one for keeping them in position.

Dovetailing is used for connecting angles of timber together, such as lantern curbs or linings, and is the strongest form. When an end of timber is let entirely into another timber it is said to be *housed*. Where timbers cross one another and require to be flush on one or both faces, sinkings are cut in each so as to fit over each other (*halving*); these can either be square, bevelled or dovetailed sinkings. The end of one piece of timber cut so as to leave a third of the thickness forms a *tenon*, and the piece of timber which is to be joined to it has a mortice or slot cut through it to receive the tenon; the two are then wedged or pinned with wood pins.

A stub tenon or joggle is used for fixing a post to a sill; a sinking is cut in the sill and a tenon is cut on the foot of the post to fit into the sinking to keep the post from sliding.

The purpose of a dovetailed tenon is to hold two pieces of wood together with mortice and tenon so that it can be taken apart when necessary. The tenon is cut dovetail shape, and a long mortice permits the wide part of the tenon to go through, and it is secured with wood wedges. Where the floor joists or rafters are trimmed round fires, wells, etc., the tusk tenon joint is used for securing the trimmer joist. It is formed by cutting a tenon on the trimmer joist and passing it through the side of the trimming joist and fixing it with a wood key. Where large timbers are tusk tenoned together, the tenons do not pass right through, but are cut in about 4in. and spiked

A bridle joint or birdsmouth is formed by cutting one end of timber either V-shape or segmental, and morticing the centre of this shaped end. Similar sinkings are cut on the adjoining timber to fit one into the other; these are secured with pins and also various other forms of fastenings. Foxtail wedging is a method very similar to mortice and tenon. But the tenon does not go through the full thickness of the timber; and also on the end of

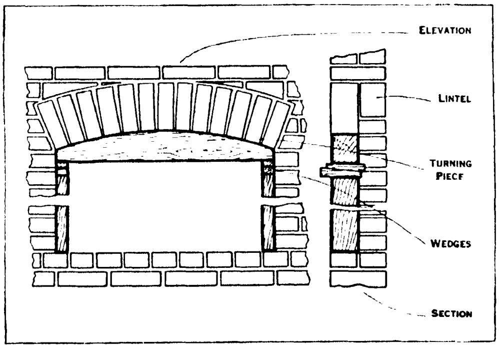


FIG. 21.—DIAGRAM SHOWING CENTRING FOR AN ARCH IN BRICKWORK
The centring, constructed of wood, is removed when the bricks are thoroughly set

the tenon are inserted two wedges, so that when the tenon is driven home the wedges split it and wedge tightly into the mortice. This joint is used mostly in joinery. The mitre is a universal joint, used for connecting angles of timber as in the case of picture frames. Built-up joints involve a system of lapping and bolting and fishing, as in the case of temporary structures, for large spans of centering for arches, and for derrick cranes. Dowels are usually 3 or 4in. long and driven into a circular hole in the foot of a door frame or post; the other end is let into a hole in the sill.

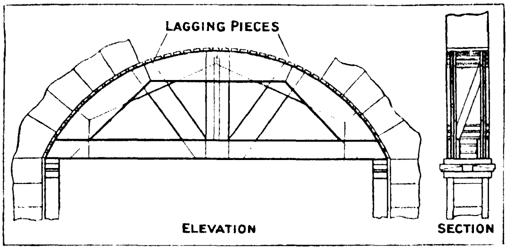


FIG. 22.—CENTRING OF VERY STRONG CONSTRUCTION FOR A STONE ARCH

Centering.—Centering is temporary timber or framing erected so as to carry concrete floors or arches of brick or stone, etc.; when the work has set the centering is removed gradually. The centering for concrete floors is usually composed of scaffold boards resting on wood bearers. One wood bearer rests along on top of the steel joists; through this bearer long bolts are suspended, and to the bottom of these bolts a second bearer is fixed, and on the bottom bearer the scaffold boards rest.

Turning piece is a name given to centering required for turning an arch over; it is only 4½in. wide on the soffit or bed, and is generally cut out of a piece of 3 or 4in. stuff, the top edge being made circular to the shape of the arch. It is kept in position whilst the arch is setting with struts from ground or sills and is nailed to the reveals, a couple of cross braces being wedged between. In the case of a semicircular or elliptical arch with 4½in. soffit this turning piece would be constructed of ribs cut out of 4in. stuff with ties and braces. Or the ribs could be cut out of 1in. stuff, in which case there must be one set of ribs outside and one inside secured with ties and braces; each set of ribs when formed of thin stuff is made of two thicknesses nailed together so as to lap the joints. For spans up to 15ft. the thin ribs would be used, and for spans above 15ft. ribs out of 4in. stuff and upwards. For arches with 9in. soffit and upwards, whether segmental or semicircular or elliptical, the centres are formed with the thin ribs and laggings up to 15ft. span; above 15ft. with 4in. ribs and upwards.

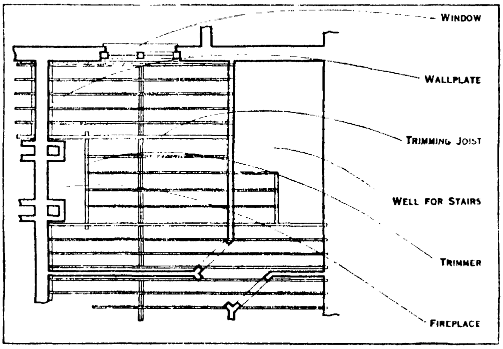


FIG. 23.—SINGLE FLOOR, IN WHICH THE FLOOR BOARDS REST ON ONE ROW OF WOOD JOISTS

The lower member of centres is called the tie, and is fixed so as to tie the extremities together and to keep the centre from spreading. Where the span is great, these ties, instead of being fixed straight, are given a rise so as to allow for access or traffic underneath. Braces are necessary to support the ribs from buckling in, and must be strong enough and so arranged as to withstand all stresses. Laggings are small pieces or strips of wood nailed on the ribs to form the surface on which to build the arch, and are spaced 1in. apart for ordinary arches; for gauged arches they are nailed close together and the joints planed off.

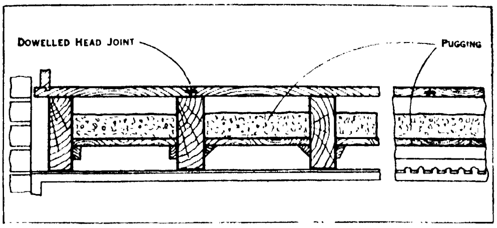


FIG. 24.—SOUND-RESISTING SINGLE FLOOR, SHOWING HOW THE FLOOR IS "PUGGED" WITH SLAG WOOL

When centres are required to be taken down, the wedges upon which the centre rests are first removed so as to allow the arch to take its bearing gradually.

Floors.—For ordinary residential purposes floors are chiefly constructed of timber. Up to about the year 1805 nearly every modern building was constructed with wood joists, but because of evidence adduced by fire brigade experts and the serious fires that have occurred fire-resisting floors have been introduced. These consist of steel girders and joists, filled in with concrete or various patented brick materials in accordance with such by-laws as those passed by the London County Council and other authorities. The majority of the floors of public buildings, factories, schools, and large residential flats are now constructed of fire-resisting materials. There are two descriptions of flooring, single and double.

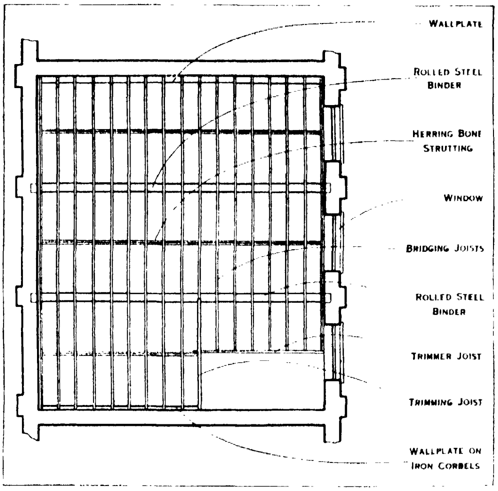


FIG. 25.—DOUBLE FLOOR WITH STEEL BINDERS. THE JOISTS, OF FIR, ARE TRIMMED INTO STEEL GIRDERS

Single Flooring.—This consists of one row of joists resting on a wall at each end without intermediate support, and receiving the floor boards on the upper surface and the ceiling on the underside. Joists should never be less than 2in. thick, or they are liable to split when the floor brads are driven in; the thickness varies from 2 to 4in. and the depth from 5 to 11in.; the distance between each joist is usually 12in. in the clear, but greater strength is obtained in a floor by having deep joists and placing them closer together. These floors are made firm and prevented from buckling by the use of strutting as mentioned hereafter.

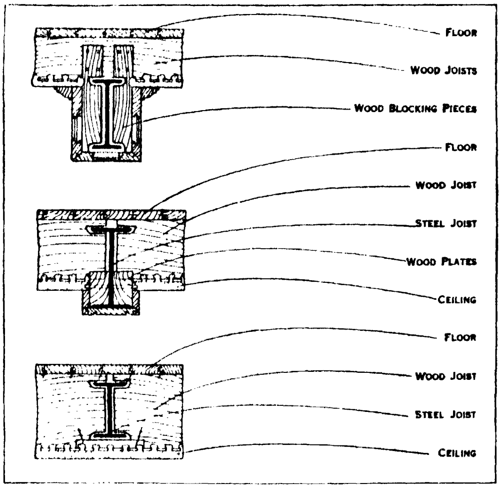


FIG. 26.—DOUBLE FLOORING, SHOWING THE WOOD PLATES BOLTED TO THE STEEL JOISTS TO RECEIVE THE ENDS OF THE SINGLE WOOD JOISTS

The efficiency of single flooring is materially affected by the necessity which constantly occurs in practice of trimming round fire-places and flues, and round well holes such as lifts, staircases, etc. Trimming is a method of supporting the end of a joist by tenoning it into timber crossing it; the timber so tenoned is called the trimmer joist, and the timber morticed for the tenon of the trimmer is called the trimming joist, while the intermediate timbers tenoned into the trimmer are known as the trimmed joists. This system has to be resorted to when it is impossible to get a bearing on the wall.

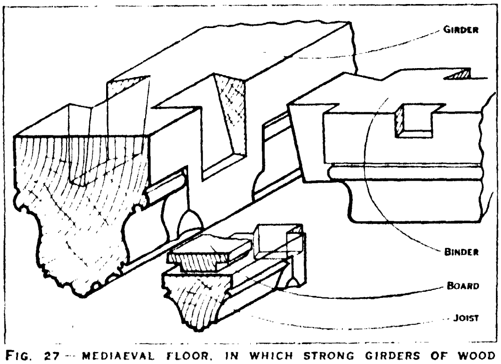
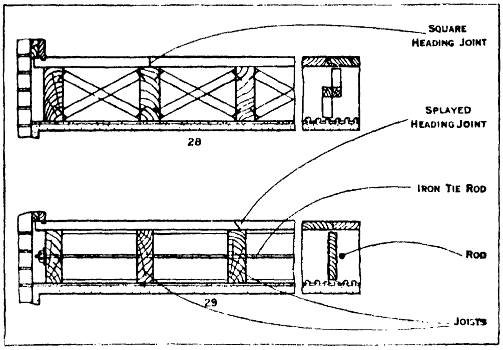


FIG. 27—MEDIAEVAL FLOOR, IN WHICH STRONG GIRDERS OF WOOD BORE THE JOISTS, AND ALL THE WORK WAS WROUGHT

A trimmer requires for the most part to be carried or supported at one or both ends by the trimming joists, and both the trimmer and the trimming joists are necessarily made stouter than if they had to bear no more than their own share of the stress. In the usual practice the trimmer and trimming joists are 1in. thicker than the common joists, but there are special regulations and by-laws set out by local authorities to which attention must be given.

The principal objection to single flooring is that the sound passes through from floor to floor, so that, in some cases, conversation in one room can almost be understood in another. To stop the sound from passing through floors the remedy is to pug them. This consists in using rough boarding resting on fillets nailed to the sides of the joists about half-way up the depth of the joists, and then filling in on top of the boarding with slag wool usually 3in. thick. Also further to prevent sound from passing through floors the flooring should be tongued and the ceiling should have a good thick floating coat; in poor work the stuff on ceilings is very stinted. In days gone by, ceiling joists were put at right angles to the floor joists, but this took up head room and was costly, and the arrangement is obsolete.



FIGS. 28 AND 29.—TYPES OF STRUTTING FOR STRENGTHENING FLOORS
The top figure shows herring-bone strutting; the lower figure shows solid strutting of 1½ in. boards, fitted tightly between the joists

Double Flooring.—This consists of single fir joists trimmed into steel girders; in earlier times a double floor consisted of fir joists called binding, bridging and ceiling joists, but these are very little used now and the single fir joists and steel girders have taken their place. Steel girders span from wall to wall, and on their flanges are bolted wood plates to receive the ends of the single joists which are notched over plates and run at right angles

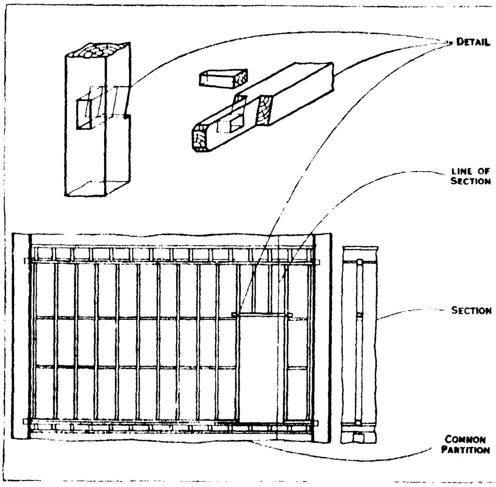
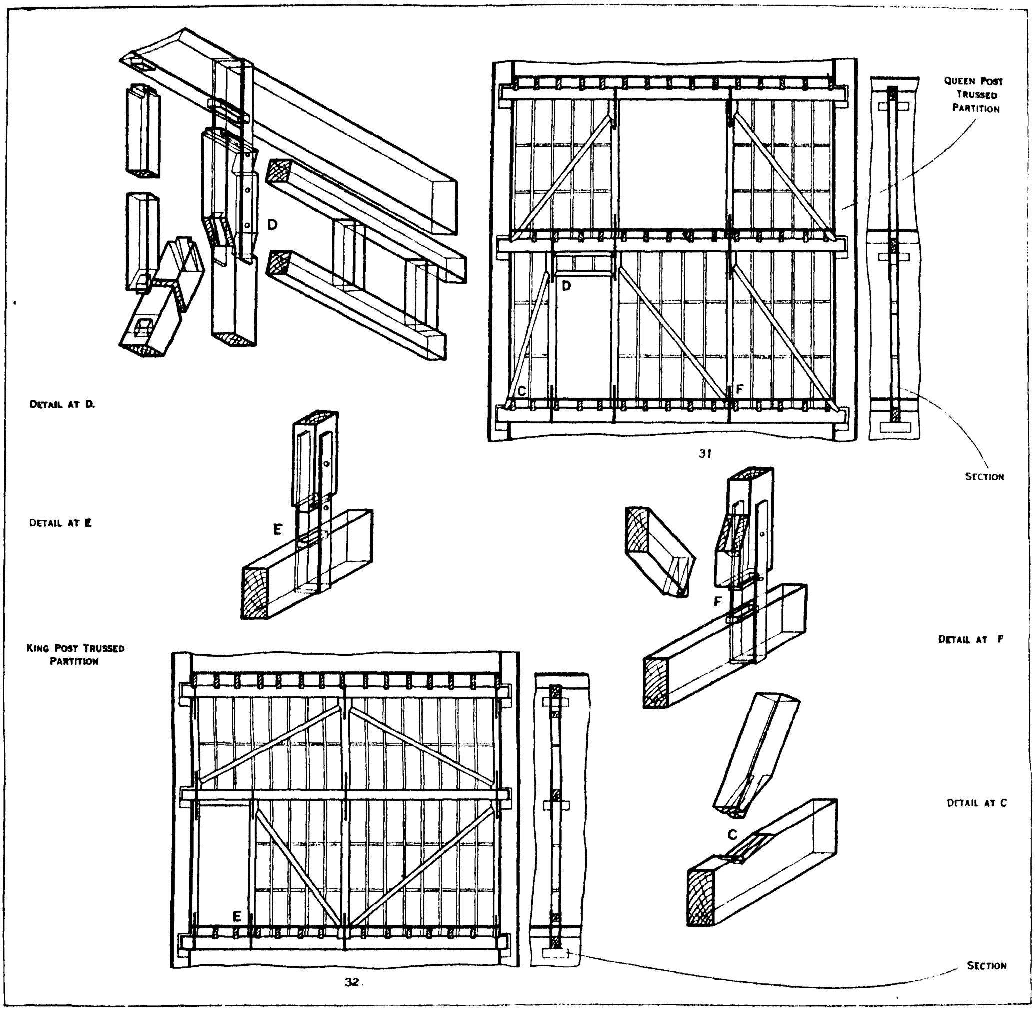


FIG. 30.—A COMMON WOOD PARTITION, BUILT OF 4 IN. X 3 IN. HEAD AND SILL, AND 4 IN. X 2 IN. UPRIGHT STUDS, WITH NAGGING PIECES



FIGS. 31–32.—QUEEN POST AND KING POST TRUSSED PARTITIONS

to the girders. The bearings of the joists on the wall also rest on wall plates, so as to get a level bed, and are sometimes notched over them. Wall plates, which are usually 4½in. x 3in. and are bedded on walls in mortar, take the ends of joists and distribute the weight along the wall. The plates bolted on the side of girders are of sizes to suit the width of the flanges.

The mediaeval floor consisted of the framed floor with wood girders, binding, bridging and ceiling joists, and the underside of all the timbers was usually wrought, the girders and binders being boldly moulded and the other timbers either square or stop chamfered.

Flooring is strengthened by the use of strutting, either herring-bone or solid. Herring-bone strutting consists of two pieces of timber, usually 2in. x 2in., fixed diagonally between each joist in continuous rows, the rows being about 6ft. apart. Solid strutting consists of 1¼in. boards, nearly the same depth as the joists and fitted tightly between the joists, and nailed in continuous rows 6ft. apart. Where heavy weights are likely to be put on floors long bolts are passed through the centre of joists at the side of strutting; since this draws the strutting tightly together and does not produce any forcing stress on the walls, it is undoubtedly the best method.

Floors are usually constructed to carry the following loads (including weight of floor):

Residences, 1¼cwt. per foot super of floor space.

Public buildings, 1½cwt. per foot super of floor space.

Factories, 2½ to 4cwt. per foot super of floor space.

Partitions.—Partitions are screens used to divide large floor spaces into smaller rooms and are sometimes constructed to carry the floors above by a system of trussing. They are built of various materials; those in use now are common stud partitions, brick-nogged partitions, and solid deal and hardwood partitions, 4½in. brick walls or bricks laid on their sides, so making a 3in. partition, and various patent partitions such as coke breeze concrete or hollow brick partitions (*see* BRICKWORK), iron and wire partitions, and plaster slab partitions (*see* PLASTERWORK).

There are two kinds of stud or quarter partitions, common and trussed.

Common partitions simply act as a screen to divide one room from another, and do not carry any weight. They weigh about 25lb. per foot superficial including plastering on both sides, and are composed of 4in. x 3in. head and sill and 4in. x 2in. upright studs; 4in. x 2in. nogging pieces are fitted between the studs to keep them from bending in, and are placed parallel with the head, usually 4ft. apart. Where door-openings occur in these partitions the studs next the opening are 4in. x 3in. Should the floor boards have been laid, the sill of the partition would be laid direct on them, but if the partitions are erected at the time of building the structure the sill should either rest directly over a joist, if parallel with it, or at right angles to the joists; should the position of the sill come between two joists, that is, parallel with them, then short pieces called bridging pieces of 4in. x 2in. stuff are wedged between the two joists and nailed to carry the sill.

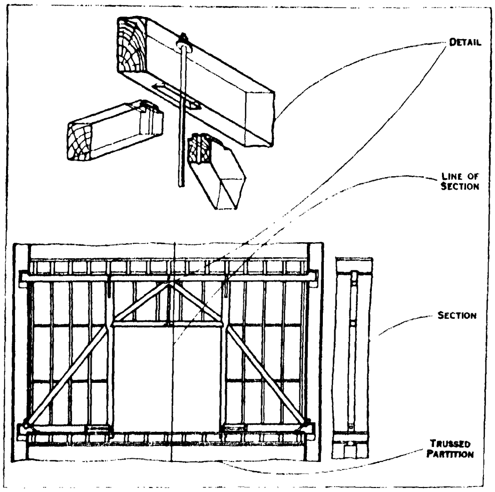


Fig. 33—A TRUSSED WOOD PARTITION, CAPABLE OF BEARING A CONSIDERABLE WEIGHT

Trussed partitions are very similar to the last, but they are so built as to carry their own weight and also to support floors, and in addition have braces; the head and sill are larger, and calculated according to the clear bearing and the weight put upon them. There are two forms of trussing, namely, queen post and king post.

Bricknogged partitions are formed in the same manner as the common stud partition, except that the studs are placed usually 18 or 27in. apart in the clear instead of 12in., and the 18 and 27in. widths being multiples of a brick dimension, they are filled in with brickwork 4½in. thick and always built in cement. These are used to prevent sound from passing from one room to another, and also to prevent fire from spreading, and are vermin-proof. Another method is to fill the space between the studs with coke breeze concrete instead of brickwork.

Timber Work.—Half-timber work consists of a framework of timber; the upper storeys of suburban and country residences are often thus treated, and the spaces between the timbers are filled in with brickwork and plastered inside, and rough cast outside, though sometimes tiles are hung on the outside. In some instances in country places there is no filling between the timbers, and both sides are lath-and-plastered, and in others the timbers are solid, or facing pieces are simply plugged to the walls, the joints being pinned with hardwood pins. Half-timber work is still frequently employed in domestic and even in commercial architecture because of its aesthetic qualities. The best and most durable wood to use is English oak worked smooth on the external face and usually painted; the by-laws of various authorities differ considerably as to the method of construction and in the restrictions as to its use. Some very fine early examples are to be seen in England, as at Holborn Bars, London, in the old parts of Bristol, and at Moreton Old Hall, near Congleton, Cheshire. A notable modern commercial example of half-timbered work is the fine building erected in Regent street, London, by Messrs. Liberty and Co.

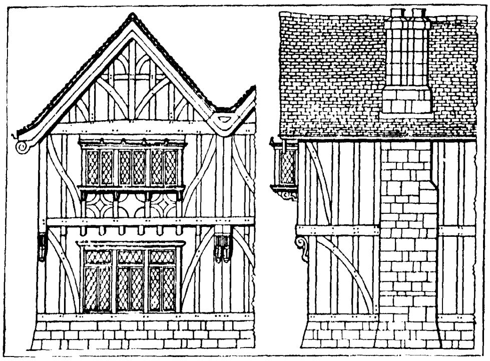


Fig. 34.—HALF TIMBER CONSTRUCTION IN WHICH A FRAMEWORK, PROPERLY OF OAK, IS FITTED IN WITH BRICKWORK. MODERN BY-LAWS OFTEN REQUIRE A SOLID BRICK BACKING TO THE TIMBERS

Timber-framed permanent buildings are not used in the towns of England, not being allowed by the by-laws. In some English villages timber bungalows are allowed, plastered inside, and either rough cast outside, or with tiles, or with sheet iron painted.

In America and the British colonies this class of building is very largely erected on the outskirts of the cities. In American practice in framing the walls of wooden buildings two distinct methods are used and are distinguished as "braced" and "balloon."

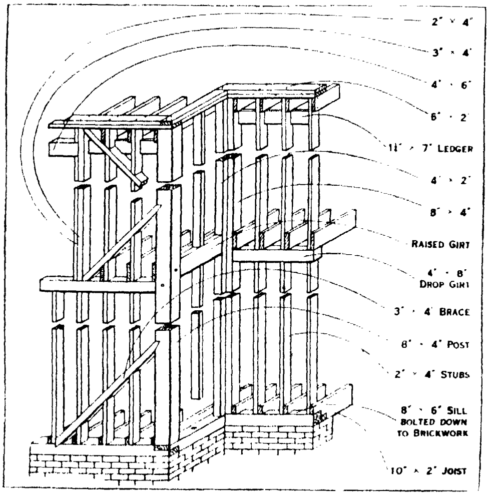


Fig. 35.—BRACED FRAME, SHOWING THE POSTS, GIRTS AND PLATES, WHICH ARE OF HEAVY TIMBER, MORTICED AND TENONED TOGETHER, AND BRACED STRONGLY

The braced was the only kind in use before about the year 1850. In this method of framing the sills, posts, girts and plates are made of heavy timber morticed and pinned together and braced with 4in. x 4in. or 4in. x 6in. braces and common studding.

To frame a building in this way it is necessary to cut all the pieces and make all the mortice holes on the ground, and then fit them together and raise a whole side at a time or at least one storey of it. The common studs are only one storey high.

The balloon frame is composed of much smaller scantlings and is more rapidly erected and less expensive. The method is to first lay the sill, generally 4in. x 6in., halved at the angles. After the floor is laid, the corner posts, usually 4in. x 6in., are erected and temporarily secured in place with the aid of stays. The common studs are then set up and spiked to the sill, and a temporary board nailed across their face on the inside. These common studs are the full height from sill to roof plate, and the second tier of floor joists are supported by notching a 1¼in. x 7in. board, called a false girt or ribbon, into their inside edge at the height to receive the floor joists. The ends of the joists are also placed against a stud and spiked. The tops of the studs are cut to a line, and a 2in. x 4in. plate is spiked on top, an additional 2in. x 4in. plate being placed on the top of the last breaking joint. Should the studs not be long enough to reach the plate, then short pieces are fished on with pieces of wood spiked on both sides. The diagram shows a portion of the framework of a two-storey house constructed in the manner described. In the balloon frame the timbers are held together entirely by nails and spikes, thus permitting them to be put up rapidly. The studs are doubled where windows or openings occur. In both these methods dwarf brick foundations should be built, upon which to rest the sill. For buildings of a superior kind a combination of the braced and balloon frames is sometimes adopted.

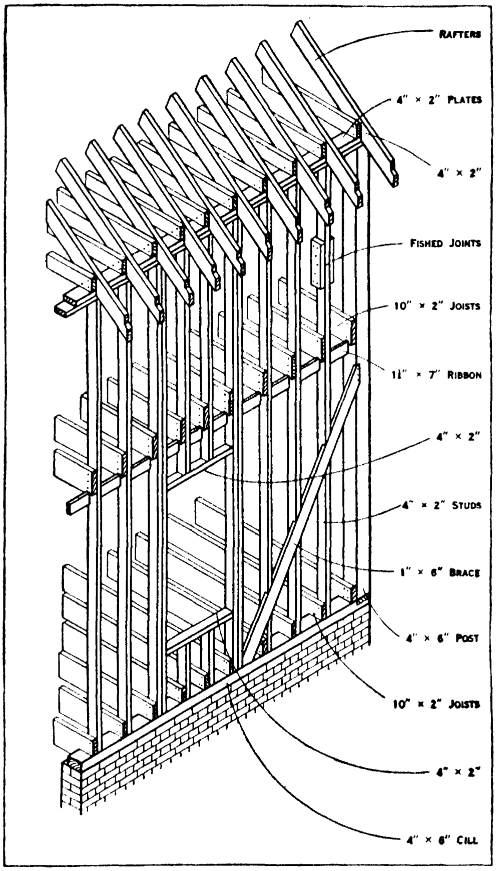


FIG. 36.—CARPENTERS' BALLOON FRAME, A FORM OF FRAMED WORK LIGHTER AND LESS EXPENSIVE THAN THE BRACED FORM

The sides of frame buildings are covered with siding, which is fastened to a sheathing of rough boards nailed to the studs. The siding may consist of matched boards placed diagonally, or of clapboards or weather boards—which are thin boards thicker at one edge than the other, and arranged horizontally with the thick edge downwards and overlapping the thin edge of the board below. Shingles or wooden tiles are also employed.

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CARPET. For the history of carpet-making, *see* RUGS AND CARPETS. For present methods of manufacture, *see* CARPET MANUFACTURE.

CARPET-BAGGER, a political slang term for a person who stands as a candidate for election in a locality in which he is a stranger. It is particularly used of such a candidate sent down by the central party organization. The term was first used in the western states of America of speculative bankers who were said to have started business with no other property than what they could carry in a carpet-bag, and absconded when they failed. The term came into general use in American politics in the reconstruction period after the Civil War, as a term of contempt for the northern political adventurers in the South who, by the help of the negro vote, gained control of the administration.

CARPET-KNIGHT, one who has been knighted in time of peace, on the carpet before the king's throne, not on the battlefield as a reward for valour. It is a term of reproach for a soldier who stays at home and avoids active service.

CARPET MANUFACTURE. Modern carpet manufacture involves the use of machinery and of many different materials, such as woollen and worsted yarns for the surface of the carpet, and cotton, linen and jute for the back. The wool which is most suitable for carpet yarn is generally fairly long in the staple and rather coarse than fine. It is obtained from Scotland, China, Thibet, India, Russia, Australia, New Zealand, Egypt, Iceland and the East Indies. It can be spun into yarn of any required thickness, dyed to any shade, and woven into any fabric; therefore it is an ideal material for the surface of carpets, especially as it retains its appearance and withstands reasonably hard wear.

Silk carpets are very beautiful, possessing a wonderful sheen, but they get soiled more quickly and have less resilience than wool carpets of a similar quality; and this, combined with their high cost, makes them luxuries for the few.

Cotton is used for chain warps in all kinds of carpeting, and forms the chain of Axminster and weft of Wilton and Brussels carpets. Flax yarn is sometimes used as a weft yarn in Brussels and Tapestry. Jute and hemp are used in considerable quantities as a filling, to give body or weight to the carpet, and as a weft in Axminster.

Other materials used occasionally in the manufacture of carpets are mohair, cowhair and horsehair for the surface of the carpet and ramie for the back. Twisted paper yarn has been tried for weft, chain or "stuffer."

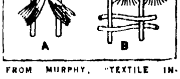
Dyeing.—Dyeing plays a most important part in carpet manufacture, as practically all yarns used on the surface have to be dyed; and fast colors are essential.

The yarns are impregnated with the oil or grease which they received during the process of spinning. Washing is then a necessary preliminary to dyeing, as the presence of grease would prevent the dye permeating the fibers. Scouring is effected by soap and hot water, and passes, without being fully dried, to the dyeing machine.

The process of dyeing the yarn in skeins is generally effected by mechanical means and is similar to that adopted in other branches of the textile trade. (*See* DYEING.)

Hand-made Carpets.—The main classification of carpets is between those which are made by hand and those which are made by machine; and of these classes, especially of the latter, there are many subdivisions.

Hand-made carpets are the oldest type, and are the historical parents of all modern carpets. This kind of carpet is made to-day in the United Kingdom, on the Continent, and in the East in almost exactly the same manner in which it has been made by the Orientals for several hundred years. The principle is extremely simple. The warp threads, or chain, are wound on two horizontal beams, between which they are stretched vertically. The beams are carried by upright posts on which they can revolve, the space between the posts determining the width of the rug or carpet. The weavers sit side by side in front, the carpet as it is woven being gradually wound on to the lower beam and the warp correspondingly unwound from the upper beam. The yarn for the pile is cut about 2in. in length and is knotted round two warp threads, tuft by tuft, according to the paper design, in front of the weaver. As each row, or part of a row is finished, two weft threads are put in, one in the shed formed between the front and back halves of the chain, and a second in an alternate shed, which is formed by the weaver pulling forward the back half of the chain temporarily in front of the front half. The second weft is put in straight, the first one loose, zig-zag or vandyked, so as to fill up the back of the carpet and to avoid the tendency towards lateral contraction. The weft is beaten down into its place by a heavy fork or beater. This interlocking of warp and weft with the tuft forms the weave of the carpet, and has been imitated more or less in all mechanically woven carpet fabrics. There are two different kinds of knot employed, the Ghiordes or Turkish, and the Senne or Persian; the tufts of yarn in the former coming in pairs between the two warp threads (fig. 1, A) and in the latter coming singly between each warp thread (fig. 1, B). In either case the tufts do not stand up vertically to the plane of the fabric but lie over obliquely towards the starting end of the carpet. This presents to the eye and foot of the user partly the ends and partly the sides of the tufts, and is a very characteristic feature of hand-made carpets.



FROM MURPHY, "TEXTILE INDUSTRIES" (GRESHAM)

FIG. 1.—A. GHIORDES, OR TURKISH KNOT. B. SENNE, OR PERSIAN KNOT

Another kind of hand weaving is the tapestry method, wherein the weft colours, wound upon wooden needles, are threaded round and between the warp ends, leaving a flat or slightly ribbed surface, not unlike that of an ingrain carpet. The absence of a tufted pile does not make this a luxurious carpet, but it enables a fine pitch to be employed and the richest and most delicate effects of design and colour to be obtained. Carpets of this type have long been made at Les Gobelins, Paris, Aubusson and Beauvais in France, and Tournai in Belgium. The work is slow and highly skilled, and the product is naturally very expensive.

There is no better carpet than that made by hand; though this is far from implying that all hand-tufted carpets are superior to all machine-made ones. The hand-tufted carpet possesses an individuality, even in its faults, which no product of a machine can attain; and which, after all, is an attribute of a work of art.

Hand-made carpets have a further advantage in their adaptability to requirements. A single carpet, for instance, can be made to any specified shape, size, design, colour and quality. It is possible to produce in one piece carpets of oval, circular or L-shaped form, or to conform to irregular curves and angles.

Qualities are numerous, but they may be said to vary between about ·9 and 400 tufts to the sq. inch. The average European hand-made carpet will not run to more than from 16 to 30.

The principal seats of the Oriental hand manufacture of carpets are India, Persia, Egypt, Turkey-in-Asia and China; to which countries may perhaps be added Greece, to where, since the World War, a certain amount of the Turkish carpet industry has been transferred.

In Persia the chief centres are Kerman, Feraghan and Kurdistan; each of which produces carpets of characteristic patterns and qualities.

Turkish carpets are, broadly speaking, of coarser texture than Persian. The typical Turkey carpet comes from Ushak, but the industry extends over many parts of Asia Minor.

Carpets are also made in Tripoli, Tunis and Algiers.

The manufacture of carpets is widely distributed throughout India in the localities of Mirzapore, Benares, Masulipatam, Kashmir, Multan, Amritzar and Peshawar; while rugs of a cheaper type are made in Bengal. Indian carpets generally are less fine in fabric, as well as in design and colour, than Persian.

The European, or Occidental, branch of the trade is located in Maffersdorf (formerly Czechoslovakia), Holland, Donegal, Carlisle, Wilton and the Balearic islands.

European hand-tufted carpets may be regarded upon a different footing from Asiatic, inasmuch as, although in the localities named, carpets of characteristic Eastern design and colouring are produced, their staple trade has always been rather along the lines of specialties; and the makers have catered rather for architects, decorators and public bodies than for the average consumer.

In the East, the weaving of carpets has long been and is still largely a family affair. The women and children sit in front of the loom, and work under the supervision of the matriarch. Obviously the degrees of skill employed will vary; and this leads to some of the irregularities in Eastern carpets. It is not to be implied, however, that all Oriental carpets are still the product of family or tribal industry. Western methods have penetrated even to the "unchanging East"; organization of the industry has been set up; and carpet dealers' and importers' syndicates in New York, London and Paris have their agents in the East and even control their own factories.

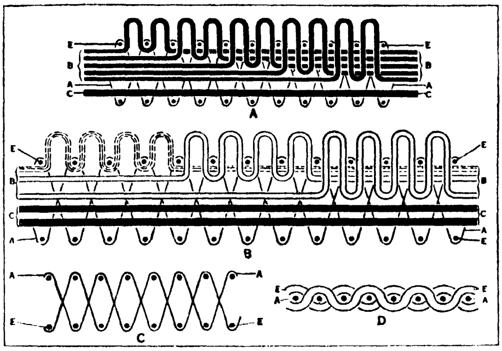
It is a common fallacy that the yarns of Oriental carpets are dyed solely with vegetable dyes, and that those dyes are intrinsically superior to aniline and alizarine dyes such as are employed for yarns for machine-made fabrics. The latter have been used for many years now by European carpet manufacturers, not because they are cheaper than vegetable dyes, but because they are easier to use, more accurate for matching purposes and faster to light. There are, of course, good and bad synthetic dyes; but the best are immeasurably superior to dyes made from plants, barks and berries. This fact has long been recognized by those who control the production of Oriental carpets, for the yarns for which aniline and alizarine dyes are now extensively employed.

The subject of dyeing naturally leads to that of the so-called "washing" or "faking," to which a large proportion of Eastern carpets are submitted. The object of this is two-fold; to soften the colours and to give an appearance of age, and to obtain a gloss which the wool does not naturally possess. The process involves the use of chlorine or acetic acid to give the faded effect, while glycerine and ironing are employed to get the glossiness. It can hardly be supposed that this treatment does not detract to some extent from the life of the carpet; but this consideration appears to be outweighed by that of the more attractive appearance. The process has been tried upon Wilton carpet, but with doubtful success.

Brussels Carpets.—Of machine made carpets, Brussels is naturally first to be mentioned, as it was the first to be made in Europe. It is a loop-pile fabric, having a strong foundation of linen, jute and cotton yarns, together with that portion of worsted yarn which is not utilized on the surface to form the pattern. The pattern itself is formed by differently coloured threads of worsted yarn looped over a wire. The body and back of the carpet is provided for normally by two warp beams, called the chain and the stuffer. The chain is usually of cotton, and its object is to form, in combination with the weft, the woven base of the fabric. The threads of the two chains are led through eyelets mounted on heald-frames or gears, which rise alternately in such a way as to allow the shuttle carrying the weft to be shot through the opening thus formed. The purpose of the stuffer or "dead" warp is solely to give body or weight to the fabric.

The stuffer threads are carried on eyelets in a frame, similar to the chain, but are not divided, and remain practically in the middle of the fabric. The worsted yarn, which forms the pile warp, is arranged on bobbins, in frames (generally five in number), and the threads are drawn through the harness, which consists of cords carrying eyelets, and kept taut by the weight below while connected with the Jacquard mechanism above.

The Jacquard principle is well known throughout the textile trades, and is a device for selecting and raising the threads required to form the pattern. All the warp threads are drawn through the sley or reed in such a way that there will be in each reed-space five threads of worsted (for a "five-frame" carpet), two of cotton chain, and one of stuffer. When the loom is running the Jacquard mechanism lifts one worsted thread in each reed, thus forming a shed under which the wire is introduced from the side. Underneath the wire lies the body of the fabric, consisting of the four other worsted threads in each course, the stuffer warp, and one-half of the cotton chain warp. Below the body of the fabric is the lower shed formed by the other half of the cotton chain, and through this the shuttle passes, carrying the weft at the same time as the wire is being inserted. Then the lathe, which has been lying back to allow the passing of the shuttle and the entrance of the wire, comes forward with the sley and beats up the wire and the last shot of weft against the breastplate of the loom and the last part of the woven fabric. At the same time the Jacquard allows the harness carrying the ends selected for the last lash to drop back on to a level with the others, and the gears carrying the cotton chain begin to change. Next, the lathe goes back again; one half of the chain is brought up to form a shed, under which and over the rest of the threads the shuttle passes back, thus effectively tying in the worsted threads which are looped over the wire.



A FROM MURPHY, "TEXTILE INDUSTRIES" (GRESHAM); B, C AND D FROM "CARPET MANUFACTURE" (BRADBURY)

FIG. 2.—A. LONGITUDINAL SECTION OF FIVE-FRAME BRUSSELS CARPET WITH SINGLE STUFFER WARP. B. LONGITUDINAL SECTION OF THREE-FRAME BRUSSELS CARPET WITH DOUBLE STUFFER WARP. C. LONGITUDINAL SECTION OF CARPET, SHOWING CHAIN AND WEFT. D. TRANSVERSE SECTION OF CARPET, SHOWING CHAIN AND WEFT. A. CHAIN; B. PILE WARP, C. STUFFER WARP, E. WEFT

Brussels and Wilton carpets are described as being 5, 4 or 3 frames, according to the number of sets of creol bobbins carrying worsted warp threads. (*See* fig. 2.)

The demand for all qualities of Brussels carpeting has declined steadily for many years, as the fabric has suffered from the competition of Axminster and of Tapestry; being essentially less economic in manufacture than either of these. A good Brussels, however, is an excellent carpet, and will last for many years.

After leaving the loom the roll of carpet is measured, dried, "picked" or mended, shorn, inspected, and sometimes pressed.

Wilton Carpets.—Wilton carpet is similar in manufacture in many respects to Brussels, and the looms are in practice convertible from one fabric to the other without much difficulty. The preparation of yarn is substantially identical, and the weaving and finishing operations very similar.

The essential differences are:—

In weaving Wilton the loops of worsted yarns are cut, so that the surface is velvety instead of being ribbed. This is effected by the use of a flat narrow wire ending in a knife blade, which stands outside the fabric when the wire is inserted but severs the loops of worsted as it is withdrawn. Many makes of Wilton, for the sake of holding down the pile more securely, have three shots of weft to each row of pile instead of two. The cutting of the yarn, which has the effect of exposing the ends instead of the sides of the wool fibre, gives a richer "plush-like" surface effect both in appearance and to the touch; while the treble weft makes a firmer fabric. (Fig. 3.)

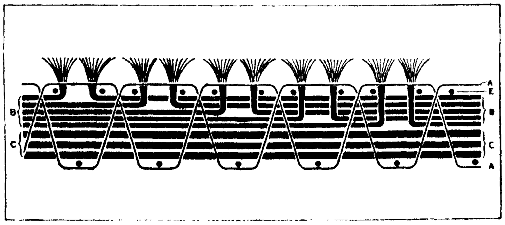
The standard Wilton quality has a pile of about $\frac{3}{16}$in. high and contains about 90 points to the sq.in.; but the fabric lends itself readily to fine and luxurious effects, and there are qualities made with a deeper pile and of a fineness of about 120 to the sq. inch. Cheaper qualities are also made with a woolen pile yarn of a coarseness of about 60 to the sq.in., but these qualities do not compete very effectively with the more attractive Axminster at about the same cost.

Wilton carpets, like Brussels, have two limitations—one economic and one artistic. For every square of the pile warp showing on the surface there are two to five parts uneconomically used in the body of the fabric; and the number of "frames" that can be worked one over the other to form the pattern is limited to six. These limitations, however, are not serious ones; and the Wilton carpet in its higher grades is regarded by many as the best of all machine-made carpets. It is certainly the finest; and the closeness of texture, broadly speaking, means both finer effects and better wear.

The higher grades of Wilton are made from 95 to 128 points to the sq.in.; so that, in the matter both of delicacy of design and of texture, effects can be produced in Wilton which surpass those of any other carpet fabric, with the exception of the finest Persians.

Axminster Carpets.—An Axminster carpet presents a somewhat similar appearance to a Wilton carpet, but the essential difference between the two fabrics is that the surface of the former is composed of tufts inserted in the fabric, while the surface of the latter is formed by cutting the pile warp threads.

Axminster carpets, though in point of time a comparatively recent development of the industry, may claim to be, in point of structure, the nearest related of all machine-made carpets to the Oriental ancestor. The similarity lies in the fact that they are tufted; and the tuft, though inserted in the fabric mechanically and bound down without being knotted, undoubtedly represents the knotted tuft of the original hand-made carpet. The essential feature of a tufted Axminster carpet is that the tufts are inserted row by row between the warp threads, either before or after being cut off, and are then bound down by the weft, and so woven into the ground of the texture. Each tuft is used on the surface and forms part of the design; none of the tuft material is buried or wasted in the body of the fabric, beyond what is needed for attachment to the weft.



FROM MURPHY, "TEXTILE INDUSTRIES" (GRESHAM)

FIG. 3.—LONGITUDINAL SECTION OF FIVE-FRAME WILTON CARPET WITH TREBLE STUFFER WARP. A. CHAIN; B PILE WARP; C. STUFFER WARP, E. WEFT

As in other carpet fabrics, there are various qualities of Axminster carpeting, the most popular is made in a pitch of 7 to the inch, with a beat-up of about $6\frac{1}{2}$; giving 45 tufts to the sq in., each tuft being about $\frac{7}{8}$in. high. Fig. 4 gives the transverse section through the weft of the weave ordinarily employed, though there are several variations, of which another is shown in the same figure. The figure forms a flat back and gives the tuft a distinct inclination out of the vertical, adding a point of similarity to the hand-tufted carpet; and the latter figure gives the back a ribbed appearance, the tuft in this case remaining vertical.

Each of these two named weaves has its merits. The former gives better cover with its sloping tuft, while the latter claims increased resiliency and immunity from the shading in made-up carpets, so noticeable with the first-named weave.

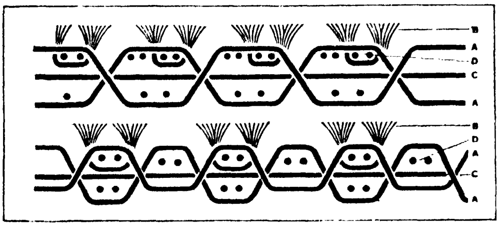
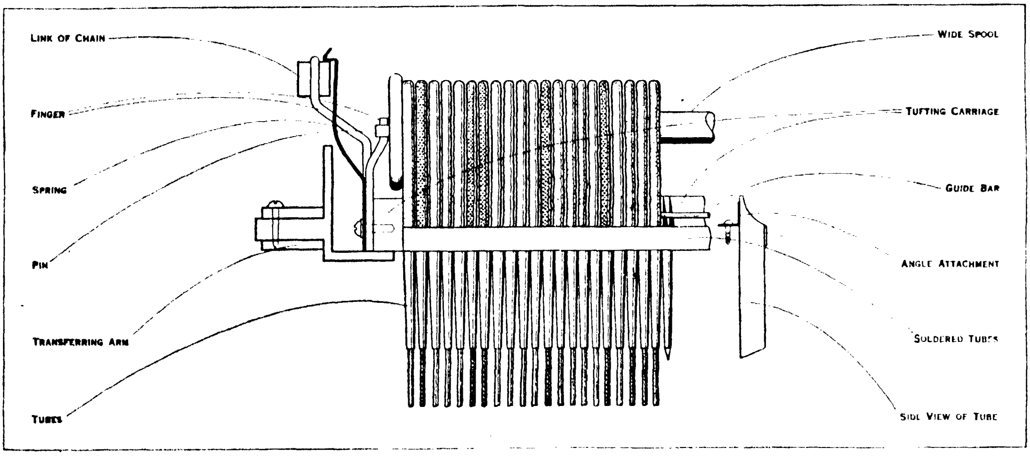


FIG. 4.—LONGITUDINAL SECTIONS OF IMPERIAL AXMINSTER. A. CHAIN, B TUFTS; C STUFFER WARP D. DOUBLE WEFT

Axminster manufacture consists of two processes, the pile yarn being arranged to form the design before it is put into the loom The dyed yarn of the various colours for the design is first wound on to a 6in. bobbin. The yarn from this bobbin has then to be wound on to a series of wide spools, the number of which will be the number of the rows of tufts in one complete repeat of the design to be woven, while each spool contains as many ends of yarn as there are squares in the width of the design. This operation is called setting, or sometimes reeding-in. The 6in. bobbins are arranged on a frame on vertical or horizontal pegs in their various colours, corresponding to those of the first row of the design. The yarn is then wound off the bobbins on the 27in. spool, and when the spool is full the operation is repeated as often as is necessary for weaving the required quantity. Then the bobbins are rearranged for the second row of the design and so on.

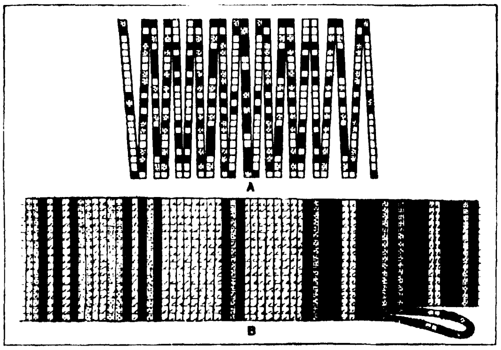


FROM MURPHY, "TEXTILE INDUSTRIES" (GRESHAM)

FIG. 5. TUFTING MECHANISM FOR AXMINSTER LOOM

The yarn on the wide spools is then threaded through a series of tin tubes, the number of which corresponds with the number of ends on each spool. The tufting carriages are then placed, in the correct rotation to form the pattern, upon a pair of endless chains, which are actuated by the mechanism of the loom. The wide spools and carriages are then successively detached from the chains and carried down to the fell of the cloth in such a way that the ends of the tuft yarns are inserted between the upper shed of the chain warp. In this position they are tied down by the passing of a weft shot, and are then cut off by a pair of broad knives working at the level of the surface of the carpet. The spool and carriage are then replaced on the chains, and the succeeding spool brought into position (fig. 5).

Another method of the Axminster principle of inserting tufts into the weave of the fabric is that of conveying tufts already cut by means of gripper or nippers. This is sometimes worked in combination with the wide spools, but more satisfactorily in combination with yarn carriers operated by a Jacquard with a differential lift mechanism for selecting the colours. In this case the yarns are placed on bobbins in frames as in the Brussels or Wilton looms, and then led into carriers which are grooved and slotted metal strips. The slots are fitted with springs which hold the threads of yarn one above another, presenting their ends to the front of the loom. The Jacquard mechanism causes the colour required for each square of the pattern to be lifted to a certain height. The grippers, mounted on a shaft, are operated so as to seize the ends of the tufts, which are then cut off and inserted at the fell of the cloth between the chain warp threads, where they are tied down by weft shots.

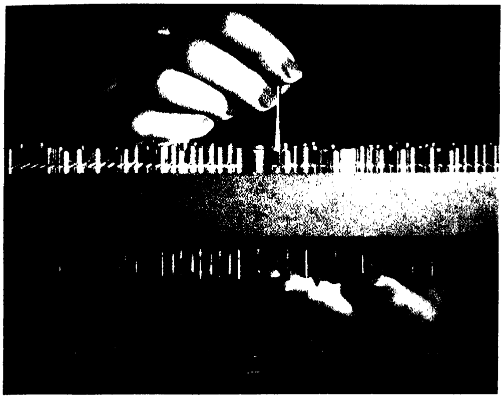


FROM MURPHY, "TEXTILE INDUSTRIES" (GRESHAM)

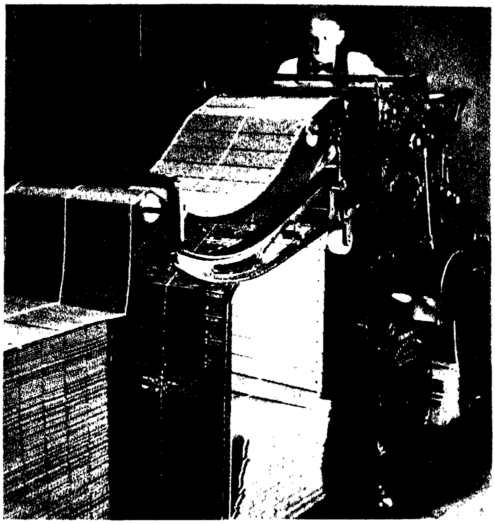
FIG 6.—A. CHENILLE DESIGN PAPER CUT-UP. B. CHENILLE CLOTH BEFORE CUTTING

Chenille Carpets.—Chenille Axminster carpeting possesses features which differentiate it from the other kinds of carpets. Like Orientals, it can be woven to any width, up to 33ft., any reasonable length, any shape, and of any design or number of

CARPET MANUFACTURE



Cutting the Jacquard cards. The weaving process for Wiltons is similar in principle to the operation of a player-piano; the needles in the loom are controlled by a series of pattern cards with holes punched according to the colour appearing on the checked design paper

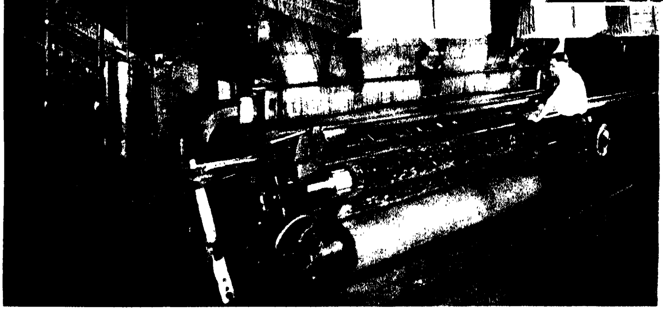


Making duplicate sets of Jacquard cards on a repeating machine after they are laced together, so that several looms may be used to produce carpets of the same design

Winding the yarn on spools

Placing the spools of yarn in proper order on the creel frames back of the loom. From two to six frames are used, one for each colour; additional colours may be obtained by designing the fabric so that more than one colour is used in a number of the frames

PHOTOGRAPHS BY COURTESY OF MOHAWK CARPET MILLS, INC.

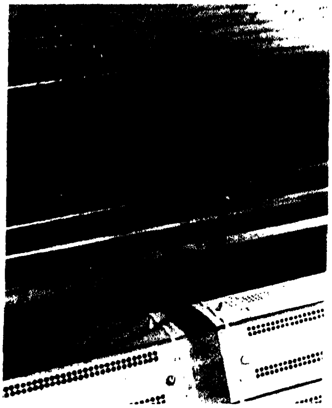


Side view of a Wilton loom, showing the creel frames of yarn in the rear and the Jacquard cards at the top. For a close-up view of the Jacquard mechanism in operation see Plate II, fig. 1

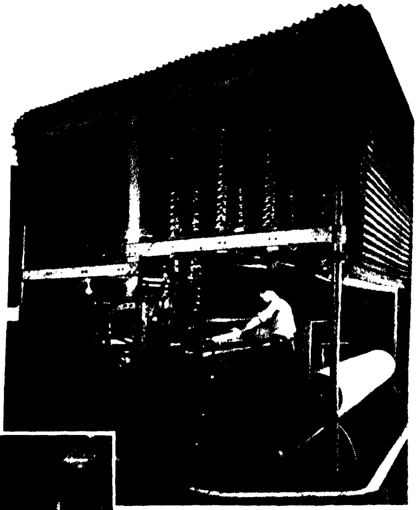
STEPS IN THE WEAVING OF WILTON CARPETS AND RUGS

PLATE II

CARPET MANUFACTURE



Left: Close view of the Jacquard mechanism for a Wilton loom. As the Jacquard card (see Plate I) moves against the needle plate, the needles enter the individual holes in the card, thereby permitting the hooks on top of the lift wires, through which the yarn is threaded, to engage the lifting grate shown at the top of the picture. The surface yarns are thus raised in the weave to effect the design. All other needles are pushed back by the card, and the hooks controlled by them are not engaged in the lifting grate. These yarns are then buried in the body of the fabric



Above: Axminster loom. The spools of yarn are placed in sequence in an endless chain; each spool presents itself at exactly the right moment to achieve the design. One complete revolution of the chain weaves a complete rug

Left: Chenille loom. The furry strips of chenille are woven into fabrics up to 30 ft. in width. The tufting is done by hand, with steel combs

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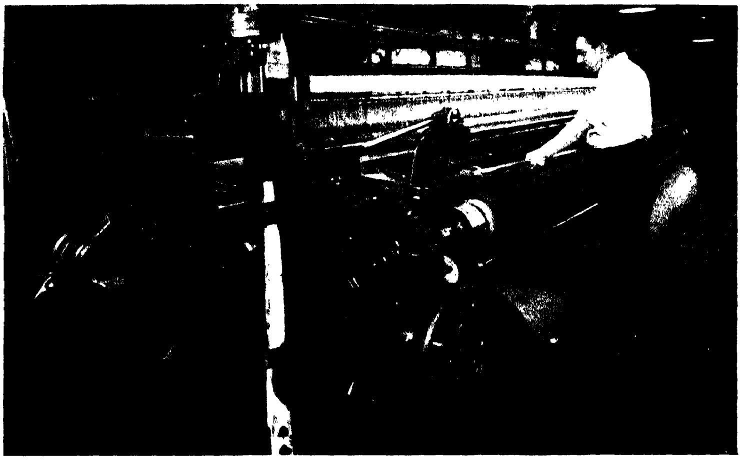
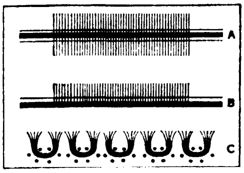


Right: Velvet tapestry loom, which produces most solid-colour broadloom fabrics. The pile is woven over wires and is cut as the wires are withdrawn

LOOMS FOR WEAVING WILTON, AXMINSTER, CHENILLE AND VELVET OR TAPESTRY CARPETS colours. It is the product of two distinct processes; the formation of the chenille fur, and the weaving of that fur, which is the weft, into a carpet. It is, in fact, about the only cut-pile carpet fabric in which the pattern is distinctively formed by the weft; for in almost all other makes the weft only performs the function of combining with the chain to form the woven fabric.

The dyed yarn, which is generally woollen, is wound on to cops which fit inside shuttles for the weft looms. The paper design to which the weaver has to work is cut up into strips two squares wide (fig. 6a), and the weaver attaches this strip to the fabric as it is woven and changes the shuttles carrying yarn of various colours in accordance with the colours on the design paper. The warp of the loom consists of sets of ends of fine cotton at intervals of from half-an-inch to an inch, according to the pile desired. Thus the woven fabric consists of a woollen weft of various colours held together at intervals by a fine cotton warp (fig. 6b).

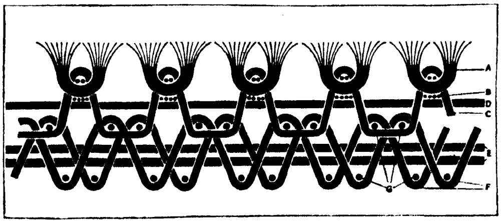


FROM "CARPETS" (PITMAN AND SONS)

FIG. 7.—A. CHENILLE FUR AFTER CUTTING. B. CHENILLE FUR CUT AND FOLDED. C. TRANSVERSE SECTION SHOWING FUR INSERTED

The next process is the fur-cutting. The roll of cloth with its horizontal stripes is taken to the cutting machine, where it is cut into strips by a series of knives set upon a revolving cylinder and spaced so that they sever the woollen weft-threads between the cotton warps as the fabric passes over the cutting bed, and leave the independent strips of fur held together by the fine cotton warp. Immediately after being cut free these strips of fur pass over a jet of steam and steam-heated cylinder, whose surface is formed with a series of **V**-shaped grooves. This has the result of folding upwards the cut ends of the woollen yarn and giving a permanent **V**-shape in section to the fur. The object of this is that when the fur comes to be woven its pile shall be turned in one direction. The damping of the fur just before passing over the grooved cylinder is sometimes effected by rollers revolving in a trough filled with water (*fig. 7*). The newly formed fur is then reeled off into individual skeins. It is marked both with its pattern number and series number and sorted into its proper sets.

The second part of Chenille manufacture is the weaving of the fur into the carpet, which is done on what is known as a setting loom. The warp of a setting loom consists of chain and stuffer, as in the Brussels and Wilton looms, while sometimes an additional one is used, called the float warp. There is also the catcher warp, which is of fine strong cotton. Its function is merely to hold down the fur weft when it is inserted into the fabric. Besides the fur weft, there is the jute or coarse woolly filling weft, of which there are four shots to each one of fur. (*See* fig. 8.)



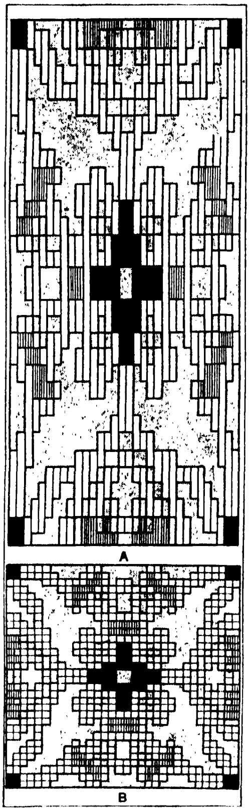
FROM "CARPETS," (PITMAN AND SONS)

FIG. 8.—LONGITUDINAL SECTION OF CHENILLE AXMINSTER
A. Chenille fur. B. Fur weft. C. Catcher warp. D. Float warp. E. Stuffer warp. F. Chain. G. Filling weft

When a carpet is to be woven the fur is wound into cops, which are served out to the weaver in their proper order. The shuttle carrying the fur weft is shot across the loom below the catcher warp but above all other warps. The loom stops automatically, and the weavers (two to each wide loom) set the fur with combs, taking care that the design matches correctly with the previous shot, and that the catcher threads settle down neatly through the pile. The loom is restarted and the four shots of filling weft inserted. Alternatively the fur may be inserted by a travelling arm, operated between the catcher and the other warps, which leads the fur from a basket or can. Chenille carpets have become very popular since their introduction, partly of course owing to this fabric being the first with a cut pile to be applied to the manufacture of wide carpets in one piece; partly to the wide range of colours that can be employed; and partly to its comparative cheapness.

Tapestry Carpets.—Tapestry is a fabric made alternatively with a looped pile or a cut pile, called Velvet, which possesses a close affinity to Brussels and Wilton respectively in its appearance and texture. In its method of manufacture, however, it has something in common with Chenille, inasmuch as it is essentially a two-process fabric, while the pattern is wholly in the surface and is the direct result of the preliminary and not of the weaving process. No Jacquard is used.

The underlying principle of the fabric is the attainment of economy by the use of one frame of worsted yarn on which the pattern is printed in its various colours instead of dyeing five frames of yarn, each of a different colour. The worsted can be coloured before or after the weaving, and in the former case, which is the standard method, it is printed in an elongated form to allow for the reduction caused by the insertion of the wires in weaving (fig. 9). The yarn is wound on to a large drum from 12ft. to 40ft. in circumference and with a face of from 18in. to 72in.; and the colour is applied by means of a carriage bearing a colour-roller, which is drawn across the face of the drum pressing upon the yarn threads. The printer changes the colours in accordance with the design paper and the "scale-board." When the printing is finished the yarn is scraped, removed from the drum, looped and ticketed in rotation to show the place each thread occupies in the design. The colour is then fixed by being steamed, and the yarn is rinsed and dried. The yarn is wound on to large bobbins, duly numbered, and thence on to a warp beam of the width of the fabric to be woven. The "setters" arrange the threads so as to form the pattern, which is still in its elongated form (fig. 10a), but which assumes its correct shape when woven (fig. 10b).



FROM MURPHY, "TEXTILE INDUSTRIES" (GRESHAM)

FIG. 9.—A. REPEAT OF DESIGN IN A TAPESTRY CARPET, ELONGATED AS PRINTED. B. SAME DESIGN AS IT WILL APPEAR WHEN WOVEN

The method of weaving is substantially the same as with Brussels and Wilton, the wires being round for Tapestry or provided with knives for the Velvet (fig. 11).

The demand for Tapestry and Velvet carpets has changed, as with other fabrics, from piece goods to breadth squares and on to seamless squares, with a corresponding increase in the cost of manufacture, for the Tapestry and Velvet carpet can only be produced economically if in large quantities.

The chief disadvantage of these fabrics is that the transition from one colour to another in the same length of worsted cannot be made quite suddenly, so that in the design the colour will appear to have run, and the clearly defined pattern effect of Brussels and Wilton is unobtainable. Apart from that, Tapestry and Velvet have much to commend them. They can be sold at moderate prices, and are capable of a wide range of effects in design and colour, circumstances which have given them a considerable measure of popularity with the public.

Ingrain Carpets.—The kind of carpet that is variously called Kidderminster, Scotch or Ingrain differs considerably from any of the carpets hitherto described. Perhaps essentially, and in regard to texture, it is most akin to hand-woven Tapestry, having a flat ribbed surface, without tufts like Axminster or loops like Brussels.

The original type of this carpet was the Ingrain or "Two-ply Super." It was made with a worsted warp and a woollen weft in 36in. width (fig. 12a).

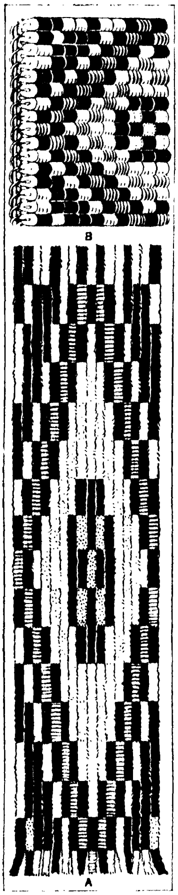
Developments have been made in various directions, but principally in those of heavier fabrics and wider looms. Additional colour effects are obtained by increasing the number of warps and of wefts, while heavier fabrics are made "three-ply." (*See* figs. 12b, c, d.)

The yard wide Ingrain is now almost extinct, and the modern form of the fabric is the so-called Art Square, a fairly heavy seamless carpet, generally produced in bold and simple effects of design and colour.

Compared with some carpet fabrics, Ingrain must take a modest place. It cannot be regarded as luxurious to tread upon, its flat surface lacking the resiliency which the looped or cut pile gives to even a cheap Brussels or a Tapestry velvet. On the other hand, it is capable of giving artistic effects, within its limits, and the fabric is clean in wear and easily handled.

Modern Developments: Wide-Looms.—The exact date cannot be fixed; but from about the first decade of the 20th century a demand began to be evinced in the carpet markets of the world for carpets made without seams, and manufacturers began to set themselves to meet the demand. Hitherto, seamless carpets had, broadly speaking, only been available in hand-tufted fabrics, in Art Squares, and in Chenille; but thereafter there was a speedy development in other machine-made fabrics.

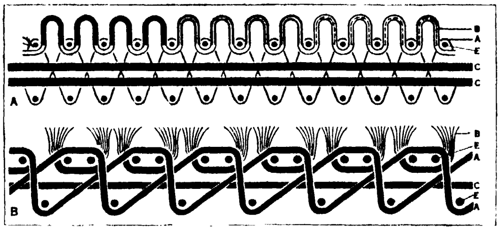
Wilton.—Looms of 9ft. in width and upwards were constructed in both the United States and in Great Britain on the same principles as the 27in. loom, and worked with fair success; although the expense, both of construction and of operations, made the fabric costly out of proportion to the narrow goods. In particular, the withdrawing of the wire at the side necessitated the total width of the loom being more than double the width of the fabric woven and slowed down the rate of production considerably. To overcome these objections a loom was devised in the United States in which the cutting of the loops was effected by a series of knives placed across the carpet parallel to its length. Looms on this principle have been brought to something like perfection and are being operated in Great Britain and in the United States with success; while other wide looms are being run both in these countries and on the Continent.



FROM MURPHY, "TEXTILE INDUSTRIES" (GRESHAM)

FIG. 10.—A. PRINTED THREADS AS SET READY FOR WINDING ONTO THE BEAM. B. THE SAME AS WOVEN

Axminster.—Similarly, the tube principle has been extended from the 27in. width to widths of 9ft. and more, and the gripper principle, combined with the Jacquard, has had a like development. The most striking departure, however, of the Axminster principle has been a wide loom which produces mechanically a fabric in which the tufts are tied with a Ghiordes knot, exactly as in the Oriental hand-looms. This loom was introduced into Kidderminster in 1910, and has been brought to a high pitch of efficiency. The fabric is made in various qualities up to 49 tufts per inch.



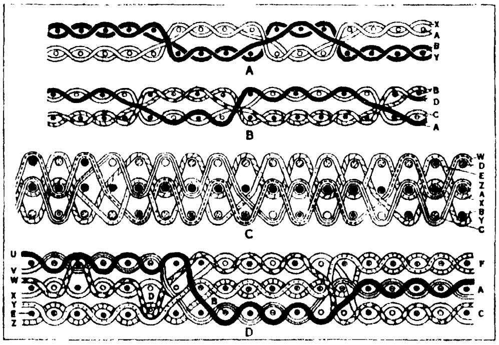
FROM "CARPET MANUFACTURE" (BRADBURY)

FIG 11.—A. TAPESTRY CARPET WITH ROUND WIRE. B. TAPESTRY VELVET CARPET WITH CUT PILE. A. CHAIN. B. PILE WARP. C. STUFFER WARP. E WEFT

Tapestry.—This fabric has followed the same lines of development, and many wide printed fabrics, especially with the cut pile velvet, are being produced on the same principle as the narrow weave.

Design and Colour.—There was a time when the phrase "flaming Brussels carpet" was not entirely undeserved, but this has long passed. The naturalistic and geometrical styles, both brightly coloured, passed away, partly under the influence of William Morris, who introduced, and of others who developed, the conventional style of decoration in carpets.

The carpet trade then passed into an era of reproduction, the masterpieces of Oriental and, in particular, of Persian art being studied and carefully copied. The next stage in the development of carpet design was the drawing of inspiration from the characteristic decorative styles of other countries and ages; first China and Japan, then France; the periods of Louis XIV., Louis XVI., and of Rococo, Renaissance, Empire. The ancient art of Egypt, Crete, Greece, Assyria and Rome was laid under contribution, and with creditable and interesting results which have proved healthy and stimulating for the industry. Finally, the Cubist or Futurist or



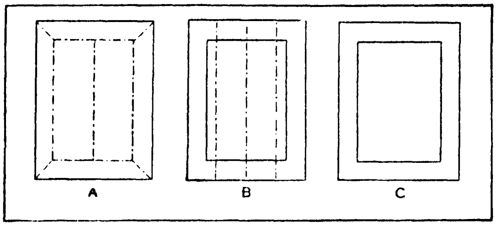
FROM "CARPET MANUFACTURE" (BRADBURY)

FIG. 12.—INGRAIN CARPET

A. Two-ply in warp and weft, transverse section, through warp. A and B. warp threads of different colours. X and Y. wefts of corresponding colours. B. Two-ply warp and weft, four colours in each warp and weft. A. black; B. red; C. white; D. olive. C. Three-ply warp and two-ply weft; section through warp. A. black stuffer warp; B,C,D,E. coloured warps; W,X,Y,Z. wefts of same colours as B,C,D,E. D. Three-ply warp and weft section through warp. A,B,C,D,E,F. coloured warps; U,V,W,X,Y,Z. coloured wefts

Modern movement in the world of art has not been without its influence on carpet design, to which indeed the flat and bold treatment of decoration is very suitable. In the result, therefore, it may be said that there is a cosmopolitanism and an eclecticism of taste in carpet design at the present day; and a good pattern of whatever style, provided that it be true to the style and that it be well coloured, whether quietly, brightly or richly, is sure of acceptance.

Carpet Statistics.—In Germany the industrial census of 1925 gives the number of carpet factories as 1,016, and of workers as 15,265, of whom 6,297 were female. The chief localities of the industry are Barmen, Elberfeld, Düren, Chemnitz, Leipzig, Berlin and Cottbus; but there are many small concerns scattered throughout the country.



A.—MITRED RUG, OR SEAMED RUG MADE FROM ROLL-GOODS
B.—SEAMED RUG (MADE FROM RUG PARTS)
C.—SEAMLESS RUG (WOVEN WHOLE)

A large number of carpet factories is given in a French trade directory of 1926, but the majority of these are small concerns making hand-tufted carpets. The most important centres are Roubaix and Tourcoing for machine-made goods, and Aubusson, Beauvais and Felletin for hand-tufted. Nîmes, Halluin, Lannoy and Persan are also centres.

In 1913 the value of production was estimated at 25,000,000frs. No post-War figures are available, but in 1926 France exported 16,925sq.in. of knotted woollen carpets to the value of 5,747,000frs. and 23,124 metric cwts. of other woollen carpets, to the value of 101,061,000frs. No reliable figures are obtainable as to the number of workers now engaged in the industry.

The principal centres of the carpet trade in Great Britain are in the south of Scotland (about 25%), the north of England (20%), and Kidderminster (40%). There are about 4,500 looms of various kinds and widths in the whole trade, of which number Wilton, Chenille, Tapestry and Axminster contribute together equally about 95%, the balance being ingrain and hand-tufted looms. The total number of employees in 1927 was about 37,000, of whom rather more than one quarter were male.

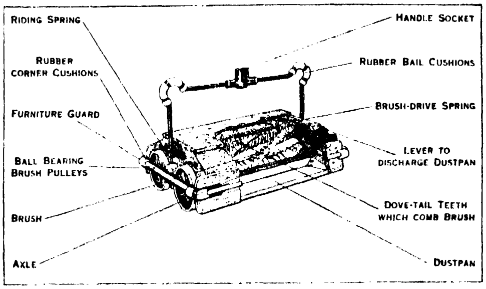


DIAGRAM OF THE INTERIOR MECHANISM OF MODERN CARPET SWEEPER

The total production in the United Kingdom in 1924 was 21,617,000sq.yd., in the following proportions:—Tapestry 31%, Brussels and Wilton 16%, Axminster (tufted and chenille) 45%, hand-tufted and other n.e.s. 6%. The value was £9,844,000 in the following proportions:—Tapestry, 16%, Brussels and Wilton 22%, Axminster 55%, ingrain 1%, hand-tufted and others 6%.

The imports have increased from 605,181sq.yd. of the value of £1,168,055 in 1919 to 5,684,859sq.yd. value £3,043,914 in 1927; figures which are ominous for the future of the British carpet manufacturing industry. The exports in 1920 were 6,921,400sq.yd. valued at £4,544,376; and in 1926, 6,757,200sq yd., valued at £3,063,148.

In the United States there are 62 carpet factories. In 1927 the production amounted to 65,628,740sq.yd., and the number of workers employed was 32,290. The chief centres of manufacture are Philadelphia, Pa., Amsterdam and Yonkers, N. Y., Worcester and Clinton, Mass., Freehold, N. J., and Thompsonville, Conn. The imports of oriental carpets into the United States in 1928 were 2,294,865sq.yd.

See R. S. Brinton, *Carpets* (1919). (R. S. B.)

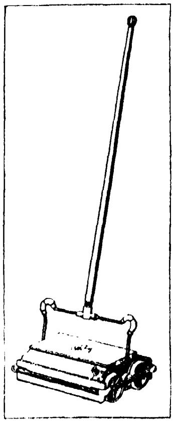
In 1927 production in the American carpet and rug industry, according to the U.S. bureau of census, used 88,159,905 lb. of wool and purchased 34,705,995 lb. of woollen and worsted yarn from independent spinners. The square yardage produced that year was: carpets 16,228,421, rugs, 49,400,310. This yardage was divided as follows:

	Yd.		*Yd.*
Chenille . . .	329,176	Axminster . .	24,831,411
Velvet . . .	16,079,418	Tapestry . . .	6,410,441
Smyrna . . .	473,169	Ingrain . . .	265,609
Wilton . . .	10,266,199	All others . .	6,973,317

Sixty-two manufacturers reported a total of 9,771 looms and a total production value of $164,709,290.00. For the calendar year 1928 the U.S. tariff commission reported 3,184,520 sq yd. of woven floor coverings imported—mostly oriental rugs from Persia, Turkey and China. The exports have always been negligible and in 1928 the total yardage shipped, mainly to Mexico and Canada was 124,600.

CARPET-SWEEPER. The first mechanical carpet-sweeper seems to have made its appearance sometime in the sixties. About 1865, a satisfactory sweeper was manufactured which consisted of a substantial cast-iron box, carried upon a pair of transverse rollers, containing a roller-brush which derived its motion from a belt pulley which was fixed upon the projecting end of the rearward roller. The brush, by its rotation, was assumed to throw its sweepings into the box, which would subsequently be turned upside down and emptied. Owing to the weakness of the belt drive and the extreme resistance offered by the brush due to its compact formation as a roller, this machine swept imperfectly. Other carpet-sweepers followed during the next decade, all designed with a brush of the same close formation, and each creating for its driving apparatus the same difficulty of overcoming the frictional resistance of the carpet. In some, however, came the germ of the modern system which discards the belt pulleys and secures rotation by the friction of four rubber faced carrying wheels against the peripheries of drums which are fixed upon the brush.

There was still, however, the problem of the fully filled brush, and the sluggish movement which arose from its grip on the carpet. Succeeding designers, therefore, abandoned the brush with the roller surface and introduced one bearing somewhat the appearance of a paddle wheel, the bristle being set in four rows and so arranged in a waved or serpentine form, that while not more than five knots of bristle could grip the pile at any one time, the carpet was as fully covered in the course of a complete revolution as if the brush retained its former mass of closely packed material. Now, driven with less resistance and turned more swiftly by means of the rubber faced 'friction drive," the brush at last swept successfully, and thus gave an acceptable foundation for all the developments which have followed.



MODERN CARPET SWEEPER

After 1889 improvements came rapidly. Among them must be counted the introduction of the ball-bearing brush, an innovation which established antifriction bearings at the point most vital to assured rotation of the essential sweeping element: also the automatic comb, by means of which the revolving brush is cleaned while working and so relieved of any entwining hair or thread which otherwise would tie the bristle; the resilient india-rubber cushions which guard salient parts of the machine to neutralize the effects of hurried sweeping. (*See* also HOUSEHOLD APPLIANCES.) (J. L. P.)

CARPI, GIROLAMO DA (1501–1556), Italian historical and portrait painter, born at Ferrara, was one of Benvenuto Garofalo's best pupils. He spent several years in copying the works of Correggio, succeeding so well as to be able to dispose of his own works as originals by the master. Da Carpi's best paintings are a "Descent of the Holy Spirit," in the church of St. Francis at Rovigo; a "Madonna," an "Adoration of the Magi," and a "St. Catharine," at Bologna; and the "St. George" and the "St. Jerome" at Ferrara.

CARPI, UGO DA, Italian 15th-century painter, was long held the inventor of the art of printing in chiaroscuro, later brought to such perfection by Parmigiano and by Baltasar Peruzzi of Siena. The researches of Michael Huber (1727–1804) and Johann Gottlob Immanuel Breitkopf (1710–94) have proved, however, that this art was known and practised in Germany by Johann Ulrich Pilgrim (Wächtlin) and Nikolaus Alexander Mair (1450-*c.* 1520), at least as early as 1400, while the date of the oldest of Da Carpi's prints is 1518. Printing in chiaroscuro is performed by using several blocks. Da Carpi usually employed three—one for the outline and darker shadows, another for the lighter shadows, and a third for the half-tint. By means of them he printed engravings after several pictures and after some of the cartoons of Raphael. Of these a "Sybil," a "Descent from the Cross," and a "History of Simon the Sorcerer" are the most remarkable.

CARPI, a Dacian tribe established upon the lower Danube from the 1st century B.C. They rose to considerable power during the 3rd century A.D., and, claiming to be superior to the Goths, demanded that their incursions into Roman territory should likewise be bought off by tribute. When this was refused they invaded in force, but were beaten back. After this, they joined with the Goths in their successful inroads until both nations were defeated by Claudius Gothicus. Later, after repeated defeats under Diocletian and Galerius, they were taken under Roman protection and the greater part established in the provinces of Pannonia and Moesia; some were left beyond the Danube, and they are last heard of as allies of the Huns (*q.v.*) and Sciri in the time of Theodosius I.

CARPI, a town and episcopal see of Emilia, Italy, in the province of Modena, 9 mi. N.N.W. by rail from the town of Modena. Pop. (1936) 13,805 (town), 34,189 (commune). It is in the centre of a fertile agricultural district. Carpi contains several Renaissance buildings of interest, the façade of the old cathedral (an early Romanesque building), the new cathedral (after 1513), the nave of S. Niccolò and a palace, all by Baldassare Peruzzi: while the prince's palace (with a chapel containing frescoes by Bernardino Loschi of Parma, 1489–1540) and the colonnades opposite the theatre are good. These, and the fortifications, are all due to Alberto Pio of Carpi, a pupil of Aldus Manutius.

See *Memorie Storiche e documenti su Carpi* (Carpi, 1905).

CARPINI, JOANNES DE PLANO, the first noteworthy European explorer of the Mongol empire (in the 13th century), and the author of the earliest important Western work on northern and central Asia, Russian Europe and other regions of the Tatar dominion. He appears to have been born at Piano della Magione (formerly Pian del Carpine) near Perugia. He was one of the companions and disciples of his countryman, St. Francis of Assisi, and can hardly have been younger than the latter, born in 1182. Joannes took a foremost part in Franciscan teaching in northern Europe, holding successively the offices of warden (*custos*) in Saxony, and of provincial (*minister*) of Germany, and afterwards of Spain, perhaps of Barbary and of Cologne. He was in Cologne at the time of the great Mongol invasion of eastern Europe and of the disastrous battle of Liegnitz (April 9, 1241). The dread of the Tatars was still on men's minds four years later, when Pope Innocent IV. despatched the first formal Catholic mission to the Mongols (1245), partly to protest against the latter's invasion of Christian lands, partly to gain trustworthy information regarding the hordes and their purposes; behind there may have lurked the idea of opening diplomatic intercourse with a power whose alliance might be invaluable against Islam.

At the head of this mission the pope placed Friar Joannes, at this time certainly not far from 65 years of age; and to his discretion nearly everything in the accomplishment of the mission seems to have been left. The legate started from Lyons, where the pope then resided, on Easter day (April 16, 1245), and was joined at Breslau by another Minorite, Benedict the Pole, appointed to act as interpreter. The onward journey lay by Kiev; the Tatar posts were entered at Kanev; and thence the route ran across the Dnieper (*Neper, Nepere,* in Carpini and Benedict) to the Don and Volga (*Ethil* in Benedict; Carpini is the first Western to give us the modern name). Upon the last-named stood the *Ordu* or camp of Batu, the famous conqueror of eastern Europe, and the supreme Mongol commander on the western frontiers of the empire, as well as one of the most senior princes of the house of Jenghiz. Here the envoys, with their presents, had to pass between two fires, before being presented to the prince (beginning of April 1246). Batu ordered them to proceed onward to the court of the supreme khan in Mongolia; and on Easter day once more (April 8, 1246) they started on the second and most formidable part of their journey—"so ill," writes the legate, "that we could scarcely sit a horse; and throughout all that Lent our food had been nought but millet with salt and water, and with only snow melted in a kettle for drink." Their bodies were tightly bandaged to enable them to endure the excessive fatigue of this enormous ride, which led them across the Jaec or Ural river, and north of the Caspian and the Aral to the Jaxartes or Syr Daria (*quidam fluvius magnus cujus nomen ignoramus*), and the Mohammedan cities which then stood on its banks; then along the shores of the Dzungarian lakes; and so forward, till, on the feast of St. Mary Magdalene (July 22), they reached at last the imperial camp called *Sira Orda* (*i.e.*, Yellow Pavilion), near Karakorum and the Orkhon river—this stout-hearted old man having thus ridden something like 3,000m. in 106 days.

Since the death of Okkodai the imperial authority had been in *interregnum*. Kuyuk, Okkodai's eldest son, had now been designated to the throne; his formal election in a great *Kurultai*, or diet of the tribes, took place while the friars were at Sira Orda, along with 3,000 to 4,000 envoys and deputies from all parts of Asia and eastern Europe, bearing homage, tribute and presents. They afterwards, on Aug. 24, witnessed the formal enthronement at another camp in the vicinity called the Golden Ordu, after which they were presented to the emperor. It was not till November that they got their dismissal, bearing a letter to the pope in Mongol, Arabic and Latin, which was little else than a brief imperious assertion of the khan's office as the scourge of God. Then commenced their long winter journey homeward; often they had to lie on the bare snow, or on the ground scraped bare of snow with the traveller's foot. They reached Kiev on June 9, 1247. There, and on their further journey, the Slavonic Christians welcomed them as risen from the dead, with festive hospitality. Crossing the Rhine at Cologne, they found the pope still at Lyons, and there delivered their report and the khan's letter.

Not long afterwards Friar Joannes was rewarded with the archbishopric of Antivari in Dalmatia, and was sent as legate to St. Louis. He died on Aug. 1, 1252; hence it is clear that the priest did not long survive the hardships of his journey.

He recorded the information that he had collected in a work variously entitled in the mss. *Historia Mongalorum quos nos Tartaros appellamus*, and *Liber Tartarorum*, or *Tatarorum*. This treatise is divided into eight ample chapters on the country, climate, manners, religion, character, history, policy and tactics of the Tatars, and on the best way of opposing them, followed by a single (ninth) chapter on the regions passed through. Friar Joannes' *Historia* is in many ways the chief literary memorial of European overland expansion before Marco Polo. It first revealed the Mongol world to Catholic Christendom; its account of Tatar manners, customs and history is perhaps the best treatment of the subject by any Christian writer of the middle ages. We may especially notice, moreover, its four name-lists: of the nations conquered by the Mongols; of the nations which had up to this time (1245–47) successfully resisted; of the Mongol princes; and of the witnesses to the truth of his narrative, including various merchants trading in Kiev whom he had met. All these catalogues, unrivalled in Western mediaeval literature, are of the utmost historical value.

For a long time the *Liber Tartarorum* was known chiefly through an abridgment in the vast compilation of Vincent of Beauvais (*Speculum Historiale*) made in the generation following the traveller's own, and printed first in 1473. Hakluyt (1598) and Bergeron (1634) published portions of the original work; but the complete and genuine text was not printed till 1838, when it was put forth by M. D'Avezac as an editorial masterpiece embodied (1839) in the 4th volume of the *Recueil de voyages et de mémoires* of the Geographical Society of Paris. It was edited by C. R. Beazley for the Hakluyt Society in 1913. Joannes' companion, Benedictus Polonus, also left a brief narrative taken down from his oral relation. This was first published by M. D'Avezac in the work just named.

The following four mss. may be noticed: (1) "Corpus," *i.e.*, Corpus Christi college, Cambridge, No. 181; (2) "Petau," *i.e.*, Leyden university, 77 (formerly 104)—both these are certainly earlier than 1300; (3) "Colbert," *i.e.*, Paris, National Library, Fonds Lat. 2,477, of about 1350; (4) "London-Lumley," *i.e.*, London, British Museum mss. Reg. 13 A xiv., of late 13th century. Three other mss. certainly exist; yet six more are perhaps to be found, but none of these possesses the value of those given above. Besides the editions referred to in the body of the article, we may also mention (1) P. Girolamo Golubovich, *Biblioteca bio-bibliografica della Terra Santa e dell' Oriente Francescano* (1906), vol. i. (1215–1300), pp. 190–213; (2) *William of Rubruck . . . with . . . John of Pian de Carpine*, edit. by W. W. Rockhill, Hakluyt Society (1900), especially pp. 1–39; (3) C. Raymond Beazley, *Dawn of Modern Geography*, ii. (1901), 279–317, 375–380; iii. 85, 544, 553; and *Carpini and Rubruquis*, Hakluyt Society (1903), especially pp. 7–18, 43–144, 249–295.

CARPZOV (Latinized *Carpzovius*), the name of a family, many of whose members attained distinction in Saxony in the 17th and 18th centuries as jurists, theologians and statesmen. The family traced its origin to Simon Carpzov, who was burgomaster of Brandenburg in the middle of the 16th century, and who left two sons, Joachim (d. 1628), master-general of the ordnance in the service of the king of Denmark, and BENEDIKT (1565–1624), an eminent jurist.

BENEDIKT CARPZOV was born in Brandenburg on Oct. 22, 1565, and after studying at Frankfurt and Wittenberg, and visiting other German universities, was made doctor of laws at Wittenberg in 1590. He was admitted to the faculty of law in 1592, appointed professor of institutions in 1590, and promoted to the chair *Digesti infortiati et novi* in 1601. In 1602 he was summoned by Sophia, widow of the elector Christian I. of Saxony, to her court at Colditz, as chancellor, and was at the same time appointed councillor of the court of appeal at Dresden. After the death of the electress in 1623 he returned to Wittenberg, and died there on Nov. 26, 1624, leaving five sons. He published a collection of writings entitled *Disputationes juridicae*.

BENEDIKT CARPZOV (1505–1666), second of the name, was the second son of the preceding, and like him was a great lawyer. He was born at Wittenberg on May 27, 1505, was at first a professor at Leipzig, obtained an honourable post at Dresden in 1639, became ordinary of the faculty of jurists at Leipzig in 1645, and was named privy councillor at Dresden in 1653. Among his works which had a very extensive influence on the administration of justice, even beyond the limits of Saxony, are *Definitiones forenses* (1638), *Practica nova Imperialis Saxonica rerum criminalium* (1635), *Opus decisionum illustrium Saxoniae* (1646), *Processus juris Saxonici* (1657), and others. He did much, both by his writings and by his official work, to systematize the body of German jurisprudence which had resulted from the intersection of the common law of Saxony with the Roman and Canon laws. His last years were spent at Leipzig, and his time was entirely devoted to sacred studies. He died at Leipzig on Aug. 30, 1666.

JOHANN BENEDIKT CARPZOV (1607–1657), fourth son of the first Benedikt, was born at Rochlitz in 1607. He became professor of theology at Leipzig in 1643, made himself chiefly known by his *Isagoge in Libros Ecclesiarum Lutheranarum Symbolicos* (pub. in 1665), and died at Leipzig on Oct. 22, 1657, leaving five sons, all of whom attained some literary eminence.

AUGUST CARPZOV (1612–1683), fifth son of the first Benedikt, distinguished himself as a diplomatist. Born at Colditz on June 4, 1612, he studied at the universities of Wittenberg, Leipzig and Jena, and in 1637 was appointed advocate of the court of justice (*Hofgericht*) at Wittenberg. Entering the service of Frederick William II., duke of Saxe-Altenburg, he took part in the negotiations which led to the peace of Westphalia in 1648, and was appointed chancellor by the duke in 1640. From 1672 to 1680 he was chief minister of Ernest I. and Frederick I., dukes of Saxe-Coburg-Gotha, and died at Coburg on Nov. 19, 1683. August, who was a man of earnest piety, wrote *Der Gekreuzigte Jesus* (1679) and some treatises on jurisprudence.

JOHANN GOTTLOB CARPZOV (1670–1767), grandson of Johann Benedikt, was born at Dresden in 1670. He was educated at Wittenberg, Leipzig, and Altdorf, became a learned theologian, and in 1719 was appointed professor of oriental languages at Leipzig. In 1730 he was made superintendent and first pastor at Lübeck His most important works were the *Introductio in libros canonicos bibliorum Veteris Testamenti* (1721), *Critica sacra V. T.* (1728), and *Apparatus Historico-criticus Antiquitatum V. Test.* (1748). He died at Lübeck on April 7, 1767.

JOHANN BENEDIKT CARPZOV (1720–1803), great-grandson of the first Johann Benedikt, was born at Leipzig, became professor of philosophy there in 1747, and in the following year removed to Helmstädt as professor of poetry and Greek. In 1740 he was named also professor of theology. He was author of various philological works, wrote a dissertation on Mencius, and published an edition of Musaeus. He died on April 28, 1803.

On the family of Carpzov, *see* Dreyhaupt, *Beschreibung des Saalkreises*, supp. to pt. 2, p. 26.

CARQUINEZ STRAIT BRIDGE, in California, about 25m. N. of San Francisco, begun April 1923 completed May 1927, is one of the largest cantilever bridges in the world. The Carquinez bridge is notable also for its deep-water pier foundations, built in 90ft. of water, 132ft. below water-level.

It is noted also for the consideration which was given in designing the structure to provide special protective details against possible earthquake forces.

The main bridge has two anchor arms of 500ft., two cantilever spans of 1,100ft. and a central tower span of 150ft. At the southern end the bridge has a steel viaduct approach 1,132ft. long, making the total length of the bridge 4,482ft. between abutments. The trusses are spaced 42ft. centre to centre, providing space for a roadway 30ft. wide between curbs and two sidewalks 4ft. wide. The floor is a reinforced-concrete slab and was designed for a loading of three lines of 20-ton trucks, or two lines of 20-ton trucks with a track for electric trains. Silicon steel (80,000–95,000lb. ultimate strength, 45,000lb. minimum yield-point) was adopted for the main material of the towers and for compression members and built tension members in the trusses of the suspended spans, cantilever arms and anchor arms. For the principal tension members in the main trusses (and for some tension members in the viaduct trusses) heat-treated carbon steel eyebars were adopted, specified to have a minimum elastic limit of 50,000 and a minimum ultimate resistance of 80,000lb. per square inch. Provision for longitudinal expansion of the main structure is made at the shore end of each anchor arm and at the shore end of each suspended span. Each suspended span is fixed to the tower cantilever arm, the entire 11-in. expansion of the 1,100ft. span being provided for at the shore end of the suspended span. Stops are provided at the ends of the main structure to limit the longitudinal movement to the necessary temperature expansion. For greater security against longitudinal forces (including possible earthquake effects), six hydraulic buffers are provided at the expansion joints between the suspended spans and the shore cantilever arms, also between the main structure and the viaduct, in order to check longitudinal vibrations or any other sudden longitudinal movement. Their valves close and arrest the motion of the main piston whenever force is applied with a velocity exceeding 0·4in. per second. The horizontal earthquake force assumed in the investigation of the structure and in the proportioning of the buffer details corresponds to an assumed maximum acceleration of 15in. per second per second. (D. B. S.)

CARRACCI, LODOVICO, AGOSTINO and **ANNIBALE,** three celebrated Italian painters, were born at Bologna in 1555, 1557, and 1560 respectively. They were the founders of the so-called eclectic school of painting,—the principle of which was to study in the works of the great masters the several excellences for which they had been respectively pre-eminent, and to combine these in the productions of the school itself.

Lodovico, the eldest, son of a butcher, was uncle to the two younger, Agostino and Annibale, sons of a tailor, and had nearly finished his professional studies before the others had begun their education. He studied under Tintoretto in Venice, and ultimately projected the opening of a rival school in his native place. He then sent for his two nephews, and induced them to abandon their handicrafts (Agostino being a goldsmith, and Annibale a tailor) for the profession of painting. Agostino he first placed under the care of Fontana, retaining Annibale in his own studio; but he afterwards sent both to Venice and Parma to copy the works of Titian, Tintoretto and Correggio. On their return, the three relatives, assisted by an eminent anatomist, Anthony de la Tour, opened, in 1589, an academy of painting under the name of the Incamminati. The affability and zeal of the Carracci rapidly lifted their academy in popular estimation They continued together till, at the invitation of Cardinal Farnese, Annibale and Agostino went to Rome in 1600 to paint the gallery of the cardinal's palace. Thence the latter went to Parma to paint the great salon of the Casino. Here he died in 1602, when on the eve of finishing his renowned painting of "Celestial, Terrestrial and Venal Love." Annibale continued to work alone at the Farnese gallery till the designs were completed, when he retired to Naples, where he died in 1609. Lodovico always remained at his academy in Bologna. He died in 1610, and was interred in the church of Santa Maria Maddalena. The works of Lodovico are numerous in the chapels of Bologna. The most famous are: —the "Madonna standing on the moon, with St. Francis and St Jerome beside her, attended by a retinue of angels," "John the Baptist," "St. Jerome," "St. Benedict," and "St Cecilia"; and the "Limbo of the Fathers" With skill in painting Agostino combined the greatest proficiency in engraving (which he had studied under Cornelius de Cort). Annibale's chief works are: the "Dead Christ in the lap of the Madonna," the "Infant and St. John," "St. Catherine," "St. Roch distributing alms" (now in the Dresden gallery), and the "Saviour bewailed by the Maries."

See A. Venturi, *I Carracci e la loro scuola* (1895).

CARRANZA, BARTOLOMÉ (DE MIRANDA) (1503–1576), Spanish theologian, was born at Miranda d'Arga, Navarre. He studied at Alcalá, entered (1520) the Dominican order, and then studied (1521–25) at Salamanca and at Valladolid, where he was teacher of theology. No Spaniard save Melchior Cano rivalled him in learning. In 1530 he was denounced to the Inquisition as limiting the papal power and leaning to opinions of Erasmus, but the process failed. In 1540 he declined the sees of Canaria and of Cusco, Peru. Charles V. chose him an envoy to the Council of Trent (1546) where he insisted on the duty of bishops and clergy to reside in their benefices, publishing at Venice (1547) his *De necessaria residentia personali*, which he treated as *juris divini*. His Lenten sermon to the council, on justification, caused much comment. In 1550, he was made provincial for Castile. Charles sent him to England (1554) with his son Philip on occasion of the marriage with Mary. He became Mary's confessor, and laboured earnestly for the old religion, especially in Oxford In 1557 Philip appointed him archbishop of Toledo. In 1558 he was again denounced to the Inquisition, on the ground of his *Comentarios sobre el Catechismo* (Antwerp, 1558), which in 1563, however, was approved by a commission of the Council of Trent. Philip now imprisoned him for nearly eight years, and the book was placed on the Index. Carranza appealed to Rome and after ten years confinement, the final judgment found no proof of heresy, but compelled him to abjure 16 errors, and suspended him from his see for five years, and secluded him to the Dominican cloister of Sta. Maria sopra Minerva. He died on May 2, 1576. His *Summa Conciliorum et Pontificum* (Venice, 1546) has been often reprinted (as late as 1821), and has permanent value.

See P. Salazar de Miranda, *Vida* (1788); J. A. Llorente, *Hist. Inquisition in Spain* (English abridgment, 1826); Hefele in I. Goschler's *Dict. encyclopédique de la théol. cath.* (1858); H. Laugwitz, *Bartholomaus Carranza* (1870).

CARRANZA, VENUSTIANO (1859–1920), president of Mexico, was born in Cuatro Ciénegas, Coahuila, in 1859. He was educated in Mexico City but later returned to his native State where he took part in public life from 1887 to 1900. He was a senator from 1901 to 1911. In 1910 he joined the revolution of Francisco I. Madero against President Porfirio Díaz. Upon Madero's triumph Carranza was elected governor of Coahuila, and was acting in that capacity when President Madero was overthrown and assassinated in 1913. Carranza protested against the murder and became the leader of the revolution against Gen. Victoriano Huerta, being recognized by all revolutionists under the title of "first chief." While the revolution was going on Carranza initiated important social and economic reforms, such as the nationalization of petroleum and coal subsoil, the endowment of commons (*ejidos*) to townships and laws protecting industrial and country labour. These reforms were later embodied in the constitution of 1917.

After Gen. Huerta had been forced to leave the country, Francisco Villa and other military leaders turned against Carranza but he succeeded in defeating them. Carranza, thereupon, gathered in Querétaro a constituent assembly to support the new constitution of Mexico, which was promulgated on Feb. 5, 1917. He was elected president of Mexico, and remained in power from May 1, 1917, until his death. While in the presidency his efforts were primarily directed towards the reconstruction of his country. When the United States entered the World War, Mexico remained neutral mainly on account of Carranza's firm decision to keep his country outside the influence of the United States, which he feared would have been the result of entrance into the World War.

Carranza's name is chiefly known in South America on account of his constant efforts towards a closer co-operation between the Latin-American countries, and his attempts to lay down the foundations for a permanent understanding between the South American States.

At the beginning of 1920, when presidential elections were approaching, the two foremost military leaders, Alvaro Obregón and Pablo González, both candidates, revolted against the Government, charging Carranza with giving official support to Ignacio Bonillas, a civilian candidate. Carranza, feeling unsafe, left Mexico City and attempted to reach Vera Cruz in order to organize his followers; but he was defeated at Aljíbes, Puebla, and fled towards the north with a handful of faithful partisans. A few days afterwards he fell into a snare set by Obregón's generals, and was murdered at Tlaxcalaltongo, Puebla, on May 21, 1920.

(L. CA.)

CARRARA or **CARRARESI,** a powerful family of Longobard origin which ruled Padua in the 14th century. They take their name from the village of Carrara near Padua, and the first recorded member of the house is Gamberto (d. before 970). In the wars between Guelphs and Ghibellines the Carraresi at first took the latter side, but they subsequently went over to the Guelphs. This brought them into conflict with Ezzelino da Romano; Jacopo da Carrara was besieged by Ezzelino in his castle of Agna, and while trying to escape was drowned. Another Jacopo led the Paduans in 1312 against Cangrande della Scala, lord of Verona, and though taken prisoner managed to negotiate a peace in 1318. To put an end to the perpetual civil strife the

Paduans elected him their lord, but at his death (1324) his nephew and heir, Marsiglio, was forced to give Padua over to Cangrande and was appointed its governor. When Cangrande died in 1319, and was succeeded by his nephew Martino, Marsiglio negotiated with the Venetians in 1336, and in 1337 secretly introduced Venetian troops into Padua, and regained the lordship. He died in 1338, and was succeeded by his relative Ubertino, a typical mediaeval tyrant, but a patron of the arts, who built the Palazzo dei Principi, the castle of Este. He died in 1345. His distant kinsman Marsiglietto da Carrara succeeded him, but was immediately assassinated by Jacopo da Carrara, a prince famed as the friend of Petrarch. In 1350 Jacopo was murdered by Guglielmo da Carrara, and his brother Jacopino succeeded, reigning together with his nephew Francesco.

In 1355 Francesco (il Vecchio) rose against his uncle and imprisoned him. Francesco changed the traditional policy of his house by quarrelling with the Venetians, in the hope of obtaining more advantages from the Visconti of Milan. He refused help to the Venetians, at war with Hungary over Dalmatia in 1356, and his mediation between them and Hungary, at the instance of the pope, was unfavourable to the republic. He received Feltre, Belluno and Cividale from the Hungarian king, but in 1369 a frontier dispute led to war between him and Venice, in which Carrara was defeated and had to pay a huge indemnity (1373). In 1378 he joined the league against Venice formed by Genoa, Hungary and the Scala and took part in the siege of Chioggia. In 1385 the Venetians set the Scala against Carrara, who thereupon allied himself with the treacherous Gian Galeazzo Visconti. The Scala were expelled from Verona, but Carrara and Visconti quarrelled over the division of the spoils. Visconti was determined to capture Padua as well as Verona, and made an alliance with Venice and the house of Este for the purpose. Francesco surrendered to Visconti, in whose hands he remained a prisoner until his death in 1392.

Francesco Novello, his son, was compelled to surrender owing to dissensions in Padua itself. He was forced to renounce his dominions and received a castle near Asti; but he escaped to France and, after a series of romantic adventures, succeeded in making peace with Venice, which was becoming alarmed at the restless ambition and treachery of Visconti; in 1390 he raised a small armed force and seized Padua, where he was enthusiastically welcomed by the citizens, and for several years reigned there.

At the death of Visconti in 1402 Carrara allied himself with Guglielmo Scala, seized Verona, and tried to capture Vicenza. But the Vicentini had always hated the Carraresi, and after a short siege gave themselves over to Venice. This led to a war between that republic and Padua, for now that Visconti was dead the Venetians had no longer any reason to protect Carrara. Padua and Verona were besieged; the latter, defended by Novello's son Jacopo, was soon captured. Novello himself, besieged in his capital, held out until Nov. 1405, hoping for help from Florence and also from certain Venetian nobles with whom he was intriguing. He and his sons, Francesco III and Jacopo, were conveyed to Venice, and when their intrigues with Venetian traitors came to light they were tried and strangled in prison (1406). Novello's other son Marsiglio made a desperate attempt to recover Padua in 1435, but was discovered and killed.

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CARRARA: *see* APUANIA.

CARREL, ALEXIS (1873–1944), surgeon and biologist, was born at Ste. Foy-les-Lyon, France, June 28, 1873. He graduated at the University of Lyons in 1890, received his medical degree in 1900, and for two years was prosecteur à la Faculté de Médecine. He began there his experimental researches, and continued them in 1905 at the University of Chicago. In 1906 he was appointed to the staff of the Rockefeller Institute for Medical Research in New York, becoming a member in 1912. He developed a new method for suturing blood vessels, which made it possible to perform blood transfusion safely, and to transplant arteries, veins and organs. He also studied the preservation of tissues outside the body and its application to surgery. This work led him in 1911 to investigate the conditions of tissues when they are living actively outside the organism. He was awarded the Nobel Prize in physiology and medicine in 1912 for his contributions to the surgery of blood vessels. On the outbreak of World War I he returned to France and devised the Carrel-Dakin treatment for wounds, by means of which many lives were saved and countless amputations were avoided. At the same time, with Dr. du Noüy and other collaborators he studied the laws of the cicatrization of wounds. In 1919 he resumed his work at the Rockefeller Institute for Medical Research, and developed new techniques for the cultivation of tissues and organs *in vitro* Among his publications are *Man, the Unknown* (1935) and (with Charles A. Lindbergh) *The Culture of Organs* (1938).

CARRERA, JOSÉ MIGUEL (1785–1821), leader in the early struggle for the independence of Chile, and first president of the country, was born in Santiago, Chile, on Oct. 15, 1785. He received a military education in Spain, and served in the Spanish army against Napoleon. In July 1811 he returned to Chile, where, supported by his brothers, Juan José and Luis, he based a successful revolution against Spain upon the ineffectual beginnings of Martínez de Rozas. By a *coup d'état* in 1812 he placed himself at the head of the nationalist government and later in the same year made himself dictator. He reorganized the nationalist army and the public finances, created the National institute, and inaugurated the first newspaper. He forced Martinez de Rozas to seek refuge in Mendoza (1813); and but for the common danger of invasion from Peru in 1813, his rivalry with Bernardo O'Higgins would have culminated in civil war. In the same year his military incompetence caused the national junta to displace him in favour of O'Higgins, but early in 1814 he headed a fresh revolt and regained control. During the ensuing invasion of Spanish forces from Peru, he and O'Higgins were defeated at Rancagua (Oct. 1814) and fled to Mendoza. When San Martín sided with O'Higgins, Carrera sought aid against his opponents, first in Buenos Aires, and then in 1815 in the United States. On his return to Argentina in 1816, he was forbidden entrance to Chile. This and the death of his brothers at the hands of the followers of San Martín moved him to lend his military experience to the provincial chiefs in their sporadic revolts against Buenos Aires. He was eventually betrayed by his own men, captured, and shot at Mendoza on Sept. 4, 1821.

CARRERA, RAFAEL (1814–1865), Guatemalan president, was born on Oct. 24, 1814, in Guatemala city, of mixed parentage, partly Indian. He had no formal education, and throughout his life remained illiterate. After Guatemala became a member of the United Provinces of Central America, Carrera allied himself with the Centralists or conservatives and led Indian guerrilla bands against the liberal Federalist government Guatemala city came under his control in 1839 and the Federalist government collapsed. With it collapsed the Central American union, and Guatemala became an independent state. From then until his death Carrera remained almost uninterruptedly in control of Guatemala, ruling it absolutely and suppressing all attempts at liberalism. In 1851 he put down the only serious threat to his rule by defeating an army of Federalists who were again attempting to unite the Central American governments. In 1854 he was made president for life. Until his death on April 4, 1865, Guatemala was the dominant country of the Central American republics.

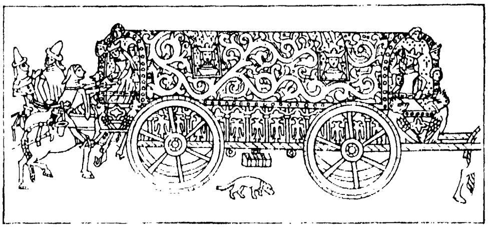
Probably more than any other single person, Carrera was responsible for the dissolution of the union of the Central American republics and for their formation into separate states

CARRHAE, BATTLE OF, 53 B.C. Not since Cannae (*q.v.*) had the Romans suffered a defeat which made such a deep impression upon them as this, at the hands—or, more truly, the arrows

—of the Parthians. And four centuries were to pass before they sustained such another, at Adrianople (*q.v.*), this time irreparable in its more profound aspects. But as the damage wrought at Adrianople was more permanent than at Carrhae, so Carrhae was never retrieved as Cannae had been. For not only was the immediate effect of Carrhae to turn back the tide of Roman conquest, its ebb taking it as far back as the Aegean, but only one of their subsequent expeditions against Parthia achieved practical success, and that even was not long-lived. Crassus, triumvir with Caesar and Pompey, invaded Parthia with seven legions, totalling some 35,000 foot and 4,000 cavalry. On reaching the plains of Mesopotamia he was met by the Parthian general, Surena, with an army composed entirely of horse-archers, mainly light cavalry but with a nucleus of heavy. To the foot-marching Roman legions they were an intangible foe, and not until he had penetrated several days' march beyond the Euphrates, through the desert, did Crassus make contact with them, and then apparently with only a detachment of light cavalry, who served to screen the concentration of the main body. Crassus is said to have accepted the advice of his son for an immediate attack in contradiction to that of his other subordinates who urged that the army should encamp and rest, on the banks of the river Balissus. Upon the Roman advance the Parthians opened and, wheeling outwards, encircled the Roman army, and from a distance kept it under a continuous shower of arrows. Whenever the Romans sought relief by a charge of their own light troops, the Parthians fell back, only to close again and renew the arrow-storm as soon as these retired. Moreover, its moral and material effect was sustained by the battle drill which, as with the Mongols later, was the basis of the Parthian tactics. This comprised a repeated "leap-frogging" by which the forward troops were relieved by successive echelons in rear, while those relieved replenished their quivers from camel-borne reserves. The younger Crassus ultimately attempted a powerful charge with a mixed body of some 6,000 cavalry and foot to ease the pressure. But the Parthians lured it into a continued pursuit which drew it far from the main body, and then, holding it in front with a line of heavy cavalry, surrounded it with light horse, and kept it under fire until its ranks withered and died—all but a few hundred taken prisoners. The return of the victors to the main battlefield strained still more the morale of the sorely harassed Roman army, and although still unbroken when nightfall brought temporary relief, its dissolution was only postponed. During the night it made a short retreat to the shelter of the walls of Carrhae, where it stayed during the day following. A further retreat was attempted the next night, but at daybreak it was assailed afresh and had to take refuge on a hill. Here Crassus was killed during negotiations for surrender and only an exhausted remnant of his army succeeded ultimately in recrossing the Euphrates. Carrhae saw the first great failure of the flexible infantry legion evolved from the Hannibalic war and from the reforms of Marius. The instrument of its downfall was the mobile horse-archer, and it is noteworthy that the eastern Roman empire came later to adopt this instrument in place of the legionary infantry as the staple of its military organization. This fact has all the more significance since the introduction in modern armies of the armoured fighting vehicle (*see* TANKS), for between this and the horse-archer, especially the armoured horse-archer, there is a close historical parallel just as there is between the campaign of Carrhae and the effects seen in the early exercises of experimental armoured forces. The parallel has struck the imagination of many of the advocates of the tank, but there is still greater significance in the sequel to Carrhae seen in the military organization of the Byzantines.

CARRIAGE, a vehicle which is designed for animal traction and is provided with accommodation for the driver and those travelling. A carriage may have seats for the passengers only, such as when it is driven by one or more mounted postilions. A trotting sulky, used for racing, is an example of a conveyance which has a seat for the driver only.

The Primitive Vehicle.—The earliest type of vehicle was the sledge, having no wheels and mounted on runners. From the sledge was evolved the rude cart with wheels made of wooden discs, used for agricultural and other purposes for many centuries with few modifications. Such carts are still to be seen in Spain, Portugal and Mexico drawn by a pair of yoked oxen.


STATE CARRIAGE OF THE 14TH CENTURY, AFTER THE LOUTERELL PSALTER
This carriage was pulled by a team of 5 horses in single file, two of them ridden by grooms

The requirements of war and hunting had a marked effect on the general design of the vehicle, for as early as 1500 B.C. the Egyptian two-wheeled chariot had reached a high state of perfection. These chariots, and those of the Assyrians, Greeks and Romans may be regarded as the first carriages, since they were made for carrying man, rather than as a means for helping him to move his belongings more easily. The chariot was without seats or springs, the horses were yoked to a central pole, but the wheels had spokes and the various parts were well finished and often elaborately decorated. The chariot was entered from behind, an exception being the British chariot which had a front entrance and also a seat, a pattern developed by the Romans for dispatch riding and civil uses.

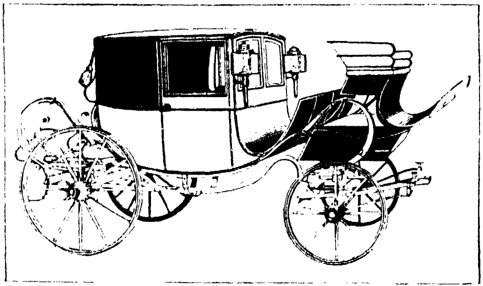


FIG. 1.—THE "CHARIOT," THE FASHIONABLE CARRIAGE OF THE EARLY 19TH CENTURY
This model has 6 springs, leather braces, combined wood and iron perch, and a swan neck for turning in narrow places. There is a front boot with high driving seat. The swelling at the back of the body is the sword case

Early Types of Four-wheeled Wagons.—Equally important as the chariot, from the historical standpoint, was the four-wheeled Grecian agricultural wagon. The Romans adopted this wagon and many were used for carrying baggage. They also used the *reda* which came from Hungary. These wagons, modified and made more luxurious, were utilized for carrying persons of rank, a practice copied, perhaps, from the Persian triumphal cars. The evolution of the vehicle has consisted of improvements as much in the design of the under-carriage and suspension of the body as in the body itself. The wagon which had a direct influence on the design of the first coaches had its front and hind axles connected by long wooden poles, later called the perch. The front of this perch was inserted into a transom, a piece of timber lying directly above and parallel with the front axle. The back of the perch was held between the upper and lower portions of the hind axle. Above the transom and hind axles respectively further cross pieces were mounted, on which any type of body could be built by joining these cross pieces with longitudinal poles and planks to form a floor. Uprights were inserted at the ends of the cross pieces allowing body sides to be erected. The front of the perch was not fastened to the front axle as at the rear, because it was necessary that the front axle should be able to turn about its centre. For this purpose a pin was inserted right through the transom and front axle. In modern times when trees are cut down the logs are carted away on a vehicle fundamentally the same as that just described.

From A.D. 300 to 1350 was largely a period of stagnation. The war chariot had gone out of use. The two-wheeled cart was used for husbandry, and, as a decorated car, occasionally for ceremonial purposes, while the four-wheeled wagon was still employed in agriculture and for carrying goods of various kinds. The roads made by the Romans had fallen into disuse and riding in any sort of vehicle, instead of on horseback, was denounced as unmanly.

Rise of the Coach.—The contemporary horse litter was a bed or couch mounted on poles harnessed to a horse at either end. The litter was provided with a cover or tilt supported on a wooden framework. The first coach bodies were similar to the litter, but later had four corner posts supporting a canopy which took the place of the tilt, while the door was merely an apron hung on a cross bar. Such was the coach used by Queen Elizabeth. The next step was the suspension of the body on leather braces and the building in of the roof as part of the structure of the body, a type of coach used by Charles II. Carriage building may now be considered as an established industry; hackney carriages appeared early in the 17th century and stage coaches towards the latter half of the same century. About 1660 the coach body was panelled and had a hinged door, while in 1669 Pepys mentions in his diary that his coach had glass windows and that experiments were being made with steel springs. These were first introduced between the body and the ends of the leather suspension braces.

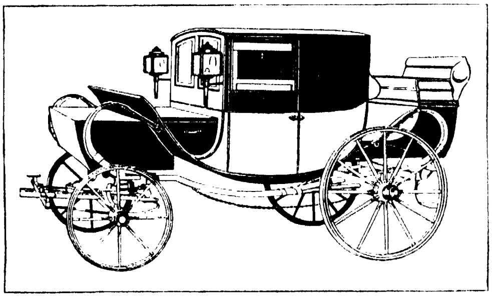


FIG. 2.—POSTING CHARIOT, USED FOR JOURNEYS IN THE EARLY 19TH CENTURY

It had a hind rumble and the body was equipped with pistol holder and sword case

Carriages of the 18th Century.—Improved craftsmanship was now in evidence. The four-wheeled chariot appeared in 1744. The body was similar to the sedan chair (introduced in 1634 into England from France) in outline and had a single seat, whereas the coach had two seats facing one another. The post chaise was like the chariot but driven by postilions. By the end of the 18th century the landau, which became very popular, was coming into use. This was similar to the coach but with the upper quarters made to open and fold back in opposite directions. There was also the barouche which had a folding head to the back seat only. Amongst two-wheeled carriages were the curricle provided with a pole and yoke, recalling the harnessing of the ancient chariot, and also various types of gigs, both varieties being self-driving carriages, showing that a new pastime had been inaugurated. Another self-driving carriage was the high perch phaeton which afforded much material for contemporary caricaturists. Between 1700 and 1800 the small elbow spring had given place to larger whip springs which formed the connection between the hind axle and the upper ends of the braces. Later the C spring was used, but still the perch under-carriage was maintained in all its essential features, as in the days before steel springs or braces were used. Wheels had iron tyres both mounted as separate pieces or as a continuous hoop. In 1792 the Collinge axle was invented which carried two or three months' supply of oil instead of a day's grease, as with the old type of axle.

The Perfection of the Art.—The increasing use of vehicles drew attention to the bad state of the roads, but improvements in this direction were slow. The first mails had been carried by coach in 1780. A much larger number of stage coaches were running and private carriages from now until the establishment of railways were being much used for long journeys, as well as for town work (Figs. 1 and 2). In 1804 the elliptic spring was invented which allowed a rigidly made body to be connected directly to the axles, so that the perch was no longer required, although the traditional type of under-carriage was improved by the addition in 1815 of an under-spring to the existing C springs and fitted to the best class of carriages. In 1838 the brougham was introduced, the idea being to provide a compact closed carriage which could be drawn by one horse. By 1850 various patterns of both two- and four-wheeled dog carts had appeared, as well as wagonettes which had longitudinal vis-à-vis seats. From the middle until the end of the 19th century the railway was performing the work of the carriages formerly used for extended travelling. (Figs. 3 and 4.) Carriages were designed to give greater ease of access, and being unencumbered with travelling equipment, more attention could be given to elegance and the reduction of weight. Various sizes of pony phaetons appeared between 1850 and 1860; then about 1870 the victoria phaeton, which was essentially a park carriage, came into fashion. For the next thirty years no new styles of carriages were invented. Within a few years of the inception of the motor car the building of horse carriages fell away rapidly, the trade adapting itself to the construction of motor bodywork.

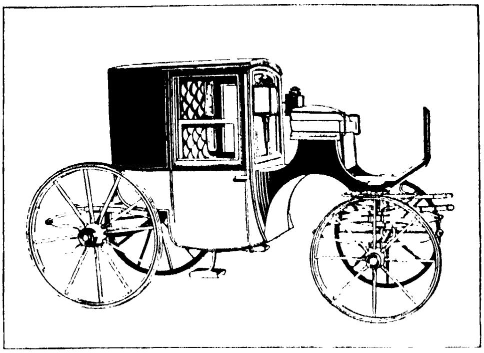


FIG 3—BROUGHAM, INTRODUCED IN THE MID 19TH CENTURY AND STILL IN USE

This carriage is called after Lord Brougham, to whose design it was made in 1838. It has the elliptical springs invented by Elliot in 1804

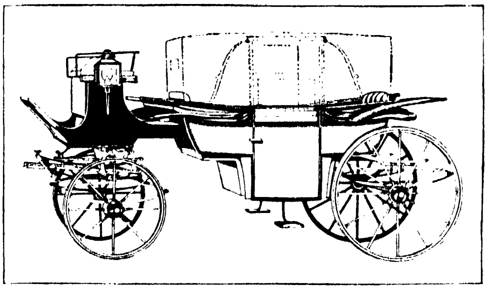


FIG. 4.—SQUARE LANDAU, WHICH STILL SURVIVES FOR CEREMONIAL PURPOSES

This landau of the late 19th century possessed the advantages of three distinct vehicles—a close carriage, a barouche or half headed carriage, and one entirely open. The dotted lines show the position of the head when up

American Carriages.—Although European styles were adopted in the United States, a distinctive type of vehicle began to be built about 1800. Extreme lightness of construction was the leading characteristic. The slender under-carriage consisted of comparatively high wheels, with the axles connected by a thin perch. The American industry developed into the largest in the world and a considerable number of buggies and other types were exported to South America, Australia and other countries.

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CARRICKFERGUS, a seaport, watering place and urban district of Co. Antrim, Northern Ireland, on the N. shore of Belfast Lough, 9½ mi. N.E. of Belfast by the Northern Counties (L.M.S.) Ry. Pop. (1937) 4,309. Area .2 sq.mi. In 1182 John de Courcy fixed a colony in the district. The castle came in the 13th century into the possession of the De Lacy family who, being ejected, invited Edward Bruce to besiege it (1315). He took it and again in 1386 the town fell to the Scots and in 1400 was destroyed by the combined Scots and Irish. Subsequently it suffered by famine and the occasional assaults of neighbouring Irish chieftains, to whom the townsmen were at length forced to pay annual tribute. Under Charles I many Scottish Covenanters settled here to avoid persecution. In the Civil wars, from 1641, Carrickfergus was one of the chief places of refuge for the protestants of Antrim; and in 1642 the first presbytery held in Ireland met here. It was later held by partisans of James II, but surrendered in 1689 to Schomberg and in 1690 William III landed here on his expedition to Ireland. In 1760 it was surprised by a French squadron which held it for a few days.

Elizabeth gave the town a charter, which was confirmed by James I, who added the privilege of sending two burgesses to the Irish parliament. The corporation, however, was superseded in 1840 by a board of municipal commissioners. Carrickfergus was a parliamentary borough until 1885; and a county of a town till 1898. It was the county town of Co. Antrim until 1850. The castle keep is still in good preservation and the town walls, built by Sir Henry Sidney, are still visible on the west and north; the north gate also remains. Trade is in linen goods, and there are flax spinning mills, bleach works and brick works. Distilling is carried on. Oyster fisheries are valuable. At Duncrue and Eden, rock salt, found in the Triassic sandstone, is mined.

CARRICKMACROSS, market town, Co. Monaghan, Eire, 68 miles N.N.W. of Dublin on the Great Northern railway. Pop. of urban district (1936) 2,095. There are remains of an Elizabethan castle, destroyed in 1641. It is an agricultural centre and manufactures lace.

CARRICK-ON-SHANNON, market and county town, Co. Leitrim, Eire. Pop. (1936) 1,015. It is situated on the upper Shannon near the confluence of the Boyle, and is on the Great Southern railway 90 m. N.W. of Dublin. It is an assize town and has some river trade.

CARRICK-ON-SUIR, market town, Co. Tipperary, Eire, on the north bank of the Suir, 14 mi. W.N.W. from Waterford on the Great Southern railway. Population of urban district (1936) 4,840. The castle dates from 1309. The suburb of Carrickbeg, connected by a 14th century bridge, has remains of a 14th century abbey. Trade is in agricultural produce and slate is quarried.

CARRIER, JEAN BAPTISTE (1756–1794), French Revolutionist and Terrorist, was born at Yolet, in Upper Auvergne. In 1792 he was chosen deputy to the National Convention. He was already known as one of the influential members of the Cordeliers' club and of that of the Jacobins. At the close of 1792 he was sent by the Convention to Flanders as their commissioner. In the following year he took part in establishing the Revolutionary Tribunal. After a mission into Normandy, Carrier was sent, early in Oct. 1793, to Nantes, under orders from the Convention to suppress the revolt which was raging there. He established a revolutionary tribunal, and formed a body of desperate men, called the Legion of Marat, to destroy in the swiftest way the masses of prisoners heaped in the jails. The form of trial was soon discontinued, and the victims were sent to the guillotine or shot or cut down in the prisons *en masse*. He also had large numbers of prisoners put on board vessels with trap-doors for bottoms, and sunk in the Loire. These, the *Noyades* of Nantes, made Carrier notorious. He was recalled by the Committee of Public Safety on Feb. 8, 1794, took part in the attack on Robespierre on the 9th Thermidor, but was himself brought before the Revolutionary Tribunal on the 11th and guillotined on Nov. 16, 1794.

See Comte Fleury, *Carrier à Nantes* (1897, 2nd ed. 1901); Lallié, *J. B. Carrier . . . 1756–1794*, etc. (1901); G. Martin, *Carrier et sa mission à Nantes* (1924). *See* also, *Correspondence of Jean-Baptiste Carrier . . . during his mission in Brittany, 1793–1794*, collected and translated by E. H. Carrier (1920).

CARRIER, a term of general application to any person who undertakes to carry the goods of another for hire, whether by land, air or water, irrespective of the method of transit. The principle of law imposing responsibility upon the carrier for the safety of the goods carried is derived from a praetorian edict of the civil law contained in the ninth title of the fourth book of the Pandects. This states: "*nautae, caupones, stabularii, quod cujusque salvum fore receperint, nisi restituent, in eos judicium dabo.*" The simplicity of the rule so enunciated has swept away, throughout most civilized nations, all secondary questions or discussions as to the measure of culpability or negligence on the part of the carrier for loss or damage to the goods carried and imposes upon him the obligation of an insurer of the goods, leaving any limitation of this general responsibility to be separately adjusted by special contract.

The law of England recognizes a distinction between common and private carriers. The former is one who holds himself out to the public as ready to carry for hire from place to place the goods of such persons as choose to employ him. The owner of a stage-wagon, a railway company, the master of a general ship, and a wharfinger carrying goods on his own lighters are common carriers, and, at common law, it makes no difference that one of the *termini* of the journey is out of England. A person who carries only passengers is not, however, a common carrier; nor is a person who merely engages to carry the goods of particular individuals or to carry goods of a particular description or upon any particular occasion. A common carrier is subject at law to peculiar liabilities. He is bound to carry the goods of any person who offers to pay his hire unless there is good reason to the contrary; as, for example, when his carriage is full or the article is inherently dangerous. He ought to carry the goods in the usual course without unnecessary deviation or delay.

Liability commences upon due delivery of the goods to him in the known course of his business. His charge must be reasonable; and he must not give undue preference to any customer or class of customers. The latter principle, as enforced by statute, is of great importance in the law of railway companies. In respect of goods entrusted to him, the carrier's liability, unless limited by special contract, is that of an insurer. There is no question of negligence as in the case of injury to passengers, for the warranty is simply to carry safely and securely. The law, however, excepts losses or injuries occasioned immediately "by the act of God or the king's enemies"—which words have a strict technical signification. It would appear that concealment without fraud, on the part of the customer, relieves the carrier from liability for negligence, though not for actual misfeasance. Fraud or deceit by the customer (*e.g.*, misrepresentation of the real value of the goods) will relieve the carrier from his liability.

The responsibility of the carrier ceases only upon delivery of the goods to the proper consignee. By the Carriers Act, 1830, the liability of carriers for "articles of great value in small compass" is determined. Should the article or parcel exceed £10 in value, the carrier is not liable for loss unless such value is declared by the customer. Where the value is thus declared, the carrier may, by public notice, demand an increased charge, for which he must, if required, sign a receipt. Failing such notice or receipt, the carrier must refund the increased charge and remains liable as at common law. Except as above no mere notice or declaration affects a carrier's liability; but he may make special contracts with his customers. The carriage of goods by sea is subject to special regulations. (*See* Affreightment.) The carriage of goods by railway and canal is subject to the law of common carrier except where varied by particular statutes. The effect of these acts is to prevent railway companies as common carriers from limiting by special contract their liability to receive, forward and deliver goods, unless the conditions embodied in the special contract are reasonable, and the contract is in writing and signed by, or on behalf of, the sender.

A railway company must provide reasonable facilities for forwarding passengers' luggage. Where luggage is taken into the carriage with a passenger, the company is not responsible for loss or damage due to the passenger's interference with the company's exclusive control of it. As carriers of passengers, companies are bound to exercise due care and diligence and are responsible for personal injuries occasioned by negligence or want of skill. Where there is a special contract or there has been contributary negligence on the part of the passenger, *i.e.*, where he might by the exercise of ordinary care have avoided the consequences of the defendants' negligence—he is not entitled to recover. By the Act of 1846 (commonly called Lord Campbell's Act), when a person's death has been caused by such negligence as would have entitled him to an action had he survived, an action may be maintained against the negligent party on behalf of the wife, husband, parent or child of the deceased. (*See* INTER-STATE COMMERCE for special American problems and practices.)

CARRIÈRE, EUGÈNE (1849–1906), French painter, born at Gournay (Seine-Inférieure) on Jan. 17, 1849, son of a Flemish father and an Alsatian mother, passed his early youth at Strasbourg and moved with his parents to Saint Quentin in 1868. His enthusiasm for art was roused on seeing the pastels of La Tour. He went to Paris in 1870 to study at the École des Beaux Arts. The war with Germany, however, interrupted his work; he enlisted as a volunteer, was made a prisoner and taken to Dresden. Here he had opportunity of studying the works of art in the gallery, and felt especially attracted to Rubens. On his return to Paris he resumed his studies under Cabanel (1872–76). In 1877 he married the woman who was henceforth to figure in his famous pictures of "maternity," and of family groups. He developed gradually a distinctive style by suppressing local colour and outline, and by modelling in planes by means of delicate contrasts of light and dark. The figures seem to be enveloped in a grey mist. His portrait renderings are alive and sensitive; and he painted some distinguished personalities of his literary and artistic circle of friends: Alphonse Daudet, Anatole France, Paul Verlaine, Louis Henri, Devillez and others. He undertook to decorate the town hall of the X. Arrondissement in Paris with a series of large panels (Palais des Beaux Arts), a work which remained uncompleted at his death in Paris on March 27, 1906. The Luxembourg has several of his pictures; but most of his work is in private ownership (Paul Gallimard and Madame Montagne Devillez). Eugène Carrière also practised lithography and sculpture. He was an enthusiastic teacher, taking an active part in the artistic life of Paris as one of the founders of the Société Nationale des Beaux Arts and of the Salon d'Automne. His writings and letters were published by the *Mercure de France* (1909).

See also Gabriel Seailles, *E. Carrière* (1901) and *E. Carrière, Essai de biographie psychologique* (1910); Gustave Geffroy, *L'oeuvre de E. Carrière* (1901); Ch. Morice, *E. Carrière* (1906); Elie Faure, *E. Carrière, peintre et lithographe* (1908).

CARRIÈRE, MORITZ (1817–1895), German philosopher and historian, was born at Griedel in Hesse Darmstadt. He studied at Giessen, Göttingen, and Berlin, taught philosophy at Giessen, and in 1853 was appointed professor at the University of Munich, where he lectured mainly on aesthetics. An avowed enemy of Ultramontanism, he helped to make the idea of German unity more palatable to the South Germans. He belonged to the theistic school of the younger Fichte, whose aim was to reconcile deism and pantheism, and he upheld the fundamental truths of Christianity. His most important works are: *Aesthetik* (Leipzig, 1850; 3rd ed., 1885), supplemented by *Die Kunst im Zusammenhang der Kulturentwicklung und der Ideale der Menschheit* (3rd ed., 1877–86); *Die philosophische Weltanschauung der Reformationszeit* (Stuttgart, 1847; 2nd ed., Leipzig, 1886), and *Die sittliche Weltordnung* (Leipzig, 1877; 2nd ed., 1891), in which he recognized both the immutability of the laws of nature and the freedom of the will. He described his view of the world and life as "real-idealism." His essay on Cromwell (in *Lebensskizzen*, 1800), which may be considered his political confession of faith, also deserves mention. His complete works were published at Leipzig in 1886–94.

See S. P. V. Lind in *Zeitschrift f. Philos.* (cvi. 1895, pp. 93–101); W. Christ in *Allgemeine deutsche Biographie* (1903).

CARRIERS. Normally when an individual recovers from an infective disease he rids himself of the causal organisms so that when he is convalescent or recovered he ceases to be infective. It has been found that a certain proportion of individuals, however, do not rid themselves of the disease-causing germs, but retain them for varying periods of time. These persons—termed carriers—have recovered completely from the disease and are apparently healthy. They exhibit no signs of infection whatsoever, and, although the bacteria are tolerated by the carriers harbouring them, the germs are capable of giving rise to disease in susceptible individuals.

The first direct evidence of the existence of carriers was brought forward by Dr. Robert Koch in 1902, who showed that in typhoid fever the convalescent patient harbours the specific germ and is the most fruitful source of further infection.

The existence of urinary carriers had previously been shown by Horton Smith in England in 1900, while repeated outbreaks of typhoid fever in Folkestone, due to contaminated milk, were described by Dr. Theodore Thomson in 1901. In these epidemics it was noticed that a certain milker had worked on the three different farms associated with the outbreaks of enteric fever in the years 1896, 1897 and 1899. The importance of this observation was not realized until the work of Koch appeared, when it was found that this milker constantly excreted large numbers of typhoid germs.

A certain number of individuals may harbour pathogenic or disease-causing organisms during convalescence, but these bacteria rapidly disappear, and the case is termed a *temporary carrier*. If pathogenic organisms persist for more than three months, the individual is termed a *chronic carrier*.

The following diseases are maintained and spread by carriers: typhoid and paratyphoid fevers, bacillary and amoebic dysentery, cholera, diphtheria, cerebro-spinal meningitis, scarlet fever, anterior poliomyelitis (infantile paralysis), malaria. (*See* MALARIA.)

Typhoid and Paratyphoid Carriers.—The carrier state is much more common in women than in men. Carriers may be (*a*) faecal; (*b*) urinary. In faecal carriers the typhoid germs remain in the upper part of the alimentary tract, and particularly in the gall bladder whence they reach the intestine in the bile. These carriers are very liable to periodic attacks of inflammation of the gall bladder and to gall stones. Typhoid bacilli may appear only intermittently in the excreta so that at times a carrier is non-infective.

Typhoid and paratyphoid carriers are usually very chronic and may harbour the organisms for many years or even a lifetime. The diseases are spread by the direct contamination of food or water-supply with the specific germ due to the uncleanliness of the carrier. That typhoid is much less common than previously is due to the great improvement in sanitation and provision of pure water-supplies, and the detection and isolation of carriers.

Treatment.—The typhoid carrier presents a difficult problem to the health authorities. The carrier must be isolated, must observe rigorous personal cleanliness, and not have anything to do with the preparation of food. Treatment is of little avail, although removal of the gall bladder, particularly when it contains gall stones, brings about the disappearance of the typhoid germs in a number of cases, but even this is often ineffectual. Urinary carriers show no response to treatment and these are more dangerous than faecal carriers owing to the greater difficulty of strict cleanliness and disinfection. Some carriers show spontaneous cure.

Dysentery.—In bacillary dysentery the organisms persist in the lower part of the intestine. They are excreted intermittently as a rule and may only be found when the carrier has a mild dysenteric attack. In amoebic dysentery carriers the parasites pass into a resistant resting state termed cysts. These cysts do not multiply but remain quiescent until they are carried by food or water into the intestinal canal of another individual, when the actively growing stage is resumed with the resultant attack of dysentery. Treatment of amoebic dysentery carriers with emetine is usually effective.

Cholera.—The cholera germ persists in the upper part of the intestine and in the gall bladder, and the condition is similar to the typhoid carrier. The germs are excreted from the bowel only, and food or water is infected as in typhoid. The treatment of cholera carriers is similar to that for typhoid carriers, and as frequently disappointing.

Diphtheria.—In this disease the germs are present in the throat and nose, and infection is spread direct from one throat to another, either in talking, sneezing, etc., or by contamination of drinking vessels. In diphtheria, carriers are not so persistent as in typhoid fever, and usually become free of infection within a year or two, although in some cases the diphtheria organisms may persist for a long time. Young children are more likely to become carriers than adults. In the throat the germs are found in the tonsils, while in the nose they are associated with a chronic inflammatory condition.

When diphtheria bacilli are found in the nose or throat of a supposed carrier, it is necessary to test the organisms bacteriologically to prove that they are capable of causing disease. It has been shown that about 9% of all cases of diphtheria become carriers. Usually the carriers are in good health and show nothing abnormal beyond a tendency to nasal catarrh. Outbreaks of diphtheria occur where many persons are congregated together as in schools, institutions, camps, barracks, etc., and the duty of the health authorities is to examine bacteriologically the nose and throat of all contacts in order to discover and isolate the carrier.

In fever hospitals all recovered cases are carefully examined by bacteriological methods for diphtheria bacilli, and cases are not discharged until all virulent germs have disappeared.

Treatment.—When found the carrier must be segregated. There is a tendency to spontaneous cure. When the germs are present in the throat removal of the tonsils usually brings about a cure, but when the nose is infected this treatment has no effect. Nasal carriers are very refractory to treatment, but recently it has been found that nasal douching with a mild alkaline fluid, and the administration of autogenous vaccines frequently bring about a rapid disappearance of the diphtheria organisms.

Cerebro-spinal Fever.—As in diphtheria the germs of the disease—meningococci—are found in the throat, and direct infection takes place through talking, sneezing, etc., particularly where many individuals are congregated together as in schools, camps, etc. Not every person infected, however, takes the disease, but the meningococci may multiply in the throat and be transmitted to a third person who may either contract the disease or transmit the infection to others. Thus, where an outbreak of cerebro-spinal fever has taken place many healthy persons may have meningococci in the throat, but comparatively few may take the disease. The germs in the throat of the healthy persons usually do not persist more than a very short time and disappear spontaneously. Chronic carriers do occur and the germs may be found over long periods. Gargles and sprays with antiseptic materials often cure the carrier condition.

Scarlet Fever.—It has recently been shown that scarlet fever is due to a haemolytic streptococcus. Patients recovered from scarlet fever may still contain these streptococci in their throats and it appears that scarlet fever is spread by these carriers in a similar manner to diphtheria. Up to the present, however, the examination of convalescent scarlet fever patients before discharge is not done as a routine as in the case of diphtheria. Gargles and antiseptic sprays of the nose and throat tend to shorten the period during which streptococci may be found.

Anterior Poliomyelitis (Infantile Paralysis).—It has been shown that during an epidemic of this disease the infective virus may be present in the throats of healthy contacts.

(J. E. M.)

CARRINGTON, RICHARD CHRISTOPHER (1826–1875), English astronomer, son of a brewer at Brentford, was born in London on May 26, 1826, and educated at Trinity college, Cambridge. He was astronomical observer in the University of Durham (1849–52), and in 1853 established an observatory of his own at Redhill. Here he devoted three years to a survey of the zone of the heavens within 9° of the North Pole, the results of which are contained in his *Redhill Catalogue of 3,735 Stars*. He investigated the motions of sun-spots, by which he determined the elements of the sun's rotation and made the important discovery of a systematic drift of the photosphere, causing the rotation-periods of spots to lengthen with increase of solar latitude. He died on Nov. 27, 1875.

See *Monthly Notices Roy. Astr. Society*, vols. xiv., xviii., xix., xxxvi.; *Memoirs Roy. Astr. Soc.*, xxvii.; *The Times*, Nov. 22 and Dec. 7, 1875; *Roy. Society's Cat. Scient. Papers*, vols. i. and vii.

CARROCCIO, a war chariot drawn by oxen, used by the mediaeval republics of Italy. It was a rectangular platform on which the standard of the city and an altar were erected; priests held services on the altar before a battle, and the trumpeters beside them encouraged the fighters to the fray. In battle the carroccio was surrounded by the bravest warriors in the army and its capture was regarded as an irretrievable humiliation. The Florentine carroccio was usually followed by a smaller car bearing the *martinella*, a bell to ring out military signals. When war was regarded as likely the *martinella* was attached to the door of the church of Santa Maria in the Mercato Nuovo in Florence and rung to warn both citizens and enemies. In times of peace the carroccio was in the keeping of some great family which had distinguished itself by signal services to the republic. It was first employed by the Milanese, in 1038.

CARRODUS, JOHN TIPLADY (1836–1895), English violinist, was born on Jan. 20, 1836, at Keighley, in Yorkshire. He made his first appearance as a violinist at the age of nine, and afterwards studied at Stuttgart with Molique. He made his début as a solo player at a concert given by the Musical Society of London in 1863 and succeeded Sainton as leader at Covent Garden in 1869, acting in the same capacity also for the Philharmonic and other leading orchestras.

CARROLL, CHARLES (1737–1832), American political leader, of Irish ancestry, was born at Annapolis, Md., on Sept. 19, 1737. He was educated abroad in French Jesuit colleges, studied law at Bourges, Paris and London, and in Feb. 1765, returned to Maryland, where an estate known as "Carrollton," in Frederick county, was settled upon him; he always signed his name as "Charles Carroll of Carrollton." Before and during the Revolutionary War, he was a whig or patriot leader, and as such was naturally a member of the various committees of correspondence, committees of observation, council of safety, provincial convention (1774–76) and Constitutional Convention (1776). From 1777 until 1800 he was a member of the Maryland senate. In April–June 1776 he, with Samuel Chase and Benjamin Franklin, was a member of the commission fruitlessly sent by the Continental Congress to Canada for the purpose of persuading the Canadians to join the 13 revolting colonies. From 1776 to 1779 he sat in the Continental Congress, rendering important services as a member of the board of war, and signing on Aug. 2, 1776 the Declaration of Independence, though he had not been elected until the day on which that document was adopted. He outlived all of the other signers. He was a member of the U.S. Senate from 1789 to 1792. From 1801 until his death, at Baltimore, on Nov. 14, 1832, he lived in retirement, his last public act being the formal ceremony of starting the construction of the Baltimore and Ohio railway (July 4, 1828). In politics, after the formation of parties, he was a staunch Federalist. Of unusual ability, high character and great wealth, he exercised a powerful influence, particularly among his co-religionists of the Roman Catholic faith, and he used it to secure the independence of the colonies and to establish a stable central government.

See the *Life* by Kate Mason Rowland (1898); Lewis A. Leonard, *Life of Charles Carroll of Carrollton* (1918); and "Charles Carroll: the Catholic 'Signer'," in *Catholic Mind*, vol. xxii., p. 126–130 (1924).

CARROLL, JOHN (1735–1815), American Roman Catholic prelate, was born at Upper Marlborough, Md., Jan. 8, 1735, the son of wealthy Catholic parents. He was educated in Flanders, and ordained priest in 1769, becoming professor of philosophy and theology at the Jesuit college in Liége. In 1771 he became a professed father of the Society of Jesus and professor at Bruges. Shortly after the papal brief of July 21, 1773, suppressed the Society of Jesus, he returned to America and set to work at a mission at Rock Creek, Md. He shared the feeling for independence growing among the American colonists, foreseeing that it would mean greater religious freedom. In 1776, at the request of the Continental Congress, he accompanied Benjamin Franklin, Charles Carroll and Samuel Chase on their mission to secure the aid or neutrality of the French Canadians. In 1783 he took a prominent part in the petition to Rome to take the control of the American Church away from London; and after the recognition of the American Church as a distinct body, he was named prefect apostolic. In 1786 he induced the general chapter to authorize a Catholic seminary (now Georgetown university); and in 1788 he was chosen first American bishop. He was consecrated at Lulworth Castle, England, Aug. 15, 1790, and his first synod met Nov. 7, 1791. At this period, although busy with administrative matters, he was an outstanding leader in the educational and cultural life of Baltimore. Already in 1802 he was pressing for the creation of new sees in his diocese, and the Louisiana Purchase of 1803 gave added weight to this request; in Sept. 1805 the Propaganda made him administrator apostolic of the diocese of New Orleans; and in 1808 Pius VII divided Carroll's great diocese into four sees, Boston, New York, Philadelphia and Bardstown (Ky.), suffragan to the metropolitanate of Baltimore, of which Carroll actually became archbishop on Aug. 18, 1811. In 1811 ecclesiastical jurisdiction over the Danish and Dutch West Indies was bestowed upon him. He died in Georgetown Dec. 3, 1815.

See Daniel Brent, *Biographical Sketch of the Most Rev. John Carroll, . . . with Select Portions of His Writings*, edited by J. C. Brent (1843); J. G. Shea, *History of the Catholic Church in the United States* (vol. ii., 1888).

CARROLL, LEWIS: *see* DODGSON, CHARLES LUTWIDGE.

CARROLL, a city of western Iowa, U.S.A., on Federal highways 30 (the Lincoln) and 71, at an altitude of 1,270 ft.; the county seat of Carroll county. It is served by the Chicago and North Western and the Chicago Great Western railways. The population in 1940 federal census was 5,389. It is the trade centre of a rich agricultural district, ships grain, flour, produce and livestock, and manufactures farm implements and ladders. The city was founded about 1867 and incorporated in 1868.

CARROLLTON, a city of western Georgia, U.S.A., 45 mi. W.S.W. of Atlanta, on the Little Tallapoosa river. Federal highway 78 and the Central of Georgia railway; the county seat of Carroll county. Pop. (1940) 6,214. The city ships large quantities of cotton and has textile factories and other manufacturing industries. It was founded about 1829 and incorporated in 1831. West Georgia Junior college is there.

CARRONADE: *see* ORDNANCE.

CARROT. Wild carrot, *Daucus Carota*, a member of the family Umbelliferae, grows wild in fields and on roadsides and sea-shores in Britain and the north temperate zone generally of the old world. It has become naturalized as a weed in the United States, where it is a pest in many sections, especially in carrot-seed growing areas, where it may cross-pollinate with cultivated varieties. It is an annual and resembles the cultivated carrot, except in the root, which is thin and woody. It is the origin of the cultivated carrot, a biennial. In the cultivated carrot, during the first season of growth, the stem remains short and bears a rosette of graceful, long stalked, branched leaves with deeply cut divisions and small, narrow ultimate segments. During this period the plant is storing food in the so-called root, which consists of the upper part of the true root and the short portion of the stem between the root and the lowest leaves. A transverse section of the "root" shows a central core, orange or yellow in colour, and an outer red or scarlet, yellow or orange rind. The core represents the wood of an ordinary stem and the outer ring the soft outer tissue (phloem). In the second season the terminal bud in the centre of the leaf-rosette grows at the expense of the stored nourishment and lengthens to form a furrowed, rather rough, branched stem 3 to 5 ft. high and bearing the flowers in a compound umbel. The umbel is characterized by the fact that the small leaves (bracts) which surround it resemble the foliage leaves on a much reduced scale, and ultimately curve inward, the whole inflorescence forming a nest-like structure. The flowers are small, the outer white, the central ones often pink or purplish. The fruit consists of two one-seeded portions, each portion bearing four rows of stiff spinous projections, which cause the fruits when dropped to cling together, and in a natural condition help to spread the seed by clinging to the fur of animals. As usual in the Umbelliferae, the wall of the fruit is penetrated lengthwise by canals containing oil.

Carrots vary considerably in the length, shape and colour of their roots and in the proportion of rind to core. The White Belgian, which gives the largest crops, has a very thick root which is white below, pale green above, where it projects above ground. For nutritive purposes it is inferior to the red and yellow varieties, such as Chantenay and Danvers Half Long. The carrot is suited by a deep, rich, sandy soil, which should be well drained and deeply trenched. Soil is not trenched in the United States, but ploughed and harrowed as for other crops. A good, well-decomposed peat soil is considered ideal in the United States.

The carrot requires a cool to moderate mean temperature so is grown extensively in the warmer parts of the temperate zones only in the fall, winter, and spring, and in the cooler regions during the summer. Prior to 1920 carrots were little used as a vegetable in the United States. Knowledge of their value for their carotene (pro-vitamin A) content, as well as improved production and shipping facilities, has made the carrot a favourite year-round vegetable. Production increased from 2,500,000 bushels in 1923 to nearly 18,000,000 bushels in 1941. Millions of pounds annually of dehydrated carrots were prepared and sealed in carbon dioxide in tin for shipment abroad during World War II. California, Texas, New York and New Jersey were the largest producing states from 1930 to 1941.

CARRYING CHARGES, in the United States, interest charges made by brokers for money supplied by them to carry the accounts of customers who have purchased securities on margin. The rate of such interest is generally slightly higher, 1 to 2%, than the prevailing call loan rate. The term is also used in the grain and commodity markets, in which case it means the cost of warehouse, storage, insurance and haulage on the commodities involved, plus loss of interest on the investment. Equivalents in England are "carrying over," "settlement," etc.

CARRYING OVER or **CONTINUATION,** a stock exchange term for the operation by which the settlement of a bargain transacted for money or for a given account may for a consideration (called either a "contango" or a "backwardation") be postponed from one settling day to another. Such a continuation is equivalent to a sale "for the day" and a repurchase for the succeeding account, or to a purchase "for the day" and a resale for the succeeding account. The price at which such transactions are adjusted is the "making-up" price of the day. (*See* STOCK EXCHANGE.)

CARSIOLI, an ancient city of Italy (mod. CARSOLI), on the Via Valeria, 42 mi. N.E. of Rome. It was founded in the country of the Aequi between 302 and 298 B.C., just after the establishment of Alba Fucens, no doubt as a stronghold to guard the road to the latter. It was sacked in the Social War. The old site does not seem to have been abandoned until the 13th century. It is now occupied only by vineyards, and lies about 2,100 ft. above sea level, in a plain surrounded by mountains, now called Piano del Cavaliere. The line of the city walls can be traced, and so can the scanty remains of several buildings.

See the monograph by G. J. Pfeiffer and T. Ashby in *Supplementary Papers of the American School in Rome*, i. (1905), 108 *seq.*

CARSO, a limestone plateau, extending south-eastwards from the east bank of the Isonzo to the Gulf of Fiume, and south-westwards from the valley of the Vipacco to the gulf of Trieste. Its general level is about 300 ft. above the Isonzo, but it increases to 1,500 ft. above sea-level as it goes south-eastward, and even in its western portion isolated summits are higher still with frequent cavities, originally formed by surface erosion, but gradually enlarged when they find a fissure which gives a subterranean outlet. They then come to resemble small craters and are called *doline;* their average diameter is about 50 yards. In other cases caves are formed often traversed by subterranean streams. (*See* POSTUMIA-GROTTE; MONFALCONE.)

On the outbreak of World War I the Austrians withdrew across the Isonzo, after flooding the plain by means of dykes, and fortified themselves on the Carso whose rocky formation lent itself admirably to defence. The Italians advanced from Ronchi and Monfalcone, and delivered attack after attack on the rock-bound fastness but it was not until the fall of Gorizia (*q v.*) in August 1916, and at the cost of terrible losses that the whole ridge was conquered. In June the trenches east of Selz and Hill 46 above Vermegliano were captured, and on July 26 the summits of Sei Busi; the highest point (Hill 118), after being taken and lost more than once, was finally captured on April 23, 1916, but remained exposed to heavy fire until August following. The village of Doberdò, east of Sei Busi, was the centre of the Austrian supply services until it fell to the Italians after the fall of Gorizia, but it was subsequently reduced to a heap of ruins by bombardment. Close by is the little lake of Doberdò. The rocky plateau east of Doberdò was fought over from Sept. 1916 to Sept. 1917, and conquered after five desperate attacks; the chief positions occupied are Sangrado di Merna (Sept. 1916), Nova Vas (Oct. 1916), the Veliki Kribak, Loquizza, the Pecinka and part of Castagnevizza (Nov. 1916), Boscomalo, Jamiano and the heights east of Flondar (May 1917). The approaches to the Hermada were attacked at the end of May and in August, but some of the positions captured were subsequently lost. North of Sei Busi is the vast war cemetery of Redipuglia, where 30,000 dead lie buried. East of Doberdò is the Vallone del Carso, a depression 8 or 9 km. long, 80 to 100 m. deep and some 100 m. wide, cutting through the plateau from north to south. It was occupied by the Italians in August 1916, and as it was well sheltered from enemy fire, was used as a large depot for munitions and supplies. Further north is another ridge extending along the Isonzo from Sagrado to the Vipacco, with Monte S. Michele as its culminating point (275 metres) which was also the scene of very heavy fighting between June 1915 and August 1916. Bosco Lancia, Bosco Cappuccio, S. Martino del Carso (197 metres) and S. Michele were the chief positions fought on. On San Michele a great monument to the Italian infantrymen who fell in the war was erected. The whole Carso area had to be evacuated after the enemy had broken through at Caporetto in October 1917, but the retreat was carried out in orderly fashion by the III Army, which had conquered it and held it.

Many villages of the Carso were completely destroyed during the war.

The term karst (*q.v.*), the German word for carso, has been applied by extension to areas where the terrain resembles that of the Carso.

See E. Barbaridi, *La Carsia Giulia nella Geografia nella storia e nell' Arte militare* 1925.

CARSON, CHRISTOPHER ("KIT") (1809–1868), American hunter and scout, was born in Madison county, Ky. on Dec. 24, 1809, but was raised on the Missouri frontier. For a brief period a saddler's apprentice and teamster in the southwest, after 1826 he became a professional trapper, hunter and guide. He accompanied John C. Frémont on his exploring expeditions of 1842 and 1843–44, and on his California expedition in 1845–6. Carson took part in the Mexican War, and in 1854 he became Indian agent at Taos, N.M., in which position, through his knowledge of the Indian traits and language, he was able to exercise for many years a restraining influence over the warlike Apaches and other tribes. During the Civil War he rendered valuable aid to the Federal cause in the Southwest. In March 1865 he was breveted brigadier-general of volunteers "for important services in New Mexico, Arizona and the Indian Territory"; after the war he resumed his position as Indian agent, which he held until his death at Fort Lyon, Col., on May 23, 1868. "Kit" Carson, often called "the Nestor of the Rocky Mountains," occupied in the later period of American pioneer history a position somewhat similar to that held by Daniel Boone earlier, as the typical frontier hero and Indian fighter, and his hairbreadth escapes, resourcefulness, and personal prowess are the subject of innumerable stories.

The chief biographies are by DeWitt C. Peters (1858), Charles Burdett (1859), J. S. C. Abbott (1873), E. S. Ellis (1899) (the most reliable) E. L. Sabin (1914) and Stanley Vestal (1928); *Kit Carson's Own Story of His Life,* used as the basis of the Peters narrative, ed. Blanche C. Grant (1926).

CARSON, EDWARD HENRY CARSON, BARON (1854–1935), British politician and lawyer, son of Edward Henry Carson, a civil engineer of Dublin, was born Feb. 9, 1854 and educated at Portarlington School and Trinity College, Dublin. He became an Irish barrister and made his reputation as crown prosecutor in the difficult years when A. J. Balfour was Chief Secretary for Ireland. During this period he was continually in danger. Yet it is probable that even then he was never really unpopular. He became a Q.C. at the Irish bar in 1889, was called to the English bar, and took silk there in 1894.

Meanwhile he had been returned to the British Parliament in 1892 as Unionist member for his own University of Dublin and was for a few months solicitor-general for Ireland. He entered Parliament just when Mr. Gladstone was about to make a second effort to pass an Irish Home Rule bill, and he helped to defeat the measure. During the next 20 years he was occupied with his professional work. Having risen to a leading place at the bar in Ireland, he achieved an even more striking success at the English bar (he was successful with a jury to a degree rarely known) and in 1900 became solicitor-general, a post which he held till the fall of Balfour's Government in Dec. 1905.

It was not until 1911, when another Irish Home Rule bill was imminent, that Carson, who had gradually become the spokesman of the Irish Unionists in Parliament, emerged as a political figure of importance. He strenuously resisted the Parliament bill, which was to curtail the power of the Lords and enable a measure of Home Rule to be passed without a direct appeal to the people.

Feeling against the Home Rule-for-Ireland policy was bitter in Protestant Ulster. Carson went to Ulster, and at an enormous Unionist demonstration at Craigavon, near Belfast, endorsed the threats of armed opposition against Home Rule which previous speakers had made. Belfast, he said, was the key of the situation; Ulster would never submit to a Parliament in Dublin. They must be prepared, if necessary, to take over the administration of those districts which they were entitled to control. Practical measures were immediately taken in this direction, though Liberals and Nationalists scoffed. His position was that he and his Ulster friends were loyal to the constitution as it existed; they were rebels, he said, in the sense that they desired to remain under the King and the Imperial Parliament.

In anticipation of the introduction of the Home Rule bill in the spring of 1912, he presided over a gigantic gathering in Belfast in Easter week, which Mr. Bonar Law, the newly appointed Unionist leader, came to address; and he made those present repeat after him, "We will never in any circumstances, submit to Home Rule." He himself, in a speech instinct with passion, moved the rejection of the bill on its introduction, and took a leading part in opposition during its subsequent stages. But his activity was mainly outside Parliament. During this period he sacrificed a very lucrative practice and devoted himself to the anti-Home Rule Party strong in Ulster.

His principal work was in the organization of resistance in Ulster itself, including the formation of a local volunteer force, which speedily assumed large proportions. At Belfast on Sept. 28, 1912, he took the lead in signing a solemn covenant, by which the men of Ulster bound themselves to stand by one another in defending their position of equal citizenship in the United Kingdom, and in using all necessary means to defeat the proposal to set up Home Rule, and further pledged themselves to refuse to recognize an Irish Home Rule Parliament. He followed this up by moving (unsuccessfully) in Parliament on New Year's Day 1913 the exclusion of Ulster from the bill.

In the autumn of 1913 the Ulster Unionist Council organised itself, under his supervision, into a provisional government, of which he was the leading member, and a guarantee fund of £1,000,000 was started to which he himself contributed £10,000. He reviewed the Volunteers, who were rapidly becoming a formidable military force, approaching in number 100,000 men. But when ministers, who had refused to prosecute him or to interfere with his activities, began to realise the determination of his followers in six northeastern counties, he did not repulse their overtures for a settlement but said that it must not establish a basis for separation. His advice during the following winter to his Ulster friends was "peace but preparation." He entirely declined to accept Asquith's offer, in the early spring of 1914, of a county option of exclusion for six years. That was "sentence of death with a stay of execution." There was only one policy possible, he told the House of Commons: "Leave Ulster out until you have won her consent to come in." He became a member of the abortive Buckingham Palace Conference convened by the King, and when that broke down, at the end of July, it looked as if he and his Ulster friends would have to make good in action their policy of force.

The World War intervened and switched off his activity into another direction. He went to Belfast in order to stimulate Ulstermen to join the British Army, and had considerable success. He joined Asquith's coalition ministry of 1915 as attorney-general, resigning however in October because he thought that the policy of the Cabinet, after the defection of Greece, involved the desertion of Serbia, in whose fate he took a profound interest. He accepted office as First Lord of the Admiralty under the coalition Government formed in Dec. 1916. Outside his departmental duties he warmly promoted the Irish Convention which the Government assembled in 1917. In July he quitted the Admiralty to become a member of the War Cabinet without portfolio, a position which he resigned at the begining of 1918 because the Irish question arose again. But, in or out of office, his activity was directed wholeheartedly to the vigorous prosecution of hostilities.

After the War was over Ulster and Ireland regained the first place in his thoughts. At the General Election of 1918 he left Dublin University in order to represent one of the divisions of Ulster's capital, Belfast. On the anniversary, in July 1919, of the battle of the Boyne, he restated, speaking near Belfast, Ulster's position and claims, and threatened to call out the Volunteers if any attempt were made to change her status. When, however, Mr. Lloyd George proposed in the winter his bill for the reform of the government of Ireland, establishing parliaments and executives both in Dublin and in Belfast, and a Federal council for all Ireland, he modified his attitude. Though he would have preferred no change, yet, as this bill gave the six Protestant counties of Ulster a Parliament of their own, besides representation in the Imperial Parliament, he would not oppose it.

After it had passed, he exerted himself with success to secure a strong Unionist majority in the elections in May 1921 for the first Parliament of Northern Ireland. He had thus achieved his main political object of saving Protestant Ulster from domination by the Roman Catholic majority of the south and west.

In 1921 he accepted a life peerage as Baron Carson of Duncairn, and from that year until 1929 was a lord of appeal in ordinary. He denounced the treaty which constituted the Free State, both at its conclusion and when the bill to carry it into effect was before his House. He also protested in 1924 against the bill which empowered the British Government to appoint, owing to Ulster's default, a third commissioner on the Irish Boundary Commission. But he welcomed the agreement, in 1925, between the British Government, the Government of the Irish Free State, and that of Northern Ireland, which finally settled this question. He was twice married—in 1879 to Sarah A. F. Kirwan (died in 1913), and in 1914 to Ruby Frewen. He died Oct. 22, 1935.

CARSON CITY, the capital of Nevada, U.S.A., and the county seat of Ormsby county, 12m. from Lake Tahoe, which lies at the crook in the western boundary of the State. It is on federal highways 50 and 395, and is served by the Virginia and Truckee railway, which has repair shops there. It is picturesquely situated in Eagle valley, near the eastern base of the Sierra Nevada, 4,720 ft. above sea level. In 1890 the pop. was 3,950; in 1940, 2,478. The city is federal headquarters for Nevada, as well as the seat of the state government. In Carson City there is a branch of the United States mint, a federal school for Indians, a state orphans' home and the state prison, and a museum with a series of mastodon skeletons and prehistoric remains found in the neighbourhood. A trading-post was established there in 1851. The town was laid out in 1858, was made the capital in 1861 and was chartered as a city in 1875. It was named after Christopher ("Kit") Carson, frontier hero and guide.

CARSTARES or CARSTAIRS, WILLIAM (1649–1715), Scottish clergyman, was born in Cathcart manse, near Glasgow, on Feb. 11, 1649, and was educated at the University of Edinburgh and at Utrecht. He became a close friend of the prince of Orange. The British Government disliked Carstares for several reasons. He was the intimate of William; he had been the bearer of messages between the disaffected in Scotland and Holland; and he was believed to be concerned with Sir James Steuart (1635–1715) in the authorship of a pamphlet, *An Account of Scotland's Grievances by reason of the D. of Lauderdale's Ministrie, humbly tendered to his Sacred Majesty.* On his return to England, at the close of 1674, he was committed to the Tower; the following year he was transferred to Edinburgh castle, and only released in Aug. 1679. During 1682 he was in Holland, but in the following year he was again in London, and was implicated in the Rye House Plot. He was examined before the Scottish Council and put to the torture. Although he was assured that his admissions would not be used in evidence, they were in fact used against Baillie of Jerviswood. On his return to Holland he became court chaplain to the prince of Orange; and after the Revolution he continued to hold this office, under the title of royal chaplain for Scotland. He was the confidential adviser of the king, especially with regard to Scottish affairs. On the accession of Anne, Carstares retained his post as royal chaplain, but resided in Edinburgh, having been elected principal of the university. During Anne's reign, the chief object of his policy was to frustrate the measures which were planned by Lord Oxford to strengthen the Episcopalian Jacobites—especially a bill for extending the privileges of the Episcopalians and the bill for replacing in the hands of the old patrons the right of patronage, which by the Revolution settlement had been vested in the elders and the Protestant heritors. He died on Dec. 28, 1715.

See *State-papers and Letters addressed to William Carstares*, to which is prefixed a Life by M'Cormick (1774); Story's *Character and Career of William Carstares* (1874).

CARSTENS, ARMUS JACOB (1754–1798), German portrait and historical painter, was born in Schleswig, and in 1770 went to Copenhagen to study. In 1783 he went to Italy, where he was much impressed by the work of Giulio Romano. He settled in Lübeck, but visited Rome again in 1792. His fine subject and historical paintings, *e.g.*, "Plato's Symposium" and the "Battle of Rossbach" made him famous. He was appointed professor at Berlin, and in 1795 a great exhibition of his works was held in Rome, where he died in 1798. Carstens ranks as a leader of the later school of German historical painting.

CART. A general term for various kinds of vehicles, in some cases for carrying people, but more particularly for transporting goods, for agricultural or postal purposes, etc., or for carriers. Though constructed in various ways, the simplest type for goods is two-wheeled, topless and springless; but as a general term "cart" is used in combination with some more specific qualification (dog-cart, donkey-cart, road-cart, polo-cart, etc.), when it is employed for pleasure purposes. The "dog-cart," so called because originally used to convey sporting dogs, is a more or less elevated two-wheeled carriage, generally with seats back to back, in front and behind; the "governess-cart" (presumably so called from its use for children), a very low two-wheeled pony-carriage, has two side seats facing inwards; the "tax-cart," a light two-wheeled farmer's cart, was so called because formerly exempted from taxation as under the value of £21. (*See* the articles CARRIAGE and WAGON.)

CARTAGENA, a city, seaport and the capital of the department of Bolívar, Colombia, South America, on the Caribbean coast. Pop. (1905, official estimate) 14,000; (1938) 72,767. The population of Cartagena is largely composed of blacks and mulattos, who form the predominant type on the lowland plains of northern Colombia. The well-to-do whites of Cartagena usually have country houses on the Turbaco hills, where the temperature is much lower than on the coast. The mean annual temperature in the city is 82°, and the port is classed as very unhealthful, especially for unacclimatized foreigners. The harbour is formed by an indentation of the coast-line shut in by two long islands lying parallel to the mainland. There were formerly two entrances to the harbour—the Boca Grande (large mouth), between the low sandy island or peninsula on which the city stands and the island of Tierra Bomba, and the Boca Chica (small mouth), at the south end of the latter island. The Boca Grande was filled with stone after the city had been captured three times, because of the ease with which an enemy's ships could pass through it at any time, and the narrow and more easily defended Boca Chica, 7 mi. farther south, has since been used.

The city occupies a part of the upper island or peninsula facing the northern end of the harbour and is separated from the mainland on the east by a shallow, lagoon-like extension of the bay, which is bridged by a causeway passing through the extra-mural suburb of Xiximani on another island. The old city, about ¾ mi. long, north and south, and ⅓ mi. wide, is enclosed by a heavy wall, in places 40 ft. thick, and is defended by several formidable looking forts, which have long been dismantled but are still in a good state of preservation. At the mainland end of the causeway leading from the city is the fort of San Felipe, about 100 ft. above sea-level, adapted as a distributing reservoir in the city's waterworks; and behind it are verdure-covered hills rising to an elevation of 300 ft., forming a picturesque background to the grey walls and red-tiled roofs of the city. The streets are narrow, irregular and roughly paved but are lighted by electricity; tramway lines run between the principal points of the city and suburbs. The houses are built with thick walls of stone and brick round open courts, in the Moorish style, and their iron-barred doors and windows give them the appearance of being a part of the fortifications. Among the numerous churches, the largest and most imposing is the Jesuit church of San Juan de Dios, with its double towers and celebrated marble pulpit; an old monastery adjoins. Cartagena is an episcopal see, and its cathedral dates from colonial times. The city was once the headquarters of the Inquisition in South America, and the edifice which it occupied, now private property, is an object of much interest. The water supply of the city was formerly obtained from rainwater tanks on the walls or by carriage from springs a few miles inland, but in 1906 a British company received a concession to bring water by pipes from springs on the Turbaco hills, 300 ft. above the sea.

The commercial importance of Cartagena declined greatly during the period of civil disorders which followed the war for independence but in later years revived. In the reign of Philip II the Spaniards had opened a canal ("El Dique") through some marshes and lagoons into a small western outlet of the Magdalena which gave access to that river at Calamar, about 81 mi. above the bar at its mouth. During Cartagena's decline this was allowed to fill up; it was reopened in 1846 for a short time and then was obstructed again by river floods, but it has been reopened for steam navigation. Toward the end of the 19th century a railway, 65 mi. long, was built between Cartagena and Calamar. With the development of oil exploitation in the Middle Magdalena basin, pipelines were laid to Mamonal, a suburb of Cartagena, and more than 3,000,000 metric tons of oil and petroleum products were exported in 1940. Besides petroleum the chief export of Cartagena is raw coffee, of which more than 30,000 metric tons were shipped in 1940.

Cartagena was founded in 1533 by Pedro de Heredia. In 1544 it was captured by pirates, who plundered the town; in 1585 by Sir Francis Drake, who exacted a large ransom; and in 1697 by the French, who obtained from it more than £1,000,000. It was taken by Bolívar in 1815 but was surrendered to the royalists in the same year. It was recaptured by the republicans on Sept. 25, 1821, and thereafter remained in their possession.

CARTAGENA or CARTHAGENA, a city of S.E. Spain, in the province of Murcia, on the Mediterranean sea, and terminus of a branch railway from Murcia. Pop. (1940) 43,104 (mun., 113,468). Cartagena stands at the head of a splendid natural harbour whose easy defense has made it the chief naval base of Spain, with arsenal and dockyards ranking with those of Ferrol and San Fernando near Cádiz. The city occupies a small lowland at the north end of the bay; is fairly modern and uninteresting except for remnants of old walls and castle overlooking the harbour. It is an episcopal see. On the northeast a fertile valley gives access to the interior but on the west, southwest and southeast the port is surrounded by high mountains. The harbour, the largest in Spain after that of Vigo, and the finest on the east coast, is a deep, spacious bay, dominated on the seaward side by four hills, crowned with forts, and approached by a narrow entrance guarded by batteries and a torpedo station. The outer bay is sheltered by the island of La Escombrera, the ancient Scombraria (*i.e.*, "mackerel fishery"), 2½ mi. S., and the harbour by a breakwater on its eastern side. On the northwest lies the Arsenal basin, often regarded as the original harbour of the Carthaginians and Romans, and the naval shipbuilding yards, with a dry and a floating dock. There are valuable mines near the town, producing lead, silver-lead, zinc, iron, copper and sulphur, and a mineral railway from Los Blancos, passing through the chief mining and smelting district of La Unión, 6 mi. E. of the town, runs on to the quay in Cartagena harbour. The city exports the ores but also has important smelting works, chiefly located in the Santa Lucia suburb east of the bay. Glass and esparto fabrics are other manufactures. The industrial and commercial progress of Cartagena was much hindered during the first half of the 19th century by the prevalence of epidemic diseases, the abandonment of the arsenal, and rivalry with the neighbouring port of Alicante. Its sanitary condition, though still defective, was improved by the drainage of the adjacent Almajar marsh, and after 1870 Cartagena advanced rapidly in size and wealth. The opening of the railway enabled it to compete for a time with Alicante, and revived the mining and metallurgical industries, while the coast and land defenses were modernized and new quays, docks and other harbour works were added. As a naval station, Cartagena suffered severely in 1898 from the maritime disasters of the Spanish-American War, but after the decree of 1908 for bringing the Spanish navy up to date, considerable naval construction went on in the port. As a general commercial port Cartagena was adversely affected after the beginning of the 20th century by the increasing importance of Barcelona, Málaga and Alicante on the same coast. It exports some olive oil, dried fruits and esparto grass, and ordinarily imports coal, coke and machinery from Great Britain, timber from the United States and dried cod-fish from Norway and Newfoundland, but it is above all a mineral port. Even this activity was somewhat reduced after the establishment in 1898 of Portman, a mining village on a sheltered bay 11 mi. E., an independent port which, connected by rail with La Unión, imports coke and coal and exports iron ore and lead.

GATE IN THE OLD CITY WALL AT CARTAGENA

Cartagena was founded about the year 243 B.C. by the Carthaginian, Hasdrubal, probably on the site of a much older town, and was called Carthago Nova or New Carthage, to distinguish it from the African city of Carthage. It was conveniently situated opposite the Carthaginian territory in Africa and was early noted for its harbour. Its silver and gold mines were the source of great wealth both to the Carthaginians and to the Romans. In 210 B.C. this important place, the headquarters and treasure city of the Punic army, was taken with great slaughter by P. Scipio (*see* below). The city continued to flourish under the Romans, who made it a colony, with the name Colonia Victrix Iulia Nova Carthago. In A.D. 425 it was pillaged and nearly destroyed by the Goths. Cartagena was a bishopric from about 400 to 1289, when the see was removed to Murcia. Under the Moors it became an independent principality, which was destroyed by Ferdinand II of Castile in 1243, restored by the Moors and finally conquered by James I of Aragon in 1269. It was rebuilt and fortified by Philip II of Spain (1527–98) for the sake of its harbour. In the War of the Spanish Succession it was occupied by Sir John Leake in 1706 and by the duke of Berwick in 1707. On Nov. 5, 1823, it capitulated to the French. Cartagena took part in the revolutionary movement of 1844 and in 1873 was bombarded by the Spanish fleet under Admiral Lobos. The city was occupied by government troops on Jan. 12, 1874. It was the loyalist naval base during the civil war of 1936–39

See G. Vicent y Portillo, *Biblioteca histórica de Cartagena* (1889, etc.); I. Martínez Rito, *Fechos y fechas de Cartagena* (Cartagena, 1894); P. Diaz Casson, *Serie de los obispos de Cartagena* (1895); I. M. Ibáñez García, *Biblioteca de la Santa Iglesia Catedral de Cartagena en Murcia* (Cartagena, 1924).

Capture by Scipio Africanus.—In military history it is, above all, famous for its capture by Publius Cornelius Scipio (*q.v.*), who later earned the surname of Africanus, an event which paved the way first to the overthrow of the Carthaginian power in Spain, and later to the destruction of that power in Africa. After the disaster to his father and uncle, Scipio, although only 24, was appointed to the command in Spain, and sailing with reinforcements, reached the Roman base at Tarraco (modern Tarragona) in 209 B.C. The acute strategical instinct which marked him in a day when strategy, as distinct from battle-tactics, had hardly been born evidently showed him that as Spain was the key to the whole struggle against Hannibal, who was then in Italy, so "New Carthage" was the key to Spain. It was the Carthaginians' chief naval base, the direct sea connection with Africa, their treasury and their depot of war material. Thus, after taking steps to restore the shaken confidence of the troops and the allies of Rome in the peninsula, he decided upon a surprise coup against the Carthaginian base—which was also Hannibal's life-line. Spreading misleading rumours, and keeping his plans secret from all except Laelius, who was despatched thither with the fleet, he concentrated all his available force, left a small detachment to safeguard Tarraco, and with about 25,000 foot and 2,500 horse crossed the Ebro.

He had learned that New Carthage itself was weakly garrisoned—both because of its supposed impregnability and because "no one dreamed that while the Carthaginians were masters of nearly the whole of Spain it would enter anyone's head to besiege the city" (Polybius). The main Carthaginian forces were distributed in three armies, one in central Spain, one near Gibraltar, one near modern Lisbon and none of them within less than ten days' march of New Carthage, while the Romans, as the event proved, were within seven days' forced marches of it and had an additional interval of grace in the time that news would take to reach them.

On the seventh day from the start of the march Scipio arrived before the city and encamped, the fleet arriving simultaneously in the harbour, thus cutting off communication on all sides. This harbour formed a circular bottle, its mouth almost corked by an island, while Cartagena itself was like a candle stuck in the bottom of the bottle, the city standing on a narrow rocky spit of land protruding from the mainland. This small peninsula bore a distinct resemblance to Gibraltar, and the isthmus joining it to the mainland was only about 400 yd. across. The city was guarded on two sides by the sea, and on the west by a lagoon. Here was a hard nut to crack, seemingly impregnable to any action save a blockade, and of this time did not permit. The Carthaginian commander, Mago, armed 2,000 of the sturdiest citizens and posted them by the landward gate for a sortie. The rest he distributed to defend the walls to the best of their power, while of his own regulars he disposed 500 in the citadel on the top of the peninsula and 500 on the eastern hill.

Next day Scipio encircled the city with ships, throwing a constant stream of missiles, and about the third hour—the Roman day began at sunrise—sent forward along the isthmus 2,000 picked men with ladder bearers, for its narrowness prevented a stronger force being deployed. Appreciating the handicap of their cramped position if counterattacked by the yet unshaken defenders, he astutely designed to turn this handicap to his own advantage. The expected sortie came as soon as Scipio sounded the bugle for assault, and a close-matched struggle ensued. "But as the assistance sent to either side was not equal, the Carthaginians arriving through a single gate and from a longer distance, the Romans from close by and from several points, the battle for this reason was an unequal one. For Scipio had purposely posted his men close to the camp itself in order to entice the enemy as far out as possible"—Livy says the Roman advanced troops retired, according to orders, on the reserves—"well knowing that if he destroyed those who were, so to speak, the steel edge of the population he would cause universal dejection, and none of those inside would venture out of the gate" (Polybius). The Carthaginian sortie was driven back, the pursuit being pressed so promptly that the Romans nearly succeeded in forcing an entrance on the heels of the fugitives. Even as it was, the scaling-ladders were put up in full security, but the great height of the walls hampered the escaladers, and the assault was beaten off. Polybius gives a picture of the Roman commander during this phase which reveals how he combined personal influence and control with the duty of avoiding rash exposure: "Scipio took part in the battle, but studied his safety as far as possible, for he had with him three men carrying large shields, who, holding these close, covered the surface exposed to the wall, and thus afforded him protection." ". . . thus he could both see what was going on, and being seen by all his men he inspired the combatants with great spirit."

Scipio had achieved his first object of wearing down the defenders and checking the likelihood of further interference with his plans from Carthaginian sorties. The way was thus paved for his next and decisive move. While at Tarraco, from enquiries among fishermen who knew Cartagena, he had learned that at certain times the lagoon was fordable. For this project he assembled 500 men with ladders on the shore of the lagoon, and meanwhile reinforced his contingent in the isthmus with both men and ladders, enough to ensure that in the next direct assault "the whole extent of the walls should be covered with escaladers"—an early example of the modern tactical axiom that a "fixing" attack should be on the broadest possible front in order to occupy the enemy's attention. He launched this assault simultaneously with a landing attack by the fleet, and when it was at its height "the water gradually receded from the edge of the lagoon, a strong and deep current setting in through the channel to the adjoining sea, so that to those who were not prepared for the sight the thing appeared incredible. But Scipio had his guides ready, and bade all the men told off for this service enter the water and have no fear." He possessed a particular talent for inspiring confidence and sympathy in his troops when he called upon them. "Now when they obeyed and raced through the shallow water, it struck the whole army that it was the work of some god . . . and their courage was redoubled" (Polybius). Of this episode Livy says: "Scipio, crediting this discovery, due to his own diligence and penetration, to the gods and to miracle . . . ordered them to follow Neptune as their guide"; but it is interesting to see that, while exploiting the moral effect of this idea, he made practical use of less divine guides. The 500 passed without difficulty through the lagoon, reached the wall, and mounted it without opposition, because all the defenders "were engaged in bringing succour to that quarter in which the danger appeared." "The Romans having once taken the wall, at first marched along it, sweeping the enemy off it." They were clearly imbued with the principle that a penetration must be promptly widened before it is deepened. Next they converged on the landward gate, already assailed in front, and, taking the defenders in rear and by surprise, overpowered the resistance and opened the way for the main body of the attackers. The walls *thus captured, Scipio at once exploited his success. For while the mass of those who had by now scaled the walls set about the cus*tomary massacre of the townsmen, Scipio took care to keep in regular formation those who entered by the gate, and led them against the citadel. Here Mago, once he "saw that the city had undoubtedly been captured," surrendered.

Leaving New Carthage strongly garrisoned, Scipio himself fell back on Tarraco, allowing the moral influence of his success to sink into the minds of the Spanish and thus gain their support before taking the offensive anew.

For ancient authorities *see* Polybius x. 2–20; Livy xxvi. 42. Modern Works: B. H. Liddell Hart, *A Greater than Napoleon—Scipio Africanus* (1926); Kromayer Veith, *Schlachtenatlas* (1922) for topography.

CARTAGO, the fifth city of Costa Rica, Central America, 12 mi. E. of San José on the main line of the Costa Rica railway at an altitude of 4,930 ft. above sea-level. The population in 1940 was 8,786. Cartago lies on the plateau of San José at the base of the Irazú volcano (11,200 ft.) and is the first city reached by the traveller after leaving the Caribbean coast at Puerto Limón, 92 mi. to the east. The climate is subtropical; the temperature averages about 68°. The town is in the heart of the coffee region of Costa Rica and is one of the oldest cities in Central America. It has been visited by various earthquakes and almost destroyed a number times, the last disturbance in 1920 being accompanied by fire. In 1723 water in the crater of Irazú was loosed on the city by an earthquake and in 1841 a severe earthquake destroyed many of the oldest buildings. The ancient churches are still in existence, however, and some of the older government buildings. The town was founded by the Spaniard Vazquez de Coronado in 1522, the present name dating from 1563. It was the capital of Costa Rica until 1823 when the seat of the government was transferred to San José. The town lies on the main highway to the Caribbean coast, not always passable by automobiles, but one of the oldest highways in Central America, and it is also on the main line of the Costa Rica railway which was built to Cartago from San José in 1871. Famous hot mineral springs are situated in Bella Vista, a suburb of Cartago The chief industry is coffee growing in the volcanic soil, the type of land in which the most famous of the Central American coffees are cultivated.

CARTE, RICHARD D'OYLY (1844–1901), English impresario, was born in Soho, London, on May 3, 1844, the son of a flautist, who was a partner in the firm of Rudall, Carte and Co., instrument makers. Young Carte matriculated at University college, London, in 1861, and then entered his father's business, using his spare time for the composition of operettas. In 1870 he set up in business for himself as a concert and lecture agent, and soon had many famous names on his list. His first important theatrical venture was the production of Gilbert and Sullivan's *Trial by Jury* (March 25, 1875). He then formed a small syndicate to rent the Opéra Comique for the production of other Gilbert and Sullivan operas. The enterprise was a huge success. After the production of *H. M. S. Pinafore* (1878) the syndicate was dissolved, and Carte, Gilbert and Sullivan conducted the enterprise as partners, Carte being manager of the theatre. Carte then built a permanent home for light opera in the Savoy Theatre, where for many years the Gilbert and Sullivan operas enjoyed unlimited popularity, making the fortunes of all concerned. For the subsequent course and eventual termination of the partnership *see* the articles GILBERT, SIR WILLIAM SCHWENK and SULLIVAN, SIR ARTHUR SEYMOUR. The last work which they wrote together was *The Grand Duke* (1896). After that date Carte relied partly on revivals, and on new combinations of authors and composers. At the same time he organized touring companies which performed the Savoy works all over the country. A less successful venture on his part was the building of what was called in the first instance the English Opera House, with the object of establishing grand opera on a permanent basis in London. For the undertaking, after making a promising start with Sullivan's *Ivanhoe* (Jan. 31, 1891), followed by an English version of Messager's *La Basoche*, proved a failure, and Carte sold the house to Augustus Harris, who turned it into the Palace Theatre. Carte did not *long survive his friend Sullivan, dying on April 3, 1901, but the operations of the touring companies which he had founded con*tinued to be carried on with success by his widow, Mrs. Stanley Carr Boulter.

CARTE, THOMAS (1686–1754), English historian, was born at Dusmoon, near Clifton. He was secretary to Atterbury, and spent some time in exile after Atterbury's disgrace. His *General History of England* (4 vols. 1747, 1750, 1752 and 1755) has value as a storehouse of facts. He also published *A Life of James, duke of Ormond*, containing letters, etc. (3 vols. 1735–36; new ed., in 6 vols., Oxford, 1851), and a *History of the Revolutions of Portugal*, with letters of Sir R. Southwell during his embassy there (London, 1740). His papers became the property of the university of Oxford, and were deposited in the Bodleian library.

CARTEL or **KARTEL,** a form of combination among manufacturers, by which the independent firms and establishments in a particular trade or process contract to regulate their output and, in certain cases, their prices.

During the last decade before the World War, in Germany and in other countries cartels were gaining great importance. They were by no means confined to the so-called heavy industries, which are most suited for the formation of cartels owing to their large scale; industries with smaller units, especially the textile industries, were also increasingly organized in such groups. The increasing formation of cartels in merchanting, partly under the influence of the great industrial cartels; may also be mentioned.

During the World War the Government of the German Reich made use of cartels for supplying the enormous requirements of the army. As the output capacity of the individual undertakings was known, it was possible to allocate orders amongst them in a satisfactory way. It is true that the sudden demand, even apart from the scarcity of raw materials, which soon set in, necessitated the grant of higher profits, but the price increases were often much higher where application had to be made to individual firms.

Many cartels, especially the so-called contracts cartels, were formed during the war for the exploitation of urgent army requirements, and, later, associations of traders were formed to exploit the increasing scarcity of goods; but the great and well known cartels were moderate in their price-fixing. The fixing by the State of maximum prices was not so often necessary in their case, and was, in any case, more easily effected. Nevertheless the Government soon found themselves compelled to intervene in the cartel system, because many cartels failed to show proper consideration to consumers. The textile cartels, in particular, were compelled to reduce prices to the consumer.

State Interference.—But State interference with the cartels went further, as a rule, in the form of maintaining existing cartels or of compulsory amalgamation. It was recognized that dissolution of the cartels and return to unregulated competition was economically undesirable, and would render impossible the economic utilization of raw material and labour. Following the precedent created in the case of the potash syndicate, which in 1910 was compulsorily reconstituted in order to prevent its collapse, the German Governments have created compulsory syndicates, especially in mining. Under the threat of such action the Rhenish-Westphalian coal syndicate was reconstituted just before the contracts expired. The State justly feared that if this great organization fell to pieces the maintenance of a regular supply to the consumers and a uniform control, both of export and of internal consumption, would not be possible.

The industrialists have, for the most part, not been opposed to such compulsory cartels, because the accompanying rationing of production, raw materials and marketing also facilitated future monopolistic combination. Herein, however, lies the danger of these methods, which the State endeavours to counter by granting the consumer and also the workers certain rights in these organizations, and by consulting with their representatives.

The power of the State in relation to industry, which had grown extraordinarily during the war, was still further strengthened in Germany when the Socialists came into power after the collapse in 1918, and demanded the socialization of these industries. In practice, however, the existing compulsory syndicates for potash, coal and iron were merely further extended, and far-reaching powers for the regulation of prices were given to the Federal coal council and the Federal potash council, on which workers and consumers were represented. In the iron and steel federation (Eisenwirtschaftsbund) State intervention was not carried so far. On the other hand, in the electrical industry, where the so-called "mixed undertakings" (whose capital was raised jointly by public and private bodies) had played a great rôle in the production and delivery of power over large areas before the war, the attempt was made to increase the influence of the Reich and of its constituent states.

TRUSTS IN GERMANY

Even before the World War cartels were far from the only form of combination of several undertakings. After the strong cartels in coal-mining had come into being, it was more advantageous for the large iron and steel works to possess their own coal-mines. The so-called "pure" rolling-mills, which had to buy their raw material from the combined steel works, which were also their competitors in the sale of the manufactured products, were likewise at a disadvantage. Thus the association of raw material producing and manufacturing concerns in a single undertaking became increasingly common. Great combined undertakings arose, above all in the mining industry and in the electrical and other metal industries, which extended far into the finishing industries. The term "trust" made its appearance; but real trusts—the amalgamation of a whole industry into a single monopolistic undertaking—these were not. Such trusts only arose in a few specialized industries: in the dynamite trade, and also in regard to the amalgamation of all German rice-mills in a holding company, and in the accumulator industry.

With the increase in the number of joint-stock companies in many industries, the tendency to fusion, and still more to the acquisition of participations in other industries, was very active. In banking, the linking of provincial banks to the great Berlin banks had been going on for a long time. Participation and the formation of subsidiary companies was most extensive in the electro-technical industry and in large constructional undertakings. A substitute for cartels is provided in a smaller category of undertakings by the *Interessengemeinschaften*. These consist chiefly in a pooling of profits to secure an equalization and distribution of risk; they are mostly formed for long periods, and practically exclude competition between those concerned. As a rule there is also an interchange of directors and members of control boards (*Aufsichtsräte*), and often participation by the acquisition of shares. After the crisis of 1900 the first important *Interessengemeinschaft* was the agreement concluded in 1902 for 20 years between the two largest German shipping companies and the International Mercantile Marine Company, which ended at the outbreak of the war.

The Chemical Industry.—Of still greater importance were the two great *Interessengemeinschaften* formed in 1904 in the chemical industry. The first, between the Höchster Farbwerke and the firm of Cassella & Co., took the form of an exchange of shares, the second, between the Badische Anilin und Soda Fabrik, the Elberfelder Farbenfabriken and the Berliner A.G. für Anilin-Fabrikation, took the form of pooling profits in the proportion of 43 : 43 : 14. In 1916 these groups combined to make common cause against the fierce foreign competition expected after the war, and two other large factories also came into the combine.

CARTELS AFTER THE WAR

In the post-war period, with its economic insecurity and its colossal inflation, financial forms of organization became more prominent, while the cartels lost for the time being in importance. With the shortage of goods and the apparent prosperity due to inflation, high prices could be obtained without cartels. These played a larger rôle in local industry and trade, where it was important to make prompt adjustments to the daily price increases. In large-scale industries, however, certain traders and speculators took advantage of the opportunity of buying up whole groups of undertakings with cheap credits. There arose the great vertical combines (*Konzerne*), such as had already existed in the electrical and mining industries, whose scope was now greatly extended.

By the dissociation of the Lorraine and Luxembourg works many of the greatest undertakings had lost their economic basis, and had to be completely reconstructed. Thus Hugo Stinnes created in the Siemens-Rhine-Elbe-Schuckert Union a close *Interessengemeinschaft* of three great mining undertakings with the electro-technical Siemens-Schuckert-Konzern. At the same time he built up a great private combine with a number of very distinct undertakings. Other mining combines also, such as the Phönix, Klöckner, Lothringen, etc., were further extended. In the potash, cotton and cement industries great vertical combines were also created. The penetration of wholesale trade, which had made very large profits during the war, into industry is worthy of note; often even very large undertakings suddenly came into the hands of a large trader or speculator. In many cases undertakings were thus grouped together which stood in no organic relation to one another, and which were only kept united by the financial transactions of the founders. In 1926 about 75% of the German coal output, 75% of the coke output, and about 70% of the steel output was produced in the great vertical combines of the mining industry.

With the stabilization of the mark in 1924 and the great scarcity of capital consequent on the destruction of all liquid capital, many of these artificial combines broke down, with great losses for those concerned. On the other hand the shortage of capital and the unfavourable economic outlook demanded a great reduction of costs and the most efficient technical and commercial organization. Thus many new amalgamations came into being, mostly in the more rational form of a complete fusion. The seven chemical firms already mentioned as being associated in an *Interessengemeinschaft* were absorbed by the oldest and largest of them, the Badische Anilin und Soda Fabrik, which increased its capital for this purpose from 176,000,000 marks to 640,000,000 marks, and took the name of Interessengemeinschaft Farben-Industrie A.G. In 1926 the capital was raised to 1.1 milliards marks, and the great explosives ring of the Cöln-Kottweil A.G. and Dinamit Nobel A.G. were taken into it, through which the I.G. dyestuffs industry came into yet closer relation with the artificial silk industry. There are also relations existing with other German and English artificial silk producers, with the Imperial Chemical Industries, Ltd., with the two great oil rings (through the German Gasolin Gesellschaft) and with many more German and foreign chemical enterprises. This group had already a monopoly position in many products, so that here we may speak of a real trust.

An equally great concentration of capital is found in the union of several of the greatest vertical combines of the Rhine-Westphalian iron and steel industry, namely, the Phönix A.G., the Thyssen undertakings, the combine of the Gelsenkirchen and German-Luxembourg Mining Company, to which the Bochum Cast Steel Union also belongs, and of the Rheinische Stahlwerke. These transferred their production plants to the newly founded Vereinigten Stahlwerke A.G. (capital 800 million marks common shares, and 125 millions preference shares). They themselves remained in existence, however, as holding companies. The construction is here somewhat different from that of the great chemical industry. Although other large steelworks have been acquired (Stinnes Trust), the Vereinigten Stahlwerke (United Steelworks) have no monopolistic position. Their share in the various federations amounts only to 22–53%. In Upper Silesia and Central Germany also there have come about great fusions of steelworks.

In other industries, the striving for the greatest possible cheapening of costs of production makes fusion very prevalent. Many great fusions are to be found in the linoleum industry, in jute, cement, and mill construction, and in the watch, clock and photographic industries.

In spite of these great amalgamations, the number of cartels has not become less; the desire of employers to restrict competition was further increased by the severe economic crisis. The saying that cartels are children of necessity holds good.

The Cartel Court.—For a long time a cartel act was demanded in Germany. In July, 1922 a cartel advisory committee was formed, including members of the *Reichstag*, the *Reichsrat* and the

Federal Economic Council. On Nov. 2, 1923, the Government issued an "order against the misuse of monopoly power." A cartel court was erected which can be set in motion by the Government as well as by the contracting parties. The chief provisions are as follows:

Section 1: "Contracts and regulations which lay down obligations in regard to production and marketing, conditions of business, the nature of price fixing or price lists (syndicates, cartels, conventions and similar agreements) must be made in writing." Verbal contracts and the like are invalid.

Section 4 is the most important: "If a contract or regulation of the type described in Section 1 . . . endangers the economic system as a whole or the well-being of the community, the Federal minister of economics can (1) appeal to the cartel court to declare the contract or regulation to be invalid . . . (2) decree that all parties to the contract or regulation can at any time cancel the contract or withdraw from the regulations, (3) demand the submission of copies of all agreements. The welfare of the community is to be regarded as endangered when production or marketing are restricted in an economically unjustified manner, when prices are raised or kept high, or when price increases are made to cover the risk of currency depreciation, or when economic freedom is inequitably restricted by embargoes on purchase or sale or by discriminating prices or conditions."

These provisions are only permissive, since power is merely given to the Federal minister of economics under certain circumstances to apply for a declaration rendering the contract null and void. Section 8 goes much further. It runs:

"Contracts or regulations of the type described in Section 1 can be cancelled without notice where an important reason exists." An important reason is always to be held to exist if the economic freedom of the cancelling party is inequitably restricted in regard to production, marketing or the determination of prices.

Section 9 runs: "Guarantees may not be demanded, nor embargoes or similar prejudicial measures be imposed, in virtue of contracts and regulations of the type described in Section 1, without the consent of the chairman of the cartel court. Those concerned can appeal within a week of the decision to the cartel court."

Hitherto Sections 8 and 9, which are directed against the so-called exclusive contracts (obligations to trade exclusively with members of the cartel, boycotts, embargoes on delivery and the like) have been mainly enforced. But in the summer of 1925 the Government resolved, in connection with its endeavours to bring about a fall in prices, to proceed more energetically against the cartels, and a number of them have been dissolved, while others have been compelled to alter their trading conditions. (*See* TRUSTS; COMBINES.)

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CARTER, ELIZABETH (1717–1806), English poet and translator, daughter of the Rev. Nicholas Carter, was born at Deal, Kent, on Dec. 16, 1717. Dr. Carter educated his children, boys and girls, alike; but Elizabeth's slowness tired his patience, and it was only by great perseverance and hard work that she acquired her learning. She learned Greek and Latin, and Dr. Johnson said concerning a celebrated scholar that he "understood Greek better than any one whom he had ever known except Elizabeth Carter." She learned also Hebrew, French, German, Italian, Spanish, Portuguese, and Arabic, besides studying astronomy, ancient geography, and ancient and modern history; and yet Johnson commended her housewifery no less than her learning. In 1734 some of her verses, signed "Eliza," appeared in the *Gentleman's Magazine*, to which she contributed for many years. In 1738 Cave published her ***Poems upon Particular Occasions;*** in 1739 she translated Algarotti's *Newtonianismo per le Dame*, as *Sir Isaac Newton's Philosophy explained for the use of the Ladies, in six Dialogues on Light and Colour.* Her translation of Epictetus (1758) was undertaken in 1749 to please her friends, Thomas Secker (afterwards archbishop of Canterbury) and his niece, Catherine Talbot, to whom the translation was sent, sheet by sheet, as it was done. In 1762 Miss Carter printed a second collection of *Poems on Several Occasions.* She died in Clarges street, Piccadilly, on Feb. 19, 1806.

Her *Memoirs* were published in 1807; her correspondence with Miss Talbot and Mrs. Vesey in 1809; and her letters to Mrs. Montagu in 1817. *See* also *A Woman of Wit and Wisdom* (1906), a biography by Alice C. C. Gaussen.

CARTER, HOWARD (1873–1939), Egyptologist, was born in Swaffham, Norfolk, Eng., and educated privately. He received training in archaeological surveying under Professor Flinders Petrie and others, joined the staff of the Egyptian Exploration Fund in 1890 and engaged in excavations on their behalf until 1899. Later he became inspector-general under the Antiquities Department of the Egyptian Government and found the tomb of King Mentuhetep. Subsequently, when working in collaboration with the earl of Carnarvon (d. 1923), Carter discovered many tombs, among them that of Tutankhamun, during the years 1907–23. He has given an account of his discoveries in *The Tomb of Tut-ankh-Amen, The Tomb of Thothmes IV.*, and in contributions to various archaeological journals.

CARTERET, SIR GEORGE (*c.* 1610–1680), English politician, born between 1609 and 1617, on the island of Jersey, was the son of Helier de Carteret of St. Ouen. In 1639 he was made comptroller of the English navy, and during the Civil War was active on the king's side. Succeeding his uncle, Sir Philip Carteret, as bailiff of Jersey in 1643, he was appointed lieutenant-governor of the island in the same year. After subduing the Parliamentary party in the island, he was commissioned (1644) a vice-admiral of Jersey, and as such carried on an active privateering campaign in the Royalist cause. Under his rule Jersey was a refuge for Royalists, among them Prince Charles (1646 and 1649–50), who created Carteret a knight and baronet. Parliament branded him as a pirate and excluded him from any future amnesty. In 1651 Carteret, after a seven weeks' siege, surrendered Jersey to a Parliamentary force, and, joining the Royalist exiles in France, for a time held a command in the French navy.

He returned to England at the Restoration, became a privy councillor, sat in parliament for Portsmouth, and served as vice-chamberlain of the royal household. From 1661 to 1667 he was treasurer of the navy, but was censured by parliament for his lax method of keeping accounts. In 1667 he became a deputy treasurer for Ireland, and was later appointed a commissioner of the Admiralty and a member of the committee of trade and plantations. Carteret was one of the eight to whom Charles II. granted the country of the Carolinas by the charters of 1663 and 1665, while in 1664 James, duke of York, granted his American territory between the Hudson and Delaware rivers to Carteret and to John, Lord Berkeley; this tract was called New Jersey in Carteret's honour. In 1674 Lord Berkeley disposed of his share of the grant, which finally fell under the control of William Penn and his associates. With them Carteret agreed (1676) upon a division of the colony into East and West Jersey. He died in Jan. 1680, and two years later his heirs disposed of his New Jersey holdings to Penn and other Quakers.

Sir George Carteret married Elizabeth George Carteret, daughter of his uncle, Sir Philip Carteret. George, son of his eldest son Philip, was created Baron Carteret of Hawnes in 1681.

CARTERET, a borough of Middlesex county, New Jersey, U.S.A., 5 m. S. of Elizabeth; served by the Central railroad of New Jersey. Pop. (1920) 11,047 (46% foreign-born white, the majority from Austria and Hungary); 1940 federal census, 11,976. It has important industries, notably the refining of metals and the manufacture of iron, steel, fertilizer and chemicals. Carteret was founded (under the name of Roosevelt, later changed in honour of Philip Carteret, the first governor of the colony) in 1906 and incorporated in 1907.

CARTERSVILLE, a city of Georgia, U.S.A., 45 mi. northwest of Atlanta, on the Etowah river and federal highway 41; the county seat of Bartow county. It is served by the Louisville and Nashville, the Nashville, Chattanooga and St. Louis and the Seaboard Air line railways. The population was 5,250 in 1930 (34% Negroes) and was 6,141 in 1940 by the federal census. It is in a productive agricultural and mining region, and ships cotton, lime and limestone rock, iron ore, manganese, barites, slate, potash and manufactured ochre. The city was founded in 1760 and incorporated in 1859.

CARTESIANISM signifies the philosophy of René Descartes and his followers, more especially Antoine Arnauld, Arnold Geulincx and Nicolas Malebranche. The most characteristic views of this whole school of thought are (1) its Dualism, that is, the view that minds (or souls) and material bodies are absolutely distinct substances incapable of any interaction, and (2) its Occasionalism, that is, the view that all apparent interaction between mind and matter is really due to the direct intervention of God, who produces a change in the one kind of substance on the occasion of the occurrence of a change in the other kind of substance.

See DESCARTES; CARTESIANS, and the literature given there.

CARTESIANS, the name by which the followers of the French philosopher, Descartes, and his school are now generally known. The word was taken from the last syllable of the founder's name, and although Spinoza and Leibnitz are sometimes included among Cartesians, their modifications ultimately exclude them. The accomplishments of Descartes' followers cannot be properly understood or estimated apart from a survey of the deficiencies in his philosophy that remained to be made good. These may be reduced to five. (1) Descartes concludes that physical bodies and particular selves or minds form two separate classes of substances. Their existential independence and complete qualitative dissimilarity is guaranteed by the fact that we can have a clear and distinct idea of each of them without having to think of the other. But man is, in some sense, "a unity" of the two, an embodied mind. in him, these two independent substances co-exist. So one task Descartes leaves for completion is that of explaining how, if these substances are disparate in existence and nature, their unity is to be conceived. Arnauld questioned the validity of this conclusion, but Geulincx, admitting it, supplies an answer to the problem. (2) Minds and bodies being disparate, it followed, Descartes thought, that there was no causal interaction between them. States of mind could not cause bodily changes, nor could the latter cause the former. Descartes restricts himself to this negative conclusion, offering no account of the causation of mental or physical events. The theory of Occasionalism, in the "restricted" form invented by Geulincx, and in the "complete" form of Malebranche, supplements this defect by an extension of Cartesian principles. (3) If body and mind are separate substances, what is their relation to God? For God also is a substance, and one that is infinite and complete. But a substance is that which depends on nothing else for its existence, so it should follow that mind and body are independent of God. But Descartes had previously argued that their nature and existence depended on God. The contradiction is not removed by his subsequent distinction between God as genuine substance, and body and mind as "secondary" ones. This verbal emendation is without logical efficacy and simply amounts to a piece of theological etiquette. It is the Occasionalism of Geulincx and Malebranche which removes this difficulty, though only at the cost of introducing a new one. (4) Descartes' statements about the nature of ideas were deficient in detail. Malebranche considers himself to supplement them by his theory of ideas and his "vision in God." This emendation is the subject of a controversy with Arnauld, which, though violent, had fruitful consequences for all subsequent philosophy. (5) Descartes developed no strictly ethical theory, though his *Passions of the Soul* would have constituted its psychological basis, if he had done so. He writes to Chanut (1646), prior to his unfortunate visit to the Queen of Sweden, that ethics was a province on which he dared not enter, for professors had fallen into a passion even on account of his harmless principles of physics; they would give him no rest if he wrote on ethics. This prediction seems to have been fully borne out in the unhappy and persecuted life of his follower, Geulincx, who completed the Cartesian system with an important treatise on Ethics.

Minor Cartesians.—The new Rationalistic philosophy speedily became a subject of admiration for the best scholars of the time, and a ground of persecution for its ecclesiastical detractors. Descartes himself stood aloof from the *mêlée* of enthusiasm and vituperation so far as was humanly possible. Regius (Henry le Roy) had introduced Cartesian physiology into his lectures in medicine at the University of Utrecht, but the worth of his zeal is dubious. His text-book on physics (*Fundamenta physicae*) contained so many unproved assertions and reduced the Cartesian dualism of body and mind to a materialism, that Descartes had publicly to disclaim responsibility for it. More important is Sylvain Régis, whose *System de philosophie* (1690) shows the first definite move towards an Occasionalism. God is the only substance, therefore the only genuine cause. Physical and mental events have only "secondary" causes, bodies and minds are merely instruments which manifest God's causality. The self is not independently active though it does independently determine the character which the communicated activity shall manifest; thus it is a "director" but not a "producer" of changes. Body and mind, however, are still conceived as separate, events in one occurring collaterally with those in the other. Louis de la Forge maintains substantially the same view, but with this significant difference. The self is a genuine cause of all changes voluntarily and consciously initiated, God causing only those changes that are involuntary and unconsciously brought about. Géraud de Cordemoy reaffirms (*Dissertations philosophiques sur le discernement de l'âme et du corps*) the contention of Régis, that God alone is genuinely causative. Bodies, not being possessed of volition, cannot cause changes either in other bodies or in minds. Movement is not imparted from one body to another, but from God to each. The self can cause its own volitions, though again, their occurrence is only the occasion on which God causes an external change to occur, corresponding to the purpose willed. So the efficient cause of a movement in our body, whether willed by us or not, is never our own self, but God We neither produce nor "direct" physical changes or events For this reason, John Clauberg inferred the uniform correspondence between the two orders of events to be a standing miracle. But the self can "direct" (determine the character of) the physical activity resulting in its own body on the occasion of particular volitions, though the body cannot likewise determine the character of mental events occurring in the self it embodies. In this way, Clauberg combines the views of de la Forge and Régis, but deviates from those of Cordemoy. These are brought to their logical completion by Geulincx.

GEULINCX

So far then, only hesitant moves towards Occasionalism are traceable. But with Arnold Geulincx of Antwerp (1625–69), the doctrine is for the first time definitely elaborated. It is no longer merely proposed as an hypothesis, but an attempt is made to formulate it strictly and demonstrate it with certainty. His Metaphysics falls into three divisions, viz., Autology, or Knowledge of Self; Somatology or Rational Physics; and Theology, though it is generally agreed that his finest work lies in moral philosophy, viz., the "*Γνῶθι σεαυτὸν, sive Ethica.*" Like Descartes, Geulincx sets himself methodically to doubt every belief which can be doubted, with the object of discovering *one* whose truth being self-evident constitutes a piece of certain knowledge. This he too finds in the *Cogito, ergo sum;* his own existence is the one thing with which he can be directly and indubitably acquainted. Descartes' constructive use of the *Cogito* was to infer from it the epistemological principle that any other proposition which is equally clear and distinct is likewise true and certain, though he did not always respect the principle in practice. Geulincx's constructive use of the *Cogito* is to infer from it the principle that all activity of the self is conscious activity, no unconscious activity can be an activity of the self, and to this he does always strictly adhere But interrogation of the self so disclosed to inspection elicits seven clear and distinct beliefs, which are true, viz., (i.) that we conceive an external world, (ii.) of which we form a part, (iii.) that our self is related our body, (iv.) that we did not produce the world, (v.) nor any of the movements in it, (vi.) that we did not produce our own body, (vii.) nor any of the changes in it. They are ordinary beliefs of common sense, except (v.) and (vii.), which follow by the principle inferred from the *Cogito.* But self-examination further discloses the presence to mind of very various sorts of thoughts, other than these beliefs, also the occurrence of different kinds of mental events. Hence, two fields of enquiry open out, viz., what is the character of our thoughts, volitions and mental activities generally, and of that which thinks and wills on such occasions? Now the former are of indefinite variety, but the latter is single and simple (*i.e.*, without parts and unchanging). Further examination of the infinite variety of thoughts, volitions and other mental activities shows that though they are all "ours," they are so in two quite distinct senses. Some mental activities are "ours," since it is our own self that wills them, or causes their occurrence; hence, they are dependent on our self for their existence. Other mental activities are "ours," in another sense, viz., that they occur "in" us, but are not caused by us. This distinction among our mental activities, according as they are, or are not, caused by us, is vital for Geulincx. We are the cause of all our mental states of which we know, not merely *that* they occurred, but also *how* they occurred. "If you do not know the means by which a thing is produced, it is not you who produced it"; *i.e.*, if you are not acquainted with the entire course of events which led up to the occurrence of the state in question, it is a state causally independent of yourself. This fundamental principle of Geulincx is taken along with the *Cogito,* as being self-evidently true, and therefore a piece of certain knowledge. Now the mode of production of all activity that is not caused by our self is to be conceived by analogy with that which is so caused. From which it follows that our independent states or activities are caused in us by some other individual who knows and wills them, and this can only be God. But although the causation of independent states can be assigned to God, the diversity of their characteristics cannot be so explained, for God, like the self, is simple, and thus not the ground of diversity. So, since everything which exists is either God or a self, or a body, and neither God nor a self can be the ground of diversity, it must be due to bodies. Hence the diversity of the extended world is the ground of the diversity in my experiences. So God's activity accounts for the fact of the *occurrence*, and Matter for the *character*, of our independent states or of external events. Pure thought and volition are the two properties of the self, extension and mobility those of matter or bodies.

But among the many bodies in the world, one I recognize as being "mine." It is "mine" in the sense, not that my self can directly cause changes in it, but that it is through this body, and it alone that I come to have my "independent" experiences. What then is the relation of "my body" to me; what is meant by speaking of "my" body? Strictly, Geulincx replies, it is meaningless to speak of my mind or self being "united" with my body. Had I no body, I should still have the idea of movement, though I should not experience those sensations that are aroused in me on the occasion of movement in the outer physical world. A self is related to its body in being active or passive in respect of the changes that occur in it. This relationship between self and body, which constitutes the two a human individual, is not initiated by any volition of that self. And when that relation ceases to relate its terms, *i.e.*, at death, the self ceases, not from existing, nor from exercising its essential activity of thinking and willing, but only from experiencing sensations and memories, for these depend on bodily changes. Hence, to be a man is not to be a self united to a body, but to be a self which is active and passive, relatively to some one and the same material body.

Occasionalism.—Geulincx reaffirms that materiality and mentality are completely disparate qualities. A physical change cannot cause a mental change, nor *vice versa.* Neither can matter, being only extended, cause changes among its parts (*i.e.*, motion). But changes, both physical and mental, do appear to occur; what then causes them? Changes in our sense organs and nervous system consequent upon physical stimulation, are, it is true, followed by mental changes, but the bodily changes are only the occasions on which a subsequent mental change occurs; they do not cause it. Physical events and mental events form two closed systems that are not causally related. The occurrence of an event in one order is simply the occasion on which God causes the occurrence of another event, either in that order or in the other. So all "external" and "internal" physical events are caused by divine volitional activity. And all occurrences of "independent" experiences, since they depend on the body, are similarly caused. But what causes the occurrence of the self's "dependent" experiences? Here two views are possible; the one (Complete Occasionalism), that these experiences too (*i.e.*, volitions and pure thought activity) are caused by divine activity; the other (Restricted Occasionalism), that they, though no other kinds of mental events, are the spontaneous and essential activity of the self, and therefore caused by it. The former was held by Malebranche, the latter by Geulincx. Thus, when I perceive a bodily change and will to perform a certain action in consequence, an action of that kind then ensuing in the physical world, according to Malebranche all these events, physical and mental, are successive effects of divine volition; for Geulincx, though the occurrence of the perceptual act and the physical action are effects of divine volition, the volitional act is caused by myself and not by God, the perception God caused being the occasion on which my self caused its own volition to occur, and this in turn being the occasion on which God caused the external change to occur. My own causal efficacy then is limited to volitional acts. But I may will to *do* something, or to *know* something. Hence two sorts of problems arise at this juncture, those of epistemology and of ethics. My empirical knowledge, being dependent on my perception of events in my own or in other bodies, is due to divine causation. But knowledge of *a priori* truths (*e.g.*, mathematical propositions) is a knowledge of ideas in the divine mind. In so far as we can acquire a systematic knowledge of such *a priori* ideas, we attain to a knowledge of the world independently of sense experience, and so to a knowledge of the world and its parts as a system of bodies uncharacterized by sensible qualities (Rational Mechanics).

Ethics.—My own effective causation is limited to my volition. But it is possible for me to will, not merely changes whose occurrence is not caused by me, but changes which do not occur at all. Of all possible volitions, some only are effectual, and of these again, some only are permissible. And our knowledge of which effectual volitions are permissible depends on discovering the nature of divine thought and will. Hence virtuous conduct is the result of making our volitions conform to the divine reason, which is the expression of perfect rationality. Virtue is therefore defined as "the unique love of right reason" (*cf.* Spinoza's "Intellectual Love of God"). There are three kinds of love, viz., the determination to benefit (1) oneself, or (2) another, and (3) the love of reason. Love of self is the root of all moral evil, and the attainment of virtue involves both of the self's proper activities; reason, to ascertain what is the will of God, and volition, so as to will accordingly. Our volition so conformed will be the good will; we shall will to do what we see to be right simply because we see it to be right. So the source of all virtuous conduct is the good will, which is simply the determination to will only those actions which conform to reason. It is evinced in four classes of action, each of which manifests a specific or cardinal virtue, viz., diligence, obedience, justice and humility Diligence consists in withdrawing our love from the external things of sense and, by means of self-examination, in becoming attentive to reason, which is conceived as an inward disclosure of which actions are right and which are wrong. These discovered, it remains to act in conformity with them, and such action expresses the virtue of obedience. Our actions are just in proportion to the exactness with which our volitions conform to the requirements of reason, which sets the standard or mean. Failure to realize this virtue in our conduct shows that we have erred, by excess or defect, through yielding to non-rational motives or impulses. But the sum and complete realisation of all virtues is humility; if this be attained nothing is lacking. Humility in conduct is the manifestation through it of a true recognition and conception of self, and is the outcome of adequate self-examination. To know ourselves as we really are renders self-assertion impossible, for we see the futility of worldly desires which, issuing only from self-love, now cease from tormenting us. We realize our dependence on God. We recognize that the performance of our duty is required of us unconditionally, and not because it will conduce to happiness or protect us from harm or suit our convenience in any other way or confer any benefit upon us.

The good, which is the end of all action, is defined as that which we rationally love, and evil, as that which we rationally dislike. The useful is only instrumental; the pleasant can only be the aim of self-love, but love of the good is an imperative of reason. Emotions and desires are really neither good nor bad. When we call them so, we mean simply that they are pleasant or painful. They have no ethical significance except in relation to the love of reason, when, as hindrances to its expression, they are bad. Self-knowledge, then, brings resignation. He who is good and wise in his life renounces the world, its pleasures, honours and riches, and submits to the rational or divine order of life. So the connection between the nature of self and its place in the world, the relation between the autology and the ethics, becomes clear. Where we can do nothing we ought to will nothing. Now we cannot produce changes in our own body any more than in the world at large. Hence we should *desire* nothing for our body; our relation to the body is one of knowledge, not one of action So renunciation of "the world and the flesh" follows: *despectio sui* is the consequence of *inspectio sui*.

ARNAULD

The first philosophical contribution of worth from Antoine Arnauld (1612–94) is his *Objections* to the *Meditations* which Descartes had circulated for criticism prior to publishing. Discussion centres in the main around the distinction between the human body and the human mind. Descartes had maintained that we can infer with certainty from our direct acquaintance with the self that its essential nature was unlike that of physical bodies. His critic admits this may be so but denies Descartes to have proved it. All that his argument establishes is that *some* trustworthy knowledge of the self is possible independently of any knowledge of the body. This does not warrant his asserting that the quality of being conscious exhausts the nature of the self, therefore he has no right to conclude that the self is not corporeal as well as conscious. Arnauld expresses himself satisfied with Descartes' reply, though later he seems to return to a view in all essentials similar to that of his *Objections*.

But his principal work in philosophy is undoubtedly the treatise *Des vraies et fausses idées* (1683), a most detailed and incisive refutation of the doctrine of Representative Ideas contained in Malebranche's *De la Recherché de la Vérité*. Malebranche follows Descartes in dividing all existents into two qualitatively exclusive orders, the mental and the physical, and concludes that neither the senses nor imagination can yield us knowledge of external bodies, since the senses can only acquaint us with states of our own mind that occur collaterally with certain physiological changes in the brain. So when we say that we are aware of certain physical objects before us, what our mind is directly related to, Malebranche argues, is not physical objects at all, but certain ideas of them. Physical objects cannot under any conditions cause our minds to know them for four reasons, (i.) because they are inferior in nature to mind, and (ii.) different from our minds in quality. Further, (iii) causal action between finite existents is in any case impossible (*cf.* Occasionalism), and (iv.) the "local" difference, or spatial distance of physical objects from minds, renders direct knowledge of the former impossible, for "to know" is "to be *intimately* connected with" what is known, and "intimate" connection is impossible at a distance. So whilst Descartes required four ultimate terms with which to account for our knowledge of the material world (viz , God, selves, external objects and ideas) Malebranche, eliminating external objects, requires only three. Ideas are the only objects we can directly know (though we can be acquainted with our "feelings" and purely subjective states without "ideas"); "God is the source, the reality and the place of ideas." So whenever we have knowledge we are "seeing things in God."

It is this theory of Ideas that Arnauld attacks with consummate logical skill and acumen in his *Treatise on True and False Ideas.* He first points out there is no sense in asking *why* the mind has perceptions, any more than *why* material bodies have shape, for it is just the nature of mind to be perceptive. Explanation of facts cannot reasonably be required *ad infinitum.* Malebranche, further, has used the term "idea" in varying senses throughout his arguments, to denote indifferently (i.) perception, (ii.) non-representative entities, (iii.) particular existents, numerically distinct from perceptions and thoughts, yet indispensable for our awareness of material things. So Arnauld first undertakes an analysis of the notion of "idea," and the result is an important distinction for epistemology. The Malebranche-Arnauld controversy then centres around the question whether there are "ideas" in the sense of separate mental entities which exist and represent to our minds what is non-mental, or physical in character. The word "idea" is ambiguous. As popularly used it denotes a perceptual or cognitive act of some self; as used by Malebranche, it denotes a representative entity, numerically distinct from cognitive acts and from physical things. In brief, Arnauld decides that the former sense is permissible, but that the latter is a fiction invented simply on account of the fallacious assumption that mind, being mental, cannot be related by way of knowledge, to what is non-mental.

He next examines the grounds Malebranche adduces for demonstrating the indispensability of representative ideas. (1) To the argument that we cannot see an object unless it is present, Arnauld answers that there is a sense in which this is true, and one in which it is false. The "objective presence" and the "physical presence" of an object must be distinguished. To say we perceive, implies that there is *something* perceived; there must be something present to mind if the mind is to perceive it. But this "objective presence" is quite distinct from "local presence," for when I am said to be "thinking of" a person, that person is thereby objectively present to my mind, even though he is "locally" or spatially absent from my vicinity. Whatever I think of or perceive is objectively present by the very fact of my thinking *of* it, but what is objectively present is often physically or locally absent. Malebranche's error consists in having supposed that a thing could not be objectively present to my mind, without thereby being also locally present to it. And one of the functions of the representative idea was precisely to make good, by its presence, this absence of the physical body But imagination and memory furnish countless instances to show the independence of objective presence and local presence. Arnauld does not deny "representation" in every sense. He denies representativeness to ideas in the sense in which, *e.g.*, a photograph "represents" the person whose likeness it is, for such representation, if affirmed of ideas, involves the existence of a separate intermediary between the mind and the physical object represented. But he admits explicitly that there is another sense in which all perceptual activity is representative (or better, "presentative"), viz., the sense in which external objects become presented, when locally near, or "represented" when locally absent, to a mind, by means of that mind's cognitive activity.

(2) Arnauld next deals with the argument that material bodies cannot cause our mind to know them, even when locally present, since, being material, they cannot cause (mental) events in a non-material self. This presupposes that our mind can only know what is capable of acting on it. But to be objectively present to a mind is not to be active on it. The relation of presentation must be distinguished from that of causation, which done, the argument falls.

(3) The next argument is that representative ideas are required because, external objects being material, are "too coarse" in nature to admit of being directly perceived. For this, they would have to be "intimately connected" with the mind, but the mind, being spiritual, could not be connected with anything "coarse" like material particles Hence the supposed necessity of mental intermediaries or ideas which could be "intimately connected" with our minds. Arnauld makes short work of this argument. Even supposing such "imperfection" in bodies, that would only be a ground for denying that a body could be a percipient, not for denying that it could be perceived.

the theory of ideas offends against the principle of logical economy that we should not employ more terms than necessary for an adequate explanation of our problem. Arnauld reiterates, again and again, that the idea, as an intermediate entity between the self and the objects it knows, is completely otiose. There is no good reason for denying that we are directly confronted with physical objects themselves, just as common sense believes. Far from explaining, by means of representative ideas, how we come to know external objects, Malebranche in fact explains just how we *cannot* come to know them. How can we ever know that there do exist independent objects at all, such as our "representative knowledge" is asserted to represent? To call it "representative knowledge" begs the question, for how are we ever to know that any external objects exist? The mind is condemned to a permanent disability from ever knowing material bodies at all. The onus of demonstrating how we come to know of the existence of an external world surely lies with him who denies that we know it by direct perception. And certainly self-inspection does not disclose the presence of any representative or instrumental ideas. Malebranche doubtless foresaw this weighty objection, for he returns the only answer possible, namely, that in point of fact, we do *not* know particular material objects at all. In believing that we do, we fall into illusion and error. What we really know is not this or that particular body, but the geometrical and formal properties of all body. Matter does not really have, but only appears as having, sensible characteristics Pure thought alone, and not sense-perception, can give us genuine knowledge of bodies, as distinct from their appearances. By a deft stroke of Occam's razor, then, Arnauld efiaces these representative intermediaries, and therewith the need for "intelligible ideas in the mind of God." He retains only selves capable of perceptual activity, and external objects. Acts of perception are dually related, viz., to the self, whose states or modifications they are, and to physical bodies, as being directly presented to that self. Before his controversy with Malebranche, Arnauld endorsed his complete Occasionalism, as explaining the occurrence of mental and physical events, but in 1686 (*Réflections théologiques et philosophiques*), he decided against it, maintaining not only that the self is capable of changes of state independently of divine intervention, but, as against even Descartes, he sees no reason why the self should not cause changes in the physical world. Efficient causation between mental and physical events is thus reinstated.

Now as may be anticipated, Arnauld's view is less explicit and satisfactory where what is in question is our knowledge of universals and not of particular bodies. Here he follows the conceptualists, maintaining that universals have significance and reality only in and for our minds: *universalia tantum in mente*. But he sufficiently answers Malebranche that the conceptual activity by which we represent the notion of infinity, is not itself infinite. Wherever Malebranche departs from Cartesian doctrine, Arnauld is at variance with him, and, proceeding in an empirical way more akin to Reid and the Scottish common-sense school, than to the deductive tendency of Cartesianism, he retains most of Descartes' conclusions, even in respect of the origin of our ideas, until his later period His specific problems were those of 17th century French philosophy; his conclusions, and the spirit in which he worked to them, are more suggestive of 18th century thought in England. Except for his conceptualism, Arnauld may well be regarded as having established some of the basic theses of present-day Realism

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(S. V. K.)

CARTHAGE, one of the most famous cities of antiquity, on the north coast of Africa; it was founded about 814–813 B.C. by the Phoenicians, destroyed for the first time by the Romans in 146 B.C., rebuilt by the Romans in 122 B.C., and finally destroyed by the Arabs in A.D. 698. It was situated in the heart of the Sinus Uticensis (mod. Gulf of Tunis), which is protected on the west by the promontory of Apollo (mod. Ras Ali el Mekki), and on the east by the promontory of Mercury or Cape Bon (mod. Ras Addar). Its position naturally forms a sort of bastion on the inner curve of the bay between the Lake of Tunis on the south and the marshy plain of Utica (Sukhara) on the north. Cape Gamart, the Arab village of Sidi-bu-Saïd and the small harbour of Goletta (La Goulette, Halk el Wad) form a triangle which represents the area of Carthage at its greatest, including its extramural suburbs. Of this area the highest point is Sidi-bu-Saïd, which stands on a lofty cliff about 490 ft. high On Cape Gamart (Kamart) was the chief cemetery. The citadel, Byrsa, was on the hill on which to-day stand the convent of Les Pères Blancs and the cathedral of St. Louis, with a very interesting archaeological museum, containing the results of the excavations conducted by Père Delattre, while the objects found in the excavations conducted by the Government are at the Bardo (*see* TUNIS). The harbours lay about three-fifths of a mile south of Byrsa. The tongue of land, from the site of the harbours as far as Goletta, to the mouth of the Catadas which connects the Lake of Tunis with the sea, was known as *taenia* (ribbon, band) or *ligula* (diminutive of *Lingua*, tongue). The isthmus connecting the peninsula of Carthage with the mainland was roughly estimated by Polybius as 25 stades (about 15,000 ft.); the peninsula itself, according to Strabo, had a circumference of 360 stades (41 m.). The distance between Gamart and Goletta is about 6 m.

From Byrsa, which is only 195 ft. above the sea, there is a fine view; thence it is possible to see how Carthage was able at once to dominate the sea and the gently undulating plains which stretch westward as far as Tunis and the line of the river Bagradas (mod Mejerda). On the horizon, on the other side of the Gulf of Tunis, rise the chief heights of the mountain-chain which was the scene of so many fierce struggles between Carthage and Rome, between Rome and the Vandals—the Bu-Kornain ("Two Horned Mountain"), crowned by the ruins of the temple of Saturn Balcaranensis; Jebel Ressas, behind which lie the ruins of Neferis; Zaghwan, the highest point in Zeugitana; Hammam-Lif, Rades (Ghades, Gades, the ancient Maxula) on the coast and 10 m. to the south-west the "white" Tunis (λευκὸς Τύνης of Diodorus) and the fertile hills of Ariana.

Harbours.—The ancient harbours were distinguished as the military and the commercial. The remains of the latter are to be seen in a partially ruined artificial lagoon which originally had an area of nearly 60 acres; there were, however, in addition a large quay for unloading freight along the shore, and huge basins or outer harbours protected by jetties, the remains of which are still visible at the water-level. The military harbour, known as Cothon, communicated with the commercial by means of a canal now partially ruined; it was circular in shape, surrounded by large docks 16½ ft. wide, and capable of holding 220 vessels, though its area was only some 22 acres. In the centre was an islet from which the admiral could inspect the whole fleet. The site is traversed by the railway to the north of the village of Douai ech Chott. From this point northward the whole city was laid out in rectangular blocks, each about 130×500 feet and numerous streets have been located. *See* Haverfield, *Ancient Town Planning* (Oxford, 1913, 113–115).

Byrsa.—The hill of St. Louis, the ancient citadel of Byrsa, has a circuit of 4,525 ft. It appears to have been surrounded, at least at certain points, by several lines of fortifications which have been found to a height of over 20 metres; a well preserved battery for catapults and munition store was also found, but destroyed. *See* R. Fuchs in *Jahrb. d. Instituts* xxxii. (1917); *Arch. Anz.* 3 *sqq.* It was, however, dismantled by P. Scipio Africanus the younger, in 146 B.C., and was only refortified by Theodosius II. in A.D. 424; subsequently its walls were again renewed by Belisarius in 553. On the plateau of Byrsa have been found the most ancient of the Punic tombs, huge cisterns in the eastern part, and near the chapel of St. Louis the foundations of the famous temple of Eshmun and the palace of the Roman proconsul. To the west are the ruins of the amphitheatre. Rather more than half a mile north-west of Byrsa are the huge cisterns of La Malga, which, at the time of the Arab geographer, Idrisi, still comprised twenty-four parallel covered reservoirs of which fifteen only remain (312×410 feet over all). A more recent theory identifies the site of Byrsa with that of La Goletta and the two ports, the quadrilateral commercial harbour and the circular naval harbour, with the Goletta channel and its basin and with the lagoon of Tunis itself (Pinza in *Monumenti dei Lincei,* xxx. [1925] 5 *sqq.*). The quarter of Dermèche, near the sea, whose name recalls the Latin *Thermis* or *Thermas,* is remarkable for the imposing remains of the baths (*thermae*) of Antoninus. Not far off is a Byzantine church with a baptistery, etc. A precinct of Tanit with a large cemetery of infants, small animals and birds, has been also discovered. Farther north are the huge reservoirs of Borj-Jedid which are sufficiently well preserved to be used for the supply of La Goletta.

Behind the small fort of Borj-Jedid is the plateau of the Odeum where the theatre and odeum, with fine marble statues of the Roman period and some private houses have been laid bare; beyond is the great Christian basilica of Damus-el-Karita (perhaps a corruption of *Domus Caritatis*); in the direction of Sidi-bu-Saïd is the *platea nova,* the huge stairway of which, like so many other Carthaginian buildings, has of late years been destroyed by the Arabs for use as building material; on the coast near St. Monica is the necropolis of Rabs where fine anthropoid sarcophagi of the Punic period have been found; while to the north of Damus-el-Karita is the basilica of S. Perpetua. Several extensive cemeteries have been found at various points. In the quarter of Megara (Magaria, mod. La Marsa) it would seem that there never were more than isolated buildings, villas in the midst of gardens. At Jebel Khaui (Cape Kamart) there is a Jewish cemetery.

We must mention finally the gigantic remains in the western plain of the Roman aqueduct which carried water from Jebel Zaghwan (*Mons Zeugitanus*) and Juggar (*Zucchara*) to the cisterns of La Malga. From the *nymphaeum* of Zaghwan to Carthage this aqueduct is 61 Roman miles (about 56 English miles) long; in the plain of Manaba its arches are nearly 49 ft high.

The main authority for the topography and the history of the excavations is Audollent's *Carthage romaine* (Paris, 1901). A topographical and archaeological map of the site was published in 1907; but there is no general up-to-date résumé. For a brief bibliography and plan *see* Pace and Lantier in *Monumenti dei Lincei* xxx. (1926), 129 *sqq.* (X.)

HISTORY

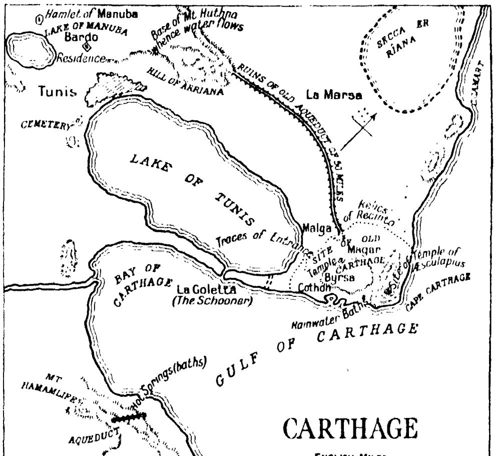
The history of Carthage falls into five periods: (1) from the foundation to the beginning of the wars with the Sicilian Greeks in 550 B.C.; (2) from 550 to 205 B.C., the first year of the Punic Wars; (3) the Punic Wars to the fall of Carthage in 140 B.C.; (4) the period of Roman and Vandal rule, down to the capture of Carthage by Belisarius (A.D. 533); (5) the period of Byzantine rule, down to the destruction of the city by the Arabs in A.D. 698.

(1) **Foundation to 550 B.C.**—From an extremely remote period Phoenician sailors had visited the African coast and had had commercial relations with the Libyan tribes who inhabited the district which forms the modern Tunis. In the 10th century B.C. the Sidonians established a trading station called Cambe or Caccabe. Near Bordj-Jedid, unmistakable traces of this early settlement have been found. Carthage was founded about 850 B.C. by Tyrian emigrants led by Elissa or Elissar, the daughter of the Tyrian king Mutton I., fleeing from the tyranny of her brother Pygmalion. Elissa subsequently received the name of Dido, *i.e.,* "the fugitive." The new arrivals bought from the mixed Libyo-Phoenician peoples of the neighbourhood a piece of land on which to build a "new city," *Karthadshat,* whence the Greek and Roman forms of the name. Dido, having obtained "as much land as could be contained by the skin of an ox," proceeded to cut the skin of a slain ox into strips narrow enough to extend round the whole of the hill which afterwards from this episode gained the name of *Byrsa* (Gr. *bursa* "hide," "skin," play on words with the Phoenician *bosra, borsa,* "citadel," "fortress").

In the 6th century, Carthage is a considerable capital with a domain divided into the three districts of Zeugitana, Byzacium, and the Emporia which stretch to the centre of the Great Syrtis. The limit between the settlements of Carthage and those of the Greeks of Cyrene were eventually fixed and marked by a monument known as the "Altar of Philemae." The destruction of Tyre by Nebuchadrezzar (*q.v.*) in the first half of the 6th century, enabled Carthage to take its place as mistress of the Mediterranean. The Phoenician colonies founded by Tyre and Sidon in Sicily and Spain, threatened by the Greeks, sought help from Carthage. The Greek colonization of Sicily was checked, while Carthage established herself on all the Sicilian coast and the neighbouring islands as far as the Balearic Islands and the coast of Spain.

(2) **Wars with the Greeks.**—In 550 B.C. the Carthaginians led by Malchus, the suffete (*see* p. 946: *Constitution*), conquered almost all Sicily. In 530 B.C. they defeated the Phocaeans and the Massaliotes on the Corsican coast. But Malchus, having failed in Sardinia, was banished by the Carthaginian senate. He laid siege to Carthage itself, and entered the city as a victor. He was put to death by the party which had supported him. Mago, son of Hanno, of the powerful Barca house succeeded Malchus. He conquered Sardinia and the Balearic Islands, where he founded Port Mahon (*Portus Magonis*). The first agreement between Carthage and Rome was made in 509 B.C., in the consulship of Iunius Brutus and Marcus Horatius. It assigned Italy to the Romans and the African waters to Carthage. Sicily remained a neutral zone.

Mago was succeeded by his elder son Hasdrubal (*c.* 500) who died in Sardinia about 485 B.C. His brother Hamilcar, having collected a fleet of 200 galleys for the conquest of Sicily, was defeated by the combined forces of Gelon of Syracuse and Theron of Agrigentum under the walls of Himera in 480 B.C. the year in which the Persians' fleet was defeated at Salamis. It is claimed that 150,000 Carthaginians were taken prisoners.



FROM "MONUMENTI ANTICHI," BY COURTESY OF RAYMOND LANTIER

MAP SHOWING THE SITE AND PRINCIPAL MONUMENTS OF ANCIENT CARTHAGE

About 460 B.C., Hanno, son of Hamilcar, passing beyond the Pillars of Hercules (Straits of Gibraltar), founded settlements along the West African coast, in the modern Senegal and Guinea, and even in Madeira and the Canary Islands.

In Sicily, the war lasted for a century. In 406 B.C. Hannibal milco destroyed Agrigentum and threatened Gela, but the thaginians were forced back on their stronghold in the southwest by Dionysius the Elder, Dionysius the Younger, Timoleon and Agathocles successively, whose cause was aided by a terrible plague and civil troubles in Carthage itself. Profiting by these troubles, Timoleon defeated the Carthaginians at Crimissus in 340 B.C. The subsequent peace was not of long duration; Agathocles besieged Carthage, which was then handicapped by the conspiracy of Bomilcar. Bomilcar was crucified, and Agathocles having been obliged to return to Sicily, his general Eumarcus was compelled to carry his army out of Africa, where it had maintained itself for three years (Aug. 310 to Oct. 307 B.C.). After the death of Agathocles, the Carthaginians re-established their supremacy in Sicily, and Mago even offered assistance to Rome against the invasion of Pyrrhus (280 B.C.). Pyrrhus crossed to Sicily in 277 B.C., and was preparing to sail to Africa when he was compelled to return to Italy. Delivered from these dangers, Carthage claimed the monopoly of Mediterranean waters, and seized every foreign ship found between Sardinia and the Pillars of Hercules.

(3) **The Punic Wars.**—(*See* also ROME: *Ancient History*). The first Punic War (268–241 B.C.) (Lat. *Poeni*, Phoenicians) was fought by Carthage for the defence of her Sicilian possessions and her supremacy in the Tyrrhenian Sea. The Romans, victorious at the naval battles of Mylae and Ecnomis (260 and 256 B.C.), sent M. Atilius Regulus with an army to Africa. But the Carthaginians, with the help of the Spartan Xanthippus, captured Regulus. The fighting was then transferred to Sicily, where Hasdrubal was defeated at Panormus (250 B.C.); subsequently the Romans failed before Lilybaeum and were defeated at Drepanum, but their victory at the Aegates Islands ended the war (241 B.C.). Carthage now desired to disband her forces, but the mercenaries claimed their arrears of pay, and, on being refused, revolted under Spendius and Matho, pillaged the suburbs of Carthage and laid siege to the city itself. The genius of Hamilcar Barca raised the siege; the mercenaries were cut down in the defile of the Axe. This war is known as the *bellum inexpiabile*.

Carthage then undertook the conquest of Spain. This operation lasted nine years up to the day of Hamilcar's death, in 228 B.C. His son-in-law, Hasdrubal Pulcher, built Carthagena in 227 B.C. and concluded with Rome a treaty by which the Ebro was adopted as the boundary of the Carthaginian sphere. On his death the soldiers chose as leader Hannibal, son of Hamilcar. At this period, Carthage, with a population of perhaps 1,000,000, was in the enjoyment of extraordinary prosperity. The manufacture of woven goods was a flourishing industry. In Sicily, Italy and Greece the Carthaginians sold black slaves, ivory, metals, precious stones and all the products of Central Africa. In Spain, they exploited the modern mines of Huelva, Osca and Carthagena. The district round Carthage, with its amazing fertility, was the granary of the city, as it was later that of Rome.

In the midst of this prosperity the Second War with Rome broke out. The campaigns of Hannibal (*q.v.*) in Spain, Italy and Africa have won the admiration of military experts of all ages. In 210 B.C. he captured Saguntum, which was in alliance with Rome. Passing through Spain and Gaul, Hannibal resolved to carry the war into the heart of Italy (218–217 B.C.). The battles of the Ticinus, Trebbia and Trasimene Lake are but stages in the wonderful progress which culminated in the battle of Cannae (*q.v.*, Aug. 2, 210 B.C.). The road to Rome was now open to him, but he did not profit by his advantage, while the Carthaginian senate withheld all further support. His brother Hasdrubal with his relieving army was defeated at the Metaurus in 207 B.C.; the Romans recovered their hold in Spain, and seeing that Hannibal was unable to move in Italy, carried the war back to Africa. Hearing that Scipio (*q.v.*) had taken Utica (203 B.C.) and defeated Hasdrubal and Syphax, king of Numidia, Hannibal returned from Italy, but with a hastily levied army was defeated at Zama (Oct. 19, 202 B.C.). The subsequent peace was disastrous to Carthage, which lost its fleet and all save its African possessions.

After the Second War, Carthage soon revived. The population is said to have numbered 700,000, and the city never ceased to inspire alarm at Rome. The Numidian, Prince Massinissa, rival of Syphax and a Roman *protégé*, took advantage of a clause in the treaty of 202 B.C., which forbade Carthage to make war without the consent of the Roman senate, to extend his possessions at the expense of Carthage. In response to a protest from Carthage an embassy including Porcius Cato the Elder (*q.v.*) was sent to inquire into the matter, and Cato was so impressed with the city that on returning to Rome he never made a speech without concluding with the warning *Delenda est Carthago* ("Carthage must be destroyed").

At this time, the popular faction, which was turbulent and exasperated by the bad faith of the Romans, expelled the Numidian party and declared war in 140 B.C. on Massinissa who was victorious at Oroscope. Rome then intervened. The third Punic War lasted three years, and after a heroic resistance the city fell in 146 B.C. The last champions of liberty entrenched themselves under Hasdrubal in the temple of Eshmun, the site of which is now occupied by the chapel of St. Louis. The Roman troops were let loose to plunder and burn. The site was dedicated to the infernal gods, and all human habitation throughout the ruined area was forbidden.

Constitution and Religion.—The narrative may here be interrupted by an account of the political and religious development of Phoenician Carthage. Carthage was an aristocratic republic based on wealth rather than on birth. So Aristotle, writing about 330 B.C., emphasizes the importance of great wealth in Carthaginian politics. The government was in fact a plutocracy. The aristocratic party was represented by the two suffetes and the senate; the democratic by the popular assembly. The suffetes (*Sofetim*), two in number, presided in the senate and controlled the civil administration. The office was annual, but there was no limit to re-election. Hannibal was elected for 22 years. The senate, composed of 300 members, exercised ultimate control over all public affairs, decided on peace and war, and nominated the Commission of Ten, which was entrusted with the duty of aiding and controlling the suffetes. The commission was subsequently replaced by a council of one hundred (Gr. *gerousia*). This tribunal, which gradually became tyrannical, met frequently at night in the Temple of Eshmun, on Byrsa, in secret sessions.

The popular assembly was composed of those who possessed a certain property-qualification (translated into Gr. as *timouchoi*). The election of the suffetes had to be ratified by this assembly. The two bodies were almost always in opposition. The army was recruited externally by senators who were sent to the great emporia or trade-centres, even to the most remote, to contract with local princes for men and officers. Payments were frequently in arrears; hence the terrible revolts such as that of the *bellum inexpiabile*. It was not till the 3rd century B.C. that Carthage, in imitation of the kings of Syria and Egypt, began to make use of elephants in war. In addition to the mercenaries, the army contained a legion composed of young men belonging to the best families in the state; this force was an important nursery of officers.

The religion of Carthage was that of the Phoenicians. Over an army of minor deities (*alonim* and *baalim*) towered the trinity of Baal-Ammon, or Moloch; Tanit, the virgin goddess of the heavens and the moon, the Phoenician Astarte; and Eshmun, identified with Asklepios, protector of the acropolis. There were also special cults of Iolaus or Tammuz-Adonis, of Patechus or Pygmaeus, a repulsive monster like the Egyptian Ptah, whose images were placed on the prows of ships to frighten the enemy, and the Tyrian Melkhart (Hercules). The statue of this god was carried to Rome after the siege of 146 B.C.

From the close of the 4th century B.C. the intimate relations between the Carthaginians and the Sicilian Greeks began to introduce Hellenic elements into this religion. In the forum of Carthage was a temple to Apollo containing a colossal statue, which was transported to Rome. The Carthaginians sent offerings to Delphi, and Tanit approximated to some extent to Demeter; hence on the coins we find the head of Tanit or the Punic Astarte crowned with ears of corn, in imitation of the coins of the Greek

Sicilian colonies. The symbol of Tanit is the crescent moon; in her temple at Carthage was preserved a famous veil which was venerated as the city's palladium. On the votive stelae which have been unearthed, we find invocations to Tanit and Baal-Ammon (associate gods). Baal-Ammon or Moloch is represented as an old man with ram's horns on his forehead; the ram is frequently found with his statues. He appears also with a scythe in his hand. At Carthage children were sacrificed to him, and in his temple there was a colossal bronze statue in the arms of which were placed the victims. The children slipped one by one from the arms into a furnace amid the plaudits of fanatical worshippers.

(4) **Roman Period.**—In 122 B.C., the Roman senate, on the proposal of Rubrius, decided to plant a colony on the site of Carthage. C. Gracchus and Fulvius Flaccus were entrusted with the foundation of the new city, *Colonia Iunonia*, placed under the protection of Juno Caelestis. But its prosperity was obstructed both by unpropitious omens and by the very recollection of the ancient feud, and about 30 years later Marius, proscribed by Sulla, found the ruins practically deserted (*see* MARIUS, GAIUS). In the neighbourhood were the scattered remnants of the old Punic population. They sent ambassadors to Mithridates, the king of Pontus, assuring him of their support against Rome. Ultimately M. Minucius Rufus passed a law abrogating that of 122 B.C. and suppressing the *Colonia Iunonia.*

Julius Caesar, pursuing the last supporters of Pompey, encamped on the ruins of the city. Returning to Rome, he despatched thither the poor citizens who were demanding land from him. Later Augustus sent new colonists, and, henceforward, the machinery of administration was regularly centred there. The proconsuls of the African province had hitherto lived at Utica. In 14 to 13 B.C., C. Sentius Saturninus transferred his headquarters to Carthage, which was henceforth known as *Colonia Iulia Carthago.*

Pomponius Mela and Strabo already describe Carthage as among the greatest and most wealthy cities of the empire. Herodian puts it second to Rome. Virgil, in the *Aeneid,* celebrated the misfortunes of Dido, whom the colonists ultimately identified with Tanit-Astarte; a public Dido-cult grew up. The religious character of these legends reawakened the old distrust, and even up to the invasions of the Vandals, Rome forbade the reconstruction of the city walls. The revolt of Clodius Macer, legate of Numidia, in A.D. 68, was warmly supported by Carthage. At the moment of the accession of Vitellius, Piso, governor of the province of Africa, was in his turn proclaimed emperor at Carthage. Under Hadrian and Antoninus, there was built the famous Zaghwan aqueduct, which poured more than seven million gallons of water a day into the reservoirs of the Mapalia (La Malga). Under Antoninus Pius, a fire devastated the quarter of the forum.

In the early history of Christianity Carthage played an auspicious part (*see* CARTHAGE, SYNODS OF). The labours of Delattre have filled the St. Louis Museum at Carthage with memorials of the early Church. From the end of the 2nd century there was a bishop of Carthage; the first was Agrippinus, the second Optatus. At the head of the apologists, whom the persecutions inspired, stands Tertullian. In A.D. 202 or 203, in the amphitheatre, where Cardinal Lavigerie erected a cross in commemoration, occurred the martyrdom of Perpetua and Felicitas. Tertullian was succeeded (A.D. 248) by a no less famous bishop, Cyprian. About this time the proconsul Gordian had himself proclaimed (A.D. 239) emperor at Thysdrus (El Jem). Shortly afterwards Sabinianus, aspiring to the same dignity, was besieged by the procurator of Mauretania; the inhabitants gave him up and thus obtained a disgraceful pardon. Peace being restored, the persecution of the Christians was renewed by an edict of Decius (A.D. 250). Cyprian escaped, and subsequently caused the heresy of Novatian to be condemned in the council of A.D. 251. In A.D. 257, in a new persecution under Valerian, Cyprian was beheaded by the proconsul Galerius Maximus.

About A.D. 264 or 265 a certain Celsus proclaimed himself emperor at Carthage, but was quickly slain. Probus, like Hadrian and Severus, visited the city, and Maximian had new baths constructed. Under Constantius Chlorus, Maxentius proclaimed himself emperor in Africa, but the garrison of Carthage, which was hostile to the pretender, compelled L. Domitius Alexander to assume the purple. Domitius was however captured by Maxentius and strangled. About A.D 311 there arose the Donatist heresy, supported by 270 African bishops. At the synod of Carthage in A.D. 411 this heresy was condemned owing to the eloquence of Augustine. Two years later the Carthaginian sectaries even ventured upon a political rebellion under the leadership of Heraclianus, who proclaimed himself emperor and actually dared to make a descent on Italy itself, leaving his son-in-law Sabinus in command at Carthage. Being defeated he fled to Carthage where he was put to death (A.D. 413). Donatism was followed by Pelagianism also of Carthaginian origin, and these religious troubles were not settled when in May A.D. 429 the Vandals, on the appeal of Count Boniface, governor of Africa, crossed the Straits of Gibraltar and invaded Mauretania. Gaiseric appeared in A.D. 439 before the walls of Carthage, which had been hastily rebuilt by the order of Theodosius. Gaiseric entered almost without a blow and gave over the city to plunder before departing for his attack on Italy. From this time Carthage became, in the hands of the Vandals, a mere pirate stronghold. Once, in A.D 470, the fleet of the Eastern empire under the orders of Basiliscus appeared in the Bay of Carthage, but Gaiseric succeeded in setting fire to the attacking ships and from Byrsa watched their entire annihilation.

(5) **Byzantine Rule.**—Under Gaiseric's successors Carthage was still the scene of many displays of savage brutality, though Thrasamund built new baths and a basilica. Gelimer, the last Vandal king, was defeated at Decimum by the Byzantine army under Belisarius, who entered Carthage unopposed (A.D. 553). The restored city now received the name of *Colonia Iustiniana Carthago;* Belisarius rebuilt the walls and entrusted the government to Solomon.

At length the Arabs, having conquered Cyrenaica and Tripolitana (A.D. 647), and founded Kairawan (A.D. 670), arrived before Carthage. In A.D. 697 Hasan ibn en-Noman, the Gassanid governor of Egypt, captured the city almost without resistance. But the patrician Ioannes retook the city and put it in a state of defence. Hasan returned, defeated the Byzantines again, and decreed the entire destruction of the city. In A.D. 698 Carthage finally disappears from history. Once again only does the name appear, in the middle ages, when the French king Louis IX., at the head of the 8th crusade, disembarked there on July 17, 1270

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CARTHAGE, a city in the Ozark region of south-west Missouri, U.S.A., at an altitude of 1,007 ft.; the county seat of Jasper county. It is on federal highways 66 and 71 and state highway 96 and is served by the Missouri Pacific, White River and Frisco railways. The population in 1930 was 9,736; in 1940 it was 10,585. The city has much natural and architectural beauty. There are famous marble and white limestone quarries in the vicinity; also lead, zinc and coal mines. The city has marble and stone-cutting works, a large overall factory, and various manufacturing industries. It is the centre of an extensive poultry-raising district. Besides marble and stone, it ships flour, strawberries and other fruits, livestock, hides and furs. Carthage was founded in 1833; became the county seat in 1842; and was chartered as a city in 1873. On July 5, 1861, an indecisive skirmish took place between 3,500 Confederates and 1,500 Federal troops about 7 mi. N. of the city.

CARTHAGE, a village of Jefferson county, (N.Y.), U.S.A., 75 mi. N. by W. of Utica, on the Black river, 742 ft. above sea level, and served by the New York Central railroad. The population in 1940 federal census was 4,207. It is in a dairying and cheese-manufacturing region, and is within easy reach of the Thousand Islands and the western Adirondacks. Its industries include several paper-mills and foundries, and plants making paper-mill machinery, paper sizing, sash and blinds and lumber specialties. The village was incorporated in 1841.

CARTHAGE, SYNODS OF. During the 3rd, 4th and 5th centuries the town of Carthage (*q.v.*) in Africa served as the meeting-place of a large number of church synods, of which, however, only the most important can be mentioned here.

1. In May 251 a synod assembled under the presidency of Cyprian to consider the treatment of the *lapsi* (those who had fallen away from the faith during persecution), and declared that the *lapsi* should be dealt with, not with indiscriminate severity, but according to the degree of individual guilt. These decisions were confirmed by a synod of Rome in the autumn of the same year.

2. Two synods, in 255 and 256, held under Cyprian, pronounced against the validity of heretical baptism, thus taking direct issue with Stephen, bishop of Rome, who promptly repudiated them, and separated himself from the African Church. A third synod, September 256, unanimously reaffirmed the position of the other two. Stephen's pretensions to authority as "bishop of bishops" were sharply resented, and for some time the relations of the Roman and African Churches were severely strained.

3. The "Conference of Carthage" (*see* DONATISTS), held by imperial command in 411 with a view to terminating the Donatist schism, while not strictly a synod, was nevertheless one of the most important assemblies in the history of the African church, and, indeed of the whole Christian church.

4. On the 1st of May 418 a great synod ("A Council of Africa," St. Augustine calls it), which assembled under the presidency of Aurelius, bishop of Carthage, to take action concerning the errors of Caelestius, a disciple of Pelagius (*q.v.*), denounced the Pelagian doctrines of human nature, original sin, grace and perfectibility, and fully approved the contrary views of Augustine. Prompted by the reinstatement by the bishop of Rome of a deposed African priest, the synod enacted that "whoever appeals to a court on the other side of the sea (meaning Rome) may not again be received into communion by any one in Africa" (canon 17).

5. The question of appeals to Rome occasioned two synods, one in 419, the other in 424. The latter addressed a letter to the bishop of Rome, Celestine, protesting against his claim to appellate jurisdiction, and urgently requesting the immediate recall of his legate, and advising him to send no more judges to Africa.

See Hefele, *Church Councils*, 2nd ed. Eng. tr. vol. i. and ii., and general works on Church History.

CARTHUSIANS, an order of monks founded by St. Bruno (*q.v.*). In 1084 Bruno and his six companions presented themselves before the bishop of Grenoble and explained to him their desire to lead an ascetic life in a solitary place. He pointed out to them a desolate spot named Chartreuse, on the mountains near Grenoble, rocky and precipitous, and snow-covered during a great portion of the year, and told them they might there carry out their design. They built themselves three huts and an oratory, and gave themselves up to a life of prayer, silence and extreme austerity. After a few years Bruno was summoned to Rome by Urban II., as an adviser in the government of the Church, *c.* 1090; but after a year or so he obtained permission to withdraw from Rome, and was able to found in the forests of Calabria near Squillace a second, and later on a third and a fourth monastery, on the same lines as the Chartreuse. At one of these south Italian foundations Bruno died in 1101. On leaving the Chartreuse he had appointed a successor as superior, and the institute steadily became more settled and developed.

There was no written rule before 1130, when Guigo, the fifth prior of the Grande Chartreuse, reduced to writing the body of customs that had been the basis of Carthusian life (Migne, *Patrol. Lat.* cliii. 631); enlargements and modifications of this code were made in 1259, 1367, 1509 and 1681: this last form of the statutes is the present Carthusian rule.

The life is very nearly eremitical: except on Sundays and feasts, the Carthusians meet only three times a day in the church—for the Midnight Office, for Mass and for Vespers; once a week, on Sundays (and feasts) they have their meal in the refectory, and once a week they have recreation together and a walk outside enclosure; the rest of their time is passed in solitude in their hermitages, which are built quite separate from one another. Each hermitage is a house, containing living-room, bedroom and oratory, workshop and store-room, and has a small garden attached; the monks are supplied with such tools as they wish, and with such books as they need from the library.

The manner of life has been kept up almost without variation for eight centuries: among the Carthusians there have never been any of those revivals and reforms that are so striking a feature in the history of other orders—"never reformed, because never deformed." The Carthusians have always lived thus wholly cut off from the outer world, each one in almost entire isolation. They introduced and have kept up in western Europe a life resembling that of the early Egyptian monks, as under St. Anthony's guidance monasticism passed from the utter individualism of the first hermits to the half eremitical, half cenobitical life of the Lauras (*see* MONASTICISM).

The first English Charterhouse was established in 1178 at Witham by Selwood Forest, and at the Dissolution there were nine, the most celebrated being those at Sheen in Surrey and at Smithfield in London. The Carthusians were the only order that made any corporate resistance to the ecclesiastical policy of Henry VIII. The community of the London Charterhouse stood firm, and the prior and several of the monks were put to death in 1535 under circumstances of barbarous cruelty. In Mary's reign a community was reassembled at Sheen, and on her death it emigrated, fifteen in number, to Flanders, and finally settled in Nieuport; it maintained itself as a British community for a considerable time, but gradually dwindled, and the last of the old British Carthusian stock died in 1831. There is now a Charterhouse in Britain established at Parkminster in Sussex in 1833; the community for the most part is made up of foreigners.

At the French Revolution the monks were driven from the Grande Chartreuse, but they returned in 1816; they were again driven out under the Association Laws of 1901, and the community of the Grand Chartreuse is now settled in an old Certosa near Lucca. Of late years the community of the Grande Chartreuse has consisted of some 40 choir-monks and 20 lay brothers. Before the expulsions of 1901 there were in all some 20 Charterhouses in France.

A word may be added as to the famous liqueur, known as Chartreuse, made by the monks. At the Revolution the property of the Carthusians was confiscated, and on their restoration they recovered only the barren desert in which the monastery stood, and for it they had to pay rent. Thus they were for some years in want even of the needful means of subsistence. Then the liqueur was invented as a means of supplying the wants of the community; it became a great commercial success and produces a large yearly income. This income the monks have not spent on themselves, nor does it accumulate. The first charge is the maintenance of the Grande Chartreuse and the other Charterhouses, and out of it have been built and established the new monasteries of the order, as at Düsseldorf, Parkminster and elsewhere; but by far the largest portion has been spent on religious and charitable purposes in France and all over the world.

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Hauck, *Realencyklopädie* (ed. 3), art. "Karthäuser" and the *Catholic Encyclopaedia*, vol. iii., art. "Carthusians." For the English Carthusians, *see* E. Margaret Thompson, *Somerset Carthusians* (1895), and Dom L. Hendriks, *London Charterhouse* (1889). The best account of the actual life is by Algar Thorold (*Dublin Review*, April 1892), who spent some months in the noviciate at the Grande Chartreuse.

CARTIER, SIR GEORGES ÉTIENNE, Bart. (1814–1873), Canadian statesman, was born in the province of Quebec on Sept. 6, 1814. Called to the bar in 1835 he gained a large practice. He took part in the rebellion of 1837, and spent some time in exile. In 1848 he was elected to the Canadian parliament. In 1855 he was appointed provincial secretary and in 1857 attorney-general for Lower Canada. From 1858–62 he and Sir John Macdonald were joint prime ministers of Canada, and their alliance lasted till the death of Cartier. He promoted many useful measures, such as the abolition of seigneurial tenure in Lower Canada and the codification of the civil law of that province (1857–64). To his energy and fearless optimism are largely due the eventual success of the Grand Trunk railway and the resolve to construct the Canadian Pacific. In the face of great opposition he carried his native province into federation (1864–67), which would have been impossible without his aid. In the first cabinet of Sir John Macdonald he sat as minister of militia and defence, and carried in 1868 an important act establishing the land forces of Canada on a sound basis. Though a devout Catholic, he became involved in a political quarrel with his Church, and was defeated by clerical influence at the general election of 1872. Another seat was found for him, but his health failed and he died on May 20, 1873.

The *Life*, by Alfred O. De Celles (Toronto, 1904), may be supplemented by the sketch in Dent's *Canadian Portrait Gallery* (Toronto, 1880).

CARTIER, JACQUES (1491–1557), French navigator, discoverer of the Canadian river St. Lawrence, was born at St. Malo in Brittany. Of his early life nothing is known. On the suppression by Admiral Chabot of the trade to Brazil, an expedition consisting of two ships and 61 men was despatched from St. Malo under Cartier on April 20, 1534, to look for a north-west passage to the East. Cartier reached Newfoundland on May 10 and entered the strait of Belle Isle. On June 15 Cartier set sail for the south side of the strait, by following which he was led down almost the whole west coast of Newfoundland. Off St. George's bay a storm drove the ships out into the gulf, but on resuming his course Cartier fell in with the Bird Rocks. The island south of these he named Brion island, after Chabot (*q.v.*). Cartier mistook Magdalen and Prince Edward islands for the main shore on the south side of this inland sea. Following the coast of New Brunswick northward he was greatly disappointed to discover Chaleur bay was not a strait. During a ten days' stay in Gaspé harbour Cartier made friends with a tribe of Huron-Iroquois Indians from Quebec, two of whom he carried off with him. On discovering the passage between the island of Acosti and the Quebec shore it was decided to postpone the exploration of this strait until the following year. Heading eastward along the Quebec shore, Cartier soon regained the strait of Belle Isle and reached St. Malo on Sept. 5.

Cartier set sail again from St. Malo with three vessels on May 16, 1536, and passing through the strait of Belle Isle anchored on Aug. 9 in Pillage Bay, opposite Anticosti, which he named the bay of St. Lawrence, a name which spread to the gulf and finally to the river. Proceeding through the passage north of Anticosti, Cartier anchored on Sept. 1 at the mouth of the Saguenay, which the two Indians informed him was the name of a kingdom "rich and wealthy in precious stones." Again on reaching the island of Orleans they told Cartier he was now in the kingdom of Canada, in reality the Huron-Iroquois word for village. Leaving his two larger vessels in the St. Charles which there enters the St. Lawrence, Cartier set off westward with the bark and the long-boats. The former grounded in lake St. Peter, but in the latter he reached on Oct. 2 the Huron-Iroquois village of Hochelaga on the site of the city of Montreal. Further progress was checked by the Lachine rapid. On his return to the St. Charles, where during the winter 25 men died of scurvy, Cartier sought further information about the rich country called Saguenay, which he was informed could be reached more easily by way of the Ottawa. In order to give Francis I. authentic information of this northern Mexico, Cartier seized the chief and 11 of the headmen of the village and carried them off to France. This time he passed south of Anticosti and, entering the Atlantic through Cabot strait, reached St. Malo on July 16, 1537.

In the spring of 1541 Cartier set sail with five vessels and took up his quarters at Cap Rouge, 9m. above Quebec. The seigneur de Roberval had been chosen to command; but when he did not arrive, Cartier made a fresh examination of the rapid of Lachine, preparatory to sending the men up the river Ottawa. Roberval at length set sail in April 1542, but on reaching St. John's, Newfoundland, met Cartier on his way back to France. In the summer of 1543 Cartier was sent out to bring home Roberval, whose attempt to make his way up the Ottawa to this mythical Saguenay had proved futile. From 1544 until his death at St. Malo, on Sept. 1, 1557, Cartier appears to have done little else than give technical advice in nautical matters and act as Portuguese interpreter.

Bibliography.—Cartier's *Brief récit et succincte narration de la navigation faicte es ysles de Canada* . . . was first printed in 1545; an English translation was made by Richard Hakluyt in his *The Principal Navigations*, vol. iii. (1600). J. P. Baxter's *Memoir of Jacques Cartier* (New York, 1906), contains an English translation and detailed bibliography. *See* also *The Voyages of Jacques Cartier*, edited by H. P. Biggar (Publications of the Public Archives of Canada, No. ii.; Ottawa, 1924).

CARTILAGE, the firm elastic and gristly connective tissue in vertebrates. (*See* Connective Tissues and Joints.)

CARTON, R. C. (1853–1928), English playwright, whose real name was Richard Claude Critchett, was born in London, the son of a well-known ophthalmic surgeon. He began to play in the provinces at the age of 22, making his first real hit in 1888 at St. James's hall in a play called *Such is the Law*, and from that time had considerable success as an actor. He presently entered to partnership with Cecil Raleigh in writing plays, the first of their joint productions being the *Great Pink Pearl* (1885) with Mrs. Carton (Katherine Mackenzie Compton) as the Russian princess. In 1891 Carton began to write regularly for Sir George Alexander. Many of his later pieces were written for Miss Comp[illegible], a good example of these being *Lady Huntworth's Experiment*. The Carton plays were a clever mixture of comedy and farce One of the best of these light pieces was *Lord and Lady Algy* (1898). Carton died at Acton, London, on April 1, 1928.

Miss Compton's most successful parts were those portraying the imperturbable great lady, although she also played a number of parts in classic comedy. She made her name in the pieces written for her by her husband. Miss Compton, always known under her maiden name, died on May 16, 1925, at Acton

CARTON. A light cardboard box, used for packing small articles of many kinds, including foods, confectionery, tobacco, stationery, medicines, dentifrices, soaps, household pastes, light hardware, etc. The careful packing of such goods is one of the remarkable changes in industrial and commercial methods which marked the opening of the 20th century. In the old days, teas, soaps, tobacco, and other such things were weighed at the counter and packed loosely in paper and string, if packed at all. The growth of proprietary articles and special brands, in addition to a desire for cleaner handling, has changed all that, and carton-making has consequently become a very big industry, employing many people in every great industrial nation throughout the world. (*See* Box Making.)

CARTOON, originally a preliminary drawing, executed to full scale and often in colour, of the design to be carried out in tapestry, mosaic, mural painting, or other work of art, and usually upon a heavy or durable paper. The cartoon when used for tapestry is usually placed in the loom so that the weaver can see it clearly just below his work, for which it acts as a guide.

In the more common parlance of to-day, the word means a drawing, distributed publicly by the press or by means of handbills or posters, which crystallizes some current trend of thought into pictorial form often humorous and derisive. (W. E. Cx.)

UNITED STATES

The political cartoon has come into greater general use in the United States than in any other country. Almost every daily paper uses either a syndicated cartoon or one drawn by a staff artist. The cartoon's worth is based on its instantaneous exposition of an idea. The very specific character of the drawn picture precludes anything except a direct attack. There is no qualification in it—it says but one thing and that at a glance. Herein lies its virtue and its limitation. The cartoon of approbation is rarely successful. To say a man is a good man in a cartoon carries little force; but if the artist can say that he is corrupt or unworthy, then he is wielding a weighty club. All cartoons, however, need not be bitter to be effective. Humour plays an important part in their appeal. Ridicule is one of the most potent weapons in the world when turned into social and political channels.

The cartoon in America roughly divides itself into two schools. In one, the homely, quasi-rural setting and characters are presented somewhat in the manner of the comic "strip." John McCutcheon of the *Chicago Tribune* is the chief exponent of this, by far the more numerous, group. The chief characteristics of these artists are usually a cheerful humour, a multitude of little figures engaged in violent action, comic animals and a generous labelling of persons and objects. In these pictures the sudden impact of the idea is diffused through the multiplicity of incident. "Balloons," those bits of conversation surrounded with a wire line, must be read as well as the labels attached to the figures in order that the artist's idea may be comprehended. The other school deals in a starker form of pictorial representation. Here the meaning explodes at first glance. Everything exterior to the single idea is eliminated. This method is derived from the French of which Daumier and Forain are the leading exponents. Also, it may be noted that the execution of this second group is of higher artistic merit or at least aspiration. There is a greater sophistication, both in conception and execution in these cartoons, and they imply an audience of more mature thought than do those of the cheery, bucolic nature which abound in the country's press.

Through syndication, cartoons reach even the smallest papers so that the country is thoroughly supplied with its daily picture. The syndicate, however, having to serve all sorts of papers in all sorts of communities, has softened the "attack" quality in most of this product so that the result has been a more or less negative, qualified picture which is guaranteed to offend no one and therefore has lost most of its pungency. Lacking that virility, it has come to be simply a thing of entertainment wherein the annals of the great middle class are set forth in terms of simplicity. There is growing up in the daily press a social cartoon which is based upon a close observation of urban life—a sort of picture which has no relation to politics or public affairs, but sets forth some phase of life with either sympathy or satire. Denys Wortman of the New York *World-Telegram* is the best representative of this form.

One of the handicaps which confront the cartoonist is the paucity of symbols through which he must express himself. Through repetition the various devices become worn and threadbare; yet there is no escape from them for they have become established in the public's mind and any variant or change would obscure the meaning of the message the cartoonist wishes to convey. The G.O.P. elephant; the Democratic donkey (both originated by Thos. Nast in the days when he fought the Tweed ring); the weedy individual who was labelled "Prohibition"; the round bomb with the sputtering fuse which hasn't been seen since the days of Nihilism in old Russia; the apoplectic, silk-hatted individual who becomes "Wall Street" or "The Interests" or "The Trusts"; the meek, side-whiskered, spectacled creature who receives the brick Labour hurls at Capital and who is labelled "The Common People"—all these and more form the standardized little group of puppets with which the cartoonist must work. The figure of Uncle Sam is the most overworked of all. Each day he looks sternly out at the world from his place on the editorial page and views with alarm, warns, dictates, with pontifical fervour. Rarely does he laugh, for he is the Federal voice, and as such, deals only in weighty matters. He tells kings, potentates, labour unions, corrupt office-holders, "The Interests" (depending on whether he is a Republican or Democratic Uncle Sam) where they "get off." In his gayer moments he welcomes royal families and South American "good neighbour" delegates and, in his sadder moments, stands with bowed head at the death of a public man of importance. He is ubiquitous, untiring and the management of a daily cartoon would be difficult without his valuable services.

The influence of the cartoon is doubtless a very considerable one in the formation of public opinion; for the public at large can comprehend the simple message of the drawn picture, whereas the reading of long editorials entails a much greater sustained effort on their part. A few of the weekly magazines use a political cartoon; but here we find the methods of the comic "strip" used rather than the sterner forms of satire. It would appear that, on the whole, the editors of the United States feel that a cheerful, simple, innocuous appeal is preferable to a more mordant presentation of pictorial ideas. Many of the cartoons of the extreme left wing of the Socialist party are of great force, full of bitterness and class antagonism. Because of the restricted circulation of the papers in which they appear, they are little known to the public. On the whole, the cartoons of the daily press fairly well represent the mind of the American public in its tolerant, non-critical, excessively partisan point of view. (R. K.)

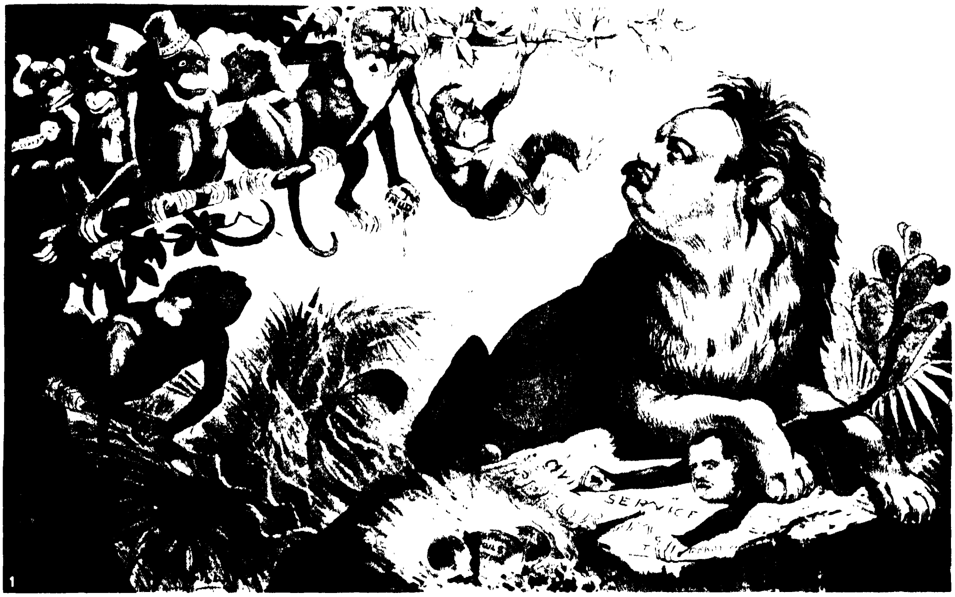
THEORY OF DESIGN, TECHNIQUE AND MATERIALS

The word cartoon will no doubt be associated mainly and lastingly with such drawings as have a political or social significance and which, unlike the ordinary run of picture comicalities, stimulate thought on public affairs.

Materials and Methods of Reproduction.—To account for the material that cartoonists have used to get the best results one's field for investigation dates from the first Philipon publications (Paris 1830) to the present time. The instruments used for drawing cartoons determine to a large extent the technique. The pencil and the pen have been the favourite tools of the cartoonist all along, the pencil holding first place in order of practicability. The pencil is used in learning to draw, and thus pencil drawings have a more intimate appearance than those done with a pen. Pen drawing is more of an acquired art, and is preferred by some masters of the cartoon because of its directness. In a sense, it is shorthand. A line must suggest more than is there; moreover, it must convey the feeling of substance—not merely the edge of something. Take for example the pen drawings of Gulbransson of *Simplicissimus* and "Phil May" of *Punch*, the former extremely grotesque, the latter but mildly exaggerated. Both cartoonists give the impression of knowing all about their subject, though they express it with the minimum of linear simplicity. The same quality is found in the work of David Low of the *London Evening Standard.*

Forain in his early work was another master of brevity, though he used a fine brush much as one would use a pen (*see* ART: *Far Eastern Methods*). Some cartoonists play sketchily with the pen, while others prefer a rigid outline. Caran d'Ache drew pen and ink outline cartoons that strongly resembled the lines made by an etching needle on copper plate. On the other hand Heinrich Kley of *Jugend* tossed his pen lines like a juggler, making gestures as if about to miss, but always impressing one with his facility in creating amazing fantasies of nudes and animals. Charles Dana Gibson used the pen as if cutting his way through his composition, the lines falling casually all about; many go part of the way only, leaving the rest to the imagination of the observer.

Two political cartoonists, Tenniel of *Punch* and Nast of *Harper's Weekly*, produced much of their work on wood-blocks. When it was later discovered, however, that a cartoon drawn on paper could be photographed on the wood, paper was used almost exclusively. Wood-cut cartoons were line drawings executed with a pen or sharp pencil, the latter quite similar to a pen point. Both Nast and Tenniel, who were contemporary, put a good deal of shading on their drawings. Nast used the cross-hatch abundantly, a method of shading produced by drawing a lot of more or less parallel lines and then going over them with other lines at right angles. Tenniel cross-hatched sparingly and shaded faces less than Nast. Tenniel had more knowledge of accurate draughtsman-



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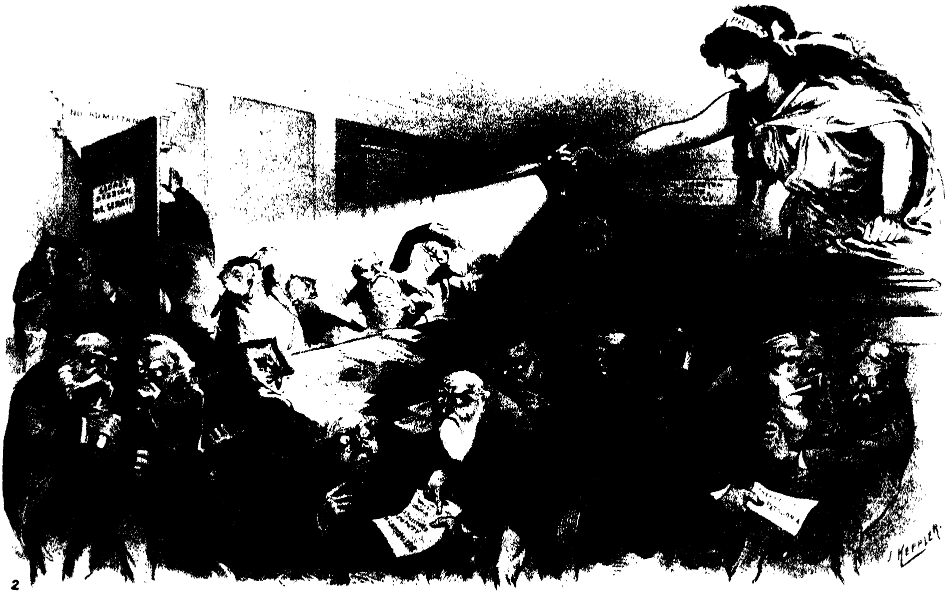
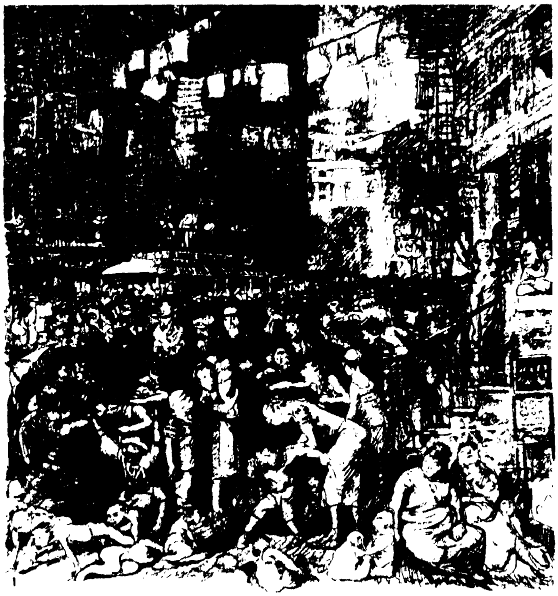


2

TWO POLITICAL CARTOONS OF THE LATE 19TH CENTURY FROM PUCK

"Why they dislike him—He will not prove himself a cat's-paw in the enterprise" by Bernhard Gillam. This cartoon, printed in September 1884, shows Cleveland defying corruption during his campaign against James G. Blaine for the presidency

2. "They Hate the Light but they can't escape it" by J. Keppler, published March 26, 1890. The Press is represented as throwing the light of publicity on the secret executive sessions of the U. S. Senate



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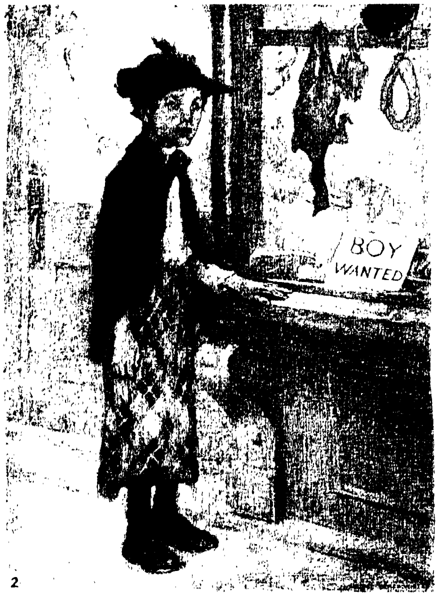

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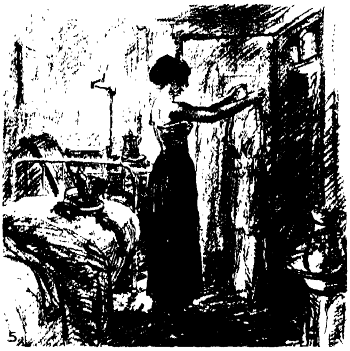
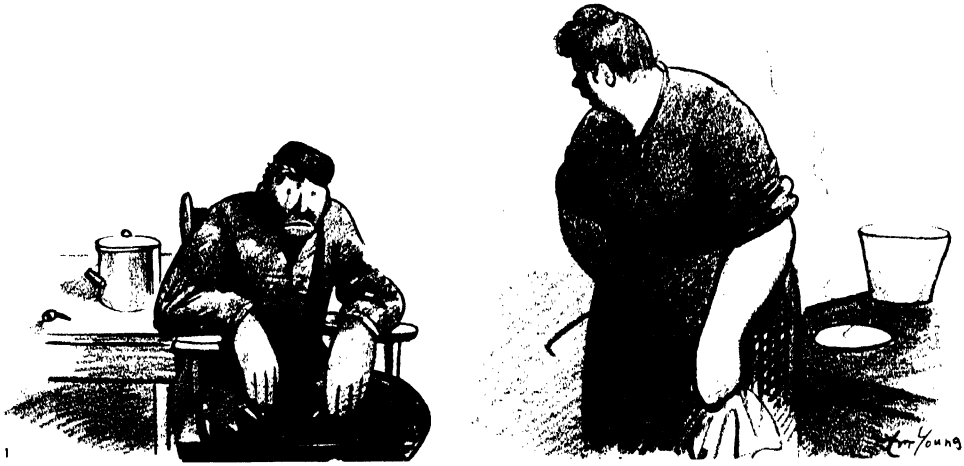


5

BY COURTESY OF (1, 2, 5) THE NEW MASSES, (3) H. KLEY, SAMMELALBUM (A. LANGEN), (4) SIMPLICISSIMUS

SOCIAL AND POLITICAL CARTOONS

1. "Why don't they go to the country?" a cartoon by George Bellows, which appeared in *The Masses*, Aug. 1913; an example of the starker form of cartooning which was used widely in this magazine. The meaning is evident at a glance and all details contribute to the impression. Cartoons of this type are usually propagandist, intended to sway popular feeling and bring about reforms
2. "Discrimination" from a drawing by Alice Beach Winter, published in *The Masses*, Feb. 1913
3. "Betriebsstorung" (the Strike) by Heinrich Kley, German cartoonist, showing the use of symbolism which was characteristic of the cartoons of that country prior to Hitler. A giant satanic figure is stopping production completely by crushing the mill and blocking the smokestacks with his hand
4. "Fiume," drawing by O. Gulbransson which appeared in *Simplicissimus*, a Munich weekly, following D'Annunzio's occupation of Fiume in 1919. D'Annunzio, the figure on the horse, is brandishing his sword and defying President Wilson, who protested that the Italian had no right in Fiume. The picture when published carried the legend, "How easily even the smallest Europeans manage to ride over the greatest American ideas."
5. "The Bachelor Girl," by John Sloan. *The Masses*, Feb. 1915



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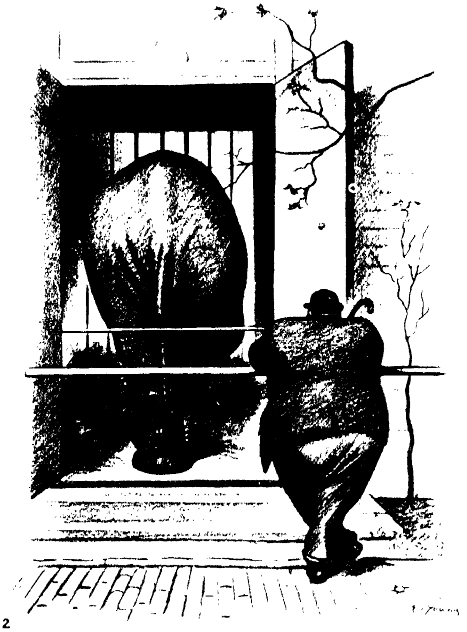

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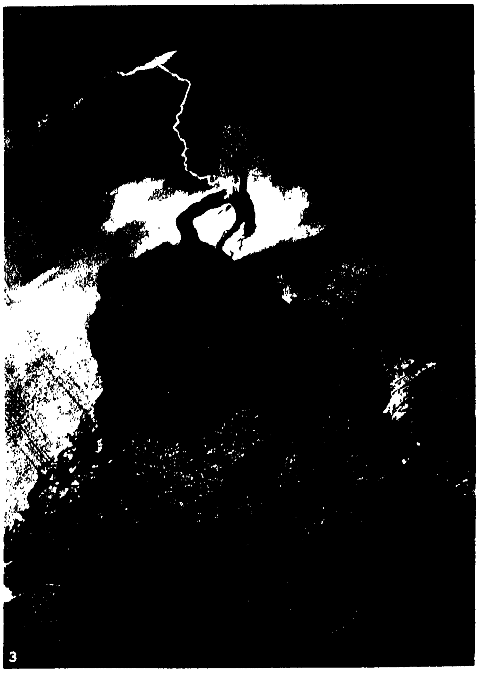


3

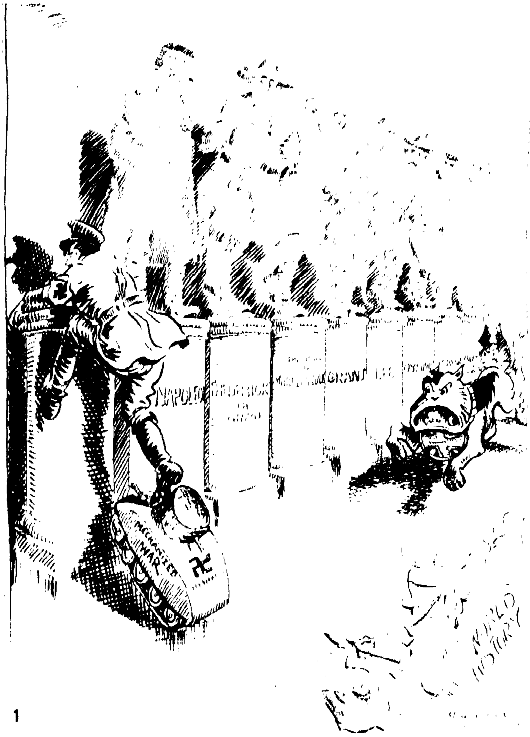
(1) BY COURTESY OF "THE NEW MASSES"

THREE CARTOONS BY ART YOUNG

1. Cartoon first printed in *The Masses* in May 1913 and since reprinted widely. The picture carried this dialogue, "I Gorry, I'm tired." "There you go! You're tired. Here I be a-standin' over a hot stove all day and you workin in a nice cool sewer." 2. "Beast and Man" and 3 "The Price of Prominence" illustrate the satirical manner of cartoon drawing, as distinguished from the cruder method of the "comic strip"

PLATE IV

CARTOON



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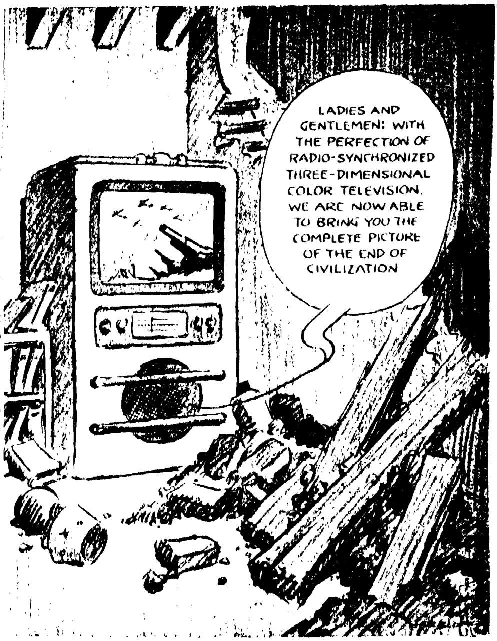
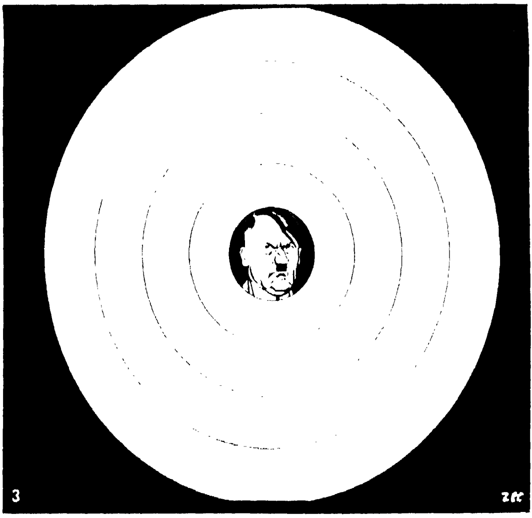

LADIES AND GENTLEMEN: WITH THE PERFECTION OF RADIO-SYNCHRONIZED THREE-DIMENSIONAL COLOR TELEVISION, WE ARE NOW ABLE TO BRING YOU THE COMPLETE PICTURE OF THE END OF CIVILIZATION



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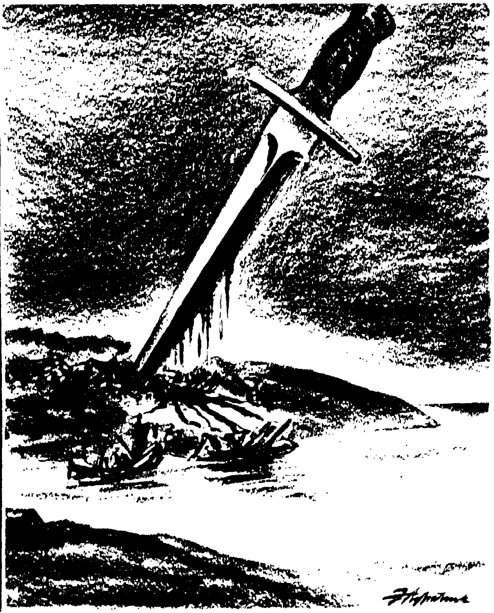

(2) COPYRIGHT NEA SERVICE

CARTOONS OF WORLD WAR II

1. "As the Greatest Battle in History Rages," by John T. McCutcheon, American, in the *Chicago Tribune*
2. "The Ultimate Triumph of Human Ingenuity," by Herblock, American
3. "War Aim," by Zec, British, in the *London Daily Mirror*
4. "Remember Pearl Harbor," by Daniel R. Fitzpatrick, American, in the *St. Louis Post-Dispatch*

ship, whereas Nast had a clumsy way of drawing all his own. Much of his work was comedy, but he had a biting satire.

What cartoonists draw with or what they draw on is of course not so important as what is drawn and how well it is done. A real artist can produce very good results with an old piece of charcoal on a barn door, but to have his work widely circulated, and that after all is what a cartoonist desires, he has been led to many experiments in reproduction. Daumier was doing his political cartoons and caricaturing life all about him, on stone; Cruikshank, at the same time, was producing his pictorial satires on copper and steel plates, ploughing through the lines of his drawing with an etching needle, making him both designer and engraver. William Blake at an earlier date did most of his work in the same way. Both processes have long since fallen into disuse except for exclusive reproduction. A remarkable facility was acquired by these artists on wood, steel and stone, in spite of the fact that mistakes made on these surfaces were hard to correct. However, the wood could be dug out and another piece glued in, the metal could be burnished and the stone could be scratched, but obviously with tedious effort and loss of time.

Most cartoons seen in the publications of the 20th century are drawn with a black crayon pencil or pen. Some cartoonists use both instruments on the same drawing. A brush is sometimes used for ready distribution of blacks. When the crayon pencil is employed the paper used has a surface similar to the lithograph stone, to all appearances quite smooth, but with a slightly rough surface (in the technical term, a "tooth" to it). Both pen drawings and those drawn with a crayon lend themselves to that most widely used process of engraving called zinc-etching. This is also called the direct process as distinguished from the half-tone process, which is the popular way of reproducing drawings having soft gradations of light and shade, executed with a brush and water colour or rubbed in with the thumb or cloth. Zinc-etching is the universal process for making plates ready for printing cartoons done with a black crayon or pen and ink (*see* PRINTING).

Theory of Design and Technique.—In the handling of pen and ink there are no rules, except those born of the artist's own feeling. The trite remark, "It is merely a matter of taste," describes the various degrees that artists go in modelling, shading and the other requirements within the main outline of their pen and ink composition. Materials and methods of reproduction are merely incidental in the world of successful cartooning; the main factors lie in the ability to invent ideas, to compose pictures and to understand the value of emphasis. Creating ideas can become habitual. As the cartoonist looks about him he sees in the every-day walks of life scenes that he thinks might apply to political situations. These ideas he notes and stores away in his subconscious mind, some day to develop and release as cartoons. Like the poet and the dramatist, he gets suggestions from the natural scene, from wide and purposeful reading, or from cartoons that have been produced in another era, endeavouring to improve them. We might say that the cartoonist is like the dramatist and, carrying the simile further, that the surface on which he draws is at once his stage-floor and proscenium arch. Within this area he creates a scene.

Doré was one of the most dramatic draughtsmen of any period of art. Had he succeeded Daumier as a cartoonist instead of becoming the illustrator of literary classics there can be no doubt he would have been an extraordinary propagandist, a great portrayer of affairs, for in the realm of both tragedy and comedy and in composing pictures that get "over the footlights," his work was always "cartoony."

The public will not admit that an actor can be both a tragedian and a comedian, but they expect this duality in a cartoonist. Keppler, Tenniel, Nast, Daumier, Doré, Steinlen, Felicien Rops, John Leech and many other draughtsmen of the past were skilful in depicting both humorous and serious ideas. The ideas of these early notables in black and white drawing, with few exceptions, also reveal minds with cultural backgrounds. Most of the political cartoonists of the 19th century, especially Tenniel, Leech, Nast and C. G. Bush of the New York *World*, often illustrated ideas that were suggested by their reading of Shakespeare, Greek mythology, Aesop's Fables and other classics, which were made analogous to situations in the English parliament, the U.S. Congress, or other seats of legislation.

Later the ideas, especially in America, became less "high brow." Ideas that were supposed not to be "above the heads of the people" were thought by editors to be more popular. As if the common man had to know all about Macbeth before the cartoonist could dress up a politician in a Macbeth costume and put a Macbeth quotation underneath his picture! Once the cartoonist has decided on his idea, then comes the composition of the cartoon. Good composing also is something one must feel, as there are no set rules. But just as in literature and all of the arts, to compose well is to feel a balanced harmony or completeness, which means that the cartoonist has relegated to second place the less essential features of the scene and stressed the most important, that he is alive to the value of contrasts and above all knows when it is time to leave off, having said enough. How much caricature or exaggeration to put into one's cartoon is also a matter of individual preference. What might be called the excessive grotesque appeals to some cartoonists. Others incline more toward a slightly emphasized naturalism, for example Braakensiek of *De Amsterdammer*.

If a public man is fat and his nose is long, good caricature in the opinion of some caricaturists is to magnify these characteristics very much—to pile Pelion on Ossa. To others the natural is almost funny enough and needs but a subtle emphasis.

Cartoon Publications.—From about 1870 to 1890 the political cartoon printed in colours was popular in Europe and became so in the United States during the late '70s, when Joseph Keppler started *Puck*. Keppler first experimented with *Puck* in St. Louis, at that time printing it from the stone in black and white only. When the St. Louis *Puck* was abandoned Keppler came to New York and drew cartoons on wood for *Leslie's Weekly*. In a few years, Adolph Schwarzman, a foreman printer of Leslie's, joined Keppler in organizing the Keppler and Schwarzman Company, and revived the name *Puck* for the humorous weekly that later became famous, popular and a financial success. The new *Puck* resembled the general *format* of the coloured cartoon papers of Europe, especially *La Flaca* in Madrid and Barcelona and *Humoristische Blätter* in Vienna.

In Australia, where Phil May started his career and that droll caricaturist Hopkins, "Hop," was a pioneer, the production of cartoons has been mostly in black-and-white. However, the tendency of these later years on the weekly humorous magazines is the use of one or two colours over pen and ink or crayon cartoons—the result of which is posterized attractiveness. Steinlen was one of the first draftsmen to use red as an accompaniment to black crayon drawings. Wilke, Heine, Thöny and others of *Simplicissimus* use flat colours, as do other cartoonists of Europe, especially in Russia. In Mexico also much of the cartooning is simply coloured.

The coloured cartoons of Keppler, like Gillam's and others on the staff of *Puck*, were drawn on and printed directly from the stone. The first printing, in black ink, was called the key-plate. Then followed the printing on this key-plate impression from other stones to register reds, blues and other colours in facsimile to the cartoonist's water-colour design. The decline of the coloured political cartoons and weekly cartoon magazines in general was due, no doubt, to the fact that daily newspapers had begun to employ cartoonists (this was about 1890) and to print coloured comic supplements. These supplements were "thrown in" for the price of the newspaper. This innovation in newspaper publishing was made possible by the invention of the fast multi-coloured printing press. In the beginning, these supplements sometimes printed coloured political cartoons in imitations of those in *Puck* and *Judge*.

As a result of all this the principal humorous weeklies of that day were not so much in public demand. But just as interest in the wood-cut and the lithograph is being revived, so the political cartoon in colours may have another day. The cartoon magazine *Life* was born a decade later than *Puck* and *Judge*. It opened a somewhat different field for artists. This magazine never had a staff in the sense that *Punch* and *Puck* were produced by a staff of artists regularly employed. John Ames Mitchell, the founder and first editor, was an artist himself, and in the first numbers of the magazine can be seen his pen and ink drawings. However, he is better known as an author. *Life* was not as political as its older contemporaries and was printed for many years without the use of colour. It indulged mostly in ridicule of social foibles and surveyed the American scene from the editor's amiable viewpoint, but not without occasional thrusts at the evils of commercialism, the law, the medical profession and other institutions.

While the Latin Quarter artists of Paris issued protesting magazines in the beginning of the present 20th century, it is generally conceded that one of the most artistic and at the same time shocking magazines was published in America. The magazine was called *The Masses*, the first number appearing in 1910 and the last in 1918. Its existence was due largely to one fact: an artist is an individualist; he wants to express himself in his own way. Many artists who believed that the sordid and the vulgar, the cruelties and hypocrisies that manifest themselves in this age of the industrial machine, should be ridiculed and caricatured without stint, joined the staff of *The Masses*. Then, too, the conventional magazine with its trite and formal make-up and its many taboos, was sooner or later doomed to become a target for the iconoclast artists. The pretty girl cover was the vogue when *The Masses* was started. One of its earliest cover designs was a picture of two poor, homely girls. One of them is saying: "Gee, Mag, think of us being on a magazine cover." On the art staff of *The Masses* were John Sloan, George Bellows, Boardman Robinson, Art Young, John Barber, Robert Minor and Stuart Davis.

With a natural aptitude for pictorial expression, with patience and hard work, the cartoonist creates ideas, composes pictures and puts exaggeration or mere emphasis where he thinks they belong. But a cartoonist cannot produce convincing cartoons that will live, more than an author can produce good books, unless he feels the truth of his work. (*See* also CARICATURE; COMIC STRIP; PEN DRAWING; PENCIL DRAWING; ILLUSTRATION.) (AR. Y.)

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CARTOUCHE. The term is applied in architecture to ornamentation in scroll form, especially to the elaborate, scrolled frames around tablets or coats of arms; by extension, the word is applied to any oval shape, or even to a decorative shield, whether scrolled or not. It is also used for the oval frame enclosing the hieroglyphs of the name of an Egyptian royal personage, and also for the amulet of similar shape, worn in ancient Egypt, as a protection against the loss of their names, *i.e.* personalities.

CARTRIDGE (corruption of Fr. *cartouche*), a case, of brass or other metal, cardboard, silk, flannel, etc., containing an explosive charge, and usually the projectile also, for small arms and ordnance. (*See* AMMUNITION.)

CARTWRIGHT, EDMUND (1743–1823), English inventor, younger brother of Maj. John Cartwright, was born at Marnham, Nottinghamshire, on April 24, 1743, and educated at Wakefield grammar school and at Oxford university. In 1779 he became rector of Goadby Marwood, Leicestershire, and in 1786 a prebend in the cathedral of Lincoln. He would probably have passed an obscure life as a country clergyman had not his attention been accidentally turned in 1784 to the possibility of applying machinery to weaving. He invented a power-loom, for which he took out a patent in 1785; it was a rude contrivance, though it was improved by subsequent patents in 1786 and 1787, and gradually developed into the modern power-loom. Removing to Doncaster in 1785, he started a weaving and spinning factory, but in 1793 he had to surrender it to his creditors. A mill at Manchester, in which a number of his machines were installed, was wilfully destroyed by fire in 1791. In 1789 he patented a wool-combing machine, for which he took out further patents in 1790 and 1792; it effected large economies in the cost of manufacture, but its financial results were not more satisfactory to its inventor than those of the power-loom, even though in 1801 parliament extended the patent for 14 years. In 1807 a memorial was presented to the Government urging the benefits that had been conferred on the country by the power-loom, and the House of Commons voted him £10,000 in 1809. He then purchased a small farm at Hollander, near Sevenoaks, Kent, where he spent many years of his life. He died at Hastings, on Oct. 30, 1823. Other inventions of Cartwright's included a corderlier or machine for making rope (1792), and an engine working with alcohol (1797), together with various agricultural implements.

CARTWRIGHT, JOHN (1740–1824), English parliamentary reformer, was born at Marnham in Nottinghamshire on Sept. 17, 1740, the elder brother of Edmund Cartwright, inventor of the power-loom. He was educated at Newark grammar school and Heath academy in Yorkshire, and entering the navy served at the capture of Cherbourg, and in the action between Sir Edward Hawke and Admiral Conflans. Engaged afterwards on the Newfoundland station, he was appointed to act as chief magistrate of the settlement (1765–1770). Ill-health necessitated his retirement from active service for a time in 1771. When the disputes with the American colonies began, he was a warm supporter of their cause, and declined to fight against the cause which he felt to be just. In 1774 he published his first plea on behalf of the colonists, entitled *American Independence the Glory and Interest of Great Britain*. In the following year, when the Nottinghamshire Militia was first raised, he was appointed major and in this capacity he served for 17 years. He was at last illegally superseded, because of his political opinions. In 1776 appeared his first work on reform in parliament, entitled, *Take your Choice*—a second edition appearing in 1777 under the new title of *The Legislative Rights of the Commonalty vindicated*. The task of his life was thenceforth chiefly the attainment of universal suffrage and annual parliaments. In 1778 he conceived the project of a political association, which took shape in 1780 as the "Society for Constitutional Information." From this society sprang the more famous "Corresponding Society." Major Cartwright was one of the witnesses on the trial of his friends, Horne Tooke, John Thelwall and Thomas Hardy, in 1794 and was himself indicted for conspiracy in 1820, and condemned to pay a fine of £100. He died in London on Sept. 23, 1824. He had married in 1780, but had no children.

The Life and Correspondence of Major Cartwright, ed. by his niece F. D. Cartwright, was published in 1826.

CARTWRIGHT, PETER (1785–1872), Methodist Episcopal preacher of the United States, was born on Sept. 1, 1785, in Amherst county, Virginia. His father, a veteran of the War of Independence, in 1790 took his family to Kentucky. Here Peter Cartwright grew up amid the rude surroundings of the frontier, received little education, and was a gambler at cards and horse-racing until 1801, when he heard John Page preach. In June he was received into the church; in May, 1802 was licensed as a regular exhorter, becoming known as the "Kentucky boy"; in the autumn of 1802 was licensed to form the Livingston circuit around the mouth of the Cumberland river; in 1806 was ordained deacon by Bishop Asbury, and in 1808 presiding elder by Bishop McKendree, under whose direction he had studied theology. He was presiding elder of the Wabash district in 1812, and of Green river district in 1813–16, and, after four years on circuit in Kentucky and two as presiding elder of the Cumberland district, was transferred in 1823 to the Illinois conference, in which he was presiding elder of different districts until 1869. Until 1856 he preached about 14,000 times, received about 10,000 persons into the church, and baptized about 12,000 persons. He died near Pleasant Plains, Sangamon county, Ill., Sept. 25, 1872. He was a typical backwoods preacher, an able, vigorous speaker, a racy writer and a powerful exponent of "muscular Christianity."

See the *Autobiography of Peter Cartwright, the Backwoods Preacher*, edited by W. P. Strickland (1856); also D. C. Seitz, *Uncommon Americans* (1925).

CARTWRIGHT, SIR RICHARD JOHN (1835–1912), Canadian statesman, was born in Kingston, Canada, on Dec. 4, 1835, son of an army chaplain. In 1863 he entered the Canadian parliament as a Conservative, but soon after federation in 1867 quarrelled with his party on the question of their financial policy.

By 1870 the breach was complete, and in 1873 he became finance minister of the Liberal ministry of Alexander Mackenzie. From 1878 to 1896 he was the chief financial critic on the side of the Liberal opposition, and on the accession of Sir Wilfrid Laurier to power in 1896 he became minister of trade and commerce. In 1898–99 he represented Canada on the Anglo-American joint high commission at Quebec. In 1904 failing health led to his retirement to the senate. In Sir Wilfrid Laurier's absence at the Imperial Conference 1907 he was acting premier. Cartwright died on Sept. 24, 1912, at Kingston, Ont.

CARTWRIGHT, THOMAS (*c.* 1535–1603), English Puritan divine, studied divinity at St. John's college, Cambridge; but on Mary's accession he had to leave the university, and found occupation as clerk to a counsellor-at-law. On the accession of Elizabeth he returned to Cambridge, and in 1569 he was appointed Lady Margaret professor of divinity at Cambridge; but John Whitgift, on becoming vice-chancellor, deprived him of the post in Dec. 1570, and—as master of Trinity—of his fellowship in Sept. 1571. After his deprivation by Whitgift, Cartwright visited Beza at Geneva. He returned to England in 1572, and might have become professor of Hebrew at Cambridge but for his expressed sympathy with the notorious "admonition to the Parliament" by John Field and Thomas Wilcox. To escape arrest he again went abroad, and acted as clergyman to the English residents at Antwerp and then at Middelburg. In 1585 he returned without permission to London and was twice imprisoned. He died at Warwick, on Dec. 27, 1603. Cartwright's views were distinctly Presbyterian and he opposed the Brownists or Independents.

CARTWRIGHT, WILLIAM (1611–1643), English dramatist and divine, was born at Northway, Gloucestershire. He was educated at the free school of Cirencester, at Westminster school, and at Christ Church, Oxford, where he took his M.A. degree in 1635. He became, says Anthony à Wood, "the most florid and seraphical preacher in the university," and appears to have been no less admired as a reader in metaphysics. In 1642 he was made succentor of Salisbury cathedral, and in 1643 he was chosen junior proctor of the university. He died Nov. 29 of the same year.

Cartwright was a "son" of Ben Jonson and an especial favourite with his contemporaries. His plays are, with the exception of *The Ordinary* (?1635), fantastic in plot, and stilted and artificial in treatment. They are: *The Royal Slave* (1636), produced by the students of Christ Church before the King and Queen, with music by Henry Lawes; *The Lady Errant* (acted, 1635–36); *The Siege, or Love's Convert.*

Comedies, Tragi-Comedies, with other Poems, by Mr. William Cartwright . . . (1651) included the plays mentioned above.

CARUCATE or **CARRUCATE** (from the Med. Lat. *carrucata*, from *carruca*, a wheeled plough), a measure of land, based probably on the area that could be ploughed by a team of oxen in a year; hence "carucage" means a tax levied on each "carucate" of land (*see* HIDE).

CARUPANO, a town and port of the State of Sucre, Venezuela, 65 mi. N.E. of the city of Cumaná. Pop. (1936) 16,088. Carúpano is situated on the Caribbean coast on an open roadstead and is a port of call for several regular steamship lines. The country immediately behind the town is rough, but there is a considerable export of cacao, coffee, sugar, cotton, timber and rum.

CARUS, CARL GUSTAV (1789–1869), German physiologist and psychologist, distinguished also as an art critic and a landscape painter, was born in Leipzig on Jan. 3, 1789, and in 1811 became a *Privatdocent* in the university there. On the subject which he selected (comparative anatomy) no lectures had previously been given at Leipzig. In 1814 he became professor to the new medical college at Dresden, where he spent the remainder of his life. He died on July 28, 1869. In philosophy Carus belonged to the school of Schelling, and his works are thoroughly impregnated with the spirit of that system. He regarded inherited tendency as a proof that the cell has a certain psychic life, and pointed out that individual differences are less marked in the lower than in the higher organisms. Among his works may be mentioned: *Grundzüge der vergleichenden Anatomie und Physiologie* (Dresden, 1828); *Psyche: zur Entwickelungsgeschichte der Seele* (3rd ed. Stuttgart, 1860); *Physis, zur Geschichte des leiblichen Lebens* (Stuttgart, 1851).

See his autobiography, *Lebenserinnerungen und Denkwürdigkeiten* (1865–66); C. Bernouilli, *Die Psychologie von C. G. Carus* (1925).

CARUS, MARCUS AURELIUS, Roman emperor A.D. 282–283, born probably at Narbona (more correctly, Narona) in Illyria, was a senator and had been appointed prefect of the praetorian guard by the Emperor Probus (*q.v.*), after whose murder he was proclaimed emperor by the soldiers. Although Carus punished the assassins he was suspected of having been an accessory to the deed. He left his elder son Carinus in charge of the western portion of the empire and took the younger, Numerianus, with him on the expedition against the Persians. Having defeated the Quadi and Sarmatians on the Danube, Carus proceeded through Thrace and Asia Minor, conquered Mesopotamia, pressed on to Seleucia and Ctesiphon, and carried his arms beyond the Tigris. But he died suddenly, probably murdered by the soldiers, who were weary of the war, at the instigation of Arrius Aper, prefect of the praetorian guard.

See Gibbon, *Decline and Fall of the Roman Empire*, Chap. XII.

CARUSO, ENRICO (1873–1921), the most famous Italian operatic tenor of his day, was born in Naples on Feb. 25, 1873. He was early apprenticed to a mechanical engineer. He began to sing in the choirs at Naples when he was 11 years old, and later studied under Guglielmo Vergine. He made his début in 1894 in *L'Amico Francesco* at the Teatro Nuovo, Naples, and first won marked success as Marcello in *La Bohème*, at Milan, in 1898. From 1899 to 1903 he was at St. Petersburg (Leningrad) in the winter, and in the summer at Buenos Aires. He appeared also in Moscow, Warsaw, Rome, Paris, London and elsewhere. In America he first appeared in 1903 at the Metropolitan Opera House, New York, where for 18 years he was the leading tenor. Caruso had a very extensive repertory, which was however confined to works of the French and Italian schools; he never appeared in Wagnerian opera, being content with the unrivalled supremacy which he enjoyed in works of the kind best adapted to display his particular powers and with which he was most in sympathy. Among these may be named *Aïda, Carmen, Les Huguenots, L'Elisir d'Amore, Pagliacci, Rigoletto, Samson and Delilah*, and last but not least, Puccini's *La Bohème* in which, to the no less incomparable Mimi of Dame Melba, he celebrated some of his greatest triumphs as Rodolfo. Caruso's voice was of the purest Italian type, being especially distinguished by the warmth and richness of its quality while in all technical respects his singing was of the highest order. He died of pleurisy on Aug. 2, 1921, at Naples.

See D. B. Caruso and T. Goddard, *Wings of Song* (1928).

CARUTHERSVILLE, a city in the southeast corner of Missouri, U.S.A., on the Mississippi river; served by the Cotton Belt and the Frisco railways; the county seat of Pemiscot county. The population in 1930 was 4,781; 1940, 6,612. It is a cotton-growing and general agricultural region, with some lumbering, and has cotton gins, a large compress, large box factory gravel industries and a shoe factory.

CARVAJAL, ANTONIO FERNANDEZ (*c.* 1590–1659), a Portuguese Marrano or Crypto-Jew, who came to England in the reign of Charles I. He was the first "endenizened" Jew in England (1655), and by his extensive trade with the West Indies rendered considerable services to the Commonwealth. Besides his commercial value to Cromwell, Carvajal was politically useful also, for he acted as "intelligencer." When Manasseh ben Israel in 1655 petitioned for the return of the Jews who had been expelled by Edward I., Carvajal took part in the agitation and boldly avowed his Judaism. Carvajal may be termed the founder of the Anglo-Jewish community. He died in 1659.

See Lucien Wolf, "The First English Jew," *Trans. Jewish Historical Society*, ii. 14.

CARVAJAL, LUISA DE (1568–1614), Spanish missionary in England, was born at Jaraicejo in Estremadura on Jan. 3, 1568. Moved by the execution of the Jesuit, Henry Walpole, in

1596, she decided to devote herself to the cause of the faith in England. With her share of the family fortune, she founded a college for English Jesuits at Louvain which was transferred to Watten near Saint Omer in 1612 and lasted till the suppression of the Order. In 1605, she arrived in England and established herself under the protection of the Spanish ambassador, whose house was in the Barbican. From there she carried on an active and successful propaganda. She made herself conspicuous by her attentions to the Gunpowder Plot prisoners, and won converts, partly by persuasion, partly by assisting the poor. She was arrested in 1608. But the protection of the Spanish ambassador, and the desire of King James I. to stand well with Spain, secured her release. She died Jan. 2, 1614.

See L. Muñoz *La Vida y Virtudes de la Venerable Virgen Doña Luisa de Carvajal y Mendoza* (1632). It is summarized by Southey in his *Letters from Spain and Portugal* (1808). *See* also *Quatre Portraits de femmes*, by La Comtesse R. de Courson (1895), and refs. in *Records of the English Province of the Society of Jesus*, by Henry Foley (1877–83).

CARVER, GEORGE WASHINGTON (c. 1864–1943) American Negro chemurgist and agricultural experimenter, was born about 1864, of slave parentage, near Diamond Grove, Mo. Eager for education, he worked his way through school and college. In 1892 he received his Master of Science degree from Iowa State College. He worked there as botanist until 1896, when he went to Tuskegee Institute in Alabama. He devoted his life to agricultural research for the betterment of the South and his people. Persuading farmers to diversify their crops by planting soil-enriching peanuts and sweet potatoes instead of soil-exhausting cotton, Dr. Carver next solved the problem of finding new uses for these crops, which had become over-abundant as foodstuffs. From the peanut he made cheese, milk, coffee, flour, ink, dyes, soap, wood stains and insulating board, to list but a few of his 300 products. From the sweet potato came flour, vinegar, molasses, rubber, etc. Years before plastics from wood wastes were first attempted, he was making synthetic marble from wood shavings. In 1940 he donated his life savings of $33,000 to establish the Carver foundation to carry on his research. In 1923 he was awarded the Spingarn medal and in 1939 the Roosevelt medal. He died at Tuskegee, Ala., Jan. 5, 1943.

CARVER, JONATHAN (1710–1780), American traveller, was born in Weymouth, Massachusetts. After serving in the French and Indian war he joined the company of Maj. Robert Rogers (*q.v.*) to explore the great north-western territories. Rogers sent him by the Fox-Wisconsin route to the Mississippi and up that river to the Falls of St. Anthony to visit the Sioux tribes. He spent the winter of 1766–67 at one of their villages on the Minnesota river. In the spring he started to return to Mackinac, but at the mouth of the Wisconsin river he met Captain James Tute, in command of a party sent out by Rogers to explore a route to the Pacific ocean. Tute brought orders for Carver to join the party as draughtsman and third in command. They proceeded up the Mississippi and crossed to and skirted the shores of Lake Superior to the Grand Portage. There they waited for supplies from Rogers, but his failure to send them caused Tute to abandon his expedition and return by the north shore of Lake Superior to the fort, where he arrived in Aug. 1768. Rogers had exceeded his powers in employing these agents, and Carver was never paid. After nine years of misfortune and poverty his book, *Travels through the Interior Parts of North America in the years 1766, 1767, 1768*, was printed in London (1778). Its success was immediate, but this came too late to bring the author any material benefit. He died in London in 1780, a broken old man, 70 years of age, and was buried in the potter's field. No narrative of early adventure and travel in America has ever approached the popularity of this work. At least 32 editions in English, French, German and Dutch were printed. The second part, dealing with the life and customs of the Indians, is largely plagiarized from earlier French writers, but this does not warrant discrediting the whole as some historians have done. Carver's original journals, including a day-by-day log of his journey, are in the British Museum and substantiate the main facts of the first part of his book. Careful comparison leads to the conclusion that the book was written from memory, with these journals not at hand. Besides the minor inaccuracies, the book is guilty of deliberate falsification when it denies Rogers credit for initiating the expedition and conceals the fact that Tute commanded it. Just how far Carver is responsible for these deceptions and the plagiarism cannot be determined.

See J. T. Lee, *A Bibliography of Carver's Travels* (Wis. Hist. Soc., Proceedings, 1909, pp. 143–183), and *Captain Jonathan Carver: Additional Data* (Ibid., 1912, pp. 87–123); W. Browning, "The Early History of Jonathan Carver" (*Wisconsin Magazine of History*, iii., 291–306); and T. C. Elliott, "Jonathan Carver's Source of the Name Oregon" (Oregon Hist. Soc., *Quarterly*, xxiii., 53–59).

(O. W. H.; X.)

CARVING. In carving a long sharp knife and a two-pronged fork are essential, and a steel should also be provided.

Sirloin.—Place the joint with the chine bone to the left and the fillet underneath. Release the meat from the chine bone and also from the blade bone for about three-quarters to one inch, according to the number of persons to be served. Then carve in thin slices the entire length of the joint. To carve the fillet or undercut, reverse the joint, loosen the meat from the bone, and cut in slices at right angles to the blade bone.

An alternate method when a large number of portions have to be served, is to turn the dish so that one end faces the carver and the chine bone is at the opposite end. Release the meat from the chine bone with the pointed end of the knife, and cut the meat, slicing vertically the whole length of the joint, commencing at the left hand outside.

Leg of Mutton.—Place the knuckle end to the left of the dish and turn the joint on the dish in such a way that the part with the most meat is away from the carver. Commence slicing about two or three inches from the knuckle, holding the knife in a slanting position and working from left to right. Continue until the meat on the upper side of the joint is removed. Turn the joint, and with the knife in a horizontal position and parallel with the dish slice off the remaining meat.

Shoulder of Mutton.—Place the joint with the knuckle towards the left hand of the carver. Put the fork securely into the knuckle, raising the joint from the dish. Commence slicing to the left hand side near the fork, carving across the grain in neat slices of about one-quarter to one-eighth of an inch thick. Towards the end of the joint it will be necessary to turn the knife slightly to release the meat from the bone. When as much of the meat as possible has been removed, turn the joint over, keeping the knuckle to the left and the knife in a horizontal position and parallel to the dish, carving thin slices, working from the right to the left.

Poultry and Game.—In the case of large birds, it is well to remove the wish-bone or merry thought before carving; birds should be placed with the legs turned away from the carver.

Turkey.—Remove the legs by cutting through the thin skin which connects the top of the leg and breast. Then gently pull the joint from the carcase and separate it with the pointed end of the knife; the meat should be cut in vertical slices from the upper joint of the leg. Remove the wing with a portion of the breast, then carve the latter in long, thin slices. An alternative method is to commence carving the breast after the removal of the leg but before the wings. Capon and large fowl are carved in the same way as a turkey.

Chicken.—Remove the legs in the same way as when carving a turkey. Cut the legs in half lengthways, serving the drum-stick half with the wing and the other part with the breast. Then slice the remainder of the breast. An alternative method, suitable for hotel and restaurant use, and when dealing with small birds, is to divide the carcase in half horizontally, cutting the remainder into two by chopping through the breast bone lengthways, rejecting the back or under-carcase. Pheasant, blackcock, capercailzie and duck are carved in the same way.

Goose.—Remove the legs and wings with a portion of the breast and slice the latter. Release the flesh from the breast bone and carve the breast in thin slanting slices, starting from where the wings have been removed.

Pigeons, Partridges and Other Small Game.—When the birds are small and only enough for two portions divide equally into two, cutting through the breast bone with a sharp knife. If available,

CARVING

PLATE I

1

2

3

4

BY COURTESY OF THE GOOD HOUSEKEEPING INSTITUTE

METHODS OF CARVING JOINTS, POULTRY AND GAME

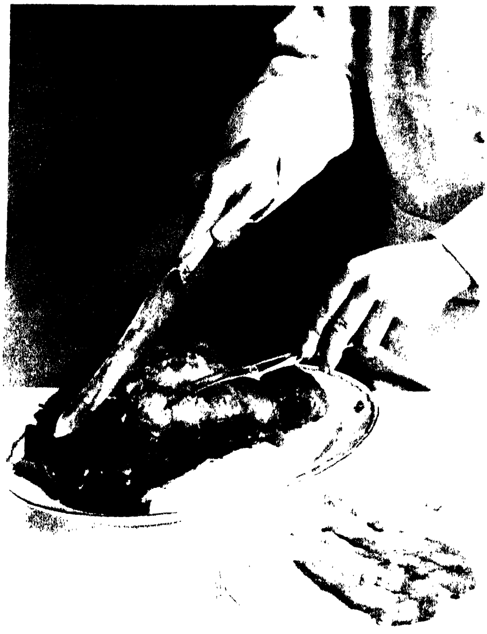
1. Carving a leg of mutton (first position)
2. Second position in carving a leg of mutton

3. Carving a goose. After one leg and the wings have been removed, slices are taken from the breast

4. Carving a roast hare. The first cuts are taken from the back

PLATE II

CARVING



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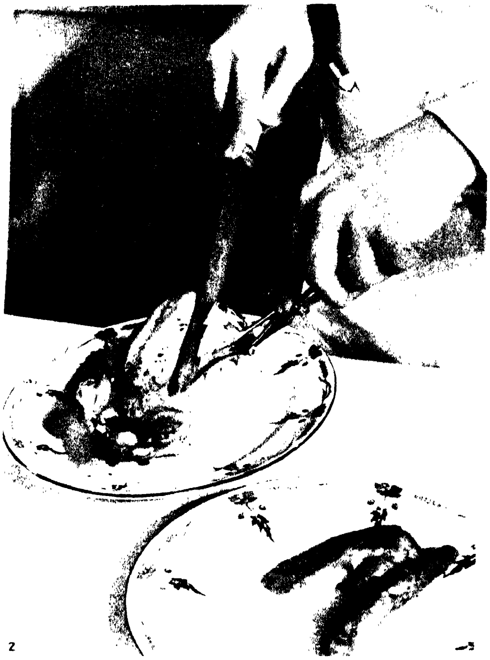

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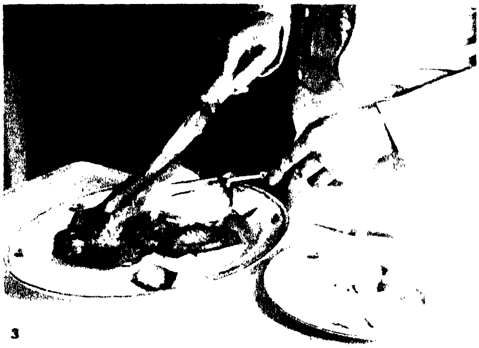

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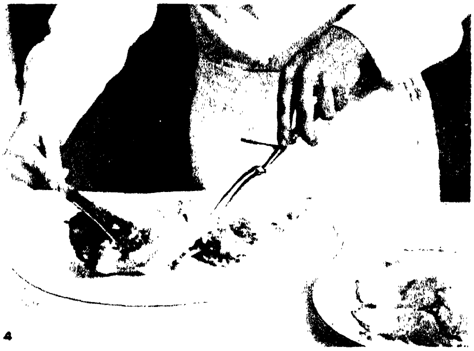


4

BY COURTESY OF THE GOOD HOUSEKEEPING INSTITUTE

METHODS OF CARVING VARIOUS MEATS

1. Carving a sirloin of beef, showing the correct position of the knife and fork with relation to each other and to the grain of the meat
2. Carving a chicken, showing method of cutting slices from the breast after the removal of one wing
3. Carving a turkey, showing, as in Figure 2, the method of removing slices of white meat from the side of the breast
4. Second position in carving a leg of mutton, showing the horizontal position of the knife. (Compare with Plate I, Figures 1 and 2)

use game scissors for they facilitate the severing of the back bone. They are also convenient for removing the base of this bone, which should be done before serving. To serve four portions cut in half along the breast bone and divide each side of the bird in half with a slanting cut from the point where the wing joins the carcase towards the neck end.

Wild Duck.—Remove the wings, dissect the entire breast away from the carcase and carve in horizontal slices across the grain.

Roast Hare.—Remove a rectangular portion of flesh from the back forming the saddle, and cut in thin slices. Then slice the flesh from the hind legs. (D. D. C. T.)

Carving in Sculpture.—To carve is to cut, whatever the material; but more particularly as appertains to the art of sculpture. The name of sculpture (*see* SCULPTURE) is commonly reserved for the great masters of the art, especially in stone and marble, while that of carver is given to the artists or workmen who execute the subordinate decorations of architecture. The word is also specially applied to sculpture in ivory (*see* IVORY CARVING) and its substitutes, and in wood (*see* WOOD-CARVING) and other soft materials (*see* also GEM).

CARVING TOOLS, the various instruments used in the art of cutting wood, stone, ivory, etc., for ornamental purposes. Primitive peoples employed sharpened fish-bones, flint and shells in carving wood and ivory articles, accomplishing results that to-day would seem impossible. After the discovery of steel the tools for carving were developed considerably; however, the principles of many of the oldest tools are still being used, differing only in the quality of steel. The names and uses of the tools employed in the carving of the most important materials, viz., wood, stone and ivory, are given below.

Wood-carving Tools.—The history and development of wood-carving tools may be said to follow the history of iron and steel tools. Except for certain refinements in the steel itself, working methods, etc., and the better and lighter design of the tools, the wood-carving tools of to-day are practically the same as those used several centuries ago. A professional wood-carver may have well over a hundred tools, most of these varying only slightly in size, width and sweep, using them according to the requirements of his work. Japanese and Chinese wood-carvers do very fine work with but few tools, a single knife often being employed for many different purposes.

Beginners are usually advised to start with a set of tools varying from 12 to 24, as the other tools are largely only variations of these in size and sweep, and may be acquired as experience dictates. The wood-carver's tools consist largely of chisels, knives and gouges of various shapes and sizes. These are generally lighter in weight and of a design more suitable for wood-carving than the chisels and gouges used by the carpenter or joiner. Many of the carving tools vary only in the size and sweep of the cutting edge. When a wood-carver speaks of the "sweep" of a gouge, he means the actual curve at the cutting edge, as made when the tool is pressed perpendicularly into a piece of wood.

Chisels and gouges for wood-carving vary from $\frac{1}{16}$ in. to 1 in. in width at the cutting edge, the curves or "sweeps" of the gouges varying from that of a half circle, called a deep gouge, to a curve that is almost flat, called a flat gouge. The chisels vary in width at the edge, some of them having the edge straight across or at right angles to the blade while others have the edge slanted off at an angle across the tool.

Wood-carving tools are made in two forms: straight-sided (fig 1, *A*) and spade-shaped or fish-tailed (*B*). The latter conceals less of the wood under the tool and also works into corners where a straight-sided tool could not be used.

A straight tool (*A*) is more generally used than any other. A "long bend" tool and a "short bend" are shown also (*C* and *D*). These two tools are used in places where the straight tool would not cut, as in deep hollows. Straight-, long- and short-bend tools may be obtained in the straight-sided or fish-tailed types. Wood-carvers also use especially shaped knives for their work, three types being shown (*E*). Stamps made of steel are sometimes used by the carver to stamp portions of carved backgrounds into more or less regular patterns, two of which are illustrated (*G*). Some wood-carvers make them from iron or steel nails, sawing off the nails and filing the ends into various shapes. Special files, called carver's rasps (*H*), are sometimes used for roughing out or smoothing off parts of the work.

For the lighter cuts the wood-carver uses the tool with his hands, one hand pushing the tool and the other hand resting on the blade, controlling it. For heavy cuts, usually in preliminary work, he uses a carver's mallet or maul to drive the tool (*F*). When clearing away large quantities of wood, as in the preliminary stages of large work, many carvers use the heavier carpenter's or wood-worker's chisels and gouges, and at times parts of the wood are bored away or entirely through, with a brace and bit, the work being of course finished up with the regular carving-tools.

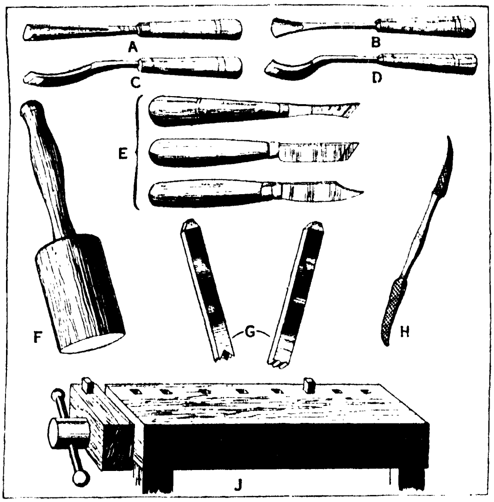


FIG. 1.—VARIOUS TOOLS USED IN WOOD CARVING. SEE TEXT FOR DETAILS

Generally the work that is being carved is held firmly to the bench by clamps, or it is clamped in a vice. A wood-carver's bench is provided with holes in the top, and the top of the vice, which is level with the bench, is also provided with a hole. Pegs fit in these holes. Flat work is rested on the bench top in such a manner as to come between a peg in the vice and one or more pegs in the bench top, the vice being squeezed up to hold the work firmly between the pegs. The top of a wood-carver's bench is here illustrated (*J*).

Wood-carving tools are made of the best grades of fine tool steel, forged into the various chisel, gouge and knife shapes by a skilled tool-smith, using a charcoal, coal or gas fire in the forge to heat the steel, usually to a dull red colour. When the tool is forged into shape, it is again heated to a dull red and hardened by plunging it into an oil or water bath, after which it is tempered by a slight reheating, the temper being drawn to a lemon yellow or a dull straw colour. Authorities differ as to the proper amount of hardness to be left in the edge of a carving-tool and many wood-carvers reharden and temper their tools to their own liking. After the tempering process the edge of the tool is ground down on a grindstone, the tool being well moistened with water to keep it from so heating as to destroy the temper. The rough edge thus formed is smoothed down by rubbing it back and forth on a fine-grained oil stone, well moistened with oil, until a very keen edge is obtained. Specially shaped stones called "slips," which are oil stones shaped to fit inside gouges and other tools, are used at this stage for the inside sharpening of the tools, the slip being held in one hand and rubbed against the tool held in the other hand. During the sharpening the edge of the tool is frequently driven into soft wood to remove the "feather edge," or fringe of steel which forms on the edge of the tool. Slips and small stones are frequently used as above by the carver to obtain very fine and accurate edges, particularly on small tools of all shapes. Many wood-carvers sharpen both sides of the edge, the under side at the usual angle and the top side at a very slight angle, though experts differ as to this. The final edge is given to wood-carving tools by stropping them on a piece of oily leather which is charged with some fine abrasive, such as crocus or rouge, to obtain the very sharp cutting edge necessary for all wood-carving tools.

Tools that are used in hard wood are frequently ground and sharpened at a lesser angle than those used in soft wood by professional carvers, who sharpen their tools frequently as they work, never allowing them to become dull. Sharpening is a very difficult art and requires much practice before a satisfactory edge may be had. Instead of a grind-stone many carvers now use a quick-cutting, flat, carborundum stone, well charged with oil, on which the tool is rubbed to a rough edge, before finishing up with the finer stones and the strop.

Stone-carving Tools.—The stone-cutter's instruments, as distinguished from those of the wood-cutter, are largely as follow: (1) Chisels, with various shapes, widths, and tempers; (2) tooth chisels, for the first or rougher cutting; (3) splitters; (4) hand-drills; (5) bow-drills; (6) points; (7) pointing machine; (8) pneumatic tools; (9) rasps; (10) hand hammers, including wooden mallets; (11) dummies, which may be of copper, soft iron or lead

Ivory-carving Tools.—The tools for ivory-carving seem to have remained much the same within historic record. The material requires very hard and sharp tools for cutting; however, it is easily sawed or filed. The average ivory-carver's tools include the following: (1) bow-saw, or a small-toothed circular saw for the preliminary cutting; (2) float, a tapering tool in a wooden handle; (3) gouge and mallet; (4) rasp and file; (5) chisels; (6) scraper, a distinctive tool of ivory-carving, resembling a wood-carving chisel, and used for removing the substance in shavings, for engraving the most delicate lines or for finishing; (7) miscellaneous tools, such as drills, compasses, groovers and a large selection of knives for paring and finishing. (*See* also SCULPTURE TECHNIQUE; IVORY CARVING.) (E TH.)

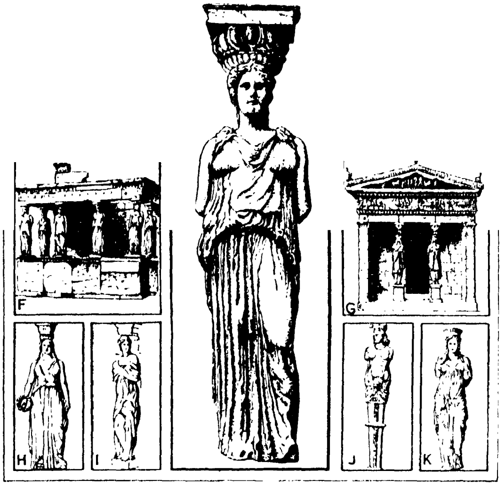
CARY, ALICE (1820–1871), and **PHOEBE** (1824–1871), American poets, were born at Mount Healthy, near Cincinnati (Ohio), respectively on April 26, 1820, and Sept. 4, 1824. Their education was largely self-acquired, and their work in literature was always done in unbroken companionship. Their poems were first collected in a volume entitled *Poems of Alice and Phoebe Carey* (1850). Alice, who was much the more voluminous writer of the two, wrote prose sketches, novels and poems, the best of which treat the surroundings and friends of her girlhood. Her lyrical poem, "Pictures of Memory," was praised by Edgar Allan Poe. Phoebe published two volumes of poems (1854 and 1868), but is best known as the author of the hymn "Nearer Home," beginning "One sweetly solemn thought." Alice died in New York city, Feb. 12, 1871, and Phoebe in Newport (R.I.), July 31 of the same year.

The collected *Poetical Works of Alice and Phoebe Cary* were published in Boston in 1886.

CARY, ANNIE LOUISE (1842–1921), American singer, was born in Wayne (Me.), on Oct 22, 1842. She studied in Milan, and made her début as an operatic contralto in Copenhagen in 1868. She had a successful European career for several years, singing in Stockholm, Paris and London, and made her New York first appearance in 1870. Until she retired in 1882, on her marriage to Charles M. Raymond, she was the most popular singer in America She died on April 3, 1921, at Norwalk (Conn.).

CARY, HENRY FRANCIS (1772–1844), translator of the *Divina Commedia*, was born at Gibraltar, the son of an army captain, and educated at Christ Church, Oxford, where he devoted much time to the study of French and Italian literature. On leaving Oxford he took holy orders. For about 11 years he was assistant-librarian in the British Museum, and in 1841 he received a Crown pension His translation of the whole of the *Divine Comedy* appeared in 1814, was praised by Coleridge, and passed through four editions during its author's lifetime Though Cary's blank verse hardly reproduces the strength and terseness of Dante's *terza rima*, the translation has great merits.

CARYATID, a draped female figure used as a support, especially in Greek, Roman and Renaissance architecture.



BY COURTESY OF LAWRENCE "LATER GREEK SCULPTURE", MAGNE "DÉCOR DE LA PIERRE" (RENOUARD); VITRY "HÔTELS ET MAISONS DE LA RENAISSANCE FRANÇAISE" (LEVY)

A, Casino of Pius IV., Rome; B, Villa Guilla; C, Erechtheum in the British Museum; D, Constantinople Museum; E, Milan Cathedral; F, Erechtheum, Athens; G, Cnidian treasury at Delphi; H, Villa Mattei; I. Grand Theatre, Bordeaux; J, House at Nancy, France; K, caryatids by Jean Goujon, Louvre

CARYOPHYLLACEAE, a family of dicotyledonous plants, containing about 80 genera with 1,300 species, and widely distributed, especially in temperate, alpine and arctic regions. The plants are herbs, sometimes becoming shrubby at the base, with opposite, simple, generally uncut leaves and swollen nodes. The main axis ends in a flower (definite inflorescence), and flower-

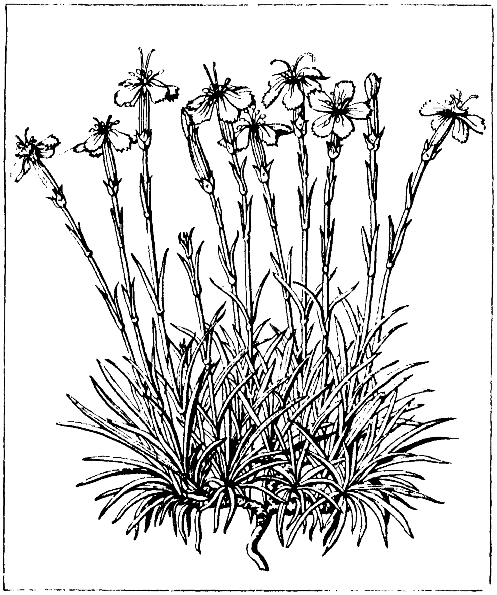


FIG. 1.—PINK (DIANTHUS), A SWEET SCENTED FLOWER OF RED OR PINK AND WHITE BLOSSOMS

bearing branches are borne one on each side by which the branching is often continued. The flowers are regular, with four or five sepals which are free or joined to form a tube in their lower portion, the same number of petals, free and springing from below the ovary, twice as many stamens, inserted with the petals, and a pistil of two to five carpels joined to form an ovary containing a large number of ovules on a central placenta and bearing two to five styles; the ovary is one-celled or incompletely partitioned at the base into three to five cells; honey is secreted at the base of the stamens. The fruit is a capsule containing a large number of small seeds and opening by apical teeth; the seed contains a floury endosperm and a curved embryo.

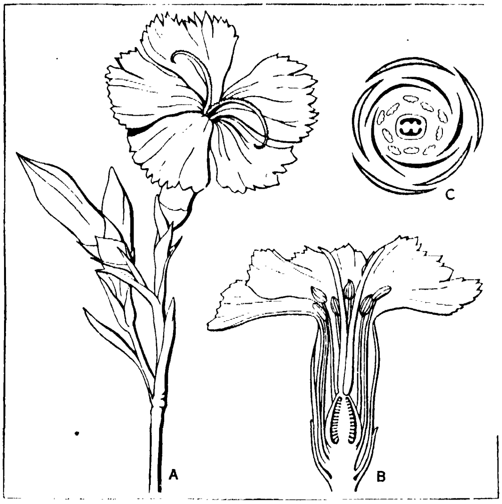


FIG. 2.—PINK (DIANTHUS), SHOWING DETAILS OF STRUCTURE
A. Flowering shoot
B. Flower in vertical section
C. Floral diagram

The family is divided into two well-defined tribes which are distinguished by the character of the flower and the arrangements for ensuring pollination.

I. *Alsinoideae:* the sepals are free and the flowers are open, with spreading petals, and the honey which is secreted at the base of the stamens is exposed to the visits of short-tongued insects, such as flies and small bees; the petals are white in colour. It includes several British genera, *Cerastium* (mouse-ear chickweed), *Stellaria* (stitchwort and chickweed), *Arenaria* (sandwort), *Sagina* (pearlwort), *Spergula* (spurrey) and *Spergularia* (sandwort spurrey).

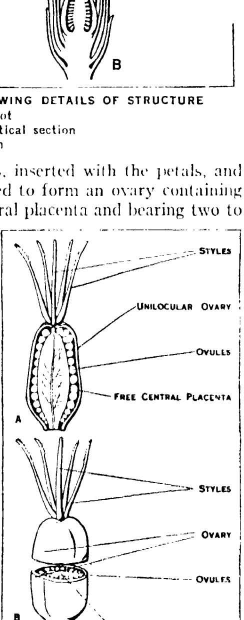


FIG. 3.—DETAIL OF THE MOUSE-EAR CHICKWEED (CERASTIUM HIRSUTUM)
A. Pistil cut vertically
B. Pistil cut horizontally, and the halves separated so as to show the interior of the cavity of the ovary

II. *Silenoideae:* the sepals are joined below to form a narrow tube, in which stand the long claws of the petals and the stamens, partly closing the tube and rendering the honey inaccessible to all but long-tongued insects such as the larger bees and Lepidoptera. The flowers are often red. It includes several British genera:—*Dianthus* (pink), *Silene* (catchfly, bladder campion), *Lychnis* (campion, *L. Flos-Cuculi* is ragged robin), and *Agrostemma* (*Githago*) (corn cockle). Several, such as *Lychnis vespertina, Silene nutans* and others, open their flowers and are fragrant in the evening or at night, when they are visited by night-flying moths.

In North America the family is represented by about 300 species, most numerous in mountain regions and belonging chiefly to *Silene, Arenaria, Alsine* and *Cerastium.* The plants of this family are of little or no economic value. *Dianthus* (carnation and pink), *Gypsophila, Lychnis* and others, are garden plants.

For a treatment of the genera *see* F. Pax and K. Hoffmann, Caryophyllaceae; Engler and Prantl, Die Natürlichen Pflanzentamilian 16 c: 275–367, fig. 120–150 (1934).

CASABIANCA, RAPHAEL, COMTE DE (1738–1825), French general, was descended from a noble Corsican family, and in 1793 was appointed lieutenant-general in Corsica in place of Pascale Paoli, who was outlawed for intrigues with England. After the 18th Brumaire he entered the senate and was made count of the empire in 1806. His nephew, LOUIS DE CASABIANCA (1762–1798), entered the French navy, and in 1792 was in command of the "Orient," which at the battle of the Nile bore the flag of Admiral Brueys. When the latter was killed, Casabianca, though badly wounded, fought the burning ship to the end, and perished with most of the crew. His son, Giacomo Jocante, a boy of ten years of age, refused to leave the ship and died in trying to save his father. This heroic act was the subject of several poems, including the well-known ballad by Mrs. Hemans.

CASABLANCA, a seaport on the Atlantic coast of Morocco, in 33° 27′ N., 7° 46′ W. The modern city, which has grown up around a small Arab town, is rectangular in shape, with its base toward the sea. The central point of the city is the Place de France, from which all the main routes of the city radiate.

The city is by far the most important seaport in Morocco, and probably of North and West Africa. It is one of the largest centres of population in the country and the fourth city of the African continent. Its excellent harbour works make it one of the largest, if not the largest, artificial ports in the world. The Cazes airport by 1945 was probably the third largest in the world and during World War II handled more traffic (chiefly military) than any other airport. The population was 257,430 in 1936 (184,668 natives and 72,762 Europeans). In 1938 trade amounted to 2,600,000,000 francs (1,700,000,000 imports, 900,000,000 exports). The town was originally founded by the Portuguese, on the site of the ancient Anfā, which they destroyed in 1465. It was occupied by the French in Aug. 1907, in consequence of the murder of a number of French and Spanish workmen engaged on the harbour works. In 1924 large electric power works, erected in connection with the electrification of the railways, were completed and further extensions of the harbour works were completed in 1925 and later years.

Casablanca was occupied by U.S. forces in Nov. 1942 and was later turned over to the administration of Gen. Charles de Gaulle's government. Anfā, a suburb of Casablanca, was the scene of an Allied conference between President Roosevelt and Prime Minister Churchill in Jan. 1943.

CASA GRANDE, a national reserve, technically known as a national monument, in Pinal county, Ariz., which has within its bounds some of the most noteworthy relics of a prehistoric age and people within the limits of the United States. The ruins are situated near the left bank of the Gila river about 12 mi. from Florence, Ariz., and 15 mi. northeast of the station, Casa Grande on the Southern Pacific railway. It resembles the Casa Grande ruin of Chihuahua, Mexico, with its walls of sundried *caliche* (a composition of lime, earth and pebbles), and its area of rooms, courts, plazas and pyramids, surrounded by a wall. The first known white man to visit Casa Grande was the Jesuit missionary Kino, in 1694. The house was already a ruin but he described it as large and ancient and certainly four stories high. In the immediate vicinity were the ruins of other houses, and in the country towards the north, east and west were ruins of similar structures. The identity of its builders is unknown as is its age, but there is reason to believe that settlements on its site antedate most of the present cliff dwellings of the southwest. Irrigation canals indicate an agricultural economy. John Russell Bartlett described the ruins in 1854, and in 1889 congress voted that it be protected as a government reservation; in 1892 it was done.

CASALE MONFERRATO, a town and episcopal see of Piedmont, Italy, in the province of Alessandria, 21 mi. N.N.W. by rail from the town of Alessandria. Pop. (1936) 25,485 (town); 37,098 (commune). It lies in the plain on the right bank of the Po, 377 ft. above sea-level, and is a junction for Mortara, Vercelli, Chivasso and Asti; it is also connected by steam tramways with Alessandria, Vercelli and Montemagno. The fine Lombard Romanesque cathedral, originally founded in 742, was rebuilt 1100–06. The church of S. Domenico is a good Renaissance edifice, and there are some fine palaces. About 10 mi. distant is the Sacro Monte di Crea, with 18 chapels on its slopes containing terracotta groups of statues, resembling those at Varallo. Casale Monferrato was given by Charlemagne to the church of Vercelli, but obtained its liberty from Frederick I (Barbarossa). It was sacked by the troops of Vercelli, Alessandria and Milan in 1215, but rebuilt and fortified in 1220. It fell under the power of its marquises in 1299, and became the chief town of a small state. In 1536 it passed to the Gonzagas of Mantua, who fortified it very strongly. It has since been of considerable importance as a fortress; it successfully resisted the Austrians in 1849, and was strengthened in 1852. There are large cement factories here.

CASALS, PABLO (1876–), eminent violoncellist, composer and conductor, was born at Vendrell, near Barcelona, Dec. 30, 1876. He received his first musical instruction from his father, an organist, later becoming a pupil of José García at the Barcelona conservatoire and then studying at Madrid. He made his first public appearance in Barcelona in 1889 but had to wait some years before he obtained general recognition. Thus it was not till 1898 that he was heard in Paris (Lamoureux concerts) and in London (Crystal palace); but thenceforward his fame rapidly extended. He paid his first visit to the United States in 1901. He married first Guilhermina Suggia, and subsequently Susan Metcalfe. *See* Lillian Littlehales, *Pablo Casals* (1930).

CASAMARI, a Cistercian abbey in the province of Rome, 6m. E.S.E. of Veroli. It marks the site of Cereatae, the birthplace of Marius, afterwards known as Cereatae Marianae. The abbey is a fine example of Burgundian early-Gothic (1203–17), paralleled in Italy by Fossanuova alone (which is almost contemporary with it), and is very well preserved.

CASANOVA DE SEINGALT, GIOVANNI JACOPO (1725–1798), Italian adventurer and author of the famous *Mémoires*, was born at Venice in 1725. His parents, taking a journey to London, left him, when he was a year old, in charge of his grandmother, who sent him at 16 to the seminary of St. Cyprian in Venice, from which he was expelled for scandalous and immoral conduct, which would have cost him his liberty, had not his mother procured him a situation in the household of the Cardinal Acquaviva where he remained for a short time before he began that career of adventure and intrigue which only ended with his death. He visited Rome, Naples, Corfu and Constantinople. By turns journalist, preacher, abbé, diplomatist, he was nothing very long, except *homme à bonnes fortunes*. In 1755, having returned to Venice, he was denounced as a spy and imprisoned. On Nov. 1, 1756 he escaped, and made his way to Paris. Here he was made director of the state lotteries, gained much financial reputation and a considerable fortune, and made a figure in high society. In 1759 he set out again on his travels. He visited in turn the Netherlands, South Germany, Switzerland—where he made the acquaintance of Voltaire,—Savoy, southern France, Florence—whence he was expelled,—and Rome, where the pope gave him the order of the Golden Spur. In 1761 he returned to Paris, and for the next four or five years lived partly here, partly in England, South Germany and Italy. In 1764 he was in Berlin, where he refused the offer of a post made him by Frederick II. He then travelled by way of Riga and St. Petersburg to Warsaw, where he was favourably received by King Stanislaus Poniatowski. A scandal, followed by a duel, forced him to flee, and he returned by a devious route to Paris, only to find a *lettre de cachet* awaiting him, which drove him to seek refuge in Spain. Expelled from Madrid in 1769, he went by way of Aix—where he met Cagliostro—to Italy once more. From 1774, with which year his memoirs close, he was a police spy in the service of the Venetian inquisitors of state; but in 1782, in consequence of a satirical libel on one of his patrician patrons, he had once more to go into exile. In 1785 he was appointed by Count Waldstein, an old Paris acquaintance, his librarian at the château of Dux in Bohemia. Here he lived until his death, which probably occurred on June 4, 1798.

The main authority for Casanova's life is his *Mémoires* (12 vols., Leipzig, 1826–1838; many later editions and translations), which were written at Dux. They are clever, well written and, above all, cynical, and interesting as a trustworthy picture of the morals and manners of the times. Among Casanova's other works are *Confutazione della storia del governo Veneto d'Amelot de la Houssaye* (Amsterdam, 1769); and the *Histoire* (Leipzig, 1788; reprinted Bordeaux, 1884; Eng. trans. by P. Villars, 1892). *See* Arthur Machen, trans., *Memoirs of Casanova;* S. G. Endore, *Casanova: His Known and Unknown Life* (1929); M. Rostand, *Private Life of Casanova* (1929).

CASAS GRANDES ("Great Houses"), a small village of Mexico, in the state of Chihuahua, on the Casas Grandes or San Miguel river, about 35 mi. S. of Llanos and 150 mi. N.W. of the city of Chihuahua. Pop. (1940) 1,126. The railway from Ciudad Juárez to Mexico City passes through the town. It is celebrated for the ruins of early aboriginal buildings still extant found nearby. They are built of "sun-dried blocks of mud and gravel about 22 in. thick, and of irregular length, generally about 3 ft., probably formed and dried *in situ*." The walls are in some places about 5 ft. thick, and they seem to have been plastered both inside and outside. The principal edifice extends 800 ft. from north to south, and 250 ft. east to west; its general outline is rectangular, and it appears to have consisted of three separate piles united by galleries or lines of lower buildings. The exact plan of the whole is obscure, but the apartments evidently varied in size from mere closets to extensive courts. The walls still stand at many of the angles with a height of from 40 to 50 ft., and indicate an original elevation of several stories, perhaps six or seven. At a distance of about 450 ft. from the main building are the substructions of a smaller edifice, consisting of a series of rooms ranged round a square court, so that there are seven to each side besides a larger apartment at each corner. The age of these buildings is unknown, as they were already in ruins at the time of the Spanish conquest. The whole region of Casas Grandes is studded with artificial mounds, from which are excavated from time to time numbers of stone axes, metates or corn-grinders, and earthen vessels of various kinds. The earthen vessels have a white or reddish ground, with ornamentation in blue, red, brown, or black, and are of much better manufacture than the modern pottery of the country. Similar ruins to those of Casas Grandes exist near Gila, the Salinas and the Colorado, and it is probable that they are all the erections of one people. Hubert Howe Bancroft is disposed to assign them to the Moquis.

See H. H. Bancroft, *The Native Races of the Pacific States of North America*, of which the principal authorities are the *Noticias del Estado de Chihuahua* of Escudero, who visited the ruins in 1810; an article in the first volume of the *Album Mexicano*, the author of which was at Casas Grandes in 1842; *Personal Narrative of Explorations and Incidents in Texas, New Mexico, California, Sonora and Chihuahua* (1854), by John Russell Bartlett, who explored the locality in 1851.

CASATI, GAETANO (1838–1902), Italian geographer and traveller in Africa. Born at Lesmo, he entered the corps of Bersaglieri in 1859 and took part in the wars of independence against Austria. Subsequently he was employed in the making of the ordnance survey maps of Italy. In 1879 Casati resigned his commission to devote himself wholly to geographical work. In the same year he started for the Bahr el Ghazal province of the Sudan to join Gessi Pasha (*see* SUDAN: *History*). He travelled widely in that region and visited the upper Welle basin of the Congo. He also carried on operations against slave raiders and on the rise of the Mahdi made his way south to Lado, where in 1883 he joined Emin Pasha, under whom he served. He was for some time Emin's agent in Unyoro. There he was made prisoner and tied naked to a tree. Left to his fate he managed to escape and rejoined Emin. In 1889 he accompanied H. M. Stanley and Emin to Bagamoyo and returned to Italy. Later he published an account of his travels (Eng. trans. *Ten Years in Equatoria*), which had added a good deal to the knowledge of the headwaters of the Nile.

CASAUBON, FLORENCE ESTIENNE MÉRIC (1599–1671), English classical scholar, son of Isaac Casaubon, was born at Geneva Aug. 14 1599, and completed his education at Eton and Oxford. For his defence of his father against the attacks of certain Catholics (*Pietas contra maledicos patrii Nominis et Religionis Hostes*, 1621) and against imposters who had published, under his name, a work on *The Origin of Idolatry* (*Vindicatio Patris adversus Impostores*, 1624), James I. conferred on him a prebendal stall at Canterbury. During the Civil War he lived a retired life, and after its conclusion refused to acknowledge the authority of Cromwell, who, notwithstanding, requested him to write an "impartial" history of the events of the period, an offer which he declined. After the Restoration he was reinstated in his benefice. He died at Canterbury July 14 1671. His editions of numerous classical authors, and especially of the *Meditations* of Marcus Aurelius (also English translation, new ed. by W. H. D. Rouse, 1900), were highly valued. Among his other works may be mentioned: *De Quatuor Linguis Commentatio* (1650), *Of the Necessity of Reformation* (1664), *On Credulity and Incredulity in Things natural, civil, and divine* (1668).

CASAUBON, ISAAC (1559–1614), French (naturalized English) classical scholar, was born in Geneva on Feb. 18, 1559, of French refugee parents. On the publication of the edict of Jan. 1562, the family returned to France and settled at Crest in Dauphiné. Till he was 19, Isaac had no other instruction than could be given him by his father, Arnaud Casaubon, during the years of civil war. His father was away from home whole years together in the Calvinist camp, or the family were flying to the hills to hide from the fanatical bands of armed Catholics who patrolled the country. Thus it was in a cave in the mountains of Dauphiné, after the massacre of St. Bartholomew, that Isaac received his first lesson in Greek, the text-book being Isocrates's *ad Demonicum*.

At 19 Isaac was sent to the Academy of Geneva, and in 1581 became professor of Greek. At Geneva he remained as professor of Greek till 1596. Here he married twice, his second wife being Florence, daughter of the scholar-printer, Henri Estienne. With few books and no assistance, in a city peopled with religious refugees, and struggling for life against the troops of the Catholic dukes of Savoy, Casaubon made himself a consummate Greek scholar and master of ancient learning. His great wants at Geneva were books and the sympathy of learned associates. He spent all he could save out of his small salary in buying books and in having copies made of such classics as were not then in print. The sympathy and help which Casaubon's native city could not afford him, he endeavoured to supply by cultivating the acquaintance of the learned of other countries. Geneva, as the metropolis of Calvinism, received a constant succession of visitors. It was there that Casaubon made the acquaintance of young Henry Wotton, the poet and diplomatist, and of Richard Thomson ("Dutch" Thomson), fellow of Clare college, Cambridge, through whom the attention of Joseph Scaliger, settled in 1593 at Leyden, was directed to Casaubon. Scaliger and Casaubon began in 1594 a correspondence which culminates in a tone of the tenderest affection and mutual confidence. Influential French men of letters, the Protestant Jacques Bongars, the Catholic Jacques de Thou, and the Catholic convert Philippe Canaye, sieur du Fresne, aided him by presents of books and encouragement and endeavoured to get him invited, in some capacity, to France.

In 1596 Casaubon accepted an invitation to the university of Montpellier, with the titles of *conseiller du roi* and *professeur stipendié aux langues et bonnes lettres*. He held the professorship there only three years as he was badly treated by the authorities. But the love of knowledge was gradually growing upon him and he began to perceive that editing Greek books was an employment more congenial to his peculiar powers than teaching. At Geneva he had first tried his hand on some notes on Diogenes Laërtius, on Theocritus, and the New Testament, the last undertaken at his father's request. His début as an editor had been a complete Strabo (1587), of which he was so ashamed afterwards that he apologized for its crudity to Scaliger, calling it "a miscarriage." This was followed by the text of Polyaenus, an *editio princeps*, 1589; a text of Aristotle, 1590; and a few notes contributed to Estienne's editions of Dionysius of Halicarnassus and Pliny's *Epistolae*. It is not till we come to his edition of Theophrastus's *Charactères* (1592) that we have a specimen of that peculiar style of illustrative commentary, at once apposite and profuse, which distinguishes Casaubon among annotators. At the time of his removal to Montpellier he was engaged upon the capital work of his life, his edition of, and commentary on, Athenaeus.

In 1598 Casaubon was in Lyons, superintending the passage of his Athenaeus through the press. There he lived in the house of Méric de Vicq, *surintendant de la justice*, a Catholic but a man of acquirements whose connections were with the circle of liberal Catholics in Paris. In the suite of de Vicq, Casaubon was presented to Henry IV., who said something about employing his services in the "restoration" of the university of Paris. In 1599 Casaubon was summoned by de Vicq, who was then in Paris, to go to him in all haste on an affair of importance. The business proved to be the Fontainebleau Conference. Casaubon allowed himself to be persuaded to sit as one of the referees who were to adjudicate on the challenge sent to du Plessis Mornay by Cardinal Duperron. By so doing he placed himself in a false position. The issue was so contrived that the Protestant Party could not but be pronounced in the wrong. By concurring in the decision, which was unfavourable to du Plessis Mornay, Casaubon lent the prestige of his name to a court whose verdict, without him, would have been worthless, and confirmed the suspicions already current among the Reformed churches that he was meditating abjuration. From this time onward he became the object of the hopes and fears of the two religious parties; the Catholics lavishing promises and plying him with arguments; the Reformed ministers insinuating that he was preparing to forsake a losing cause and only higgling about his price. At the time it was not possible for the immediate parties to the bitter controversy to understand the intermediate position between Genevan Calvinism and Ultramontanism, to which Casaubon's reading of the Fathers had conducted him.

Meantime the efforts of de Thou and the liberal Catholics to retain him in Paris were successful. The king repeated his invitation to Casaubon to settle in the capital and assigned him a pension. No more was said about the university. The reform of the University of Paris had already closed its doors to all but Catholics. In Nov. 1604 Casaubon succeeded to the post of sub-librarian of the royal library, with a salary of 400 livres in addition to his pension.

Casaubon remained in Paris till 1610. Those ten years constituted the brightest period of his life. He had attained the reputation of being, after Scaliger, the most learned man of the age. He was placed above penury. He had such facilities for religious worship as a Huguenot could have. He enjoyed the society of men of learning. Above all, he had ample facilities for using Greek books, both printed and in ms., which no other place but Paris could at that period have supplied.

In spite of all these advantages Casaubon grew restless, and offers came to him from various quarters, from Nîmes, from Heidelberg, from Sedan. His friends Lect and Giovanni Diodati wished, rather than hoped, to get him back to Geneva, but the principal source of Casaubon's uneasiness lay in his religion. The life of any Huguenot in Paris was hardly secure at that time, but Casaubon was exposed to persecution of another sort. Ever since the Fontainebleau Conference an impression prevailed that he was wavering. It was known that he rejected the *outré* anti-popery opinions current in the Reformed Churches; that he read the Fathers and wished for a Church after the pattern of the primitive ages. He was given to understand that he could have a professorship only by recantation. When it was found that he could not be bought he was plied by controversy. By the king's orders Duperron was untiring in his efforts to convert him. On the other hand, the Huguenot theologians, and especially Pierre du Moulin, chief pastor of the church of Paris, accused him of conceding too much, and of having departed already from the lines of strict Calvinistic orthodoxy.

When the assassination of Henry IV. gave full rein to the Ultramontane Party at court Casaubon began to listen to overtures, which had been faintly made before, from the bishops and the Court of England. In Oct. 1610 he came to England at the invitation of Richard Bancroft, archbishop of Canterbury. He had the most flattering reception from James I., who was perpetually sending for him to discuss theological matters. The English bishops were equally delighted to find that the great French scholar was an Anglican ready made, who had arrived, by independent study of the Fathers, at the very *via media* between Puritanism and Romanism, which was becoming the fashion in the English Church. Casaubon, though a layman, was collated to a prebendal stall in Canterbury and a pension of £300 a year was assigned him from the exchequer. He still retained his appointments in France, and his office as librarian. In order to retain their hold upon him, the Government of the queen regent refused to allow his library to be sent over. It required a special request from James himself to get leave for Mme. Casaubon to bring him a part of his most necessary books. Casaubon continued to speak of himself as the servant of the regent and to declare his readiness to return when summoned to do so.

Meanwhile his situation in London gradually developed unforeseen sources of discomfort. Not that he had any reason to complain of his patrons, the king and the bishops, but he had to share in their rising unpopularity. The courtiers looked with a jealous eye on a pensioner who enjoyed frequent opportunities of taking James I. on his weak side—his love of book talk. His windows were broken by the roughs at night, his children pelted in the streets by day. On one occasion he himself appeared at Theobalds with a black eye, having received a blow from some ruffian's fist in the street. The historian Hallam thinks that he had "become personally unpopular"; but these outrages from the vulgar seem to have arisen solely from the cockney's antipathy to the Frenchman. Casaubon could not speak English. This deficiency excluded him altogether from the circle of the "wits"; either this or some other cause prevented him from being acceptable in the circle of the lay learned—the "antiquaries." Besides the jealousy of the natives, Casaubon had to suffer the open attacks of the Jesuit pamphleteers. They had spared him as long as there were hopes of getting him over. The prohibition was then taken off, as he was committed to Anglicanism. Not only Joannes Eudaemon, Heribert Rosweyd, and Scioppius (Gaspar Schoppe),[1] but a respectable writer, friendly to Casaubon, Andreas Schott of Antwerp, gave currency to the insinuation that Casaubon had sold his conscience for English gold.

But the most serious cause of discomfort in his English residence was that his time was no longer his own. He was perpetually being summoned to one or other of James's hunting residences that the king might enjoy his talk. The king and the bishops wanted to employ his pen in their literary warfare against Rome. They compelled him to write first one, then a second pamphlet on the subject of the day—the royal supremacy. At last, ashamed of thus misappropriating Casaubon's stores of learning, they set him upon a refutation of the *Annals* of Baronius, then in the full tide of its credit and success. Upon this task Casaubon spent his remaining strength and life. He died July 1, 1614. His end was hastened by an unhealthy life of overstudy, and latterly by his anxiety to acquit himself creditably in his criticism on Baronius. He was buried in Westminster abbey. The monument by which his name is there commemorated was erected in 1632 by his friend Thomas Morton when bishop of Durham.

Besides the editions of ancient authors which have been mentioned, Casaubon published with commentaries Persius, Suetonius, the *Scriptores Historiae Augustae*. The edition of Polybius, on which he had spent vast labour, he left unfinished. His most ambitious work was his revision of the text of the *Deipnosophistae* of Athenaeus, with commentary. The Theophrastus perhaps exhibits his most characteristic excellences as a commentator. The *Exercitationes in Baronium* are but a fragment of the massive criticism which he contemplated. His correspondence (in Latin) was finally collected by Van Almeloveen (Rotterdam, 1709), who prefixed to the letters a careful life of Isaac Casaubon. But the learned Dutch editor was acquainted with Casaubon's diary only in extract. This diary, *Ephemerides*, of which the ms. is preserved in the chapter library of Canterbury, was printed in 1850 by the Clarendon Press. It forms the most valuable record we possess of the daily life of a scholar, or man of letters, of the 16th century.

Bibliography.—The most complete account of Casaubon is the full biography by Mark Pattison (1875), of which a second and revised ed., by H. Nettleship, was published in 1892; the most recent work on the subject is *Isaac Casaubon, sa vie et son temps*, by L. J. Nazelle (1897); there is a monograph on the Fontainebleau conference by J. A. Lalot (1889). Casaubon is the subject of one of Sainte-Beuve's *Causeries*, July 30 1860 (a notice of the Oxford edition of the *Ephemerides*). *See* also the article in E. Haag's *La France Protestante* (1882), and J. E. Sandys, *Hist. of Class. Schol.* (vol. ii. (ed. 1908), p. 204, *et seq.*).

CASCADE MOUNTAINS, a continuation northward of the Sierra Nevada, about 500m. across the States of Oregon and Washington, U.S.A., into British Columbia. In U.S. territory the range lies from 100 to 150m. from the coast. The Cascades are separated on the south from the Sierras by deep valleys near Mt. Shasta in California, while on the north somewhat below the international boundary of 49° N. they approach the northern Rockies, mingling with these in inextricable confusion. The Cascades are in general a comparatively low, broad mass surmounted by a number of imposing peaks in Oregon and Washington. Evidences of volcanic activity in comparatively recent geologic time are abundant throughout the length of the range, and all the highest summits are volcanic cones, covered with snow fields and, in a number of instances, with glaciers. The grandest peaks are Shasta (14,161ft.) at the south, and Rainier (or Tacoma, 14,408ft.) in Washington, two of the most magnificent mountains of America. Other notable summits are Mt. McLoughlin (9,493) formerly Pitt, Mt. Scott (8,938), Diamond Peak (8,807), Mt. Thielsen (9,178), Mt. Jefferson (10,495) and Mt. Hood (11,225), in Oregon; and Stuart (9,470), St. Helens (9,671), Baker (10,750), and Adams (12,307), in Washington. The Fraser river in the far north, the Columbia at the middle, and the Klamath in the south cut athwart the range to the Pacific. The Columbia has cut almost to the sea level through the great mountain mass, the Dalles being only about 100ft. above the sea. It is to the cascades of the tremendous rapids at this point that the mountains owe their name. The slopes of the Cascades are clothed with magnificent forests, chiefly of coniferous evergreens: firs, pine, tamarack, and cedar. The Douglas fir, the "Oregon pine" of commerce, often attaining a height of 250ft., is one of the most beautiful trees in the world. In 1926 the mountain forests were largely included in 13 national forest reserves, with a total area of nearly 13,500,000 acres, extending from the northern boundary of Washington to the southern boundary of Oregon.

See Oregon and Washington; also G. O. Smith and F. C. Calkins, *A Geological Reconnaissance across the Cascade Range near the Forty-Ninth Parallel* (1904), being U.S. Geological Survey Bulletin 253; W. D. Smith, *A Summary of the Salient Features of the Geology of the Oregon Cascades*, being University of Oregon Bulletin, new series, xiv., No. 16.

CASCARA SAGRADA, the bark of the California buckthorn (*Rhamnus Purshiana*) used in medicine. An active principle anthra gluco-sagradin has been isolated by Tschirch. Cascara sagrada is one of the most useful laxatives, since not only does it empty the bowel, but acts as a tonic to the intestine and tends to prevent future constipation. A single full dose of the liquid extract may be taken at bedtime, or divided doses, 10 to 15 minims, three times a day before meals. When a strong purgative is required some drug other than cascara sagrada should be employed, but its use in gradually decreasing doses is indicated after evacuation has been effected by podophyllin or rhubarb. Cascara sagrada is the principal constituent of most of the proprietary laxatives on the market.

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[1] Eudaemon was a Cretan, Rosweyd a Dutch Jesuit; Schoppe, a German philologist and critic.

CASE, JOHN (*d.* 1600), English Aristotelian scholar and physician, was born at Woodstock. He was educated at Oxford, but had to resign his fellowship at St. John's owing to his Roman Catholic sympathies. He subsequently opened a philosophical school in Oxford, which was largely attended. He was in addition an authority on music and a distinguished physician. Most of his works were commentaries on various treatises of Aristotle (*Organon, Ethics, Politics, Oeconomics, Physics*) under curious titles; they enjoyed a large circulation during his time, and were frequently reprinted. He was also the author of *The Praise of Musicke* (1586), dedicated to Sir Walter Raleigh.

CASE, in law, the common term for a cause or suit brought before a court of justice. *Action on the case* means an action for the recovery of damages for an injury to the person or property, where the act done was not immediately injurious (*see* Contract; Tort). A *case stated* is a statement of facts drawn up by one court for the opinion of a higher on a point of law. A *special* case is a statement of facts agreed to on behalf of two or more litigant parties, and submitted for the opinion of a court of justice as to the law bearing upon the facts so stated. In the legal systems of the United Kingdom and of the United States decided cases are considered authoritative for courts of at least equal jurisdiction with those in which the judgments were given, but on the continent of Europe the rule is, following that of the Roman law, that they are instructive but not authoritative.

A box, sheath, or covering. In building, a "case" is the facing where the backing may be of inferior material; the framework in which a window or door is hung; or the wall surrounding a stair, "staircase" properly signifying the whole structure of walls and stairs. In bookbinding, a "case" means the boards and back in which the books are bound; and in typography, the tray, divided into partitions, containing the type ready for the compositor's use

CASE HARDENING. The process of imparting to steel or wrought iron an extremely hard surface. It is of great importance in cases, and they are many, in which it is necessary to combine, in an article manufactured of iron or steel, tensile strength with resistance to surface attrition. Case hardening secures this by carburizing the outer surface of the steel employed. The article to be case hardened is cast, and the casting heated in a suitable furnace in which it is exposed to contact with charcoal at a temperature of 800° to 900° C. for from a few hours to a few days. The result of this process is very literally to give a "hard case" or skin to the metal; the body of the article being left unchanged in character. For empirical reasons, the charcoal employed is derived from horn, leather, etc. After carburizing, the articles are usually quenched in cold water. The process amounts to a partial application of the principle of cementation. Warships are cased in steel which has undergone various surface hardening processes of this kind; armour plate of the Harvey type is made of ductile steel to which a casing of great hardness is given by the surface being converted into high-carbon steel suddenly cooled. (*See* Iron and Steel; Cementation.)

CASEIN. The milk of all mammals contains casein. Cheese is a modified form of casein. It is a complex product akin to white of egg, belonging to the class of chemical compounds known as albumins. In milk, casein occurs in combination with lime (calcium oxide) as a calcium salt, and in order to isolate it the milk must be broken up by treatment with acid. A white curd is precipitated which is washed and dried, the product thus obtained being sufficiently pure for most technical purposes. From skim milk of average composition, between 3 and 3·25% of casein can be obtained.

Processes of Manufacture.—Various acids are used commercially for precipitation, the three main processes are: (1) the rennet process; (2) the process in which an acid, *e.g.*, dilute sulphuric or hydrochloric acid, is added to the milk; and (3) the self-curdling process, in which the milk is allowed to rest until it is curdled by the action of lactic acid formed from lactose or milk sugar of the milk by the activities of a bacillus (*B. acidi lactici*). Chemically the substance precipitated by the action of rennet is termed paracasein, as distinct from that precipitated by acids. In all these processes the precipitated curd is separated from the whey, washed with cold water, passed through a press or centrifugal separator, broken up, and dried by currents of dry air or other means. The dry casein is ground and packed for sale.

Properties.—Pure casein is a white powder without taste or smell. Chemically it is composed of carbon, hydrogen, nitrogen, sulphur and phosphorus. The food value of casein is comparable with that of the proteins in meat; its content of amino-acids, some 15 of which have been isolated, contributes to its nutritive qualities, these latter being enhanced also by the presence of vitamins. It is a weak acid, readily soluble in solutions of caustic alkalis and of the carbonates, borates and other salts of the alkali metals. Water dissolves casein only to a very small extent, but causes it to swell. Casein is converted by the action of formaldehyde, or formalin, into a hard material quite insoluble in water. Casein is non-inflammable. Its specific gravity is about 1·26. Commercial casein of good quality is a dry, friable white, or slightly brown powder; casein of inferior quality has an unpleasant smell and is usually moist and dark coloured.

Uses.—In many countries casein is produced on a commercial scale, and a large amount is used in the making of confectionery and special foods. Preparations are also used as media for the medicinal administration of quinine, lithium salts, iodides and other drugs. Casein forms the basis of many cosmetics, creams and ointments. It is used to some extent for printing on calico, sizing yarns, and sizing, waterproofing and coating in the paper industry. It is also used largely in the production of cold water paints and distempers, of cements for porcelain and glass, and of glues for use in bookbinding, wood-working and aircraft construction

Moulded Products.—The production of casein moulded products or plastics intended to imitate ivory, tortoise-shell, amber, horn, ebony, agate, malachite and other decorative materials is an important industry all over the world. Some thousands of tons are made annually in many of the leading countries.

Two methods of manufacture are in use, known as the wet and dry processes. In the wet process, casein prepared by acid precipitation is dissolved in an alkaline solution and the necessary dyes and filling ingredients are added; it is then re-precipitated by acid, washed, and the curd roughly pressed to remove water The product is then ready for pressing in moulds of any desired shape. The moulded objects thus prepared must be "hardened" and rendered as waterproof as possible by long soaking in a solution of formaldehyde. After prolonged drying and seasoning the article is ready for use.

Rennet casein is used in the dry process; it is first ground to a fine powder, and about one-third of its weight of water added and efficiently mixed. The apparently still dry powder is then well kneaded or pressed through a heated screw-press extruding machine from which it emerges as a soft plastic dough. This dough is then ready for moulding under pressure to the various shapes required. Moulded objects require "hardening" and seasoning, as described for the wet process.

Casein plastics are readily machined and polished and can be produced in a variety of colours, either opaque or transparent; they are difficult to ignite, of good mechanical strength, and when dry can be used for electrical insulation. A disadvantage, particularly for electrical purposes, is the readiness with which the material absorbs water. Combs, beads, buttons, manicure sets, cigarette holders and umbrella handles are among the objects which are made extensively of this material.

The production of dried casein (skim-milk product) in the United States in 1924 was 20,683,000 lb., according to the Statistical Abstract of the United States, 1925.

Bibliography.—E. Sutermeister, *Casein and its Industrial Applications*, Chemical Catalogue Co., New York (1927), a comprehensive symposium by various specialists; E. L. Taque, *Casein, Its Preparation, Chemistry and Technical Utilization* (New York, 1926).

(A. A. D.)

CASEMATE (Ital. *casa*, a house, and *matta*, dull or dim), an armoured vault or chamber or, in field fortification, a bombproof shelter; in architecture, a hollow moulding, chiefly employed in cornices.

CASEMENT, ROGER DAVID (1864–1916), British consular agent and rebel, was born at Kingstown, Co. Dublin, on Sept. 1, 1864. After serving in the Niger Coast Protectorate he entered the British consular service, and was appointed consul at Lourenço Marques, then at Loanda and then at Boma. He carried out the investigation ordered by the British Government into the conditions under which the rubber trade in the upper Congo was conducted, and his report, published in 1903, led to the official Belgian commission which resulted in the change in the Government of the Congo. In 1910 the British Government commissioned Casement to investigate certain charges brought against the Anglo-Peruvian Amazon Company, and for this service he was knighted (1911). He retired from the service in 1912 and returned to Ireland in 1913. Always a strong Irish nationalist he joined the opposition to Redmond and to the participation of Irishmen in the World War. He thought the circumstances of the war might be used to win Irish independence, and with this in view visited the United States and then in Nov. 1914 Berlin. During 1915 he published various anti-British pamphlets and attempted without success to form a brigade, for service against England, of Irish soldiers who were prisoners of war. He found that the Germans were not prepared to attempt an expedition to Ireland, and conveyed verbal messages to his friends in Ireland to that effect, hoping thus to prevent an abortive rising, although to no purpose. But when he learned of the proposed rising in Easter week 1916 he sailed (April 12) for Ireland in a German submarine, which was accompanied by a vessel laden with arms and ammunition. The latter was captured by a patrol boat. Casement landed in a collapsible boat, was captured on April 24 and brought to London. Tried for treason before the lord chief justice, he was convicted and sentenced to death on June 29, being deprived of his knighthood on the following day. His appeal against conviction was dismissed on July 18, and on Aug. 3 he was hanged at Pentonville, London.

CASEMENT, in architecture, a frame in wood or metal, which holds the glass of a window, and is hung by hinges either at the top, bottom or sides. The term is also used for any hinged window, and for a wide hollow or *cavetto* employed in late Gothic architecture.

CASERNE, a barrack or lodging for troops in a town (from French *caserne* and Spanish *caserna, casa,* a house).

CASERTA, a town and episcopal see of Campania, Italy, in the province of Naples, situated 21 mi. N.E. of Naples by rail via Acerra, and 23 mi. via Aversa. Pop. (1936), town 30,910; commune, 49,462. The modern town was a mere village belonging to the Caetani family of Sermoneta, who were counts of Caserta, until its purchase from them by Charles IV of Naples, and the erection of the royal palace, begun by Luigi Vanvitelli (van Wittel) in 1752, but not completed until 1774 for Charles's son Ferdinand IV. It forms a rectangle, the south front being 830ft. long and 134ft. high, with 37 windows in each storey. The interior is richly decorated with marbles, almost all of which, except the white Carrara marble, are Neapolitan or Sicilian. The staircase, the chapel and the theatre are especially sumptuous. Parts of it are now used for an air force officers' academy and for a commercial school. The extensive gardens which occupy the hillside behind the palace are adorned with fountains and cascades, the water being brought by an aqueduct more than 27m. long with three lofty bridges over valleys, the largest being the Ponti della Valle near Maddaloni; the botanical garden contains many trees from northern climates. Two miles north is St. Leucio, a village founded by Ferdinand IV. in 1789, with large silk factories which are still engaged in production. The old town (Caserta Vecchia) lies high (1,310ft.) about 3m. to the north-east. It was founded in the 9th century by the Lombards of Capua. The cathedral was completed in 1153. It is a copy of that of Sessa Aurunca, and preserves the type of the Latin basilica. The campanile, Sicilian in style, was completed in 1234, while the dome, which betrays similar motives, is even later. Its pulpit is decorated with the richest polychrome mosaic that can be found anywhere in Sicily or south Italy, and is quite Muslim in its brilliance.

See S. di Giacomo, *Da Capua a Caserta* (Bergamo, Arti Grafiche, n.d.) well illustrated.

CASE-SHOT, a projectile used in ordnance for fighting at close quarters, now practically obsolete. It consists of a thin metal case containing a large number of bullets or other small projectiles (*see* AMMUNITION). Case-shot was formerly called "canister," though the present term occurs as early as 1625.

CASH. Originally meaning a box, the word cash, derived from the O. Fr. *casse*, a box or chest, is now commonly applied to ready money or coin. In commercial and banking usage, "cash" is sometimes confined to specie; it is also, in opposition to bills, drafts or securities, applied to bank-notes. Hence "to cash" means to convert cheques and other negotiable instruments into coin. In bookkeeping, in such expressions as "petty cash," "cash-book," and the like, it has the same significance, and so also in "cash-payment" or ready-money payment as opposed to "credit," however the payment may be made, by coin, notes or cheque.

Cash is also the name given by British residents in the East to native coins of small value, and particularly to the copper coinage of China, the native name for which is *tsien*. Nominally, but seldom actually, 1,000 cash equalled 1 tael (*q.v.*) of silver. The cash was formerly the principal medium of exchange throughout China for retail transactions, but after 1900 began to be replaced by 10-cash copper coins and small silver coins. The coin is a round disc of copper alloy, with a square hole punched through the centre for stringing. A "string of cash," amounted to 500 or 1,000 cash, strung in divisions of 50 or 100. The English term is apparently from the Sinhalese *Kasi* and Tamil *Kasū,* a small coin.

CASH BOOK: *see* BOOKKEEPING.

CASH CREDIT. The Scottish banks long ago established a cash credit system which has worked admirably and had much to do with the wide, popular use of banks in Scotland. The system was begun in 1727 by the Royal Bank of Scotland, which was founded in that year.

A cash credit is an advance made to a trustworthy person whose faith is guaranteed personally by two or more competent sureties, who are jointly bound in respect of the advance. Thus a credit is created upon purely personal security. In this way a bank customer is established with a credit account, into which he pays his receipts, and upon which he can draw to the extent of the advance agreed upon, interest being charged to him upon his daily overdraft. Thus a very large number of small businesses have been encouraged, and the foundations of big business securely laid. To the banks also the cash credit system has proved profitable, enabling them to use their resources to great advantage.

CASHEL, city and urban district of County Tipperary, Eire, 96 mi. S.W. of Dublin on the Great Southern railway. Pop. (1936) 3,028. The town lies at the base of the Rock of Cashel (300 ft.), the summit of which is occupied by remains of St. Patrick's cathedral, a round tower, Cormac's chapel and an ancient cross, on the pedestal of which the kings of Munster were crowned. Of the defenses of the rock, a guard-tower and portions of the wall remain. At the base of the rock is Hore Abbey, a Cistercian foundation of 1272, and within the town is a Dominican priory (1243).

Legend states that the vision of an angel blessing the rock, seen by two swineherds in the 5th century, led Corc Mac Luighdheach, king of Munster, to establish a stronghold here. It became one of the chief seats of the kings of Munster, but in 1101 was given over to the church. Here Henry II received the homage of O'Brien, king of Limerick, and, later, Edward Bruce held his Irish parliament. The cathedral was burned in 1495 by the earl of Kildare. Cashel was captured during the wars of 1647. It was reduced from an archbishopric to a bishopric in 1839 and was disfranchised in 1870.

CASHEW, the edible seed or nut of *Anacardium occidentale*, a polygamous, tropical and subtropical evergreen which ranges in size from a small shrub in poor, dry soil to a 40-ft. tree where soils are fertile and the humidity great. While the species is chiefly important for the nuts which it produces, the wood is useful as material for shipping crates, boats, charcoal, etc., and a gum similar to gum arabic is obtained from the stem. The species is closely related to the American poison ivy and poison sumac and must be handled with extreme care by persons susceptible to this kind of poisoning. Of eight known species, this is the only one cultivated as a food producer. The nut, which is shaped like a large, thick bean, and is sometimes more than an inch long, forms in a most singular manner. It appears as though one of its ends had been forcibly sunk into the calyx end of a fleshy, pear-shaped fruit, called the cashew apple, which is about three times as large as the nut and of reddish or yellow colour. The nut has two walls or shells, the outer of which is smooth and glass-like over the surface, thin and somewhat elastic, but stout, and of olive-green colour until mature, when it becomes strawberry roan. The inner shell is considerably harder and must be cracked like other nuts. Between the shells, there is a brown oil which is extremely blistering in its effect on the skin. To great extent, this is salvaged and used both as a lubricant and insecticide.

The fruits are picked by hand and the nuts first detached, then thoroughly dried in the sun. By primitive methods of some localities, the dried nuts are roasted by being placed among burning logs, where the heat causes the outer shells to burst open and to release the oil. The latter quickly takes fire giving off fumes which are dangerous to the eyes and skin. By improved methods of roasting, the nuts pass through large, revolving cylinders of sheet iron with perforated sides which are made to revolve above well controlled flames. By this method, the oil drains into containers below and is salvaged. The roasting process entirely dispels all poisonous properties. Later, the inner shells are broken open by hand labour and the kernels given further heating treatment by which the skins are removed and the kernels made ready for consumption.

The cashew is indigenous to Central and South American tropics. It was discovered during the 15th century by Portuguese missionaries who took it to East Africa and India. It later became thoroughly established and very abundant at low altitudes near the seacoast in both places, and eventually so throughout tropical countries generally. Until 1923 losses due to weevil infestation while in transit practically prohibited exports to distant countries. In that year, a process was discovered and patented by a U.S. firm for using hermetically-sealed shipping containers within which the air had been replaced with carbon dioxide. This method largely eliminated losses. From that time, exports increased rapidly until World War II, the United States being the principal buyer. Purchases by that country rose from 100,000 lb. in 1923 to 33,395,000 lb. in 1940. (C. A. Rd.)

CASHIBO or Carapache ("bat"), a tribe of South American Indians of Pannoan stock, living in scanty numbers on the west side of the Ucayali, Peru.

CASHIER. (1) (Adapted from the Fr. *caissier*, one in charge of the *caisse*, or money-box), one who has charge of the payment or receiving of money in a business house. The "cashier" may be a high executive official of a banking or mercantile house—thus the name of the chief cashier of the Bank of England appears on all notes issued during his occupation of the post—or he may be merely a clerk, who receives payment for goods sold, and has the right to give receipts for the same.

(2) (In origin ultimately the same as "quash," to annul, from Lat. *quassare*, to dash or break to pieces, a frequentative of *quatere*, to shake, but also connected in form and meaning with *cassare*, to make *cassus*, empty or void), a military term, meaning originally to disband, and probably adopted from the Dutch in the 16th century. The word in various forms is used in the same sense in most European languages. It is now used in English for the dismissal of a commissioned officer from the army and navy for particularly serious offenses, in the words of the Army act for "behaving in a scandalous manner unbecoming an officer and a gentleman." "Cashiering" involves not merely the loss of the commission, but also a permanent disqualification from serving the state in any capacity.

CASHIER'S CHECK is used in the United States for a check drawn by a bank upon itself and signed by its cashier. It is a direct obligation of the issuing bank and is payable when presented to that institution. It is frequently used as a form of remittance by persons who have no bank accounts or who wish to give assurance that the check will be paid. In such cases the cashier's checks are bought from the bank by paying the face value, sometimes with a small fee for the service. Cashier's checks are also used by the bank to pay its own obligations, such as payment for securities, bills of exchange, discounting notes, purchase of supplies and often, though not always, for payment of dividends to stockholders. These checks when drawn become a credit to the cashier's account and when returned through the clearing house or other channels become a debit to the same account.

CASHIN, SIR MICHAEL PATRICK (1864–1927), Newfoundland politician, was born at Cape Broyle, Newfoundland, on Sept. 29, 1864. He was educated at St. Bonaventure's college, St. John's, and afterwards adopted a business career, becoming a fishery merchant. In 1893 he entered politics as Independent member for Ferryland, but in 1895 joined the Liberals. In 1905 he broke away from the Liberals, joining first the Independent Liberal party, and later (1908) the People's party. From 1909 to 1919 he was minister of finance and customs. In 1918 he was successively acting prime minister during the absence of Lord Morris, acting minister of militia, and acting minister of shipping, becoming prime minister in 1919. During World War I he was a member of the War Finance committee. He retired from public life in 1923. In 1888 he married Gertrude, daughter of Captain Pierre Mullowney, and had four sons and one daughter. He died on August 30, 1927.

CASH INSURANCE: *see* Insurance: Miscellaneous.

CASHMERE. A textile trade term applied originally to a type of soft woollen dress fabric of very light texture, woven from yarn spun from the fine and long fleece of the Cashmere goat. The modern Paisley shawls, manufactured in the Scottish town of that name, are beautiful reproductions of the shawls woven by the natives of Cashmere on primitive handlooms. The term "Cashmere," however, has lost its original significance and is now applied without discrimination to a variety of dress fabrics whether composed of wool, cotton, or a combination of both types of fibres.

Until the year 1857 the word "Cashmere" does not appear to have been applied to any kind of cloth manufactured in England; though cotton dress goods described as "Mousseline-de-laine" (Muslin-de-laine) were woven in the Colne valley (Lancs.) as early as 1837, and the term Cashmere was probably first used in the dress-goods trade to describe the fine twilled dress fabrics produced from the true fleece wool of the native Cashmere goat. From this date, however, the popularity of the original Cashmere fabric led to the production of inferior and cheaper fabrics first by substituting the fine Merino wool of the Spanish breed of sheep in place of Cashmere wool, and then by weaving fabrics of similar texture by employing weft either of Cashmere or else Merino wool in combination with warps produced from cotton yarn of fine counts; and, finally, by employing cotton yarn entirely, both for warp and weft, though still retaining the original description of "Cashmere."

In the Bradford trade the term Cashmere is applied to several distinct varieties and qualities of dress fabrics of lightweight texture, of which one example is a special type of twilled dress goods woven with a cotton warp in combination with Merino (Botany) worsted weft. If a similar style of fabric were woven with both warp and weft of Botany worsted it would be described as "French" or "all-wool" Cashmere; and if woven with a silk warp and Botany worsted weft it would then be termed "Henrietta," or "silk-warp" Cashmere, and of which a good quality contains 72 warp threads per inch of 70/2 spun silk, and 168 picks per inch of 82's Botany worsted weft. The usual variety of Cashmere is a light dress fabric produced either with warp of fine cotton or worsted yarn with weft of fine Botany wool, and woven with the three-end weft-face ($_{2}\text{——}^{1}$) regular twill weave. This weave develops a distinct twill effect of diagonal lines on the face of the cloth, owing to the preponderance of the weft yarn on that side, though the reverse side of the fabric, which displays a preponderance of warp yarn, has the appearance of the plain calico weave, without any resemblance whatever of a twill effect.

"French Cashmere" differs from the usual variety in that it is based on the four-end two-and-two $(^{2}{-\!-\!-}_{2})$ "Cassimere" or "Harvard" twill weave structure, as distinct from the usual three-end weft face $(_{2}{-\!-\!-}^{1})$ twill weave, and of which one quality is woven with 60 warp threads per inch of 40's Botany worsted yarn, and 140 picks per inch of 52's Botany worsted weft, approximately. Some varieties of Cashmere dress fabrics are produced entirely from cotton both for warp and weft, woven in the "grey" state and afterwards dyed; whilst others are printed to imitate a mixture or "union" texture woven from warp and weft yarn spun from a blending of wool and cotton staple fibres. One quality of cotton Cashmere contains 72 warp threads per inch of 36's T., and 140 picks per inch of 28's weft. (H. N.)

CASH ON DELIVERY. The cash on delivery service, popularly known as C.O.D., is designed principally to provide a means of ordering goods and securing delivery through an agent against payment in cash instead of on credit or prepayment. In most countries the system is a feature of the postal organization, but the facility may also be provided by private agencies or even by joint arrangement between a post office and a private agency. To the trader the system offers a ready means of supplying distant customers without risk of loss. To the customer the system offers equal attractions, not merely by providing with the minimum of trouble for the prompt delivery of, and the payment for, goods that may be ordered by post or otherwise, but by eliminating any risk involved in payment before receipt of the goods. Its essential merit is that it gives to both seller and buyer access to wider markets at a minimum cost: in conjunction with advertising it becomes a distinctive method of retail trade.

It might be thought that the system would offer particular advantages to residents in rural and sparsely populated areas and would therefore prove most popular in countries of wide territory, but experience has shown that the service is no less attractive in town and urban districts. The most striking development of the service has taken place in the United States where more than 77 million domestic cash on delivery parcels were dealt with by the post office in 1938. This, however, is not so much due to the extent of the territory as to the growth in the U.S.A. of the mail order business and the establishment in 1913 of the postal cash on delivery service.

In nearly every European country, and in many countries outside Europe, a cash on delivery service has been in operation for many years. As long ago as 1840 the Swiss post office instituted an internal service and three years later it was made the subject of a postal arrangement with Austria and with certain German Principalities But it was not until the Postal Congress held at Lisbon in 1885 that regulations were laid down for the exchange between postal administrations of cash on delivery parcels and regulations for a similar exchange by letter post were added at the Postal Congress of Vienna in 1891. The extension of the system to the letter post, first in internal services and later in international postal relations, has enormously widened the scope of the scheme by providing for the collection and remittance of the value of articles that may be sent by letter post or for the collection and remittance of charges on goods consigned by rail or otherwise.

The service, under the name of "Value payable," was introduced by the post office of India in 1877 and over 12 million articles of the total value of 28 crore of rupees were dealt with in 1926. In Australia the system was established also in 1877 and in 1922 and 1925 the arrangement was introduced by the post offices of Canada and South Africa, respectively, although a system of postal drafts presenting some features of the cash on delivery scheme was in operation in South Africa considerably earlier.

The delay in the adoption of the cash on delivery service in the United Kingdom was due, not to the opposition of the British post office, but rather to the hostility of retail trading interests. Owing to this hostility a proposal in 1904 to introduce a cash on delivery service as part of the inland parcel post had to be abandoned, but negotiations subsequently opened resulted in the establishment of the system between the post office of the United Kingdom and Cyprus, Egypt, Malta and certain British postal agencies abroad. A wide extension of the arrangement soon followed and the post offices of India, New Zealand and most British colonies and protectorates entered the scheme. In the relations between the British and various foreign post offices the arrangement was introduced generally in 1919 and 1920 and the service is now in operation between the United Kingdom and many European countries as well as with China.

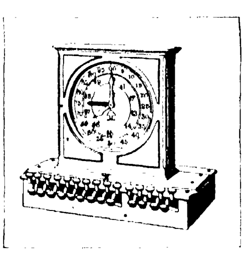
Owing to the striking development of the service abroad and to the fact that experience had shown that the apprehensions of small retail traders were groundless it was eventually decided to introduce the scheme in the United Kingdom. An inland cash on delivery service, limited as in the case of the numerous external services to the parcel post, was accordingly instituted in March 1926. It proved an instant success and the continuous increase of the traffic, which at the end of 1927 was at the rate of nearly two million parcels a year, is evidence of its growing popularity. The scheme has proved particularly attractive to motor and general engineers for the transmission of motor and machine parts, and drapers and outfitters also make considerable use of it.

The maximum amount that may be collected under the arrangement is fixed in the United Kingdom and generally by the post offices of other countries at the limit for money orders, settlement with the sender being effected by means of a special order. For the services of collection and remittance a fee is charged on an *ad valorem* scale, in addition to the postage. As against this, the vendor saves the cost of collection and the purchaser that of remittance. The British service has been found to pay its way on the existing scale of fees.

In April 1928 the British inland cash on delivery service was extended to packets sent by registered letter post as well as to consignments sent by rail to any part of Great Britain. In each case the limit of value is the same as that applicable to inland cash on delivery parcels, *viz.*, £40, and payment is effected by means of a special order.

The service by rail is conducted jointly by the British post office and the four main British railway groups, the latter undertaking conveyance and the former being responsible for the collection from the consignee of the amount due and for the transfer of this sum to the sender. The essential feature of the scheme is that the sender, having consigned his goods by rail, forwards to the consignee in a cash on delivery letter which is handed to him on payment of the amount due, a document enabling him to obtain delivery of the goods from the railway company.

The cash on delivery registered letter post is intended to provide facilities for the despatch of small articles which are more appropriate to the letter than to the parcel post. In the case of the railway service there is practically no weight restriction. The scheme is particularly suitable for consignments too heavy or too bulky for the parcel post as well as for garden and dairy produce for which the parcel limit of 11 lb. may be inadequate.



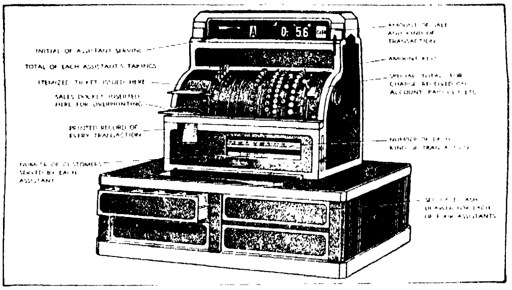
BY COURTESY OF NATIONAL CASH REGISTER CO.

THE FIRST CASH REGISTER, INVENTED BY JAMES RITTY OF OHIO IN 1879. THE RECORD WAS SHOWN BY THE HANDS ON THE DIAL

CASH REGISTER, a recording, calculating and checking machine used to help a merchant control his business, assist salespeople in serving customers and keep a record of different transactions. In various forms it has come into very wide use. The machines make records of a transaction, both for the customer and for the merchant, facilitate the handling of transactions and protect against mistakes and dishonesty.

There are a number of different types of cash registers, some for small business having only one total and others having as many as twenty-seven totals. These totals can be used to classify records in a number of different ways, such as sales of nine deartments, nine salespeople and nine different kinds of transacions, such as charge sales, money received on account, money aid out, etc.

The first cash register did nothing but indicate the amount of sale on a dial. Then came registers which punched a hole in a oll of paper ruled in columns. By adding up the number of oles in each column a total could be computed. Then came de-ail adders, with an adding counter on each key Then the total dder with the total shown on adding wheels. The most advanced orm is the total printer in which the total or totals as the case ay be are printed on paper.


A 0.56
AMOUNT OF SALE AND KIND OF TRANSACTION
INITIAL OF ASSISTANT SERVING
TOTAL OF EACH ASSISTANT'S TAKINGS
AMOUNT KEY
ITEMIZED TICKET ISSUED HERE
SPECIAL TOTAL FOR CHARGE, RECEIVED ON ACCOUNT, PAID OUT, ETC.
SALES DOCKET INSERTED HERE FOR OVERPRINTING
PRINTED RECORD OF EVERY TRANSACTION
NUMBER OF EACH KIND OF TRANSACTION
NUMBER OF CUSTOMERS SERVED BY EACH ASSISTANT
SEPARATE CASH DRAWER FOR EACH OF FOUR ASSISTANTS

BY COURTESY OF THE NATIONAL CASH REGISTER CO

DIAGRAM SHOWING THE MECHANISM OF THE MODERN CASH DRAWER
This machine can have as many as fourteen separate adding totals. Other types can have as many as twenty-seven totals.

A register has certain fundamental features and functions. It ndicates the amount of a transaction at the top of the register, so hat it can be seen by both customer and salesman. It keeps sepaate totals of sales by various classifications. It prints and issues a eceipt on cash sales or overprints a record of the transaction on a ales docket on charge sales or received on account. It keeps within he register an "audit strip" which is a complete printed record of very transaction that has been made. It has special counters which how the number of customers handled, number of each kind of ransaction and similar information. For every total showing the mount of any kind of transaction there can be an adding counter howing the number of items which were concerned. The number f features varies according to the size and type of the register.

CASILINUM, an ancient city of Campania, Italy, 3m. N.W. f the ancient Capua. Its position at the point of junction of the ia Appia and Via Latina, and at their crossing of the river Volurnus, gave it considerable importance under the Roman repub-c. In the Second Punic War it was occupied by Fabius Cunc-tor in 217 B.C., taken by Hannibal after a gallant defence by roops from Praeneste and Perusia in the winter of 216–215, but ecaptured in the following year, serving the Romans as their base f operations against Capua, and losing its independence. It seems o have been united with Capua before the time of Vespasian. liny speaks of the *morientis Casilini reliquiae*, "the remains of ying Casilinum," and only its position at the junction of the oads redeemed it from utter insignificance.

CASIMIR III., called "The Great," king of Poland (1310–370), son of Wladislaus Lokietek, king of Poland, and Jadwiga, rincess of Kalisch, was born at Kowal in Kujavia. He was ducated at the court of his brother-in-law, Charles Robert of Iungary, where he had a reputation for frivolity and lack of ersonal courage. When he became king of Poland in 1333 his ingdom, consisting of the lately reunited provinces of Great nd Little Poland, was at war with the Teutonic Order and with ohn of Luxembourg, king of Bohemia, who claimed the Polish rown. But Casimir was a man of genius, who trusted in a wise liplomacy and not in bloodshed which had brought so much rouble to Poland. He began by tying the hands of the Teutonic rder by the truce of Thorn, and he induced the king of Bohemia o relinquish his claims to the Polish throne by leaving him a free and in Silesia (conference of Trencsén, early in 1335). At the ongress of Visegrád, where both princes were entertained by he king of Hungary, the differences between them were finally adjusted, and peace was made between the king of Poland and the Teutonic Order on the basis of the cession of Pomerania, Kulm and Michalow to the knights, who retroceded Kujavia and Dobrzyn; the kings of Hungary and Poland agreed to help each other in acquiring Halicz or Red Russia (nearly corresponding to the modern Galicia). Casimir also paid over much money and renounced Polish claims to sovereignty over Masovia, a central province. The pope, jealous of the house of Luxembourg, tried unsuccessfully to set aside the decrees of Visegrád by urging Casimir to fight the knights again. Casimir, who had no male issue, recognized Louis, Charles Robert's son, as the successor to the Polish crown, Louis contracting to confirm the privileges of the Polish gentry and clergy, and to rule Poland through natives only.

In 1340 the death of George II. of Halicz, and the ravaging of that fruitful border principality by the Tatars, induced Casimir and Charles Robert to establish their joint influence there, and in 1344 the Red Russian *boyar*, Demetrius Detko, was appointed *starosta*, or governor, in the names of the two kings. In 1353 Lubart of Lithuania disputed the sway of Poland in that principality. Hungary coming to the assistance of Poland, Lubart was defeated and taken prisoner; but Casimir, to avoid a bloody war with Lithuania's Tatar allies, came to a compromise with Lubart whereby Poland retained Halicz with Lemberg (Lwow), while Vladimir, Belz and Brzesc fell to Lithuania. With the Teutonic knights, Poland's worst foe, Casimir always preserved peace. He used the Luxembourgers against them at Rome; but the disputes between Poland and the order were settled by the peace of Kalisz (July 23, 1343), when the knights engaged for the first time to pay tribute to the Polish crown. Casimir had trouble with John of Bohemia over Silesia, now split up into 17 principalities, and when he invaded that country, took Wschowa, and captured Prince Charles of Bohemia, war broke out and he was besieged in Cracow by the Czechs. But Hungary hastened to his assistance, and the Holy See restored peace in 1346. The death of the adventurous John at Crécy, and the election of his son the peaceful Charles IV. as emperor, improved the situation.

Casimir, aided by Jaroslaw Skotowicki, archbishop of Gnesen, formerly a professor at Bologna, codified the laws of Great and Little Poland in 1347 and in 1356 a supreme court of appeal was established. Casimir, the "Peasants' king," relentlessly put down, often by death, aristocratic oppression and promulgated the severe statute of Great Poland to this end. He also did much for education. Stimulated by the example of Charles IV., who had founded the university of Prague in 1348, Casimir on May 12, 1364, established and richly endowed the first university of Cracow, which has five professors of Roman law, three of Canon law, two of physics, and one master of arts. Casimir reorganized the State finances. He introduced the conscription of landowners for national defence. He founded towns, and protected home industries with tariffs, which led to a tariff war with Bohemia. Ardent Polish patriots complained of his Germanizing policy, but the "German right" which he introduced was the foundation of Polish prosperity; he also encouraged the Jews. He developed architecture, and gave Poland "brick for wood." He unified Poland, making "one law, one king, one currency."

In the course of his reign he subdued Volhynia, Podolia, the palatinates of Brescia and Beltz, beat the Russians as well as the Lithuanians and Tatars, and finally acquired control over Masovia. He set up a cordon of fortresses on his north-east borders. Casimir's last political act was the conclusion of a fresh alliance with Louis of Hungary against Charles IV. at Buda in 1369. He died on Nov. 5, 1370, from a hunting accident. He was the only Polish king called "Great."

Bibliography.—*See* Jan Leniek, *The Congress of Visegrád* (Lemberg, 1884); J. K. Kochanowski, *Casimir the Great* (1900); Kazimierz J. Gorzycki, *The Annexation of Red Russia by Casimir the Great* (Lemberg, 1889); Stanislaw Kryzanowski, *The Embassy of Casimir the Great to Avignon* (Cracow, 1900). The above are all in Polish. *See* also R. Dyboski, *Outlines of Polish History* (1925).

CASIMIR IV., king of Poland (1427–1492), second son of Wladislaus II. Jagiello, was appointed as a lad grand-duke of Lithuania by his father, and crowned king of Poland at Cracow in June 1447, three years after the death of his elder brother, Wladislaus III. Throughout life Casimir aimed at the preservation of the union between Poland and Lithuania, and the recovery of the lost lands of old Poland. Owing to his steadfast adherence to these principles Poland in the 15th century became a great power, but his essential unwarlikeness, and his impartiality between the two countries over which he ruled made him unpopular with both; while his anti-German policy, on which the future safety of the dual state depended, could only be carried through by the most humiliating concessions to patrician pride and greed. By confirming, under threat of deposition, the privileges of the nobles, he established the disastrous principle of elective monarchy in Poland. He also acquiesced when the senate decreed that the king was not to make war without their permission.

He finally subjugated the Teutonic Order after a 13 years' war, during which his subjects troubled him more than his enemies. In Oct. 1453 the Prussian cities and gentry, in dispute with the Order, which had been excommunicated by the Pope and banned by the Empire, placed themselves beneath the overlordship of Casimir; on Feb. 4, 1454, they renounced their allegiance to the Order, and captured 57 towns and castles. On March 6, 1454, Casimir incorporated the Prussian provinces with Poland, with a guarantee of autonomy and of freedom from taxation. This aroused little enthusiasm in Poland, and the Order gradually recovered ground from the incompetent Polish gentry. The king, irritated by the suicidal parsimony of the estates, threatened to retire to Lithuania, but after the bloody victory of Puck (Sept. 17, 1462) fortune favoured Poland. Finally the Holy See intervened, and by the second peace of Thorn (Oct. 14, 1466) all West Prussia was ceded to Poland, while East Prussia was held by the knights as a fief of the Polish crown.

Casimir had previously profited by the rivalry of two popes to acquire the right of appointment of bishops by the Crown; and his resistance to papal claims had naturally caused hostility at Rome. The Curia changed sides in order to enlist Casimir against the Turks. Casimir took advantage of this to get his son Wladislaus made king of Bohemia instead of the Hussite Poděbrad. But his ambitions were frustrated by Matthias Corvinus, king of Hungary, who roused the Order against him. Casimir died in June 1492.

Casimir founded the Polish diet in 1467, and his reign was a Golden Age of culture for Poland. Public schools were established for citizens, serfs and nobles. There was liberty of opinion and of the press, and the many printing presses published books banned elsewhere. Poland was a refuge of scholars, and Copernicus came to Cracow in 1492.

See Jan Dlugosz, *Opera* (Cracow, 1887); August Sokolowski, *Illustrated History of Poland* (Pol.) vol. ii. (Vienna, 1904); R. Dyboski, *Outline of Polish History* (1920).

CASIMIR-PÉRIER, JEAN PAUL PIERRE (1847–1907), 5th president of the French Republic, was born in Paris on Nov. 8, 1847, and was the grandson of Casimir Périer, the famous premier under Louis Philippe He represented Aube in the Chamber of Deputies until he became president, and he joined the Republicans of the Left. He abstained from voting on the question of the expulsion of the princes in 1883 owing to personal connections with the House of Orléans. From Aug. 1883 to Jan 1885 he was under-secretary for war, vice-president of the chamber from 1890 to 1892, president of the chamber in 1893, and prime minister in the same year. His ministry only lasted six months, and after his resignation in May 1894, he was re-elected president of the chamber. On June 24 he was elected president of the Republic but on the fall of the Dupuy ministry, six months later he resigned, complaining that he had been improperly treated by the ministers. Abandoning politics, he devoted himself to business until his death on March 11, 1907.

CASINO or CASSINO, a game of cards, of obscure origin but probably Italian. A similar game played in the early 19th century was believed to have originated in the "toe" of Italy and was therefore called Callabra. Strikingly similar also is the game Papillons, popular in Paris in the mid-18th century. Here three cards were dealt to each of the players, and from four to seven cards to the table. The object of play was to win cards by pairing or building, and to score a sweep by clearing the table.

Casino is now one of the foremost games for children, because of the practice it affords in elementary arithmetic. Played seriously, it makes severe demands on the memory and power to draw negative inference, and is therefore a favourite of professional gamblers outside their "working hours."

Casino is essentially for two players, although three or four can play. The full pack of 52 cards is used. The first deal is four cards to each player and four face up on the table, dealt two at a time. After the cards are played the same dealer gives four more cards to each player, but none to the table, and so on until the pack is exhausted. He must announce "last" in making the last deal of the pack. If the pack must be run through again to complete a game, it is shuffled and the deal passes to the other player.

The four cards in the hands are played alternately, nondealer first. The player may use his card to *trail, take in* or *build.* To *trail* is to lay the card face up, making it available for use by opponent. To *take in* is to gather one or more of the cards already on the table, with the one played. A table card may be so taken in by another card of the same rank (called *pairing* or *matching*). Two, three or four of a kind may be taken in at one turn, providing that the rank is not king, queen or knave. Court cards can be captured only singly and only by pairing.

Building is piling two or more cards together, to be taken by a card of pip value equal to the total in the pile. Ace counts one, and court cards may not be built (but see *Royal Casino*). Cards on the table may be built and then taken by a card from the hand, or the card from the hand may be added to one or more on the table, to make a build which the player can take at his next turn. The total of the build is stated verbally, to guard against error, also to fix the intention in ambiguous cases, *e.g.*, on building two fives the player must say either "building fives" or "building ten." The intention governs what card can win the build. Having the necessary card, a player may take in a build made by his opponent.

A build left on the table may be *increased* by the opponent to a higher total, *e.g.*, a build of "seven" by a 4 and 3 may be increased to "nine" by addition of a 2. At least one of the cards used for the increase must come from the hand, consequently a build cannot be taken in at the same turn as it is increased. But a *double build* (or multiple build) may not be increased. Having made a build, a player may double it by adding any other available cards with the same total. Thus, with 7, 2, 5 on the table a player may add a 4 and make a double build of "nine." Having two 9s in his hand, the player could at his next turn add one to the pile, stating "I leave it." If the opponent has meanwhile trailed a 6, the player might add it with a 3 from his hand, or, at the time of taking in the build, with a 3 or a 2 and ace, from the table.

A *sweep* is the taking in of all cards remaining on the table. It is marked by turning one card face up, in the player's pile of cards taken in. (Some players do not allow scoring for sweeps.) After the last card of the deal is played, any cards remaining on the table go to the last who took in a card, but do not count as a sweep.

The points scored for cards taken in are: *Cards*, a majority of the 52 cards, 3 points (if cards are split, there is no score); *Spades*, a majority of the 13 spades, 1 point; *Big*, or *Great, Casino*, the ten of diamonds, 2 points; *Little Casino*, the deuce of spades, 1 point; *Aces*, each 1 point; *Sweeps*, each 1 point. Game is usually set at 21 points, and some players allow *counting out* during the play, so that game may be won before the pack is exhausted Where counting out is not allowed, the points must be reckoned in the order given above, and the first to reach 21 (where both might do so in the same deal) wins. When necessary, the aces rank in counting out: spades (high), clubs, hearts, diamonds. Others play an 11-point game. Some count each complete deal a game.

Another optional feature is *overs*: Each card won by a player above 30 counts 1 point. In *spade overs* each spade taken beyond eight counts 1 point.

Partnership Casino.—When four play it is usually as partners, two against two. The order of play is clockwise, beginning with eldest hand, partners facing each other across the table and thus playing alternately.

Royal Casino is a variant much more popular among children, and rated by some students as the superior game. Here the court cards as well as lower cards may participate in building, triplicating, etc. King counts 13, queen 12, knave 11, ace either 1 or 14 as desired. Some also play that Big Casino counts 10 or 16, Little Casino 2 or 15.

Draw Casino commences with the usual first deal, but thereafter each player maintains his hand at four cards by drawing a card from the top of the pack after each play.

Spade Casino supplants the usual 1 for spades and 1 for Little Casino with an individual score for each card of the spade suit: 2 each for ace, knave, deuce, 1 each for the rest. Game is 61 points. The loser is *lurched* and loses double if he fails to reach 31 points.

CASINUM, an ancient town of Italy, probably of Volscian origin. When it came under Roman supremacy is not known, but it probably received the citizenship in 188 B.C. It is situated on the Via Latina about 40m. N.W. of Capua. Varro possessed a villa near it, in which later Mark Antony held his orgies. Strabo speaks of it as an important town; Varro mentions the olive-oil of its district as especially good. The older Volscian Casinum must have stood on the hill (1,715ft.) above the Roman town (148ft.), where considerable remains of fortifications in Cyclopean masonry, of finely cut blocks of limestone, still exist. The site is now occupied by the Benedictine monastery of Monte Cassino (*q.v.*), founded by St. Benedict himself in 529. The wall runs south-west and west, starting from the west side of the monastery, for a total length of about 300 yards. The Roman town lay at the foot of the mountain, close to the Via Latina. The amphitheatre, erected by Ummidia Quadratilla (mentioned by Pliny), is still existing and is approximately circular in plan. The external walls are 59ft. high. Above it on the hillside is a theatre less well preserved. Close by is a building converted into the Cappella del Crocefisso, originally perhaps a tomb on the Via Latina; it is a chamber in the form of a Greek cross, constructed of large masses of travertine, with a domed roof of the same material. On the opposite bank of the river Rapido are the ruins attributed to the villa of Varro.

The mediaeval town of S. Germano, which resumed the name Cassino in 1871, lies a little to the north. The cathedral was founded in the 8th century, but the present building was constructed in the 17th century. Above the town is a picturesque mediaeval castle.

CASIRI, MIGUEL (1710–1791), a learned Maronite, was born at Tripoli (Syria). He studied at Rome, where he lectured on Arabic, Syriac and Chaldee. In 1748 he went to Spain, and in 1763 he became principal librarian at the Escorial, a post which he appears to have held until his death.

Casiri published a work entitled *Bibliotheca Arabico-Hispaña Escurialensis* (1760–70). It is a catalogue of above 1,800 Arabic mss., which he found in the library of the Escorial; it also contains a number of quotations from Arabic works on history. The second volume gives an account of many geographical and historical mss., which contain valuable information regarding the wars between the Moors and the Christians in Spain. Casiri's work is not yet obsolete, but a more scientific system is adopted in Hartwig Derenbourg's incomplete treatise, *Les Manuscrits arabes de l'Escorial* (1884).

CASK: *see* COOPERAGE.

CASKET, a small box or chest commonly used for jewels, money, papers or other objects of value. The etymology is doubtful. It is possibly a diminutive of "cask," a barrel for wine or other liquor.

The Spanish *casco* meant also a skull, helmet or rind of an onion, and is probably connected with *cascar*, to break open, Latin *quassare*, French *casser*, to break, shake. The French *casque*, *casquet*, of the same origin is only used of a helmet, and the sense of "small chest" is not found in languages other than English. Skeat suggests that the word is a corruption of French *cassette*, diminutive of *casse*, box, Latin *capsa*, from *capere*, to hold, contain, *cf.* English "case." History and literature are full of references to the often disconcerting contents of these famous receptacles. The "Casket Letters" (*q.v.*) are one of the mysteries of history. Harpagnon's casket plays an important part in Molière's L'Avare; Bluebeard gives his too-curious wife the keys of his caskets filled with precious stones; the contents of Sainte-Croix's casket brought about the trial and condemnation of the marquise de Brinvilliers, the poisoner. This very ancient piece of furniture was no doubt derived from the chest, which was the original wardrobe.

It was often an object of great value, covered with ivory, enamel or stamped leather, enriched with precious metals, or encrusted with jewels. One which belonged to St. Louis and is preserved in the Louvre is covered with enamelled shields of arms and other decorations. In the 16th and 17th centuries secret hiding-places were sometimes in the thickness of the lid or in a false bottom. The word is now little used—the natural result of the desuetude of the object; but auctioneers occasionally announce that they will sell a "casket of jewels," and undertakers in the U.S.A. use it as a synonym for coffin (*q.v.*). (*See* also Box.)

CASKET LETTERS, the name given to eight letters and a series of irregular sonnets asserted by James, 4th earl of Morton, to have been found by his servants in a silver casket in the possession of a retainer of James, 4th earl of Bothwell, on June 20, 1567, six days after the surrender of Mary, queen of Scots, to her rebels at Carberry Hill. If they are genuine they prove Mary's full complicity with Bothwell in the murder of her husband, Henry, Lord Darnley, in the preceding February. The contents of the casket were produced at Westminster, on Dec. 14, 1568, before a body of English Commissioners appointed by Queen Elizabeth to investigate the charges brought by Mary, then a prisoner in England, against the rebel Scottish lords and by them against her. The originals were in French, but translations had already been made into Scots, and further translations were made into English. After the Conference, the casket and its contents were brought back to Scotland and entrusted to Morton's care; after his execution in 1581, they passed into the possession of William, 1st earl of Gowrie, who refused to comply with Elizabeth's request that they should be sent to England. Gowrie was executed for treason in 1584, and there is no further trace of the originals.

Elizabeth's Commissioners gave no decision about the authenticity of the documents, and, until comparatively recent years, controversy as to their genuineness has been complicated by doubts as to the text actually produced at Westminster in 1568. Translations into Scots, English, Latin and French were published within a few years of the close of the Conference, and it was assumed that these French translations represented the text shown to the English Commissioners. Walter Goodall proved in 1754 that the printed French text was derived from the Scots or the Latin, and this unquestionably strong argument for forgery remained a main factor in the case of Mary's defenders for over a century until the discovery of contemporary French copies of the letters in the Record Office and at Hatfield. This discovery undermined the position taken up by John Hosack in his *Mary, Queen of Scots, and her Accusers* (2nd ed. 1870–74). Hosack also made a very telling attack upon the most incriminating of the letters (Letter II.), on the ground of collusion with a declaration made by Thomas Crawford, a servant of Darnley, which was also produced at Westminster, and his argument for forgery was widely accepted until the publication of an article by Harry Bresslau in the *Historisches Taschenbuch* (1882) and of T. F. Henderson's *Casket Letters and Mary, Queen of Scots* (2nd ed. 1890), the latter of which traversed Hosack's theory of collusion between Crawford's deposition and Letter II., of which no contemporary French copy has been found. A further development of the controversy followed the discovery of a number of documents, notes of information, and indictments of Mary, which had originally been written for, or by, Darnley's father, Matthew, 12th earl of Lennox, and are preserved in the University library at Cambridge. Transcripts of the Lennox documents were lent by Father Pollen, S.J., to the late Mr. Andrew Lang, who used them in his *Mystery of Mary Stuart* (1900–04). Portions of these documents have since been printed by Maj.-Gen. R. H. Mahon in his *Indictment of Mary, Queen of Scots* (1923) and his *Mary, Queen of Scots: a Study of the Lennox Narrative* (1924). In the light of the new evidence, Lang came to the conclusion that "the least difficult theory is that Letter II. is in part authentic, in part garbled." This conclusion was controverted by Henderson in his *Mary, Queen of Scots* (1904), and in the *Scottish Historical Review* (Oct. 1907), Lang, on different grounds from those of his critic, retracted his own earlier view, and admitted that his hypothesis, that Letter II. was partly based on Crawford's deposition, was impossible. Mary, he was convinced, "wrote the whole letter."

The authenticity of Letter II. is the central point of the controversy, and the question is not seriously affected by exposures of false statements made in other connections by Mary's ac-

To the arguments of Henderson and Lang no systematic reply has yet been made, and the controversy remains where they left it, though General Mahon in his two books has advanced some arguments against the genuineness of Letter II.

(R. S. R.)

CASLON, the name of a famous family of English typefounders. William Caslon (1692–1766), the first of the name, was born at Cradley, Worcestershire, and in 1716 began in London as an engraver of gun locks and barrels, and as a bookbinder's tool-cutter. Being thus brought into contact with printers, he was induced to fit up a type foundry, largely through the encouragement of William Bowyer. The distinction and legibility of his type secured him the patronage of the leading printers of the day in England and on the Continent. The use of Caslon types, discontinued about the beginning of the 19th century, was revived about 1845 at the suggestion of Sir Henry Cole, and used for printing the *Diary of Lady Willoughby* (a pseudo-17th-century story) by the Chiswick Press. He died on Jan. 23, 1766. His son, William Caslon (1720–1778), who had been partner with his father for some years, continued the business.

CASPER, the second city of Wyoming, U.S.A., on the North Platte river, in the central part of the State; the county seat of Natrona county. It is on Federal highways 20 and 87E, and is served by the Burlington and the Chicago and North Western railways. In 1900 the population was 883; in 1920, 11,447; and in 1940 federal census 17,964. It is the industrial, financial and trading centre for a large part of the state, and one of the largest oil-refining centres in the country. Great quantities of petroleum products, wool, sheep and cattle are shipped. Teapot Dome and Salt Creek (20,000ac.) oil-fields lie about 40m. N.; Big Muddy field, 20m. east. The city has four refineries, which use an average of over 50,000 bbl. of crude petroleum daily. The assessed valuation of property (exclusive of the refineries) was $9,7[illegible]4,188 in 1940; bank debits in 1940 amounted to $80,028,000

The city owns a park of 400ac. on top of Casper Mountain, 8m to the south, and Old Fort Caspar, which guarded the principal crossing of the river in the days of the covered wagon, now belongs to the city. Goose Egg Ranch, a social centre in the early days of the cattle kings, is 14m S.W.; Hell's Half Acre, a county park of scenic marvels, 45m. W.; and 51m. S.W. is Independence Rock, a great mass of black granite, a landmark on the old Oregon Trail, on which many of the pioneers cut their names, with dates as far back as 1832. Until 1847 the site of Casper was known as The Upper Crossing of the Platte; from 1847 to 1858 as The Mormon Crossing and Ferry; from 1858, when a bridge was built, to 1865, as Platte Bridge Crossing. In 1865 the fort was renamed in honour of Lieut. Caspar Collins, who was killed in an attack on the Indians on July 26, 1865. The town was founded on June 16, 1888, when the first railway train arrived, and was incorporated in 1889. The spelling of the city's name is due to a mistake on the part of a railway clerk.

CASPIAN LANGUAGES, the designation of one division of the Iranian group of Indo-European languages, a division comprising (*a*) Mazandarani, (*b*) Gilaki, (*c*) Talishi, (*d*) Tāt and (*e*) Samnani. Mazandarani has been a literary tongue since the middle ages and is used in poetry.

General View.—The phonology of the Caspian tongues is, in general, that of the north Iranian group. Maz. *aš* (a bear) may be traced from Avesta *arĕša* (*cf.* modern Persian *khirs*); *kana* (might, power), Avesta *Kăran* and modern Persian *kun-ad.*

Morphology.—The grammatical structure of the languages again follows that of the north Iranian group. Sex is indicated by prefixing or affixing, for masc., *nar,* and for fem. *mada.* The adjective precedes the noun, e.g., *Maz.,—pira mard* (an old man), *surxa gul* (a red rose); Talishi, *serxe sevi* (a red apple); *droza mu* (a long hair). The plural (in modern Persian indicated by the suffix *-ān*) is in Maz. *-ūn*, e.g., *birarūn,* the brothers (modern Persian, *biradar*, a brother, *biradarān, biradān,* brothers).

There is an oblique case having many duties. It is marked in the different languages thus:

Maz. *-a*, *e*, *i*; Plural *ūni*, *-hāi*
Gil. *-a*, *-e*, *-i*, *-a*; Plural *-āne*, *-āni*
Tal. *-i*, *o* — — —
Sam. *-i*

In Mazandarani this case usually marks the accusative, sometimes the genitive case. In Gilaki and Talishi it usually marks the dative and in the former it is also occasionally used as a locative mark.

The comparison of adjectives is similar to that of modern Persian. The suffix *-tar* or *-ter* is used. (*Cf.* Persian *bihtar,* better.)

Numerals.—These in most of the Caspian languages, follow the Persian forms fairly closely. In Talishi they are (1) *i*, (2) *dō*, (3) *sa*, (4) *chō*, (5) *penj*, (6) *shash*, (7) *haft*, (8) *hesht*, (9) *nav*, (10) *da*.

Pronouns.—The pronouns are very similar to those of modern Persian, as will be seen from the following:

		Mazandarani	Gilaki	Talishi	Tāt	Samnani
First Person	Sing.	*Man, mun*	*Man, mū*	*az*	*mu, mya*	*ā, u, mun*
	Plur.	*amā*	*amá (hā),* *ma*	*amā*	*māya, imū*	*hamā*
Second Person	Sing.	*tu, ta*	*tu*	*tu*	*tu*	*tū*
	Plur	*shamā*	*sumā*	*shimā*	*shumu*	*shama*
Third Person	Sing.	*ve, vi*	*ūn, u*	*av*	*u*	*yu, ū*
	Plur.	*vashun*	*usan*	*avān*	*ushūn*	*yun, ui*

The languages also make use of suffixed pronouns.

The interrogative pronouns are *ki* (who), in all five languages and *cha* (what, Maz. Tāt and Samnani), *chi* (Talishi and Gilaki).

Verbs, Adverbs, etc.—The conjugation of verbs follows the Iranian group very closely. The auxiliary, root *bū-* (to be), *cf.* Persian *budan*, etc., is used as in the cognate languages.

Adverbs, conjugations, prepositions and postpositions are not declined. Many of them are almost identical in form with Iranian and modern Persian forms and betray extensive borrowings

See Geiger and Kuhn, *Grundriss der Iranischen Philologie,* 1 Band, 2 Abt. (Strasbourg, 1898–1901). (A. N. J. W.)

CASPIAN SEA, an inland sea between Europe and Asia, extending from 37° to 47° N., and from 47° to 55° E. Its length is 1,280 km. from north to south, and its breadth 160 to 440 km., and its area reaches 438,690 sq.km. (a little more than the area of the Baltic), of which 2,340 sq.km. belong to its islands. It fills the deepest part of a vast depression, sometimes known as the Aralo-Caspian depression, once an inland sea, the Eurasian Mediterranean or Sarmatian Ocean. At the present time its surface lies 26 metres below the level of the ocean and 76 metres below the level of the Aral.

Hydrography and Shores.—The hydrography of the Caspian Sea has been studied by von Baer, by N. Ivashintsev in 1862-

1870, by O. Grimm, N. I. Andrusov (1895), and by J. B. Spindler (1897), N. von Seidlitz and N. Knipowich (1904 and 1912–15). It has three sections—(1) A northern, forming in the east the very shallow Gulf of Mortvyi Kultuk which is being gradually silted up by the sedimentary deposits brought down by the rivers Volga, Ural and Terek. The Caspian steamers, for example, must lighten their loads nearly 40 miles away from the Volga mouth. The western shore, from the delta of the Volga to the mouth of the Kuma is gashed by thousands of narrow channels or lagoons, termed *limans*, from 20 to 50 km. in length, and separated in some cases by chains of hillocks, called *bugors*, in others by sandbanks. These channels are filled, sometimes with sea-water, sometimes with overflow water from the Volga and the Kuma. The coast-line of the Gulf of Mortvyi Kultuk on the north-east is, on the other hand, formed by a range of low calcareous hills, constituting the rampart of the Ust-Urt plateau, which intervenes between the Caspian and the Sea of Aral. (2) South of the line joining the Bay of Kuma with the Manghishlak peninsula in the East, in 44° 10′ N. lat., the western shore is higher and the water deepens considerably, over one-half of the area 100 metres is reached while the maximum depth (between 41° and 42° N.) reaches 768 metres. This, the middle section of the Caspian, which extends as far as the Apsheron peninsula, receives the Terek and several smaller streams that drain the northern slopes of the Caucasus. At Derbent, just north of 42° N., a spur of the Caucasus approaches so close to the sea as to leave room for only a narrow passage, the *Caspiae Pylae* or *Albanae Portae*, which has been fortified for centuries. The eastern shore of this section of the sea is also formed by the Ust-Urt plateau, which rises 150 to 250 metres above the level of the Caspian; but in 42° N. the Ust-Urt recedes from the Caspian and circles round the Gulf of Kara-boghaz or Kara-bugaz. This subsidiary basin is separated from the Caspian by a narrow sandbar, pierced by a strait only 100 to 150 metres wide, through which a current flows continuously into the gulf at the rate of 2·5 to 8 km. an hour. To this there exists no compensating outflow current at a greater depth, as is usually the case in similar situations. The area of this lateral basin being about 18,400 sq.km., and its depth but comparatively slight (1 to 12 metres), the evaporation is very appreciable (amounting to 1 metre per annum), and sufficient to account for the perpetual inflow from the Caspian. South of a line joining Baku with Krasnovodsk begins (3), the southern and deepest section of the Caspian separated from the middle section by a submarine ridge (66 metres of water), which links the main range of the Caucasus on the west with the Kopet-dagh in the Transcaspian region on the east. This section of the sea washes on the south the base of the Elburz range in Persia, sweeping round from the mouth of the Kura to Astarabad at an average distance of 60 km. from the foot of the mountains. A little east of the Gulf of Enzeli, which resembles the Kara-boghaz, though on a much smaller scale, the Sefid-rud and several smaller streams pour into the Caspian the drainage of the Elburz range. Near its south-east corner the Caspian is entered by the Atrek, which drains the mountain ranges of the Turkoman (north-east) frontier of Persia. In 1894 a subterranean volcano was observed in this basin of the Caspian in 38° 10′ N. and 52° 37′ E. The depth in this section ranges from 25 to 700 metres, with a maximum of 946 metres. The mean depth of the whole Caspian is according to Knipowich (1922) 182 metres. The volume is 79,320 cubic km., rather more than those of the North Sea and Baltic combined.

Drainage Area and Former Extent.—The catchment area from which this greatest inland sea is fed is 3,733,000 sq.km. and extends to a very much greater distance on the west and north than it does on the south and east. From the former it is entered by the Volga, which is estimated to provide $\frac{2}{3}$ of the river supply, *i.e.*, about 301 cubic km. per annum), the Ural, the Terek, the Sulak, the Samur; as compared with these, there comes from the south and east the Kura and Aras, draining the south side of the Caucasus, and the Sefid-rud and the Atrek, both relatively short. Knipowich showed (1922) that without evaporation the level would rise 1·3 metres annually, evaporation counteracts this, but the level has undergone great non-periodical oscillations, as well as seasonal ones. It is lowest in December and highest in June. If 285 cm. is the normal figure at Baku at present it was in

1306	1,305 cm.	1845	216 cm.
1638	703 ,,	1847	207 ,,
1715	305 ,,	1853	254 ,,
1815	515 ,,	1900	296 ,,

Thus in 1306 the level was more than 11 metres higher than it is now and the variations are large and irregular. The sea was so low in 1915 as to cause difficulties of navigation in the north.

The level of the Caspian, however, was formerly, in prehistoric times, about the same as the existing level of the Black Sea, although now some 26 metres below it. This is shown by the evidences of erosion on the face of the rocks which formed the original shore-line of its southern basin, those evidences existing at the height of 20 to 25 metres above the present level. Large portions of the vast region comprised between the lower Volga, the Aral-Irtysh water-divide, the Dzungarian Ala-tau, and the outliers of the Tian-shan and Hindu-kush systems are actually covered with Aralo-Caspian deposits, nearly always a yellowish-grey clay, though occasionally they assume the character of a more or less compact sandstone of the same colour. These deposits attain their maximum thickness of 30 metres east of the Caspian, and have in many parts been excavated and washed away by the rivers (which have frequently changed their beds) or been transported by the winds, which sweep with unmitigated violence across those wide unsheltered expanses. The typical fossils unearthed in these deposits are shells of species now living in both the Caspian and the Aral, though in the shallow parts of both seas only, namely (according to Ivan V. Mushketov 1850–1902) *Cardium edule*, *Dreissena polymorpha*, *Neritina liturata*, *Adacna vitrea*, *Hydrobia stagnalis*, in the Kara-kum desert, and *Lithoglyphus caspius*, *Hydrobia stagnalis*, *Anodonta ponderosa* and the sponge *Metchnikovia tuberculata*, in the Kizil-kum desert. The exact limits of the ancient Aralo-Caspian sea are not yet settled, except in the north-west, where the Ergeni Hills of Astrakhan constitute an unmistakable barrier. Northwards these marine deposits are known to exist 128 km. away from Lake Aral. The eastern limits of these deposits lie about 160 km. from Lake Aral. Southwards they have been observed without a break for 250 km. from Lake Aral, namely in the Sary-kamysh depression. Hence in late Tertiary, and probably also in Post-Tertiary, times the Aralo-Caspian Sea covered a vast expanse of territory and embraced very large islands (*e.g.*, Ust-Urt), which divided it into an eastern and a western portion. More than this, the Caspian was also, it is pretty certain, at the same epoch, and later, in direct communication with the Sea of Azov, no doubt by way of the Manych depression; for the *limans* or lagoons of the Black Sea share with the Caspian:—*Archaeobdella*, *Clessinia variabilis*, *Neritina liturata*, *Gmelina*, *Gammarus maeoticus*, *Pseudocuma pectinata*, *Paramysis Baeri*, *Mesomysis Kowalevskyi* and *M. intermedia*, *Limnomysis Benedeni* and *L. Brandti*, *Gobius*, *Clupea* and *Acipenser*.

In early Tertiary times the Caspian belonged to the Sarmatian Ocean, which reached from the middle Danube eastwards through Rumania, South Russia, and along both flanks of the Caucasus to the Aralo-Caspian region, and westwards had open communication with the great ocean. Before Pliocene times the Sarmatian Ocean was divided into sections, one of which was the Aralo-Caspian sea. During the Pleistocene Ice Age the Caspian flowed over the steppes that stretch away to the north, and was probably still connected with the Black Sea (itself as yet unconnected with the Mediterranean). After the great ice cap had thawed and a period of general desiccation set in, the Caspian began to shrink in area, and simultaneously its connections with the Black Sea and the Sea of Aral were severed.

Fauna.—The fauna of this sea has been studied by Eichwald, Grimm, Kessler, Sars and Wúkotitsch. Marine elements include the herring (*Clupea*), and freshwater elements, species of *Cyprinus*, *Perca* and *Silurus*, also a lobster. Rhizopoda (*Rotalia* and *Textillaria*), the sponge *Amorphina*, the *Amphicteis* worm, the molluscs *Cardium edule* and other *Cardidae*, and some Amphipods (*Cumacea* and *Mysidae*), are marine forms which either tolerate variations in salinity or are especially characteristic of brackish waters. Species not found elsewhere include Protozoa, three sponges, Vermes, twenty-five Molluscs, numerous Amphipods, fishes of the genera *Gobius*, *Benthophilus* and *Cobitis*, and one mammal (*Phoca caspia*). This last, together with some of the *Mysidae* and the species *Glyptonotus entomon*, exhibits Arctic characteristics, which has suggested the idea of a geologically recent connection between the Caspian and the Arctic, an idea of which no real proofs have been as yet discovered. The Knipowich expeditions found no traces of organic life below the depth of 400 metres except micro-organisms (zooplankton) and a single Oligochaete, but above that level the phytoplankton is rich. Fisheries off the mouths of Volga, Ural, Terek and Kura yielded in 1925 about 22 million tons, *i.e.*, much less than in 1913. The catch included *vobla* (a kind of roach) (44·5%), herring (42·2%), sturgeon (four varieties) and salmon (1·2%), carp, bream, perch, tench and pike. The marked drop in the sturgeon and salmon catch is due to destructive exploitation. Cold storage is provided in Astrakhan, Makach-Kala and Derbent, but the export of fresh fish is hampered by lack of refrigerator transport, and salted, smoked or dried fish, with caviare and isinglass from the sturgeon are the chief exports. Seals are hunted in Krasnovodsk bay. The northern section with great rivers has a salinity 10% or less and the water in the north-west corner is drinkable. In Mortvyi Kultuk gulf, on the east, salinity rises above 30%. In the open Caspian it averages 12·8%, less than that of the Black sea. Of the salts present common salt (NaCl) forms only 62% against 78% in the ocean, magnesium sulphate ($MgSO_4$) 24% against 5%. In the Kara-bugaz gulf into which the Caspian water streams continuously to be evaporated, salinity rises to 200% and large quantities of Mirabilite ($Na_2SO_4+10H_2O$) are deposited, to be dissolved afresh in summer. Below a level of 300 metres Caspian water contains practically no oxygen, but some H_2S, as is the case in the Black Sea. This accounts for the absence of life in the depths of both.

Currents and Climate.—Currents (Knipowich, 1922) follow the coasts in counter-clockwise direction, the east-west section crossing the sea near the boundary between shallow and deeper water. Through these currents the Volga water spreads southwards on the west and lowers the general temperature. Average temperature of the air in winter is about 16° in the north and 46° in the south, for the summer the average figures are 73° and 82° respectively. At a depth of 300 metres the temperature remains at about 41°–43°. Near the Volga mouth the Caspian is frozen for 112 days on an average, and winter in the northern basin is very severe with frequent falls of temperature to −13°, and to −22°, and lower still, on the Ust-Urt plateau. The north and east wind contribute to winter's severity; summer winds are variable, often westerly, with frequent alternation of land and sea breezes during the day

Navigation.—Transport is hindered by antiquated vessels for dry cargo freightage of timber, salt, sugar, fish and dried fruit, and by the silting of the Volga. There were in 1925 81 motor-driven vessels, freightage 112,049 tons, 162 oil barges, freightage 246,000 tons, 75 dry cargo steamers, 38,400 tons and 63 line steamers and tugs with 18,300 horse power. The total freightage carried 1925–26 was in dekatons 402,552 as against 632,214 in 1913. It consisted of—

Petroleum products	353,328
Grain	15,081
Salt	6,183
Fish	4,608
Timber	3,515
Iron	441
Coal	87
Other freights	19,309
and the number of passengers was	169,750

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CASQUE, a covering for the head, a helmet; mediaeval protective armour for the head. The ancient Greeks and Romans wore helmets of brass and sometimes of skins. Casques were either open or closed; the open usually had a bar descending from the forehead to protect the face against transverse sword cuts. Close casques were fitted with visors hinged above the ears; a beaver was fitted which covered the mouth and chin only. Slits or perforations were also provided for ventilation and vision.

There have been several patterns of casques, *e.g.*, *chapelle-de-fer*, or iron hat, worn by light horsemen under Edward I.; *bourguinote* or *burgonet*, made to the shape of the head; *bacinet*, a light helmet resembling a basin; *salade*, *salet* or *celate*, a light casque; *hufken*, headpiece for archers; *castle*, protecting the whole of the head; *morion*, open, resembling a hat, worn by musqueteers and harquebussiers; *pot*, iron hat with a broad brim. (*See* Helmet.)

CASS, LEWIS (1782–1866), American general and statesman, was born at Exeter, N.H., on Oct. 9, 1782. He was educated at Phillips Exeter academy, joined his father at Marietta, Ohio, about 1799, studied law there in the office of Return Jonathan Meigs (1765–1825), and was admitted to the bar at the age of twenty. Four years later he became a member of the Ohio legislature. During the War of 1812 he served under Gen. William Hull, whose surrender at Detroit he strongly condemned, and under Gen. W. H. Harrison, and rose from the rank of colonel of volunteers to be major-general of Ohio militia and finally to be a brigadier-general in the regular United States army. In 1813 he was appointed governor of the territory of Michigan, the area of which was much larger than that of the present State. This position gave him the chief control of Indian affairs for the territory, which was then occupied almost entirely by natives, there being only 6,000 white settlers. During the 18 years in which he held this post he rendered valuable services to the territory and to the nation. His relations with the British authorities in Canada after the War of 1812 were at times very trying, as these officials persisted in searching American vessels on the Great Lakes and in arousing the hostility of the Indians of the territory against the American Government. To those experiences was largely due the antipathy for Great Britain manifested by him in his later career. He was secretary of war in President Jackson's cabinet in 1831–36, and it fell to him, therefore, to direct the conduct of the Black Hawk and Seminole wars.

In 1836 Gen. Cass was appointed minister to France, and became very popular with the French government and people. In 1842, when the Quintuple Treaty was negotiated by representatives of England, France, Prussia, Russia and Austria for the suppression of the slave trade by the exercise of the right of search, Cass attacked it in a pamphlet which was probably instrumental in preventing the ratification of the treaty by France. In this same year the Webster-Ashburton treaty between Great Britain and the United States was concluded, and, as England did not thereby relinquish her claim of the right to search American vessels, Cass felt himself in an awkward position, and resigned his post. His attitude on this question made him very popular in America. From 1845 to 1848 and from 1849 to 1857 he was a member of the U.S. Senate, and in 1846 was a leader of those demanding the "re-annexation" of all the Oregon country south of 54° 40′ or "war with England," and was one of the 14 who voted against the ratification of the compromise with England at the 49th parallel. He loyally supported Polk's administration during the Mexican War, opposed the Wilmot Proviso, and advocated the Compromise Measures of 1850 and the Kansas-Nebraska Bill of 1854.

In 1848 he received the Democratic nomination for the presidency, but owing to the defection of the so-called "Barnburners" (*see* Free Soil Party) he did not receive the united support of his party, and was defeated by the Whig candidate, Zachary Taylor. On account of his eminently conservative attitude on all questions concerning slavery, General Cass has been accused of pandering to the southern Democrats in order to further his political aspirations. His ideas of popular sovereignty, however, were not inconsistent with the vigorous Democratic spirit of the west, of which he was a typical representative, and it is not clear that he believed that the application of this principle would result in the extension of slavery. As the west became more radically opposed to slavery after the troubles in Kansas, Cass was soon out of sympathy with his section, and when the Republicans secured control of the legislature in 1857 they refused to return him to the Senate. President Buchanan soon afterward made him secretary of state, and in this position he at last had the satisfaction of obtaining from the British government an acknowledgment of the correctness of the American attitude with regard to the right of search. In Dec. 1860 he retired from the cabinet when the president refused to take a firmer attitude against secession and he remained in retirement until his death at Detroit, Mich., on June 17, 1866. He wrote for the *North American* and the *American Quarterly Reviews*, and published *Inquiries Concerning the History, Traditions and Languages of Indians Living Within the United States* (1823), and *France: Its King, Court and Government* (1840).

See W. T. Young, *Life and Public Services of General Lewis Cass* (Detroit, 1852); W. L. G. Smith, *Life and Times of Lewis Cass* (1856). The best biography is by A. G. McLaughlin, *Lewis Cass* (revised edition, Boston, 1899) in the "American Statesmen" series. *See* also *General Lewis Cass, 1782–1806*, Cass Canfield, compiler (1916); Benjamin Freeman Comfort, *Lewis Cass and the Indian Treaties* (1923); and John Spencer Bassett, "Lewis Cass on Nomination of Andrew Jackson," *American Antiquarian Society Proceedings*, n.s. vol. xxxiii., pp. 12–33 (1924).

CASSABA or **TORGUTLU,** a town of Turkey in the vilayet of Manisa, 63 mi. E. of Smyrna, with which it is connected by rail. Pop. (1940) 22,932. It has considerable local trade, and exports the products of the surrounding district. Cotton is the most important article, and there are ginning factories in the town; the silkworm is largely raised and exported; and the "melons of Cassaba" are sent not only to Smyrna but to Constantinople.

CASSANA, NICCOLÒ (1659–1714), often called Nicoletto, Italian painter, was born at Venice, and became a disciple of his father, Giovanni Francesco Cassana, a Genoese, who had been a pupil of Bernardino Strozzi ("il Prete Genovese"). Having painted portraits of the Florentine court and of some of the English nobility, Nicoletto was invited to England and introduced to Queen Anne, who sat to him for her portrait. He died in London in 1714. One of his principal works is the "Conspiracy of Catiline," now in Florence.

CASSANDER (*c.* 350–297 b.c.), king of Macedonia, eldest son of Antipater, first appears at the court of Alexander at Babylon, where he defended his father against the accusations of his enemies. On the death of Antipater, who had passed over his son and appointed Polyperchon regent of Macedonia, Cassander allied himself with Ptolemy Soter and Antigonus, and declared war against the new regent. Most of the Greek states went over to him, and Athens also surrendered. He further effected an alliance with Eurydice, the ambitious wife of King Philip Arrhidaeus of Macedon. Both she and her husband, however, were soon after slain by Olympias, mother of Alexander the Great. Cassander at once marched against Olympias, and, having forced her to surrender in Pydna, put her to death (316). Left master of Macedonia, Cassander joined in a coalition with Lysimachus, Ptolemy, and Seleucus, against Antigonus; in 311 a peace was concluded by which Cassander was recognized as general of Europe during the minority of Alexander IV. In 310, therefore, he murdered the young king and his mother. In 303, Cassander, alarmed at the liberation of Greece by Demetrius Poliorchetes, renewed the coalition, and, when Antigonus was defeated and killed in 301, was recognized as king of Macedonia. He died of dropsy in 297. Cassander was a man of literary taste, but violent and ambitious. He restored Thebes after its destruction by Alexander the Great, transformed Therma into Thessalonica, and built the new city of Cassandreia upon the ruins of Potidaea.

See Diod. Sic. xviii., xix., xx.; Plutarch, *Demetrius*, 18. 31, *Phocion*, 31; also Macedonian Empire.

CASSANDER or **CASSANT, GEORGE** (1513–1566), Flemish theologian, born at Bruges, studied at Louvain, and taught theology and literature at Bruges. He studied the differences between the Catholic and Protestant bodies with a view to facilitating reunion, and in 1561 published anonymously *De Officiis pii ac publicae tranquillitatis vere amantis viri in hoc dissidio religionis* (Basle), in which, while holding that no one, on account of abuses, has a right utterly to subvert the Church, he disapproves of exaggerated papal claims. He appeals to Scripture explained by tradition and the fathers of the first six centuries. Such a book pleased neither party; but the German emperor Ferdinand asked him to publish his *Consultatio de Articulis Fidei inter Catholicos et Protestantes Controversis* (1565), in which, like Newman at a later date, he tried to put a Catholic interpretation upon Protestant formularies. While never attacking dogma, he criticizes the papal power and makes reflections on practices. The work, attacked both by the Louvain theologians and by Calvin and Beza was put on the Index in 1617. He died at Cologne on Feb. 3, 1566. His works were published at Paris in 1616.

CASSANDRA, in Greek tradition, daughter of Priam and Hecuba. In legend she was beloved of Apollo, who promised to bestow on her the spirit of prophecy if she would comply with his desires. Cassandra accepted the proposal, and then refused her favours. Apollo revenged himself by ordaining that her prophecies should never be believed. On the capture of Troy she was ravished by Ajax, the son of Oïleus, in the temple of Athena. In the distribution of the booty, Cassandra fell to the lot of Agamemnon (*q.v.*) and was murdered with him. It is to be noticed that there is no mention in Homer of her prophetic gifts. Together with Apollo, she was worshipped under the name of Alexandra.

CASSANO ALIONIO, a town of Calabria, Italy, in the province of Cosenza; its railway station (6 mi. S. of the town) is 37 mi. N. by E. from the town of Cosenza, while it is 6 mi. W. of Sibari, on the line between Metaponto and Reggio. Population (1936) 7,689 (town), 11,428 (commune). It is very finely situated 820 ft. above sea level; the rock above it is crowned by a mediaeval castle. *See* also Compsa

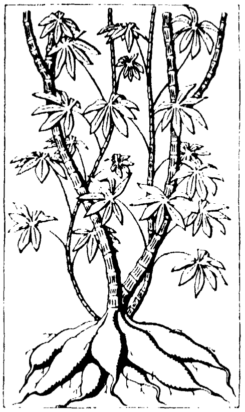
CASSATION, in music, the name of a type of orchestral work, consisting of several short movements of a light character, popular in the 18th century, serenade and divertimento being other names for much the same kind of composition. Mozart wrote three works so named.

In law, cassation signifies quashing, annulling or reversing, hence Court of Cassation as the name for a court of appeal.

CASSATT, MARY (1855–1926), American artist, was born at Pittsburgh, (Pa.), a sister of A. J. Cassatt, president of the Pennsylvania railroad. In 1875 she went to Europe to study art, spending some time in Spain, afterwards proceeding to Paris, where she was greatly influenced by Manet, Renoir, Degas and the Impressionist school. Her first exhibition in Paris was in 1893 at the gallery of M. Durand-Ruel, where in later years her works were frequently exhibited. She also contributed to the various exhibitions of the Impressionist school, but never to the salons. Her work was warmly appreciated in French artistic circles. Mothers and babies or children were to her the chief subjects of inspiration, and her pictures are distinguished by great firmness in drawing and boldness of tone and colour. As a pastellist she attained high rank. Exhibitions of her works have been held in New York and Pittsburgh, and she is represented in the public art galleries of the United States and in private collections. She died in June, 1926.

See Achille Legard, *Un Peintre des Enfants et les Mères: Mary Cassatt*, illustrated (1913); Mary Cassatt, *Painting; Bulletin of the Rhode Island School of Design*, vol. v.; L. W. Hanemeyer, *The Cassatt Exhibition; Pennsylvania Museum Bulletin*, 1927, vol. xxii.

CASSAVA, the farinaceous root of two plants of the spurge family (Euphorbiaceae, *q.v.*), the bitter cassava, *Manihot* *esculenta,* and the sweet cassava, *M. Aipi,* both important sources of food starches. They are herbaceous or semi-shrubby perennials with very large fleshy, cylindrical, tapering roots as much as 3ft. long and 6 to 9in. in diameter, and filled with milky juice. The slender stems, 5 to 9ft. high, bear large spreading long-stalked leaves, with the blade divided nearly to the base into three to seven long narrow segments. The plants are probably natives of South America, but the bitter cassava, which is the more important of the two in an economic sense, has been introduced into most tropical regions, and is extensively cultivated in west tropical Africa and the Malay Archipelago, from which, as well as from Brazil and other South American States, its starch in the form of tapioca is a staple article of export. The sap of the bitter cassava root contains hydrocyanic acid, and the root, being therefore highly poisonous, cannot be eaten in a fresh condition; while on the other hand the sweet cassava is perfectly innocuous, and is employed as a table vegetable. Exposure to heat dissipates the poisonous principle, and the concentrated juice is in that state used as a basis of cassareep and other sauces. From the bitter cassava roots many different food preparations are made in Brazil. The roots are preserved for use by being cleaned, sliced and dried; from such dried slices manioc or cassava meal, used for cassava cakes, etc., is prepared by rasping. The starch also is separated and used for food under the name of Brazilian arrowroot; and this, when agglomerated into pellets on hot plates, forms the tapioca (*q.v.*) of commerce.



CASSAVA, A TROPICAL PLANT, SHOWING THE SWOLLEN ROOTS WHICH STORE STARCH

This starch forms the Brazilian arrowroot, and, when dried, is known as tapioca

CASSEL, SIR ERNEST JOSEPH (1852–1921), Anglo-German financier, was born at Cologne, on March 3, 1852, the son of a small banker in that city, and at the age of 16 became a clerk in the banking firm of Elspacher. In 1870 he went to London and entered the foreign banking house of Bischoffscheim and Goldsmid. There he attracted notice by his skilful disentanglement of the accounts of the Khedival loans. In 1884 he set up for himself and became interested in South-American finance. He re-organized the finances of Uruguay and issued three Mexican loans, as well as acquiring the Royal Swedish railway and financing enterprises such as Vickers' absorption of the Maxim-Nordenfelt Co. and the building of the Central London railway. He also raised a Chinese loan after the war with Japan. His principal achievement was, however, the financing of the Nile irrigation work, and in connection with that the founding of the National Bank of Egypt. During the World War, though he had long been a naturalized British subject, an unsuccessful attempt was made to have his name removed from the privy council. Sir Ernest retired in 1910 and died in London on Sept. 21, 1921. His daughter married Col. W. W. Ashley, M.P., Minister of Transport, and their daughter, who inherited much of her grandfather's great wealth, married Lord Louis Mountbatten. Cassel's public benefactions to hospitals and for educational purposes have been estimated at two millions sterling. He helped to found the King Edward VII sanatorium for consumptives at Midhurst, Kent, the Radium Institute, and created an educational trust for specified purposes, among these being facilities for workers' education.

CASSEL, GUSTAV (1866–1945), Swedish economist, was born at Stockholm on Oct. 20, 1866. From 1904 to 1933 he was professor of economics in the University of Stockholm. Among his colleagues he became best known for his value theory, an attempt to escape the hedonism of English and Austrian economists, his theory of money, and an unswerving belief in the principle of free competition. He gained international prominence through his work on world monetary problems at the Brussels conference in 1920 and the League of Nations' Finance committee in 1921. He was a Swedish delegate to several meetings of the International chamber of commerce. When he was in the United States on a lecture tour in 1928, the Banking and Currency committee of the house of representatives invited him to appear at the hearings on monetary stabilization. In 1933 the Swedish government sent him to the World Economic conference at London. He died Jan. 14, 1945.

Among Cassel's published works are: *The Nature and Necessity of Interest* (1903); *The World's Monetary Problems* (1921); *Money and Foreign Exchange after 1914* (1922); *The Theory of Social Economy* (rev. ed., 1932); *The Crisis in the World's Monetary System* (1932); *I Förnuftets Tjänst* (Autobiography), 2 vol. (1940–41). (E. W. Sn.)

CASSEL, a town of northern France in the department of Nord, on an isolated hill, about 12 m. E.N.E. of St. Omer. Pop. (1936) 2,161. It was a Roman station *Castellum Menapiorum*, as numerous remains of the Gallo-Roman period attest, and an important centre of roads. It was the scene of important battles in 1071, when Robert, count of Flanders, vanquished his rival Arnulf; 1328, when Philip of Valois defeated the Flemish; and 1677, when William of Orange was defeated by Philip, duke of Orléans, brother of Louis XIV. It was the headquarters of Gen. Foch in 1914–15 and of Gen. Plumer in 1916–18, and was bombarded, though not seriously damaged, in 1918.

The former *hôtel de ville* (1634), the hôtel de la Noble Cour, once the seat of the jurisdiction of maritime Flanders, now the town-hall, and the hôtel des ducs d'Halluin are the historic buildings of the town. Its industrial establishments include tanneries and oil-mills, and there is trade in cattle and butter.

CASSEL (also KASSEL), a city of Germany, capital of the former electorate of Hesse-Cassel, and, after its annexation by Prussia in 1866, capital of the province of Hesse-Nassau. Pop. (1939) 217,087. The earliest mention of Kassel is in 913, when it is referred to as Cassala. The town passed from the landgraves of Thuringia to the landgraves of Hesse in the 13th century, becoming one of the principal residences of the latter house in the 15th century. The burghers accepted the reformed doctrines in 1527. The fortifications of the town were restored by the landgrave Philip the Magnanimous and his son William IV. during the 16th century, and it was greatly improved by the landgrave Charles (1654–1730), who welcomed many Huguenots. The latter founded the upper new town. In 1762 Kassel was captured by the Germans from the French; after this the fortifications were dismantled and New Kassel was laid out by the landgrave Frederick II. After changing hands several times in the nineteenth century, it was made in 1867 the capital of the newly formed Prussian province of Hesse-Nassau.

It is situated on both sides of the river Fulda, a tributary of the Weser, over which a stone bridge leads to the lower new town. The river is navigable for barges, and railways connect the town with all parts of Germany. The streets of the old town are narrow and crooked, and contain many gabled houses, generally of the 17th century. The principal modern streets are the Königsstrasse, the Schöne Aussicht and the Stände-platz. The Friedrichs-platz is 1,000 by 450 ft. in area. In it stands a marble statue of the landgrave Frederick II. The former residence of the electors (*Residenzschloss*) fronts this square, as well as the Museum Fridericianum. The museum contains a collection of clocks and watches. Among other public places and buildings are the Roman Catholic church, the Königs-platz, the Karls-platz, with the statue of the landgrave Charles, and the Martins-platz, with a large church—St. Martin's—containing the burial-vaults of the Hessian princes. The gallery of paintings contains one of the finest small collections in Europe, especially rich in the works of Rembrandt, Frans Hals and Van Dyck.

The descendants of the French refugees who founded the upper new town have a church and hospital of their own. A new *Rathaus* (town-hall) has been erected. The town has museums of natural history and ethnography, an industrial exhibition hall and and industrial art school. The town's command of routes explains its importance in mediaeval times, its fluctuating political fortunes in the nineteenth century and its modern development as a railway centre. It has connections with the manufacturing centres of the Ruhr, with Koblenz, Frankfurt and other cities. The industries embrace engine-building, the manufacture of railway carriages and plant, scientific instruments, porcelain, tobacco and cigars, iron-founding, jute-spinning and other textiles. Cassel was bombed several times in World War II.

CASSELL, JOHN (1817–1865), British publisher, was born in Manchester on Jan. 23, 1817. His father was the landlord of a public-house, and John was apprenticed to a joiner. He was self-educated, gaining by his own efforts a considerable acquaintance with English literature and a knowledge of French He came to London in 1836 to work at his trade; in 1847 he established himself as a tea and coffee merchant, and about 1850 started a publishing business with the object of supplying good literature to the working classes. From the offices of the firm, which became in 1859 Cassell, Petter, Galpin and Co., were issued the *Popular Educator* (1852–55), the *Technical Educator* (1870–72), the *Magazine of Art* (1878–1903), *Cassell's Magazine* (from 1852) and numerous editions of standard works. A special feature of Cassell's popular books was the illustration. At the time of the Crimean War he procured from Paris the cuts used in *L'Illustration*, and by printing them in his *Family Paper* (begun in 1853) secured a large circulation for it. The firm was converted in 1883 into a limited liability company, under the name of Cassell and Company, Limited. John Cassell died in London on April 2, 1865.

CASSEROLE, a covered earthenware dish in which meat and vegetables are cooked in the oven. The heat penetrates the porous dish thereby insuring an even temperature for all its contents. The cover prevents any of the flavour from escaping as steam so that food cooked in casseroles retains all its juices and savour. Glass casseroles which withstand oven heat, and are attractive to the eye, are also obtainable.

CASSIA, the aromatic bark derived from *Cinnamomum Cassia* (family Lauraceae) sometimes termed Chinese cinnamon. In 1940 the United States imported 283,513 lb. of Cassia oil, of which China furnished all but 13 lb. The bark is much thicker than that of true cinnamon; the taste is more pungent and the flavour less delicate, though somewhat similar to that of cinnamon. The properties of cassia bark depend on the presence of a volatile oil—the oil of cassia. Cassia bark is in much more extensive demand on the continent of Europe than in Great Britain, being preferred to cinnamon by southern nations. The chief use is for flavouring liqueurs and chocolate, and in cooking generally. When ground as a spice it is difficult to distinguish cassia from cinnamon (*q.v.*), and it is a common practice to substitute the cheap common spice for the more valuable article. *Cassia Buds*, which have a pleasing cinnamon flavour, are believed to be the immature fruits of the tree which yields Chinese cinnamon. They are brought in considerable quantities from Canton, and used as a spice and in confectionery. *Cassia pulp*, used as a laxative, is obtained from the pods of *Cassia Fistula*, or pudding pipe tree, a native of Africa which is cultivated in both the East and West Indies. Some confusion occasionally arises from the fact that *Cassia* is the generic name of an extensive genus of leguminous plants, which, in addition to various other medicinal products, is the source of the senna leaves which form an important article of materia medica.

CASSIA, VIA, an ancient highroad of Italy, leading from Rome through Etruria to Florentia (Florence). At the 11th mile the *Via Clodia* (*see* CLODIA, VIA) diverged north-northwest, while the Via Cassia ran to the east of the Lacus Sabatinus and then through the place now called Sette Vene, where a road, probably the *Via Annia*, branched off to Falerii (*see* CIVITA CASTELLANA) through Sutrium (where the *Via Ciminia*, running along the east edge of the *Lacus Ciminius*, diverged from it, to rejoin it at Aquae Passeris, north of the modern Viterbo), Forum Cassii, Volsinii (novi), Clusium and Arretium, its line being closely followed by the modern highroad from Rome to Florence. The date of its construction is, at earliest, 187 B.C., when the consul C. Flaminius constructed a road from Bononia to Arretium (which must have coincided with a portion of the later *Via Cassia*). Cicero speaks of three roads from Rome to Mutina (Modena), the Flaminia, the Aurelia and the Cassia. As milestones show, it was repaired partly by Trajan, partly by Hadrian. One stretch was called the Via Nova Traiana, but it was not a distinct road (*Year's work in Classical Studies*, 1925–26, 121).

CASSIANUS, JOHANNES EREMITA or **JOHANNES MASSILIENSIS** (360–435), a celebrated recluse, and one of the founders of monasticism in the west. His early life was spent in the monastery of Bethlehem and after dwelling for several years among the ascetics of the Nile desert, in 403 he repaired to Constantinople where he was ordained deacon by Chrysostom. Becoming a priest at Rome, he journeyed to Marseille (after 410), where he founded a convent for nuns and the abbey of St. Victor. Cassianus was one of the first Semi-Pelagians, maintaining that while man is by nature sinful, some good remains in him, and that, while the immediate gift of grace is necessary to salvation, conversion may begin by the exercise of man's will. He further asserted that God gives grace to all who seek it, though He sometimes bestows it without its being sought. At the request of Castor, bishop of Apt, he wrote two treatises on the monastic life. The *De Institutione Coenobiorum* describes the daily life, the discipline and the special spiritual dangers of monasticism. The *Collationes Patrum*, a series of dialogues with the pious fathers of Egypt, deal with the avoidance of these dangers. At the desire of Leo (then archdeacon of Rome) he wrote against Nestorius his *De Incarnatione Domini*.

EDITIONS.—Douay (1616) by Alardus Gazäus, with excellent notes; Migne's *Patrol. Lat.* vols xlix. and l.; M Petschenig in the Vienna *Corpus Script. Eccles. Lat.* (2 vols. 1886–88; Eng. trans in the Library of Nicene Fathers, vol. xi.). *See* A. Harnack, *History of Dogma*, v. 240 ff., 253 ff.; A. Hoch, *Die Lehre d. Joh. Cassian von Natur und Gnade* (Freiburg, 1895).

CASSINI, the name of an Italian family of astronomers, four generations of whom succeeded each other in official charge of the observatory at Paris.

GIOVANNI DOMENICO CASSINI (1625–1712) was born at Perinaldo near Niçe on June 8, 1625. Educated by the Jesuits at Genoa, he was nominated in 1650 professor of astronomy in the University of Bologna. In 1671 he became director of the Paris observatory, and became a French subject in 1673. Between 1671–84 he discovered four Saturnian satellites, and in 1675 the division in Saturn's ring (*see* SATURN); made the earliest sustained observations of the zodiacal light, and published, in *Les Éléments de l'astronomie vérifiés* (1684), an account of Jean Richer's (1630–96) geodetical operations in Cayenne Certain oval curves which he proposed to substitute for Kepler's ellipses as the paths of the planets were named after him "Cassinians." He died at the Paris observatory on Sept. 11, 1712.

A partial autobiography left by Giovanni Domenico Cassini was published by his great-grandson, Count Cassini, in his *Mémoires pour servir à l'histoire des sciences* (1810).

JACQUES CASSINI (1677–1756), son of Domenico Cassini, was born at the Paris observatory on Feb. 8, 1677. Having succeeded to his father's position at the observatory in 1712, he measured in 1713 the arc of the meridian from Dunkirk to Perpignan, and published the results in a volume entitled *De la grandeur et de la figure de la terre* (1720) (*see* GEODESY). He wrote besides *Éléments d'astronomie* (1740), and died on April 18, 1756, at Thury, near Clermont. The first tables of the satellites of Saturn were supplied by him in 1716.

CÉSAR FRANÇOIS CASSINI OR CASSINI DE THURY (1714–1784), son of Jacques Cassini, was born at the observatory of Paris on June 17, 1714. He succeeded to his father's official employments, continued the hereditary surveying operations, and began in 1744 the construction of a great topographical map of France. The post of director of the Paris observatory was created for his benefit in 1771, when the establishment ceased to be a dependency of the Academy of Sciences. Cassini de Thury died at Thury on Sept. 4, 1784. His chief works are: *Méridienne de l'observatoire de Paris* (1744), *Description géométrique de la terre* (1775), and *Description géométrique de la France* (1784).

JACQUES DOMINIQUE CASSINI, Count (1748–1845), son of César François Cassini, was born at the observatory of Paris on June 30, 1748. He succeeded in 1784 to the directorate of the observatory; but his plans for its restoration and re-equipment were wrecked in 1793 by the French Revolution. He spent some months in prison in 1794, and then withdrew to Thury, where he died on Oct. 18, 1845. He completed his father's map of France, which was published by the Academy of Sciences in 1793. It served as the basis for the *Atlas National* (1791), showing France in departments. Count Cassini's *Mémoires pour servir à l'histoire de l'observatoire de Paris* (1810) included the autobiography of his great-grandfather, the first Cassini.

See J. F. S. Devic, *Histoire de la vie et des travaux de J. D. Cassini* (1851); J. Delambre, *Histoire de l'astronomie au XVIIIe siècle;* C. Wolf, *Histoire de l'observatoire de Paris* (1902).

CASSIODORUS (not CASSIODORIUS), the name of a Syrian family settled at Scyllacium (Squillace) in Bruttium, where it held an influential position in the 5th century A.D. Its most important member was FLAVIUS MAGNUS AURELIUS CASSIODORUS SENATOR (*c.* 490–*c.* 585), historian, statesman, and monk. "Senator" (not a title) is the name used by himself in his official correspondence. His father attached himself to Theodoric, who appointed him *corrector* (governor) of Bruttium and Lucania, and *praefectus praetorio*. The son at an early age became *consiliarius* (legal assessor) to his father, and (in 507) *quaestor*, his chief duties being to act as the mouthpiece of the ruler and draft his despatches. In 514 he was ordinary consul, and later *corrector* of his native province. At the death of Theodoric (526) he held the office of *magister officiorum* (chief of the civil service). Under Athalaric he was *praefectus praetorio*, a post which he retained till about 540, after the entry of Belisarius into Ravenna, when he retired. He founded two monasteries—Vivarium and Castellum—in his ancestral domains at Squillace (others identify the two monasteries). The special duty which he enjoined upon the inmates was the acquisition of knowledge, both sacred and profane. He also collected and emended valuable mss., which his monks were instructed to copy, and superintended the translation of various Greek works into Latin. As he is stated to have written one of his treatises at the age of 93, he must have lived till after 580. His works are (1) historical and political; (2) theological and grammatical.

1. (*a*) *Variae*, his most important work, published in 537, contains the decrees of Theodoric and his successors Amalasuntha, Theodahad, and Witigis; the regulations of the chief offices of State; the edicts published by Cassiodorus himself when *praefectus praetorio*. It is the best source of our knowledge of the Ostrogothic kingdom in Italy (ed. T. Mommsen in *Monumenta Germaniae Historica: Auctores Antiquissimi*, xii., 1894; condensed English translation by T. Hodgkin, 1886).

(*b*) *Chronica*, written at the request of Theodoric's son-in-law Eutharic, published in 519. It is an inaccurate compilation, unduly partial to the Goths (ed. T. Mommsen in *Mon. Germ. Hist.: Auct. Ant.*, xi. pt. i., 1893).

(*c*) Panegyrics on Gothic kings and queens (fragments ed. L. Traube in *Mon. Germ. Hist.: Auct. Ant.*, xii.).

2. (*a*) *De Anima*, a discussion on the nature of the soul, in which the author deplores the quarrel between Goths and Romans. It seems to have been published with the last part of the *Variae*.

(*b*) *Institutiones divinarum et humanarum litterarum*, an encyclopaedia of literature and the arts for the monks.

(*c*) A commentary on the Psalms and short notes (*complexiones*) on the Pauline epistles, the Acts, and the Apocalypse.

(*d*) *De Orthographia*, a compilation made by the author in his 93rd year from the works of 12 grammarians, ending with his contemporary Priscian (ed. H. Keil, *Grammatici Latini*, vii.).

The Latin translations of the *Antiquities* of Josephus and of the ecclesiastical histories of Theodoret, Sozomen, and Socrates, under the title of *Historia Tripartita* (embracing the years 300–430), were carried out under his supervision.

Of his lost works the most important was the *Historia Gothorum*, which appears to have brought the history down to the death of Theodoric. His chief authority for Gothic history and legend was Ablavius (Ablabius). The work is only known to us in the meagre abridgment of Jordanes (ed. T. Mommsen, 1882).

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CASSIOPEIA, in Greek mythology, the wife of Cepheus and mother of Andromeda; in astronomy, a constellation of the northern hemisphere, easily recognized by the group of five stars forming a slightly irregular W. The most brilliant Nova (temporary star) on record broke out in this constellation in 1572 when it was observed by Tycho Brahe.

CASSIRER, ERNST (1874–1945), German philosopher, was born at Breslau, and educated at the universities of Berlin, Leipzig, Munich, Heidelberg and Marburg. He was (1919–34) a professor at Hamburg. Cassirer's interests were in the history of transcendental philosophy, the theory of scientific knowledge and the formation of concepts. His most important works are *Descartes Kritik der math. u. naturwissenschaftlichen Erkenntnis* (1899); *Leibniz' System* (1902); *Das Erkenntnisproblem in der Phil. u. Wissenschaft der neueren Zeit*, 3 vols. (1906–20); *Kants Leben u. Lehre* (1921); *Zur Einstein'schen Relativitätstheorie* (1921); *Idee u. Gestalt. Goethe, Schiller*, etc. (1921); *Philosophie der symbolischen Formen* (1923); and *Substanzbegriff u. Funktionsbegriff* (1910, Eng. trans. 1923). He died April 13, 1945.

CASSITERIDES, in ancient geography the name of islands regarded as being situated somewhere near the west coasts of Europe (from the Gr. κασσίτερος, tin, *i.e.*, "Tin-islands"). Herodotus (430 B.C.) had dimly heard of them. Later writers, Posidonius, Diodorus, Strabo and others, call them smallish islands off (Strabo says, some way off) the north-west coast of Spain, which contained tin mines, or, as Strabo says, tin and lead mines. A passage in Diodorus derives the name rather from their nearness to the tin districts of north-west Spain. While geographical knowledge of the west was still scanty and the secrets of the tin-trade were successfully guarded, the idea of tin-producing islands easily arose. Later, when the west was better explored, it was found that tin actually came from two regions, north-west Spain and Cornwall. Neither of these could be called "small islands" or described as off the north-west coast of Spain, and so the Cassiterides were not identified with either by the Greek and Roman geographers. Instead, they became a third, ill-understood source of tin, conceived of as distinct from Spain or Britain. Recent archaeological research has enlarged our knowledge of early sources of tin, apparently obtained by "streaming," and islands off the coast of Brittany which have tin-bearing sands have been suggested as the original Cassiterides. It may well be however that the name represents merely early and vague knowledge of the Greeks that tin was found overseas somewhere in or off western Europe.

BIBLIOGRAPHY.—Herodotus iii. 115; Diodorus v. 21, 22, 38; Strabo ii. 5, iii. 2, 5, v. 11; Pliny, *Nat. Hist.*, iv. 119, vii. 197, xxxiv. 156–158, are the chief references in ancient literature. T. R. Holmes, *Ancient Britain* (1907), appendix, identifies the Cassiterides with the British Isles.

CASSITERITE, the mineralogical name of tin-stone, SnO_2, the common ore of tin (from the Gr. κασσίτερος, tin). It crystallizes in the tetragonal system, usually in prisms with four or eight sides, terminated by pyramids. Twinning is common, as shown by re-entrant angles on the crystals, certain slender prismatic crystals are called "sparable tin" and "needle tin" in Cornwall, where the usual name for the ordinary mineral is "black tin." The banded and fibrous mineral of the same composition known as "wood tin" is probably formed by precipitation from the colloidal state. It is common in Cornwall and Bolivia. Cassiterite varies from colourless to dark brown or black, the darker shades being commonest. It has a brilliant adamantine lustre: hardness about 6·5 and density 7. It is also very stable and therefore readily concentrated in residual and alluvial deposits, from which in fact most of the ore is obtained. Primary cassiterite occurs in disseminations, segregations, lodes and veins in and around granites, in association with tourmaline, topaz, lithia-mica, fluorspar, beryl, and other minerals of pneumatolysis (*q.v.*), and is often accompanied by wolframite. It is believed to be formed at a late stage in the cooling of the granite by a reaction between tin-fluoride and water.

Cassiterite is found in all parts of the world.

CASSIUS, the name of a distinguished ancient Roman family, originally patrician. Its most important members are the following:

1. Spurius Cassius, surnamed *Vecellinus* (*Vicellinus*, *Viscellinus*), three times consul, and author of the first agrarian law. In his first consulate (502 B.C.) he defeated the Sabines, in his second (493) he renewed the league with the Latins, and dedicated the temple of Ceres in the Circus; in his third (486) he made a treaty with the conquered Hernici. His agrarian law was clearly intended to benefit the needy plebeians (*see* Agrarian Laws), and was violently opposed both by the patricians and by the wealthy plebeians. Cassius was condemned and executed. According to Livy, his proposal to bestow a share of the land upon the Latins was regarded with great suspicion. According to Mommsen (*Römische Forschungen*, ii), the whole story is an invention of a later age, founded upon the proposals of the Gracchi and M. Livius Drusus, to which period belongs the idea of sharing public land with the Latins.

See Livy ii, 33, 41; Dion Halic. v, 49, viii, 69–80; Cicero, *Pro Balbo*, 23 (53), *De Republica*, ii, 27 (49), 35 (60); Val. Max. v, 8.2.

The following Cassii are all plebeians. It is suggested that the sons of Spurius Cassius either were expelled from, or voluntarily left, the patrician order, in consequence of their father's execution.

2. Gaius Cassius Longinus, consul 73 B.C. With his colleague, Terentius Varro Lucullus, he passed a law (*lex Terentia Cassia*), the object of which was to give authority for the purchase of corn at the public expense, to be retailed at a fixed price at Rome.

See Cicero, *In Verrem*, iii, 70, v, 21; Livy, *Epit.* 96; Appian, *Bell. Civ* iv, 28; Orosius v, 24.

3. Gaius Cassius Longinus, prime mover in the conspiracy against Julius Caesar. In 53 B.C. he served in the Parthian campaign under M. Licinius Crassus, saved the remnants of the army after the defeat at Carrhae, and for two years successfully repelled the enemy. In 49 B.C. he became tribune of the plebs. The outbreak of the civil war saved him from being brought to trial for extortion in Syria. He at first commanded part of Pompey's fleet. After Pharsalus he became reconciled to Caesar, who made him one of his legates. In 44 B.C. he became *praetor peregrinus* with the promise of the Syrian province for the ensuing year; yet he was one of the leading conspirators against Caesar, taking an active part in the actual assassination. In September he left Italy for Syria, where he raised a considerable army, and defeated P. Cornelius Dolabella, to whom the province had been assigned by the senate. On the formation of the triumvirate, Brutus and he, with their combined armies, crossed the Hellespont, marched through Thrace, and encamped near Philippi in Macedonia. Their intention was to starve out the enemy, but they were forced into an engagement. Brutus was successful against Octavian, but Cassius, defeated by M. Antonius (Mark Antony), gave up all for lost, and ordered his freedman to slay him.

See Plutarch, *Brutus*, passim, *Crassus*, 27, 29, *Caesar*, 62, 69; Dio Cassius xl, 28, xlii, 13, xliv, 14, xlvii, 20; Vell. Pat. ii, 46, 56, 58, 69, 70, 87; Cicero, *Philippics*, xi, 13, 14, *ad Att.* v, 21, xiv, 21, *ad Fam.* xi, 3, 15, 16; Appian, *Bell. Civ.* ii, iii, 113, iii, 2, 8, iv, 60–62, 87, 90, iii, 13, 132; Caesar, *Bell. Civ.* iii, 101.

4. Quintus Cassius Longinus, the brother or cousin of the murderer of Caesar, quaestor of Pompey in Further Spain in 54 B.C. In 49, as tribune of the people, he supported the cause of Caesar, by whom he was made governor of Further Spain. His oppression of the provincials led to an unsuccessful insurrection at Corduba. Cassius punished the leaders with merciless severity, and made the lot of the provincials harder than ever. At last some of his troops revolted and proclaimed the quaestor M. Marcellus, governor of the province. The king of Mauretania and the proconsul of Hither Spain, to whom Cassius had applied for assistance, arranged with Marcellus that Cassius should go free with the legions that remained loyal to him. Cassius sent his troops into winter quarters and took ship at Malaca, but was wrecked at the mouth of the Ebro. His tyrannical government of Spain had greatly injured the cause of Caesar.

See Dio Cassius xli, 15, 24, xlii, 15, 16, xliii, 29; Livy, *Epit* III; Appian, B.C. ii, 33, 43; *Bellum Alexandrinum*, 48–64.

5. Gaius Cassius Longinus (1st century A.D.), Roman jurist, consul in 30, proconsul of Asia 40–41, and governor of Syria under Claudius 45–50. He was banished by Nero (65) to Sardinia. He was recalled by Vespasian, and died at an advanced age. Cassius was a pupil of Massurius Sabinus, with whom he founded a legal school, the followers of which were called Cassiani His chief work was the *Libri Iuris Civilis* in ten books, which was used by the compilers of Justinian's *Digest*.

See Tacitus, *Annals*, xvi, 7–9; Suetonius, *Nero*, 37; Dio Cassius lix, 29; Teuffel-Schwabe, *Hist. of Roman Literature*, § 298, 3.

CASSIUS, AVIDIUS (d. A.D. 175), Roman general, a Syrian by birth, lived during the reign of Marcus Aurelius. He distinguished himself during the Parthian War (A.D. 162–165), and was apparently appointed military governor of Asia, though the actual extent of his jurisdiction is doubtful. In 172 he was sent to Egypt, where he put down a rising of the Bucolici, the robber herdsmen of the delta, after which he returned to Syria. In 175 Aurelius fell ill, and his wife Faustina, to secure her position in case of his death, offered her hand and the throne to Cassius. A rumour of Aurelius's death having reached Syria, Cassius proclaimed himself emperor. The senate declared him a public enemy, and Aurelius set out for the east. While in Illyria, he received the news that Cassius had been slain by his own officers

CASSIUS, GAIUS, called Parmensis from his birthplace Parma, was one of the murderers of Julius Caesar, and after his death joined the party of Brutus and his namesake Cassius. In 43 B.C. he was in command of the fleet on the coast of Asia, but after the battle of Philippi he joined Sextus Pompeius in Sicily When Pompeius was defeated at Naulochus by Agrippa and fled to Asia, Cassius went over to Antony, and was present at Actium (31). He afterward fled to Athens, where he was put to death by Octavian (Suetonius, *Augustus*, 4). Cassius is credited with satires, elegies, epigrams and tragedies. Some hexameters with the title *Cassii Orpheus* are by Antonius Thylesius, an Italian of the 17th century. Horace seems to have thought well of Cassius as a poet. (*Epistles*, i. 4.3.). The story in the Horace scholia, that L Varius Rufus took his tragedy *Thyestes* from a manuscript found among the papers of Cassius, is due to a confusion.

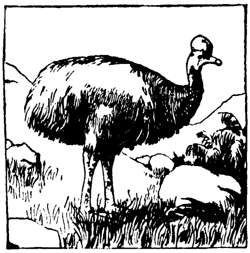
CASSIVELAUNUS or **CASSIVELLAUNUS,** a British chieftain, the ruler of the country north of the Thames, who led Caturellauni against Julius Caesar on his second expedition (54 B.C.) (*see* Britain). After several indecisive engagements, Caesar took the camp of Cassivelaunus, who was obliged to make peace on condition of paying tribute and giving hostages.

CASSOCK, a long-sleeved, close-fitting robe worn by the clergy and others engaged in ecclesiastical functions Originally applied to the dress of soldiers and horsemen and later to the long garment worn in civil life, the name came into ecclesiastical use somewhat late (as a translation of *subtaneum*, *vestis talaris*, *toga talaris*, or *tunica talaris*); and it now survives in this sense alone. The word is derived through the French from Ital *casacca*, "a frock, a horseman's cote, a long cote; also a habitation or dwelling" (Florio, *Q. Anna's New World of Words*, 1611), and this in turn is perhaps derived from *casa*, a house (*cf.* chasuble). A Slav origin has also been suggested, and the Cossack horseman may have given to the West both garment and name. Or it may be derived from *casequin* (Ital. *casecchino*), rather than vice versa, and this in turn from Arabic *kazāyand* (Pers *kashāyand*), a padded jerkin (Lagarde in *Gött. gelehrte Anzeiger*, April 15, 1887, p. 238). The cassock, though part of the canonical costume of the clergy, is not a liturgical vestment. Originally the ordinary dress of lay-people as well as clergy, it has survived only among the latter. In mild weather it was the outer garment; in cold weather it was worn under the tabard or chimere (*q.v.*); the latter name was sometimes given to it as well as to the sleeveless upper robe. In the Roman Catholic church the cassock (*Fr. soutane,* Ital. *sottana*) must be worn by the clergy both in ordinary life (except in protestant countries) and under their vestments in church. It varies in colour with the wearer's rank: white for the pope, red for cardinals, purple for bishops, black for the lesser ranks. In the Church of England the cassock, prescribed in 1604 as the canonical dress of the clergy, has been continuously, though not universally, worn by the clergy since the Reformation. It is now, however, usually only worn in church, at home or within the precincts of the parish.

See the *Report* of the subcommittee of Convocation *on the Ornaments of the Church and its Ministers* (London, 1908), and authorities there cited.

CASSONE, in furniture, the Italian name for a marriage coffer. The ancient and once almost universal European custom of providing a bride with a chest or coffer to contain the household linen, which often formed the major part of her dowry, produced in Italy a special type of chest of monumental size and artistic magnificence. The cassoni of the people, although always large in size, were simple as regards ornament; but those of the nobles and the well-to-do mercantile classes were usually imposing as regards size, and adorned with extreme richness. The cassone was almost invariably much longer than the English chest, and even at a relatively early period it assumed an artistic finish such as was never reached by the chests of northern Europe, except in the case of a few of the royal *corbeilles de mariage* made by such artists as Boulle for members of the house of France. Many of the earlier examples were carved in panels of geometrical tracery, but their characteristic ornament was either *intarsia* or *gesso*, or a mixture of the two. Bold and massive feet, usually shaped as claws, lions or other animals, are also exceedingly characteristic of cassoni, most of which are of massive and sarcophaguslike proportions with moulded lids, while many of them are adorned at their corners with figures sculptured in high relief. The scroll-work inlay is commonly simple and graceful, consisting of floral or geometrical motives, or arabesques. The examples coated with gilded *gesso* or blazoned with paintings are, however, the most magnificent. They were often made of chestnut, and decorated with flowers and foliage in a relief which, low at first, became after the Renaissance very high and sharp. The panels of the painted cassoni frequently bore representations of scriptural and mythological subjects, or incidents derived from the legends of chivalry. The arms of the family for which the chest was made might also be emblazoned upon the front. These chests rarely bear dates or initials, but it is often possible to determine their history from their armorial bearings.

CASSOWARY (*Casuarius*), a genus of ostrichlike birds, inferior in size only to the emu and ostrich, and approximating the extinct moas of New Zealand. Three or four species and many races are recognized. They are confined to New Guinea and nearby islands, only one reaching the northeastern tip of Australia. They are inhabitants of forests, and are characterized by rudimentary wings, bearing four or five barbless shafts, a few inches long, and apparently useless; and by loosely webbed feathers, short on the neck, but of great length on the rump and back, from where they descend over the body, forming a thick hairlike covering. They possess stout limbs, with which they kick, and have the inner toe armed with a long, powerful claw. The common cassowary (*Casuarius casuarius*) stands 5 ft. high, and has a horny, helmetlike protuberance on the crown of its head; the front of the neck is naked, with two brightly-coloured wattles. It is a native of the island of Ceram, where it lives in pairs, feeding on fruits and herbs, and occasionally on small animals; additional races occur over New Guinea, the tiny Aru Islands and north Queensland, Australia. The moorup, or Bennett's cassowary (*Casuarius bennetti*), is a shorter and more robust bird. It differs further in having its head crowned with a horny plate, and has no wattles. It was first discovered in New Britain, but other races are found over New Guinea and on Jobi Island. When captured shortly after being hatched, and reared by hand, it soon becomes tame. The adult bird is exceedingly shy and, owing to its great fleetness and strength, is rarely caught. It eats voraciously, and, like the ostrich, will swallow whatever comes in its way. *C. unappendiculatus*, with local races on New Guinea and on tiny Salawati and Jobi Islands, has a single wattle. The bare skin of head and neck is beautifully coloured in the different species—scarlet, blue, purple or violet. Cassowaries form a distinct order of birds, the Casuariiformes, which also includes the emu (*q.v.*) of Australia. (G. F. Ss.)



COMMON CASSOWARY. A RUNNING BIRD ALLIED TO THE OSTRICH

CAST, a throw, or something thrown (a word of Scandinavian origin, *cf.* Dan. *kaste*, throw), *e.g.*, a throw of dice, with the figurative sense of a chance; the spreading out of hounds in search of a lost scent; with the meaning of a twisted throw or turn, a slight squint in the eye. A "cast" is a measure of fish, being the amount taken in two hands to be thrown into a vessel, and similarly a potter's measure for a certain quantity of clay. It is also a term for the coils of earth thrown up by earthworms, and in fly fishing for the casting line of gut. The phrase "to cast up an account" is probably derived from the old method of calculation by counters which were thus thrown into a heap. The word is also used of a mould for casting metals, or of the copy of an original statue or relief, taken from a mould, and similarly of fossils for the mineral filling of the empty mould left by the organism. The casting of a play is the assignment of particular parts to actors and actresses who are called the cast.

CASTAGNO, ANDREA DEL (1390–1457), Italian painter of the Florentine school, was born in 1390, probably at Castagno, in the district of Mugello, and died in Aug. 1457. He imitated Masaccio and the naturalists of his time in boldness of attitude. The charge that he treacherously assassinated his colleague, Domenico Veneziano, in order to monopolize the then recent secret of oil painting as practised in Flanders by the Van Eycks, has been proved to be untrue. Domenico died four years after Andrea. The latter is commonly called "Andrea (or Andreino) degl' Impiccati" (of the hanged men), in consequence of his being commissioned in 1435 to paint, in the Palazzo del Podestà in Florence, the fallen leaders of the Peruzzi and Albizzi. One of his principal works now extant (most of them have perished) is the equestrian figure of Nicola di Tolentino, in the cathedral of Florence.

CASTALIA or **FONS CASTALIUS,** a celebrated fountain in Greece, now called the Fountain of St. John, which rises in a chasm of Mount Parnassus near Delphi. It was sacred to Apollo and the Muses, and its water was used in the religious purification of pilgrims. From its connection with the Muses it is mentioned by late Greek writers (*e.g.*, Lucian, *Jup. Trag.* 30) and Latin poets (*e.g.*, Ovid, *Am.* i, 15. 36) as a source of inspiration, and this has passed into a commonplace of modern literature.

CASTANETS, instruments of percussion, introduced through the Moors by way of Spain into Europe from the east. Castanets, always used in pairs, one in each hand, consist of two pear- or mussel-shaped bowls of hard wood, hinged together by a cord, the loop being passed over the thumb and first finger. The two halves are struck against each other by the other fingers giving out a series of hollow clicks of indefinite musical pitch. Castanets were used by the ancient Greeks, and also by the Romans to accompany the dances in the Dionysiac and Bacchanalian rites.

CASTE (INDIAN). The term caste is in English hardly older than 1800, before which year it was spelt "cast." Borrowed from the French "caste," itself an adaptation of the Portuguese "casta" (also Spanish) meaning "breed" or "clan," it was used by the earlier Portuguese travellers in the sense of tribe or even race, being often applied to the lowest Indian classes in contradistinction to their overlords. The word is probably derived ultimately from the Latin *castus*, "pure." It has no general equivalent in modern India.

A caste is in India fairly definable as an endogamous group or even as a collection of endogamous groups, bearing a common name, whose members follow traditionally a single occupation or certain cognate occupations, have by fact or fiction a common origin and are generally deemed to form a homogeneous unit, whose constituent parts are more closely allied to one another than to any other section of society. This definition is, however, only applicable to modern India, and even so may be subject to qualifications. In ancient India caste in this sense probably did not exist, but we have no real knowledge of pre-Aryan India, and it is not until we reach the Vedic Arya period (*c.* 1200 B.C.) that any records are as yet available. The social system of these Aryas resembled that of their kindred in Irān. It is fairly certain that the penetration was a long drawn out process, possibly at times peaceful, though in the main effected by tribes or military confederacies under adventurous leaders perhaps of different race, who succeeded from time to time in welding larger forces together, though none founded any lasting dynasty or permanent kingdom.

The invaders, it may be inferred from the earliest hymns of the *Rig-Veda*, were a pastoral folk, loosely organized into groups of related families or clans which, aggregated, formed tribes. Authority over these vested in chieftains and a nobility, the mass of the tribes being designated the "clans" or "peoples" always in the plural—foreshadowing the use of "caste" by Portuguese writers---while priests mostly conducted the public sacrifices of the tribe, leaving family worship entirely in the hands of its head and his consort.

But as yet there was no restriction of even the privilege of tribal sacrifice to a sacerdotal class, since it could be solemnized by a scion of a ruling family and occasionally others disputed the priestly claims. Hence we can at most distinguish three nascent orders, the noble, the priest and the mass of the clansmen; all three excluding the aborigines or Dasyus.

In the latest Vedic literature, the Brahman is represented as the incontestable head of society with the noble next and below him the "clans" or third estate; while the lower classes form the lowest or fourth order in which it would seem are merged the Dasyus, or such of them as survived. This organization was confined to quite a small area of Northern India, Kurukshetra and the adjoining lands, roughly in Moghul days the province of Sirhind. Within it lay Brahmanarta, the peculiarly holy land between the Sarasvati and the Drisbachvati; the Bicharshidisha was quite a small part of the extensive Aryaland, *Aryāvarta.*

After the Vedic period the principal document is the *Laws of Manu*, compiled soon after the Christian era but most probably going back to a much earlier epoch. This specifies the four cardinal *varnas*, "complexions," of Indian society, viz., the Brahmans, Kshatriyas, Vaisyas (the twice born) and the Sūdras, and appears to deny or forbid the existence of a fifth one. To reconcile fact with this classification, however, Manu apparently resorted to a strange device, assigning to the fruit of mixed marriages certain lowly avocations and tribes of impure descent. In so doing he recognized two main principles: (i) that while the ideal spouse for a man is a bride of his own caste (endogamy *q.v.*), marriage to a woman of a caste below his (hypergamy *q.v.*) is *by comparison* a venial offence against the endogamous rule, the chief penalty for it being a diminution of the son's shares in the inheritance; (ii.) that the union of a woman with a man of higher status was, in some circumstances, an unpardonable sin, disinheriting their children and relegating them to a degraded caste. Manu allotted a name to almost all castes in this scheme. In it, for instance, the son of a Kshatriya lady by a Brahman husband seems to be a Brahman but forfeits a fourth of his heritage. But a Brahman's son by a Vaisya wife would be an Ambashthan (mod. Ambattan), an unpretentious barber-surgeon, while his son by a Sudra became a Nishada, normally a fisherman but in the text a Parasava, a living corpse. Since the fisherman's trade must have existed before Manu, he is regarded as defining the status of *pratiloma* sons in terms of existing occupational groups. Similarly he defines a Vaisya's son by a Kshatriya wife as a Magadha, or man of Magadha, *i.e.*, S. Behar, while his son by a Brahman wife is to be a Vaideha, or man of Videha, otherwise Mithila, mod. Tirhut in Behar. For the Abhira, a generic name for tribes of the north-west, he finds a status as sons of a Brahman by an Ambashtha's daughter, and so for the Sairandhras, apparently the people of Sirhind in the E. Punjab, a much lowlier origin, nearly, if not as degraded as that of an Andhra, a man of Telingana which lay far to the south.

But while disparaging tribes of non-Aryan or not purely Aryan blood as mixed castes, Manu also branded a number of quite cleanly avocations, such as carpentry, as disreputable. The post-Vedic caste system had some merits. The Brahman was the priest and scholar who was to teach the other castes, and if he awarded himself great privileges including benefit of clergy for criminous clerks, he had renounced by a self-denying ordinance all pretensions to temporal authority. The function of the Kshatriya was defence of the realm, and if to it was added all administrative power under the king, himself a Kshatriya, that power was to be exercised under Brahman counsels, even the king's conscience being kept in a manner by Brahman advisers. The Vaisyas were the graziers, yeomen and burgesses of the community, while the Sūdras were to serve all the other castes. To which of the four Manu assigned the mixed castes is not clear but few of them can have ranked above the Sūdras, though he recognized the principle that the children of an *anuloma* union could by marrying in the paternal caste regain their father's status in six generations. For the fruit of *pratiloma* unions there was no hope of promotion in the social scale. In all Manu recognizes more than a score of mixed castes as already existing, and it is self-evident that two new mixed castes could on his principles be formed by old ones if sufficiently remote in status. If, in the event, mixed castes were not multiplied Manu had paved the way for the creation of new castes on an extended scale by creating degrees of legitimacy based on disparities of status, by bastardizing the issue of *pratiloma* unions, and recognizing function as a factor in caste-formation. From the midland the influence of his laws spread all over India, and in the south acquired new vigour by being grafted on Dravidian institutions. After Manu's time the history of caste in India enters on a period of obscurity except in the north-east, where we get light from the Buddhist writings. This part of India had rejected the Brahmanism of the midland. Thus in Buddha's time and after it we find in N E. India a social stratification which is astonishingly western and almost modern in essentials. The Kshatriya forms the highest class, and Buddha himself claimed Kshatriya birth, being a scion of the princely Sakyas of Kapilavatthu, Kapilavastu in the Buddhist Madhyadesa or "Midland" which lay to the east of the Aryan midland. But a legend tells us that Buddha in a previous incarnation had in his mind debated whether he should be reborn as a Kshatriya or a Brahman, and he decided to be re-incarnated as a Kshatriya as the then higher of the two. We find the term Kshatriya of Magadha and its adjacent principalities applied to the ruling classes in general and thus corresponding to the Vedic title of Rajanya. The Kshatriya was a warrior, a civil functionary and a teacher. His education was fully equal to that of a Brahman and youths of princely families trudged on foot from the north-east to distant Taxila, in the north-west, then the great university where all sciences were imparted to princes and Brahmans by famous teachers—one of them a former incarnation of Buddha himself. Thus equipped, the Kshatriya held his own against the Brahman's pretensions and even acted as his instructor. The Kshatriya had played a similar part in the profound teachings of the *Upanishad*, wherein he had been the Brahman's teacher, and was again to assume that rôle, after the lapse of centuries in the remote Punjab, as the founder of Sikhism. The Buddhists, carrying on keen propaganda in their witty Birth Stories *(the Jatakas)*, invented a dialogue between Buddha and Ambattha, a Brahman with a surely plebeian name, in which the latter admits that a Kshatriya's son by a Brahman wife would be recognized as a full Brahman by his caste fellows but not by the Kshatriyas, among whom purity of blood, nay more, purity of Kshatriya descent, was of cardinal importance.

The Brahmans occupied in the Buddhist society of the north-east a curiously anomalous position. They were in fact or in Buddhist theory divided into two groups, the true Brahman and the worldling. The Brahman who adopted the life and practices of a homeless ascetic, who sought no worldly wealth and attained to the ideals of his own scriptures was reverenced, whereas he who prided himself on birth, erudition in the Vedas and sacrifices performed, was contemned. But the Brahmans regarded themselves as almost a caste in the modern sense. Birth, not calling, was the prime condition of its membership. A Brahman might change his vocation and pursue the lowest without loss of "caste," which could, however, be forfeited by a *mésalliance* or by eating defiled food. Yet we read of nothing like an organization of the "caste." It had as yet no head and no council. Exclusion from it was apparently enforced solely by general sentiment—which was, indeed, strong enough to drive a Brahman, who when starving had devoured a Chandāla's leavings, to suicide.

In the Buddhist writings, however, the Brahman's distinctive calling was his function as officiant in sacrificial rites, in exorcism and the interpretation of dreams and omens. Buddhism condemned animal sacrifices, and when a king, terrified by a fancied portent, orders a fourfold sacrifice of that type completed with its four human victims, a Birth Story explains away the evil omen and discomfits the Brahmans, whereupon the king destroys the place of sacrifice. Yet we find all classes from the king downwards invoking a Brahman's aid when menaced by evil signs or in domestic events. The Brahmans as a body played an influential part in social life; they were well educated and many acquired wealth, often owning villages, bestowed on them by grateful kings as fees for their ministrations. Above all was the Brahman of the northwest held in respect.

In Buddhist times we find no Vaisya caste in the Vedic sense. Originally in the oldest Vedic days a term applied to the Aryan settlers engaged in cattle raising and cultivation, the Vaisya was made to fit into the Brahmanical scheme of caste, but comprised in fact an almost indefinite number of social groups. The principal of these included the householders, *grihapati*, the lower landed gentry and the wealthier and more prominent burgesses of the cities. In this class the foremost rank was taken by the Masters of the Guilds, the *sreshtins*, mod. *seth*, whose wealth and office brought them into close touch with the court, where they represented the commercial interests of the kingdom and often wielded great influence as personal friends of a king, while their sons were playmates of his sons and sharing in their education. The *sreshtin*, indeed, often appears as a country gentleman having doubtless made money and purchased an estate. But his wealth was based on commerce, and we find him financing businesses, *e.g.*, a tailor's and a spirit-seller's, without any apparent loss of repute. Yet the *sreshtins* as a group are careful to marry their sons in their own class and their office was hereditary.

Neither the *sreshtin* nor the *grihapati* formed a caste in any real sense. Almost a synonym for the latter term is *kutumbika*. They too formed a class of capitalists lending money to rural clients and carrying on such trades as grain dealing. They were found both in the towns and in the villages whence their daughters were sought in wedlock by leading townsmen of presumably their own class.

Of Sūdras in Buddhist literature we read little but the name. That the "caste" exists is tacitly assumed. Buddha did not seek to abolish classes. He stressed their spiritual equality, their ability to attain *nirvāna*, "emancipation," by righteous conduct. In his teaching even the outcasts, the Chandāla and the Pukkusa, could be virtuous and self-controlled since none among those who had won peace of soul was higher or lower than his fellows. But what avocations were included in the term Sūdra does not appear, an indication that it was quite vaguely used in practice of all the lower orders, excluding those which stood below the social scheme.

The depressed classes were undoubtedly remnants of the conquered races of Eastern India, speaking their own dialect or dialects, and relegated to hamlets outside the villages, and confined to uncleanly functions. To them generally the term Chandāla was applied until it became a term of abuse. Yet lower than the Chandāla ranked the Pulkasa or Pukkusa, trappers who lived by snaring animals which dwelt in holes. The hunter was also degraded probably because he destroyed life, but he did not constitute a class and could, seemingly, rise in social esteem by taking up the higher pursuits. On the other hand the Nishāda, fisher as well as hunter, could not. He, too, dwelt apart, but in a hamlet of his own, not with the Chandāla and Pulkasa. The origin of the name is unknown but they are assuredly not occupational terms.

In N. E. India the Buddhist times held certain crafts in disrepute. The basket maker and wheel-wright, the weaver, tanner, potter and barber were all despised. The Vena who wove articles of willow and cane ranked on a level with the builder of carts, and the joiner, whose abode was outside the town by the gates, graded between the Chandāla and the Pulkusa, or at least no higher than those "out-castes," though one imagines that even if the basket-making Vena was a gipsy he was less impure than an aboriginal out-caste, even though his mode of life set him below the carpenter to whose craft a needy Brahman could occasionally resort. All these groups bore occupational names and the Buddhist writers speak of the *sippas* or "arts" without disparagement (the word is applied to all the 18 "sciences" taught at Taxila), while seeming to draw some distinction between the *jāti* or tribes of the aborigines and those who were so designated.

In a very similar scheme, to the carpenter (*Ayogava*) Manu assigns a semi-servile status, emphasizing his duty to serve the twice-born castes, his inability to own property (at least when in a Brahman's service) and his obligation to serve.

The king's service was then as now a highly important numerous body. The royal ministers formed a class apart, being neither Brahmans nor Kshatriyas, but holding heritable offices. At their head stood the *senapati*, in war commander-in-chief, in peace the chief judiciary. His relations with the other ministers of justice and magistrates are vaguely defined; but the principal of them could on occasion intervene to rectify a decision wrongly given by the king in person. The judicial council as a body could be asked to give legal advice. These functionaries might be Brahmans by birth but are quite clearly distinguished as a class apart, having precedence over the Brahmans as well as the other classes. A salaried cadre of officials, surveyors, tax-collectors, treasurers, executioners and watchmen is also mentioned. But for all these officers we find no general term. Each seems to have formed a separate hereditary body, in which the king could appoint or dismiss at will, without regard to birth or standing.

Finally, outside the pale of class, were the homeless ascetics, those who had chosen an anchoret's life and had by so doing abandoned all worldly ties. They were recruited from all classes, from the king down to the barber, even to the Chandāla and the Pukkusa.

The Kings and Caste.—In the Vedic period we find few traces of the royal power regulating "caste." The king was doubtless the fountain of honour but he hardly seems to have directly interfered with caste.

In more modern times, the king found ways to influence caste a good deal. Various legends declare that a Rājā was often compelled to create new Brahmans—to increase the number which sacerdotal etiquette demanded should be fed at some great occasion—by issuing invitations to recognized and unrecognized Brahmans alike and thus elevating the latter to Brahmanhood in the lower degrees. But as a rule these new creations were either of suspected descent or of status lowered by function, or, less frequently, tribal priests of local indigenous deities.

Contrariwise a ruler could on occasion lower a caste, if we are to credit legends like that of Rājā Ballāl Sen of Eastern Bengal who deprived the Suvarnababikas, "traders in gold," once acknowledged to be Vaisyas of high standing, of the right to wear the sacred thread, and with them degraded their Brahmans too. Occasionally a king would enfranchise a servile caste which had rendered him good service in the field, or restore privileges formerly confiscated. The chief privilege bestowed was the right to wear the sacred thread.

That the king exercised considerable authority over caste affairs is, however, beyond question. The caste assembly or council, or the guild, judged offences against its rules, but it might be unable to enforce its decrees, whereupon the king could either execute its decisions or reverse them. The Brahman could pre-scribe penances for such breaches or for religious offences but he had to hand the offender over to the secular arm to secure their enforcement. On the whole the king interfered little with caste constitution. His policy was to uphold the existing social order. Any attempt to interfere with caste equilibrium might have dissolved the whole system with results not to be foreseen.

The social organization of Buddha's time displays a keen consciousness of class and position, pride in birth and strong prejudice against the lowest orders as impure. On the other hand we find no line of demarcation between the victorious invaders and their conquered subjects. Occupation is the dominant factor in fixing a man's standing or at least a conventional fashion of defining it. Marriage is limited to one's own class but of the hard and fast demarcation between the castes of modern times in regard to food and touch we find but the faintest symptoms. Above all we fail to discern many premonitions of the individual man's inability to win social promotion. Education was free to any respectable class, and even the depressed classes could attain spiritual prominence. The Brahmans held a position of influence but not of authority. In the spiritual field they met with a counterpoise in the ascetics. In the temporal they had successful rivals in the Kshatriya and the royal officials. While the king's chief minister, his guide in secular and religious matters, should be a Brahman he was by no means invariably of that class. The only royal office which the Brahmans held as of right was that of the king's domestic priest, but if a weak king fell wholly under his influence a ruler with a will of his own kept his *purohita*, his chaplain, in his place. Brahmans who had already taken to worldly pursuits could, naturally, exercise them in the royal service.

Of the transition from the older system to the new but few facts emerge. A noteworthy incident in the process of change is the disappearance of the Kshatriya caste. A myth informs us that Parasurama, an incarnation of Vishni, literally axed them repeatedly. What historical event is concealed in the myth it is impossible to say, but the fact remains that of this, the most important lay caste of ancient Hinduism, hardly a trace remains to-day. The Kshatriyas never founded a great landed class as far as we know. Though Indra was a divine Kshatriya and the welfare of the Brahmans was regarded as dependent on their maintaining good relations with the Kshatriyas, their social extermination was complete and the only caste which preserves their name is the Khatris, a trading caste localized in upper India.

THE MODERN CASTE SYSTEM

It follows from the definition of caste that the homogeneity of a unit and its consciousness of a closer alliance between its members than exists between it and other units, finds expression in definite social rules or even in outward and visible signs. The exclusiveness of caste, then, has led to prohibitions on intermarriage between castes or eating, drinking and smoking with members of castes other than one's own and even to differences in attire. It may be asked how such restrictions and precepts could be enforced. The reply is to be found in the mentality of the people. In India individuality is weak. Indian society admits of no compromise. Its principles are pushed to their extremest conclusions. In such matters as food and drink, material considerations have accentuated and to some extent justified this attitude.

The Indian is by instinct cleanly. He has invented many effective devices to protect himself from personal defilement. If many of his precautions have become ceremonial rather than hygienic he has nevertheless modified them in practice on commonsense lines. Thus a caste will sometimes refuse to inhale smoke from the *huqa* mouth piece of a lower caste, but it makes a funnel of the hand and substitutes it for the infected tube. It will decline to drink from the drinking cup but will take water poured into the hands from the waterskin which has not come into actual contact with the unclean lip. It will not eat soft food from a common dish but it will accept dry biscuit which is obviously less easily contaminated.

But where matrimony is concerned the feeling that the caste must be absolutely isolated is stronger, and it has strengthened by lapse of time. The Kshatriyas admitted, at least in theory, a maiden to choose her husband in the *swayamvara*, a festive ceremony at which her suitors were assembled and the one who found favour in her eyes was garlanded by her own hand. No doubt this freedom of choice was often replaced by the bride's capture or a contest in wit or warlike skill in which the prize was her hand. But whatever forms the usage took it has fallen into complete abeyance, its last traditional observance being ascribed to Prithiraj of Delhi, late in the 12th century A.D.

Modern usage denies to a girl any say in the choice of a husband by the simple device of betrothing her at a very early age, sometimes, indeed, before birth to a "suitable" bridegroom, who must be selected not merely within the caste but in certain groups inside it. The ancient hypergamous rule which allowed a woman to be married to a man of a higher class has also been modified so that she is now only eligible to wed in a higher group within the caste. On the other hand the Hindus and their offshoots have maintained the old exogamous principles which prevent in-breeding, though in south India cross-cousin marriage is largely practised. Hence Hindu society is endogamous restricting marriage to a group, while it is more rigidly exogamous in that it disallows it within the blood kin. It is only hypergamous to a limited degree. Complex as caste has become, its guiding principles are simple and are only departed from occasionally. It has resulted in the creation of some 3,000 or 4,000 social units, many of which are, however, not altogether homogeneous, so that these figures do not represent all its ramifications. It has accentuated the weakness of Indian individuality. The system of caste has made it virtually impossible for an individual citizen to raise himself in the social scale; but it has made it fairly easy for groups to do so. Its burden, however, lies heaviest on the women. It has made premature marriage a necessity. It has led to an embargo on the remarriage of widows, even virgin widows, because the strictest monogamy being the ideal of the highest castes, the lower have been forced to adopt it as a token of social advance. It has often so narrowed the field of selection that brides command a high and increasing price, and marriages are arranged without regard to the future wife's welfare or that of her offspring but to gratify parental greed. Even after death the individual is all but forgotten. Passing by an Indian hamlet the traveller can readily tell if it is Mohammedan or Hindu. In the former there will be a cemetery, however rude. In the latter the only graves will be those of the very young who died of small-pox and the memorials of holy men who died to the world on entering some religious order. The village fanes contain no tablets to the ashes of the dead. Cremation consigns human personality to oblivion. So faint is the memory of it that the next brother of a soldier killed in action will step into his place, take his wife and name, his regimental number and his land with hardly a formality. And if the widow display any tendency to revolt and a preference for another man, even for a near kinsman of the dead husband, all the influence of the caste will be employed to bring her to acceptance of the age-long custom.

The Brahman.—To the definition of caste given above the Brahmans certainly do not conform. In a very limited unreal sense the Brahman stands at the head of modern Hindu society owing to his congenital sanctity. But he does not form a horizontal stratum overlying it. He forms a stratified cone which penetrates it vertically from top to bottom. Divided into great territorial groups, 5 in the north, and 5 in the south, the former are the Gauda, the latter the Dravida.

Northern Groups.—Gaur, from Gauda in Oudh, Kanaujia, Central Doab, Saraswata, on the upper Jamna-Maithila, from Tirhut, Utkala in Orissa.

Southern Groups.—Mahārāshtri, Deccan, Karnāta, Mysore, Andhra, Telingāna, Dravida, Tamil, Gurjara of the The northern groups do not all hold a position of unchallenged superiority over those of the south. The Brahmans of Mahārāshtra, the modern Mahratha country, do not form an organized body and mostly follow such professions as medicine, law, teaching and government service. Even those who are priests are not always well versed in the vedas, and the later Hindu scriptures. Yet the prominent subgroup, the Chitpāwan, "pure-hearted," caste of the

Konkan, which leads Mahratha society, used to feel polluted by the food of a Saraswata Brahman because the latter ate fish, a diet forbidden to the former. They despise the Brahmans of Guzerat, the Gurjara, as water carriers and those of Telingana as cooks, and those of all other parts of India as unable to pronounce Sanskrit correctly.

Of the territorial Brahman groups it is impossible to say which really holds the leading place. The traditional centres are still occupied by the Gaur, the Kanaujia and the Saraswata, yet their supremacy is not acknowledged by the other groups. The Kanaujia and the Gaur are probably the purest in blood, but the former exhibit the acme of subdivision combined with or based on ceremonial exclusiveness. The least divided are those of the Dekkan. Hence it has been justly said that the Brahmans form "the most *heterogeneous collection of minute and independent subdivisions* that ever bore a common designation." Never organized into a tribe on a territorial basis the Brahman was, from the beginning, parasitic upon other "classes" of the communities which conferred their patronage upon him in return for his varied services. As in Vedic times the Brahman followed the fortunes of his chief, so later a village sending forth a segment of its tribal owners to found a new hamlet would send with it a detachment of its hereditary village servants including Brahmans of the section attached to the tribe; and to every group within a caste is conjoined a specific group of Brahmans whose precedence is fixed by its patrons' standing in the caste. Hence if a group lost ground socially its Brahmans also lost ground, though they had the option of declining to serve it if it dropped out of caste altogether. This new disintegrating force is ever at work. Lastly, just as function fixed or lowered or raised the positions of castes and subcastes, so it altered the status of Brahmans within their own caste. Good samples of such will be found in Bengal where the Agradani Brahmans who conduct funeral rites and accept the offerings of the dead, and the Achārji, fortune-teller, palmist and maker of horoscopes and the Bhat, a rapacious genealogist and bard living largely on blackmail, are degraded by function to a level nearly as low as the Pīrāli whose ancestors were forced some 400 years ago to eat or at least smell beef cooked for a Brahman converted to Islam when he became chief minister to a Mohammedan ruler of Jessore. Degradation may indeed go further for it ranks the Vyasokta so low that even his patrons the Chasa-Kaibartta, fishermen and cultivators, refuse to touch food in his house.

But the Brahman may abandon all Brahmanical functions altogether and take to a secular calling as a lawyer, school-master, engineer or less willingly as a physician. Land-owning is, however, of as good repute in Brahman eyes, and when grants of land were made by grateful rulers or nobles for secular service or spiritual benefits to a Brahman his descendants would often set up as plain country gentlemen farming their estates through serfs of aboriginal or lowly origin. Such Brahman squires are the Nambutiri of the Malabār coast, the Haiga or Havika in Kanara, and the Māsthān of Orissa and Guzerāt, and scattered representatives of this class exist everywhere. If, however, the estate was of poor soil or became too minutely sub-divided among its heirs the Brahman had perforce to turn farmer himself, like the Bābhan or Bhūīnhār of Bengal, the Taga of the Punjab.

Further, when economic pressure is severe, the Brahman may descend to agricultural labour, domestic cook or any vocation not involving actual defilement, without loss of caste. Military service is equally open to him, a notable example being the Nuhiāl of the Punjab, a group which has entirely given up sacerdotal functions for soldierly careers; while the Panre subdivision of the Kanaujias of the United Provinces prior to the Mutiny of 1857 enlisted freely and with their title anglicized as Pandy acquired a terrible notoriety.

Yet it is as hard for a Brahman as it is for a Mohammedan Saiyid to divest himself of his personal sanctity by turning his hand to any reputable employment. He will lessen or lose it far more readily by other means, by ministering to an unclean caste, or by eating the sins of a dead Raja and taking upon himself the pollutions they have caused. To the latter the term Achāraj has come to be applied though it originally meant only a spiritual guide or teacher, and he is also styled Mahā-Brahman or "great Brahman," doubtless to avoid the ill effects of calling him by his real and less auspicious title. The Mahā-Brahmans are endogamous, having been excommunicated by all the other Brahmans because they accepted alms made within 13 days of a death. But his functions touch even a lower depth. Occasionally he used to take food from the hand of a corpse on the funeral pyre, but this usage is dying out, and he is now paid merely to eat as much as he can in the belief that the more he consumes the better it will fare with the soul of the dead. Even lower is his own sin-eater, the Par-Achāraj who accepts from the Achāraj those gifts which the latter takes from the Hindus. But sometimes the Achāraj makes these gifts to Saniāsis who being dead to the world are seemingly beyond the reach of defilement; or they are made to his daughter or son-in-law with what consequences is not known. Naturally the touch of an Achāraj pollutes, since he never visits a house save at or after a death which has defiled it.

But the Brahmans who have taken to crime as a profession are merely degraded, not unclean. Such are the Tāgūs on the upper Jamna. They form a criminal tribe, yet seclude their women, wear the sacred thread, plead "benefit of clergy" on conviction and make vows for success in crime to a Muslim saint. They fell because their forefather married a widow of his own caste. Well above them stand the Tāga in the same locality. Gaur Brahmans by origin, they abandoned sacerdotal functions and took to farming, but they are bad farmers, strictly secluding their women and wearing the sacred thread. A notable tradition says they received a big grant of real estate in lieu of offerings, so other Brahmans refused to marry with them or even to take bread from their hands. They have in fact to employ Brahmans for their own sacerdotal business. Yet their social standing is high and the holy Jamna has spared Tāga hamlets when changing her course, while floods have swept away those of other castes.

The Modern Khatris.—Scattered over N. India the Khatri caste derives its name from the Kshatriyas, but holds a very different place in Hindu society, being the leading commercial caste. In religion it is mostly Hindu, but the founders of Sikhism belonged to it and many of its members are Sikhs (*q.v.*). In its modern organization the caste presents features unknown to the Kshatriyas and of obscure origin. It is graded in three main groups, the Bāri or "12," the Bunjāhis or "52" (suggesting some solar basis) and the Sarīn, possibly guildsmen. Not one of these groups is absolutely endogamous, but they tend to become so. Each group comprises in theory certain specified exogamous clans which strive to form yet further subgroups, by refusing to give daughters to clans of lower status, and even families rise and fall as they evolve scruples in this respect. The Sarīn group is not permitted even to smoke with the two higher. No less than 500 clans are named but even folk-etymology has failed to explain many of them; *e.g.*, the Khokharain sub-group of the "52"s claims descent from a son of Manu, but it is possibly named from the Khokhar Rājputs, and several clan-names are traced to military terms in support of the claim to Kshatriya descent. Probably the caste had a Kshatriya nucleus and its lowest group, the Sarīn, was affiliated to it when it took to trade. But the above do not exhaust the Khatri sub-groups.

Territorial groups cross-divide the status groups, so that a Lahoria or Sirhindia Khatri will not bestow his daughter on a man of the eastern group; some of the Sarīn clans have risen high in status because they gave *gurūs* or pontiffs to Sikhism, and these tend to coalesce into a subgroup, intermarrying one with another, or even splitting a clan into two exogamous septs, so as to make it possible to find equal mates for daughters. As a caste the Khatris are singularly heterogeneous in usage, many clans have special social rites at weddings and the like; and several septs possess inherited powers of curing disease, affect particular Sikh saints or even Muslim usages.

The Khatri organization has been adopted more or less imperfectly by other castes. Thus the Brahmans who are clients of Khatri clans for ceremonial purposes are graded *inter se* on the Khatri scheme and their *purohits* are invariably Saraswati Brahmans. Thus, when Parasurāma axe'd the Kshatriyas, a pregnant widow of the exterminated caste found a refuge with a Saraswati and gave birth to a boy who espoused 18 Kshatriya wives whose male offspring refounded the caste, assuming the names of as many Hindu saints. Hence the Khatri *gotras* are identical with those of the Brahmans, though they are seemingly ignored in practice.

Aroras.—Similarly the Arora, a trading caste which traces its origin to Sindh, is in part organized on the Khatri model and claims a like origin; but its clan names are frequently totemistic and in its ranks Sikhism only counts a substantial minority of Sikhs.

Bhātias.—The Bhātias, yet another trading caste which has overspread the Punjab from the south-east displays still further traces of Khatri influence, but it is stricter in its Hinduism, eschews widow remarriage and claims Rajput origin. Though it has no territorial groups the caste tradition is that while brides may be taken from the east, the western clans should avoid the converse concession. The Bhātias comprise 84 septs, 12 at the top and a group of "52"s below, with a mixed clan styled *Gond*, "defiled," sprung from widows remarried or Arora mothers. Naturally the latter are only served by Pushkar Brahmans.

Banias.—The great trading caste of the Banias or Mahājan, "great folk," spread all over N.W. India and Rājpūtāna, is obviously organized on a scheme of its own. It is split into three territorial groups, of which the principal are the Aggarwāl from Western, and the Oswāl (who became Jains) from Eastern Rājpūtāna. But the offspring of Aggarwāls by handmaidens form a kind of "half-score" subcaste whose clans are named after their mothers' clans. The pure Aggarwāls only number 17 clans, descended from as many snake maidens, but to these must be added the Gond, a half clan, due to an unwitting breach of the exogamous law, and another due to a marriage with a low-caste wife, with which last other Banias will not smoke. Finally a subcaste said to be quite distinct, descends from tanners who took to trade. Small wonder then that the Banias in the mass are admitted to be of pure Vaisya descent, eschew widow remarriage, wear the sacred thread and refuse food and drink at the hands of the yeomen who despise them. Sectarian differences have also cross-divided the Banias, since while Vaishnava and Jain families intermarry the Shaiva or Maheshri stand, or are kept, aloof. Yet the disruption is not absolute, for the Jains have made converts from groups other than the Oswāl and these with the Oswāl seem to have assumed in the Punjab the ancient title of Bhābra, now applied to any Bania from Rājpūtāna whether Jain or not. Jain Bhābras profess strict monogamy. All these trading castes of N. India contain enterprising elements, Khatris and Aroras being found in the Pathān borderland, Afghānistān and even in Turkistān. One Khatri clan, the Merwāhā, claims its origin from Merv. As an owner of land acquired by moneylending, he is a progressive landlord, but the Arora when allowed a chance runs him close. On the Punjab borderland the latter has been for centuries treated as a denizen of the Ghetto, forbidden to wear a turban, and only allowed to bestride an ass, to carry on petty trade and lend money. Never permitted to employ his capital in developing commerce or improving agriculture, he has invested it in usury of the harshest type and is equally hated and despised, dubbed a Kirār till that term has come to imply all that is mean and cowardly.

Kayasth.—In the plains of Hindustan and Bengal the Kayasth may be called the Khatri's substitute. The term simply means accountant or scrivener and in old days the Kayastha kept up court records, collected taxes and administered finance. These functions brought him into collision with the Brahmans as in Kashmīr. The present stronghold of the Kayasth caste is in Lower Bengal where tradition plausibly describes it as an importation of the 9th century into that country; but it was not organized until the 11th when Ballāl Sen forbade the immigrants to intermarry with their indigenous caste-fellows. But he apparently failed to do more than stabilize existing usage which permitted the former to take brides from the latter. However this may be, the Kayasth either imitated the Brahmans' Kulinism or, quite conceivably, founded that system which the Brahmans adopted. Whether the Kayasths were originally all Kshatriyas or comprise elements affiliated from lower classes akin to them by occupation, it is impossible to decide; but they are minutely subdivided

Caste and Occupation.—In different groups the smiths will be known by different names, but as yet mere community of vocation would not make a smith's daughter of Madras marriageable to a Punjabi smith's son. Indeed the smiths of much smaller territories than a Province would not tolerate equal alliances outside their own territorial subgroups. At best the smiths of a territory esteeming itself superior to those of another might accept daughters from an inferior territory. But the smiths were, it would seem, recruited from many sources. Some were, or asserted a claim to be, originally of a high caste like the Rājpūt, or respectable middle-class yeomen. The recollection of superior origin would die hard and the clan name would be carefully retained, so that the families so descended would only marry with families of equal descent—or at best accept brides from those not more than a degree lower. Again there are grades of occupational repute among smiths. Some may gain rank by pursuing a higher calling, as armourers. Economic pressure may turn others into nomad smiths or tinkers. The former will assume a new trade name, almost a surname, describing their skilled handicraft and the white-smiths will now intermarry still preserving their old clan exogamy. Popular speech will dub the nomads tinkers or even gipsies and they will have perforce to accept it, but they will be glad to give daughters to settled smiths, people who still form an integral factor in the village community and may even hold land of it as a retaining tenure for keeping up the village smithy. Other smiths may get engineering qualifications or build up big businesses but that will not raise them, at least not at all speedily. But to the outside world they will drop the caste name of smith, and use the one they have ready to hand; *i.e.*, their old clan name which may denote descent from a historic stock. In two or three generations they may succeed in obtaining at a price brides from impoverished families of a similar stock, thus taking the first step towards the recognition of their long-lost and not convincingly authenticated status. But such social progress is tedious as well as costly and may halt halfway, the new subgroup finding it easier to intermarry with its equals until it becomes strictly endogamous and forms a sub-caste. Yet again a number of similar families may be converted to a new sect recognized as Hindu but stressing certain Hindu doctrines on social usages which mark it off from the rest of the caste. It, too, will tend to intermarry but may continue to accept brides from the unregenerate members of the caste. Political parties when they become stabilized may some lay produce still further cross-divisions among the smiths. Meanwhile the smiths show little inclination to become Smiths by surname and probably the future history of Indian surnames will not disclose the full extent to which the craft is followed in India Still less likely is it that it will ever see hyphenated Smiths, since subcastes with social ambitions will discard any surnames reflecting their traditional calling, and metronymics have rarely found favour in India.

The present tendency is to retain or revive the old clan names which makes it quite easy to avoid breaches of the exogamous principles, or adopt titles of offices held, even if they were Mohammedan assumed under the Moghul overlords.

Bhois.—A caste of some size (about 60,000 in number) is that of the Bhois in Bombay. The term is also used to denote a litter-bearer and some Mahars style themselves Bhois. In some parts of Khandesh the Bhois are confused with Kahars, an immigrant caste of fishermen from northern India. Elsewhere they are known as Maharia and are very often called Koli on account of similarity of occupation. In the Deccan they differ little from the Mahratha Kunbis in looks, dwellings, etc., and indeed in Nasik they called themselves Kunbis and some of that caste eat with them. One authority says that they sprang from a Brahman father and a Parasar mother, and terms them Paushfikas. Yet they have dark complexions and amongst them totemism survives, chiefly among the Khandesh Bhois, whose totems are leaves of trees. The Bhois are divided broadly into five groups, each again subdivided into endogamous sections. Many of these are again subdivided but are able to eat together though they cannot intermarry. The exogamous sections are numerous but are merely surnames, many of which are found also among the Mahrathas. Fairly strict Hindus, they yet have the custom of burying the dead, especially the unmarried.

Modes of Life.—An Indian's mode of life varies with his caste and occupation, and the climate of the part to which he belongs. His vocation and his ceremonies may be said to fill his life, and they are of equal importance. The cultivator has to work on the land in due season, but his hours of leisure are taken up by the countless rites which accompany birth, marriage and death, and by fairs and festivals, so that he does not feel the want of much else to instruct or amuse him. A birth, especially a boy's birth, is the occasion for observances which occupy his family for years, and by family here is meant his sept rather than his parents and their closer kindred. A marriage is a quasi-public event and so is a funeral. Hence to abolish or reduce ceremonial would deprive the people in the mass of their employment, for there is as yet little or nothing to replace it. The sequence begins at pregnancy, which is solemnized by a series of observances often obscure in origin, but intended to result in a safe confinement, to revere ancestors, to ensure a lucky life for the child, and so on. They are continued at birth, twins being occasionally unpropitious, and certain sequences, as *e.g.*, a birth of one sex after three of the other being peculiarly so, and requiring special observances to avert their effects. An eighth child is most ill-omened to its parents. Other untoward births affect other near relatives. At birth astrology is called in to determine the child's future, and often it is sought to decide its future calling, a choice already largely made for it by its caste.

Its head may in places be moulded, but otherwise little is done for it physically. Naming is an important rite and so is the first tonsure which may mean a journey to some distant place for certain septs. These and other minor rites lead up to the investiture with the sacred thread for boys of the twice-born castes, a rite of initiation wherein they become pilgrims, at least potentially.

Marriage absorbs more rites and usages than all the rest put together. Betrothal begins with numerous minor rites, even when it is itself a binding ceremony, sometimes known as "little wedding," the *shādi* or a similar expression, the popular term for wedding meaning literally "rejoicing," but older terms are still in use. The wedding is the occasion for usages to ensure its fertility, for games to decide which of the parties is to be the dominant partner and for luck in the new household. Important rôles are assigned to women, and men whose spouses are still alive, to the best man, to the mother's brother and others. The death of a bride-to-be or a newly-wedded wife is peculiarly inauspicious. Many usages are probably survivals of obsolescent customs. At a Hindu wedding, the binding rite is often the seven-fold circumambulation of the sacred fire, as fire, like the other elements, is a witness. In many forms of marriage rite, the wedded pair are treated as a god and goddess, or are crowned like them. There are also degrees of marriage varying among different castes, and equally degrees of legitimacy, relics of ancient usages. In strict practice a bride must be a virgin, can only be ritually married once and should be given by her father without price to the bridegroom. But, as a fact, brides are usually bought or exchanged, unless the hypergamous rules compel the purchase of the groom. Widows are remarried, if custom permits, by observances which are civil rather than religious or merely by co-habitation with the dead man's next of kin. In places her children by the first husband are brought into the new one's family, but this usage is rare and the right of the widow's son to succeed as his heir is now usually contested. It is not unusual for the bride to be formally admitted into her husband's sept. Consummation is sometimes deferred, the bride remaining in her parents' house for one, three, five or even 11 years and then being brought to her new home by a rite known as *mukhlawa* ("disclosing the face"), *gauna* and so on. But this usage is by no means universal and the Legislature has fixed a more advanced age for the legal consummation of marriage. But the difficulties of dealing with such a matter by statute are immense. The community of a married pair is emphasized in the Central Provinces, where they perform the business of their caste or an imitation of it.

Death ritual is not quite as intricate or as costly. Cremation is far and away more prevalent with Hindus than burial, but some castes bury the dead, and infants are almost always buried, though they may be exposed. The lower grades of Brahmans play a fairly extensive part in death rites, taking most of the alms offered by the dying man or his heirs. The popular theory is that as the funeral rites can only be validly performed by a man's next heir, he who fulfils them will inherit and, despite innumerable decisions to the contrary, the idea dies hard. In Bengal the Hindu law of inheritance follows the sacerdotal law which regulates the sacrificial efficiency of the heirs, each in his degree.

Post death rites for the dead continue for months or even years, and their non-observance may cause harm not merely to the dead but to the living. The spirit of a sonless man is particularly liable to be malignant. Hindus believe in Put, "Hell," which is reconciled to the doctrine of metempsychosis, making it a temporary place of abode like Svarga, "Heaven." After the term therein decreed to the soul by Yama, it will be reborn, the form of its rebirth depending on its *karma* (*q.v.*), or the accumulated energy of past actions which is not wholly removed by its sojourn in Heaven or Hell. Funeral feasts, usually eaten at the grave and immediately after the funeral, are common among low castes in the Central Provinces and are probably non-Aryan in origin though also practised by Bishnois.

Seasonal Rites.—The life of a pastoral tribe is often nomadic. To find pasture, flocks and herds are taken to the hills or to lands beside the rivers in the hot season, and there is no respite for the herdsmen. Their festivals have to be held on such dates as fit in with their movements. For the cultivator things are easier, yet, even in his case, the great festivals are all held at times when manual work is slack. Thus the Holi falls in early spring when the crops are ripening and the Dasehra (*q.v.*) in autumn when the work is again slackening. Among Mohammedans the festivals and fasts, being determined by the lunar year, fall at times in the midst of the busy season and, therefore, seriously affect agricultural efficiency.

Economic Effects.—In a country where agriculture more or less supports over 72% of the population, the caste prejudices and habits of the mass of the workers prevent their taking up other occupations to utilize their spare time. A man may have insufficient land to support his family but if he is of good caste he cannot take to weaving or work for hire because that would lower his social status. This difficulty is enhanced by the laws as to tenant-right which have subdivided holdings until they are minute in area. This fact compels the tenant of a fighting caste in the Punjab and Hindustan to seek employment in the army, but in Bengal he is shut out from such a vocation. Nor does he seek work on the tea estates of Assam or the indigo plantations of Bihar. Only in the coal-fields of Bengal do the Rājpūts and even Brahmans find employment as skilled coal cutters. In southern India the conditions are apparently much the same. Obviously the lowest castes have a great advantage over the middle, even the lower middle, ones in their capacity for migration. Similar is the case of jute-spinning and weaving, the most important manufacture in Bengal. Only a fourth of the skilled workers in this industry are natives of that province. A province like Bengal where the population is already dense absorbs about 1,200,000 souls from other parts of India. The root cause of the Bengal cultivators' poverty has been attributed to his not having enough work to fill in his time. In spite of the extension of canal-irrigation in the Punjab the same remark applies to the lowest castes of that province.

Caste Government.—Caste government may have been imposed from without and not be of spontaneous growth. In N Arcot (southern India) the eighteen right-hand castes, which include few landed elements, used to obey the Desāis, intendants of a *desh* or circuit-area, who are Chettis (Sethi) of the great Telugu trading caste, the Balija, and some humbler castes still submit to them. Entitled the "protector of wealth," Dhanapála, the Chetti deals with moral delinquencies (in both sexes), his badge of office being a brass cup-shaped spoon round which a carved figure represents each caste. The post is saleable and is worth thousands of rupees, but it is kept in the Balija caste.

The Urīya, "of Orīssa," carpenter caste has an official hierarchy in its *mahārāna,* "great prince," *dondopāto mahārāna,* his criminal deputy, *swangso mahārāna,* and others, as the *agopothiria,* whose function it is to eat with a man re-admitted to caste. Here, again, for grave cases, representatives of five castes, equal or superior to the carpenters' own, are called in to sit with the caste officers and act as assessors. The Gaudo of the Urīyas in Ganjam does not call in outside assessors, but it, too, has a series of officials, including the *desia* who re-admits to caste.

Marriage and Remarriage.—The age for marriage is largely a matter of social status as well as of caste. Generally it is lowest among the high castes, but even in their case may be almost adult because their girls are more secluded, it may be difficult to arrange betrothals, or the evils of premature unions may be recognized. On the other hand, among the Cherumans, agricultural serfs in Cochin, a girl not married before puberty is regarded as polluted, as a woman "whose age is known," and out-casted. In the old days she was handed over to a headman who could marry her to his own son or sell her into slavery. The prejudice in favour of infant marriage is strongest in Lower Bengal, where a religious compulsion for it has been discovered by the Brahmans in the scripture which consigns to hell the father who lets his daughter attain puberty unwed. But the scripture may have sought a religious explanation of an aboriginal prejudice.

Over the problems of its origin and effects and reform, controversy has raged for over a century without much result. Marriage, indeed, does not necessarily imply co-habitation, which may not take place till one or any odd number of years up to 11 after the wedding, so that often the earlier the latter ceremony the later the actual marriage. It is not, however, likely that the usage will spread much. Too many factors militate against reform. A horde of parasites, the go-between, the bards, priests, artisans, prostitutes, almost every caste gets perquisites at betrothals, weddings, funerals, and the social rites therewith connected. The dullness of village life and the inconceivable *ennui* of the secluded *zenana,* among the classes which regard the emancipation of women with horror, are only brightened by the excitements which attend domestic events. When a bridegroom has to be paid for, he probably costs less if his bride is a child. When a bride has to be bought her price is high and going higher. The father of sons must buy quickly if he would secure daughters-in-law. The peasant youth who finds himself unwed at 20 may have to resort to the thoroughly disreputable matrimonial agents who abduct girls from localities where females are in excess, harbour discontented young wives or buy up low caste damsels, disposing of them at excellent prices to purchasers who are careful not to enquire too closely into antecedents. A single scandal in a family of good standing will undo years of reform propaganda; and nothing but a revolution in female education will alter things.

Closely interwoven with the problem of premature marriage is that of widow remarriage. Like *sati* the dislike to it as a social stigma is based on idealism. But the ideal is the enemy of the real.

In southern India, a group of the Mārāns, temple servants, stand higher than other sections of that caste because they forbid a widow to remarry, but permit her to take a Brahman or higher caste paramour. They are in consequence known as Orunul, "one-string." So great is the dislike among the Jāts of upper India to her remarriage even with the husband's younger brother, that they generally avoid espousing the widow, so that she remains tenant-for-life of the dead husband's land, and is kept in concubinage. If, however, she takes advantage of her position to elope with another, she is claimed by her husband's nearest kinsman on the plea that she was informally wed to him. Generally the sacrament of marriage being only once possible for a woman, her remarriage is a purely social rite unsanctified by priestly recognition. Nevertheless the general dislike of widow remarriage and the stigmas attached to it make the acquisition of a child-bride a social necessity, cost what it may. Several of the terms for "widow" connote ill-repute or ill-luck. But when the prejudice has once been overborne the widow remarried may rank higher than the ritual wife. Thus, in the eyes of the Gavara, a respectable cultivating caste in Madras, a woman who has had seven husbands is much respected: in the Himalayas, a widow's son provided he be born in her husband's house, is regarded as the husband's son even if obviously he is not: and a Jāt will conceive it a duty to put away his wife in order to fulfil the higher obligation to marry a brother's widow.

Divorce.—As a general rule, among the higher Hindu castes no divorce is recognized, but where it is recognized it is not dependent on judicial decree but on the husband's will, and no countervailing privilege is accorded to the wife. Yet, in fact, all castes would recognize the expulsion from caste and consequent annulment of a marriage in case of a wife's misconduct or misfortune such as violation. Where divorce is permissible it becomes capricious and often degenerates into sale, but as a rule caste opinion is strong enough to prevent grave abuses and marriage is remarkably permanent. Even among the humbler castes a man who had put away a wife without grave cause would find it difficult to find a new one. Dissolution of a marriage by mutual consent is usual only among inferior castes or backward tribes and is then effected by a simple rite such as the breaking of a stick, the cutting of a melon in two or the like. Even the caste council's intervention is superfluous.

Polygamy.—As an institution polygamy is the exception. It is almost the privilege of wealth, irrespective of caste and often discountenanced by important sects. Its principal justification is sonlessness in the wife. Very generally the wife first wedded holds a favoured position and the co-wife may suffer various disabilities but much depends on her relative social status, on understandings arrived at when the first bride is acquired and so on. A bride or her parents may stipulate that she shall not be given a rival, but in its zeal to void agreements in restraint of matrimony, the Indian Legislature has also invalidated covenants in restraint of polygyny, so such stipulations have been judicially declared of no avail. Polygyny is sometimes advocated by childless wives anxious to see the birth of an heir and ready, if not eager, to adopt him. A curious rule of inheritance may arise in families where all the wives have sons, the inheritance being by top-knots, each wife's sons getting an equal share collectively, irrespective of their number.

Adoption.—The intense desire for a son to inherit and to solemnize his father's funeral rites necessary to the welfare of his soul, has led to adoption in various forms in the regions under Brahmanical influences; and to various species of substituted sons. Manu's laws, which probably drew largely on primitive ideas of paternity, allow that in default of a real son, the wife's son born secretly, her son previously born or begotten, the son of a remarried wife, and a foundling or a son purchased, should inherit in his place. Yet, the principle of legitimation, *per subsequens matrimonium,* is not expressly enunciated and its rare occurrence is confined to tribes little influenced by Brahmanism. Manu accepted the *niyoga* rule whereby a sonless man could appoint his wife or widow to bear him an heir, just as he could designate a daughter to that end. The man chosen, however, must be a near agnate kinsman of the husband and one son only could be begotten by him. The Arya Samāj (*q.v.*) has inculcated a great extension of this practice, removing all Manu's restrictions. In one passage Manu condemns not *niyoga* but the levirate (*q.v.*) whereby the husband's kinsmen could impose the duty of raising an heir to him without appointment, and seems to say that if a son is born under the levirate the deceased husband's property must be absolutely surrendered to him. To the son by *niyoga,* Manu assigns the term *Kshetraja,* "field"-son, in allusion to the question discussed by him and still much debated, whether a crop grown from seed sown on an alien field belongs to the sower or the owner of the land. He decides that the latter owns it, in the absence of a contract to the contrary, although the seed is more important than the soil, but clearly other jurists differed from him. Sociologically the results of Manu's rules have been evil. Their principles have come down into modern custom in countless forms, their complexities have been fostered by advocacy resulting in costly and protracted litigation, culminating in universal debt. The demand for credit being insatiable has had to be met by the capitalist castes, and in the absence of opportunity for financing industry, Indian capital has followed the line of least resistance, lending at customary rates which it is folly to regard as usurious. An inveterate tendency to procrastinate and evade repayment of a loan has rendered security nugatory. The distinction between an assured debt and one totally unsecured is unknown to the borrower, carefully ignored by the lender and disregarded in legislation, so that a man of substance pays almost as dearly for accommodation as a man of straw. Land hunger is not confined to the cultivating classes. It is keenly felt among all. In more than one province the Legislature has been compelled to protect the peasantry *en masse* from economic serfdom and expropriation of its age-long tenures, just as it has had to check the abuses of landlordism and create fixity of tenant-right. The usurer has realized the utmost in kind, and for the still huge balance has been able to extort personal service extending even to *jus primae noctis* and creating an unrest which has found a vent in such jacqueries as occurred in the Punjab in 1914–15. The usage of *niyoga* has been attributed to customs of group marriage (*q.v.*) or to polyandry (*q.v.*), which in India is not common save among primitive groups or in tracts where women and land are scarce, as in the Himalayas, it is a precaution against fragmentation of holdings and is almost invariably fraternal. Elsewhere when custom bids a widow espouse her husband's brother or his agnatic cousin, suspicion of polyandrous practices may be justified, a theory supported by the popular view that adultery within the caste is much more venial than infidelity outside it. Among the Nairs of Madras, polyandry in the strict sense does not prevail. The rule is that a woman can have but one lawful spouse. To a man more is allowed. Among the Madu in Madras he may be polygamous in one village and polyandrous in another.

Matriarchate.—The matriarchate can hardly be traced in India, but in the south polyandrous practices make it inevitable that descent should sometimes be traced by the female line and a man's heir is then his uterine sister's son. Women, however, rarely manage property even when it vests in them and the duty is entrusted to the eldest male of the family. The Bants of S. Kanara furnish a conspicuous instance to the contrary, doubtless because the men were a feudal body like the Nairs incessantly engaged in war, and still great sportsmen, though excluded from the army. Disdain for cultivation may indeed degenerate into sheer idleness, all fieldwork being left to the women while the men knit as a pastime. Yet the purchase of wives as workers is rare.

Ritual and Caste.—A fruitful source of caste formation and ramification, especially in the south, is the complexity of ritual. Each grade of priest tends to form a separate subcaste, and every ministrant in a fane belongs to a caste-group. The bent of the barber for music in Malabār has led to his employment as a temple bandsman which function has raised him to semi-sacerdotal status with Ambalavāsi, "temple-resident," rank The latter may trace descent in the male or female line, are divided into a number of functional castes each actively fissiparous, and employed in many rites outside the temples, leading to further disintegration. The question whether they are Brahmans degraded by function or Sūdras elevated by it is insoluble.

Criminal Tribes.—Like any other calling in India, crime tends to become hereditary and as sanctified by custom, almost respectable. This tendency has been strengthened in two ways, the protection of the criminal by territorial magnates and the patronage of a goddess. The notorious Thugs furnish the classic instance in Bhawāni, the goddess who received homage from the fraternity. Similarly in Madras the Donga-Dāsuri take omens for thieving excursions from their goddesses and also from Hanumān.

Templewomen.—A feature of South Indian religion is the dedication of women of many castes to a temple where they live immoral lives. Thus, when a Bedar family has no sons or a girl child falls ill, a vow is made that she or the next girl baby shall become a Basawi and she is branded if vowed to a male deity and styled "male Basawis": if vowed to a goddess girls are known as female Basawis. The son of a Basawi is, however, affiliated to her father's family; but a daughter also becomes a Basawi In some places a Basawi lives in her parents' house and is hand-fasted to a man, the sole object in this case being to prevent extinction of the family. The Devadāsis, a god's handmaidens, are less reputable and are divided into right and left hand, the former only consorting with men of the former faction while the latter only draw the line at the lowest castes. It is hard to say how these usages arose. Possibly not earlier than the 9th century A.D., the temples seem to have taken over an older state-controlled institution. Basawi is the name also given to a cow dedicated to Shiva, but Devadāsis also serve in Vishnu's temples. The latter are divided into seven classes including the Vikrita who sells herself, the Bhritya who wishes to enrich her family, and the Bhakta who joins a temple out of devotion, but the Gopika or Rudraganika are simply hired by it. Both Gopika and Bhakta suggest a connection with Krishna. Traces occur in Northern India of girls of low caste being wedded to a god, and in Southern India both Basawis and Devadāsis are so united to the idol by wedding rites. They are often highly accomplished, learning to read and write as well as sing and dance. Their attainments have in fact given female education a distinct tinge of disrepute. Poor law relief exists in India in embryo. The practice of handing over deformed infants to religious mendicants is widespread. Thus in Madras infirm children are claimed by the Mudavāndi or "lame" Andis, a special sect of professional beggars of the Shaiva persuasion who are subsidised by the Vellālas, a land-holding class, for this service. The children are well-treated and adopted into the Andi families. Generally a deformed child is supposed to be handed over to a god in fulfilment of a vow for male issue, but quite possibly the vow is an apologetic fiction. Microcephalous infants are thus "vowed" to a so-called Muslim saint in the Punjab and are styled "Shāh Daula's rats." They are exhibited by peripatetic beggars, but not maltreated. Owing to the intensity of family and caste solidarity the aged and unfortunate are almost universally given maintenance or found work. In famines, of course, much hardship is endured, especially by secluded women of high castes who cannot "break their *purdah*," *i.e.*, emerge from privacy to find work. Some castes, like the Nuttukottai Chattis, are as noted for charity as for acquisitiveness, and alms-giving is an atonement for every sin including covetousness. That it is indiscriminate and ill-directed is undeniable, religious mendicancy having made begging reputable.

An odour of sanctity attaches to all forms of feeble-mindedness, and cruelty to the insane is rare though demoniacal possession may be deemed curable by flogging.

Slavery.—It is only of quite recent years that slavery in India has ceased, and marked traces of it can still be found from the Afghān borderland to the extreme south. It often originated in debt, a freeman selling himself for an advance of money or to pay off a debt, but praedial serfs like the Cheruman of Malabār and the Holeya of Mysore are races enslaved by conquest. Among the latter, local capitalism devised a system of hand-fasting female serfs to serfs lest marriage in a better caste should lead to emancipation Yet the serf often enjoyed strange privileges. Thus in South Travancore for some time after harvest a Pulaiyar who succeeds in casting a stone at a high-caste woman after sunset, unless escorted by a male over three years old, caused her excommunication and could compel her to accompany him. In 1695 a royal edict abrogated this usage under pain of death. Less extreme privileges of Saturnalia are common.

Feudalism.—The chronic warfare of India has played its part in the formation of castes. To defend their frontiers the kings of the great realm of Vijāyanagar employed Mutrāchas, now a caste, with the title of Palaiyukkaram, now Paligar, holder of a *palaiyan* or feudal estate (no connection with modern Greek *palleka*). A Telugu caste following various callings from agriculture down to palanquin-bearers, the Mutrāchas are largely watchmen, but some having been petty chiefs claim Kshatriya status. They have a special tutelary goddess but little or no marriage, forming unions often permanent with women of their own caste. Another caste of Pāligars is the Maravar and they stoutly defended Tinnevelly against the British up to the beginning of the 19th century. They claim descent from the boatman who ferried Rāma over to Ceylon, and the Rājā of Rāmnād, their head, has the title of Satupati, or "lord of the bridge," but inscriptions indicate that the title originated about A.D. 1400 though coins may antedate it by a couple of centuries. The Maravars are now mainly cultivating sub-tenants, but contain a large criminal element which till recently virtually ousted the police at Tinnevelly as detectives, acquiring considerable popularity.

Another feudal caste is the Bedar Kanarese-speaking and the Telugu-speaking Boyas who once formed a homogeneous caste, but many of their septs bear names which indicate that once it was a fusion of many elements. Both Bedar and Boya are now cross-divided into Uru or villagers and Myāsa or grass-land men each subdivided into buffalo-men, men of the herd, of the flower and fish-men, with each its own god. Caste government is to a great extent carried on by priests, a Vaishnava Brahman or officiants at shrines of Hanumān and other gods. But they have also such groups as Nāyaka and Pallagar and as infantry were recruited not only by the Pāligars but by Haidar Ali himself who had raised himself from the rank of *nāyaka* in the Mysore service largely by their aid. At one time they seem to have been forced or converted into partial acceptance of Islam, since some of them eat beef, but not pork, and circumcise boys. Yet they are still Hindus, worshipping both Shiva and Vishnu, with many other gods, and observing Hindu rites. The Pāligars proved so lawless that they had to be dispossessed.

In the Central Provinces the castes formed by military service seem to be mainly derived from non-Aryan tribes. With the Mahrāthas the Khandaits received grants of land as a reward for, or a condition of, such service, and rank somewhat above the cultivating castes. The Rautias of Chota Nagpur formed mainly from Kol tribes are in much the same position, while the Paiks, "footmen," and Taonlas, not having received such grants, rank below those castes. The Bangi Dhangars, "spear-shepherds," or Hatkars, enlisted in Marātha armies and still rank slightly higher than other shepherds (Dhangars).

THE MODERN LOW CASTES

In the Punjab Himalayas the Hinduism is of a primitive type and presumably caste is so likewise. Here we find the Dāgi, also commonly called Koli, and in the higher mountainous regions Betus, while those who have taken to any specific trade are styled *barhai,* carpenter, *dhogri,* iron-smelters, *pumba,* woolcomber, and *barara,* basket maker, etc., and these names stick to families long after they have abandoned these crafts. These families do not form castes. Probably Chamārs and Lohārs are merely Dāgis who once took to such trades as the tanner's and smith's, though in some parts a Dāgi will not eat with the former or marry with the latter, even though he will eat the flesh of bears and monkeys and all, except the Lohār, that of cattle which have died a natural death. The term Dāgi seems to be derived from *dāg*, a blemish, and a Dāgi is always below the Kanet and the Ghirth, the yeoman or cultivating castes of these hills. But *inter se* his status has varied and is varying. It depends for example on religious influences as round about the temple of Nirmand the Kolis will only marry with a family of Koli tanners who still style themselves Dāgis also but refrain from touching dead cattle.

Kolis.—But the Kolis are still more numerous than the Dāgis. The term Koli indeed is used in three distinct senses. The old Rājās of Kulu were known as Koli Rājās, and it appears to be in fact a territorial name; secondly it denotes the Dāgi just described, and, in Chamba, the Sippi. Thirdly it is used of Chamārs in the south-east plains of the Punjab who have taken to weaving. Of the term Koli several explanations are given. It is supposed to be derived from *kulin,* "degraded from a family," *i.e.*, of Sūdra status and so on; just as the Dāgi is said to be a degraded offshoot of the Kolis. In one part of the hills sumptuary rules restrain the Kolis and Dāgis from wearing gold and using certain instruments of music; in the lower hills both castes may use them, though Chamārs may not, and a Dāgi who makes shoes becomes a Chamār. Further the Kolis are divided into two classes, the true (*sacha*) Kolis from whose hands water may be taken by higher castes; and the rest. Another tale divides the Kanets from the Dagoli and Thākur, the latter descended from a Kanet who killed a bullock in a passion, and were degraded a degree further because they eat and drink with Muslims. Further local subdivisions exist, distinguished one from another by local customs. At some time or other the Kolis probably obtained caste promotion which took the form of sumptuary privileges granted by the local Rājās or chieftains for services rendered.

Batwāls.—Westward, in and near Chamba State, the position of the Dāgis is held by the Batwāls who in the Kāngra hills form a true caste. The term is said to mean "tax collector," and everyone so employed is thus styled, but a true Batwāl is probably a Barwāla, a maker of winnowing fans and mats, who was enlisted as a soldier and in the lower hills the latter term is applied to a man of any low caste employed as a watchman or messenger, another name for him being *satwāg*, "bearer of burdens," or *kirauk* "convener of men for forced labour." But as soon as we reach the plains we find the occupational Barwālas forming a caste though each section of them has its own temple, merely a mound of earth at which sacrifice is offered in the eldest son's honour. Although both the castes are Hindus they do not employ Brahmans but Meghs at weddings. The Batwāl tradition is that they are descended from a Rājā's daughter who went astray and was married by a Chuhra, the lowest caste, and that the name is really Betwāl, "son of a daughter," but in Chamba they claim descent from a deified ascetic.

Meghs.—The Meghs are numerous in Siālkot and ramify all along the borders of Jammu (Kashmir) into the submontane. Among them caste feeling is strong and attempts have been made to raise the standing of the fraternity by avoiding the use of dead animals and so on. Employing Brahmans of a low degree the Meghs also have prayer-sayers of their own and being by occupation largely weavers affect the cult of Kabīr; indeed further to the westward *megh* seems to be a synonym for Julāha, "weaver"; but they have also a priest of their own and his decision is final in social as well as on religious points and he has local agents. There are also two superior sections which hold aloof from the mass of the caste. It is impossible to say whether the Barwālas and Meghs are by origin occupational. Probably they are so, but their position all along this borderland from the inner high ranges down into the plains at their feet, suggests that they are *débris* of suppressed races or fragments of ancient states which have preserved something of their primitive pride.

Central Provinces.—In the Central Provinces we have a more developed system of caste among the lower strata. Occupation is the real basis of the divisions and social precedence of the castes down to the lowest. Thus the Udia Ghasias are not merely grass-cutters, but cure raw hides and do scavengers' work and are looked down on by other Ghasias. The Pardhis or "sportsmen" are divided into Shikaris who use firearms; Phansas, who use snares; Chitewalas, who tame leopards; and Gayakas who employ bullocks to stalk game. The sub-caste of Dhimars, "fishermen," are Singaria who grow waternuts, Tankiwala who sharpen grindstones, Jhingar or prawn catchers, Bansia or Saraia, "anglers," and others. Nowhere is difference of occupation more active, yet other factors also operate. The Gohardhua Chamārs wash out the undigested grain from the droppings of cattle to eat, and the Chungia group of the Satnāmi Chamārs to whom smoking is prohibited, use the chongi or leaf pipe; the Nāgle, or naked, Khonds wear only a negligible amount of clothes and the Makaria Kamārs eat monkeys: and all are despised. The taint of illicit birth is also a frequent cause of a new, more or less temporary, group within the caste. But as a rule a new subcaste subsists and among the Kumhārs the hand-using potters are still separate from those who use the wheel, though hand-made pottery is now unknown. Lastly we find groups adopted into other, even lower, castes, such as the Kor-Chamārs, Koris, "weavers," received into the Chamārs, "tanners"; Khatri Chhīpas, Khatris admitted into the dyers and printers; and similar groups in the Dāngris and tailors, probably owing a similar origin. We do not, however, find caste so much in process of formation as already formed; though the Satnāmi Chamārs of one district are now endogamous, the Kabīr-panthis only tend to be so.

The Naiyadis, or hunters, of Malabar are the dog-eaters and the lowest of the Hindu castes. Miserable specimens of humanity, they used to be excellent shots, but the Arms Act deprived them of their weapons and they now work at rope-making, slings, mats and so on, with occasional cultivation. Yet they have succession in the male line and adultery is abhorrent to them. Some have been converted to Christianity and others to Islam, the latter maintain themselves by begging from Mohammedans. Their chief priest, Muppon, is hereditary. He enquires into all matters affecting the community and can excommunicate a guilty person.

In the Central Provinces the subdivision of labour is well exemplified. Objection is taken to the growing of hemp and so Kurmis who descend to it form the Santora (from *san,* "hemp") subcaste, and so on. The Indian madder-dye (*āl*) is likewise offensive on account of its blood-like product, so we have Alia subcastes of the Kāchhis, who grow vegetables, and of the Bānias. Similarly Barais grow the betel-vine, and various groups of the *Mālis,* "gardeners," specialize in flowers, cumin and turmeric. The arts of weaving also divide castes. Thread is spun by a special caste, the Katias. Cotton is cleaned by the Mohammedan Bahnas, and coarse cloth is woven by groups of the low castes, such as the Mahārs, Gāndas and Koris; while the finer kinds are again the work of separate castes, the Patwas embroidering in silk and braid; Tāntis; Koshtis, the latter having a separate sub-caste of Salewars, "silk-weavers." Metal workers and even bangle-makers are divided on identical lines.

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CASTELAR Y RIPOLL, EMILIO (1832–1899), Spanish statesman, was born at Cadiz, on Sept. 8, 1832. He received the doctorate in philosophy and letters at Madrid in 1853, and from the time of the Spanish revolutionary movement of 1854 became active in politics, radical journalism, literary and historical pursuits. After his defeat in the first rising of June 1866, he fled to France to escape death, returning after the successful revolution of 1868 and entering the *cortes* as deputy for Saragossa. At the same time he resumed the professorship of history at Madrid. His demand for a federal republic in the constituent *cortes* of 1869 was realized on the abdication of Amadeus, but it lasted only from Feb. 11, 1873, to Jan. 3, 1874. Disorder was so rife that the president of the executive, Figueras, deserted his post. The doctrinaires, Pi y Margall and Salmeron, in successive attempts to govern, received no support from influential Spaniards. Finally at the beginning of September the federal *cortes* made Castelar chief of the executive and virtual ruler of Spain. He at once reorganized the army and sent forces to cope with the 60,000 Carlists in arms, and the cantonal insurrectionists around Alcoy and Cartagena (those of Cordoba, Seville, Cadiz, and Malaga had been already quelled under Salmeron).

Castelar next turned his attention to the Church. He put a stop to persecutions of the Church and religious orders and enforced respect of Church property. He attempted to restore order in the administration of finance, with a view to covering the expense of the three civil wars, Carlist, cantonal, and Cuban. The Cuban insurgents gave him much trouble, the famous *Virginius* incident nearly leading to a rupture with the United States. Castelar sent out reinforcements to Cuba and a new governor-general, Jovellar, whom he instructed to crush the mutinous spirit of the Cuban militia. At the end of 1873 Castelar had reason to be satisfied with the military operations in the peninsula, with the assistance he was getting from the middle classes and even from the non-republican elements. On the other hand, the extreme republicans openly dissented from his conservative and conciliatory policy. Hence when the federal *cortes* resumed its sittings (Jan. 2, 1874), it passed a vote of censure on Castelar. He resigned, and on the following day Pavia, the captain-general of Madrid, forcibly ejected the deputies, closed and dissolved the *cortes*, and called upon Marshal Serrano to form a provisional government.

A *pronunciamiento* put an end to Serrano's government in Dec., 1874, when Generals Campos at Sagunto, Jovellar at Valencia, Primo de Rivera at Madrid, and Laserna at Logroño, proclaimed Alphonso XII. king of Spain. Castelar then went into voluntary exile for 15 months, at the end of which he was elected deputy for Barcelona. He sat in all subsequent parliaments. During that period he became more estranged from the majority of the republicans, because he elected to seek the realization of the programme of the Spanish revolution of 1868 by evolution, and legal, pacific means. Hence the contrast between his attitude from 1876 to 1886, during the reign of Alphonso XII., when he stood in the front rank of the Opposition to defend the reforms of that revolution against Canovas, and his attitude from 1886 to 1891 when he acted as a sort of independent auxiliary of Sagasta and of the Liberal party. Besides the unfinished history of Europe in the 19th century he left:—*La civilisación en los cinco primeros siglos del cristianismo* (1875); *Vida de Byron* (1873); *Cartas sobre política europea* (1875); and other works. Castelar died near Murcia, on May 25, 1899.

See D. Hannay, *Life of Castelar* (1896); Butler Clarke, *Modern Spain* (1906); *Correspondencia de Emilio Castelar 1868–98* (1908); E. Varagnac, *Emilio Castelar, un grand Espagnol* (1920).

CASTELFRANCO DELL' EMILIA, a town of Emilia, Italy, in the province of Modena, 16 mi. northwest by rail from the town of Bologna. Pop. (1936) 4,980 (town), 19,360 (commune). The churches contain some pictures by later Bolognese artists. Just outside the town is a massive fort erected by Urban VIII in 1628, on the frontier of the province of Bologna, now used as a prison. Castelfranco either occupies or lies near the site of the ancient Forum Gallorum, a place on the Via Aemilia between Mutina and Bononia, where in 43 B.C. Octavian and Hirtius defeated Mark Antony.

CASTELFRANCO VENETO, a town and episcopal see of Venetia, Italy, in the province of Treviso, 16 mi. W. by rail from the town of Treviso. Pop. (1936) 4,670 (town), 17,349 (commune). The older part of the town is square, surrounded by mediaeval walls and towers constructed by the people of Treviso in 1199 (*see* Cittadella). The painter Giorgio Barbarelli (Il Giorgione, 1477–1512) was born there. The cathedral contains his Madonna with SS. Francis and Liberalis (1504), one of his finest works, in the background of which it is possible to see the town walls.

CASTELL, EDMUND (1606–1685), English orientalist, born at Tadlow, Cambridgeshire, entered Emmanuel college, Cambridge, but removed to St. John's, where he compiled his *Lexicon Heptaglotton Hebraicum, Chaldaicum, Syriacum, Samaritanum, Aethiopicum, Arabicum, et Persicum* (1669), on which he spent 18 years, working (if we may accept his own statement) from 16 to 18 hours a day, and employing 14 assistants. He was in prison in 1667 because he was unable to discharge his brother's debts, for which he had made himself liable. His own fortune had been spent on the *Lexicon*. A volume of poems dedicated to the king brought him preferment. He was made prebendary of Canterbury and professor of Arabic at Cambridge. His mss. he bequeathed to the University of Cambridge. He died in 1685 at Higham Gobion, Bedfordshire, where he was rector.

The Syriac section of the *Lexicon* was issued separately at Göttingen in 1788 by J. D. Michaelis. Trier published the Hebrew section in 1790–92.

CASTELLAMMARE DI STABIA, a seaport and episcopal see of Campania, Italy, in the province of Naples, 17m. S.E. by rail from the town of Naples. Pop. (1936) town, 36,469; commune, 46,469. It lies in the south-east angle of the bay of Naples, at the beginning of the peninsula of Sorrento, and owing to the sea and mineral water baths (12 different springs) and its attractive situation, with a splendid view of Vesuvius and fine woods on the hills behind, it is a favourite resort of Neapolitans in summer. The ruined castle from which it takes its name, on the hill to the south of the town, was built by the emperor Frederick II. There is a large royal dockyard (3,000 workmen), and a small-arms factory; there are also ironworks, cotton, flour and macaroni mills. An electric tramway leads along the coast to Sorrento.

CASTELLESI, ADRIANO (1460?–1521), Italian cardinal and writer, known also as CORNETO from his birthplace, was sent by Innocent VIII. to reconcile James III. of Scotland with his subjects. While in England he was appointed (1503), by Henry VII., to the see of Hereford, and in 1504 to the diocese of Bath and Wells, but he never resided in either. Returning to Rome, he became secretary to Alexander VI. and was made cardinal (May 31, 1503). Soon after the election of Leo X. he was implicated in the conspiracy of Cardinal Petrucci against the pope. He confessed his guilt, fled from Rome and was deposed from the cardinalate. As early as 1504 he had presented his palace (now the Palazzo Giraud-Torlonia) to Henry VII. as a residence for the English ambassador to the Holy See; and on his flight Henry VIII., who had quarrelled with him, gave it to Cardinal Campeggio. Of Adrian's subsequent history nothing is known. As a writer, he was one of the first to restore Latin to its pristine purity; and among his works are *De Vera Philosophia ex quatuor doctoribus ecclesiae* (Bologna, 1507), *De Sermone Latino* (Basle, 1513) and a poem, *De Venatione* (Venice, 1534).

See B. Gebhardt, *Adrian von Corneto* (Breslau, 1886).

CASTELLI, IGNAZ FRANZ (1781–1862), Austrian dramatist, was born at Vienna on March 6, 1781. During the Napoleonic invasions his war song, *Kriegslied für die österreichische Armee*, was printed by order of the archduke Charles and distributed in thousands. For this Castelli was proclaimed by Napoleon in the *Moniteur*. In 1815 he went to France as secretary to Count Cavriani, and, after his return to Vienna, resumed his post in the government service. In 1842 he retired to his estate at Lilienfeld, where he devoted himself to literature. Castelli's dramatic talent was characteristically Austrian; his plays were well constructed and effective and satirized unsparingly the foibles of the Viennese. But his wit was local and ephemeral. His excellent *Gedichte in nieder österreichischer Mundart* (1828) are still read. He died at Lilienfeld on Feb. 5, 1862.

Castelli's *Gesammelte Gedichte* appeared in 1835 in 6 vols.; a selection of his *Werke* in 1843 in 15 vols. (2nd ed., 1848), followed by 6 supplementary volumes in 1858. *See* his autobiography, *Memoiren meines Lebens* (1861–62); new ed. *Aus dem Leben eines Wiener Phaäken* (1912).

CASTELLO, BERNARDO (1557–1629), Genoese portrait and historical painter, born at Albaro near Genoa, was the intimate friend of Tasso, and designed the figures of the *Gerusalemme Liberata*, published in 1592; some of these subjects were engraved by Agostino Caracci.

CASTELLO, GIOVANNI BATTISTA (1500?–1569?), Italian historical painter, architect and sculptor, was born near Bergamo in 1500 or perhaps 1509, and is hence termed Il Bergamasco. He belongs, however, to the school of Genoa, but does not appear to have been related to the other two painters named Castello, also noticed here. He decorated the Nunziata di Portoria in Genoa, the saloon of the Lanzi palace at Gorlago, and the Pardo palace in Spain. His best-known works are the "Martyrdom of St. Sebastian" and the picture of "Christ as Judge of the World" on one of the vaultings of the Annunziata. In 1567 he was invited to Madrid by Philip II., and there he died, holding the office of architect of the royal palaces. The date of death (as of birth) is differently stated as 1569 or 1579.

CASTELLO, VALERIO (1625–1659), Italian painter, was the youngest son of Bernardo Castello (*q.v.*). He surpassed his father, and particularly excelled in painting battle scenes. He painted the "Rape of the Sabines," now in the Palazzo Brignole, Genoa, and decorated the cupola of the church of the Annunciation in the same city.

CASTELLO BRANCO, CAMILLO, VISCONDE DE CORREIA BOTELHO (1825–1890), Portuguese novelist, was born out of wedlock and lost his parents in infancy. He spent his early years in a village in Traz-os-Montes. He learnt to love poetry from Camoens and Bocage, while Mendes Pinto gave him a lust for adventure, but he dreamed more than he read, and grew up undisciplined and proud. He took minor orders, but his restless nature prevented him from following one course for long and he soon returned to the world, and henceforth kept up a feverish literary activity to the end. He was created a viscount in 1885 in recognition of his services to letters, and when his health finally broke down he received a government pension. When, old and blind, he died by his own hand in 1890, it was recognized that Portugal had lost the most national of her modern writers.

Apart from his plays and verse, Castello Branco's works may be divided into three sections. The first comprises his romances of the imagination of which *Os mysterios de Lisboa*, in the style of Victor Hugo, is a fair example. The second includes his novels of manners, a style of which he was the creator and remained the chief exponent until the appearance of *O Crime de Padre Amaro* of Eça de Queiroz. In these he is partly idealist and partly realist, and describes to perfection the domestic and social life of Portugal in the early part of the 19th century. The third division embraces his writings in the domain of history, biography and literary criticism. Among these may be cited *Noites de Lamego*, *Cousas leves e pesades*, *Cavar em ruinas*, *Memorias do Bispo do Grão Para* and *Bohemia do Espirito*.

Knowing the life of the people by experience and not from books, he was able to fix in his page a succession of strongly marked and national types, such as the *brazileiro*, the old *fidalgo* of the north, and the Minho priest. Among the most notable of his romances are *O Romance de un Homem Rico*, his favourite, *Retrato de Ricardina*, *Amor de Perdição*, and the magnificent series entitled *Novellas do Minho*. Many of his novels are autobiographical, like *Onde está a felicidade*, *Memorias do Carcere* and *Vingança*. No other Portuguese author has shown so profound a knowledge of the popular language as Castello Branco Though nature had endowered him with the poetic temperament, his verses are mediocre, but his best plays are cast in bold lines and contain really dramatic situations, while his comedies are a triumph of the grotesque, with a mordant vein running through them that recalls Gil Vicente.

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CASTELLO BRANCO, a Portuguese episcopal city, 1,560 ft. above the sea, on the Abrantes-Guarda railway. Pop. (1940) 9,293. The city has many Roman remains and is dominated by a ruined castle, and partly enclosed by ancient walls; its chief buildings are the cathedral and episcopal palace. Cloth is manufactured, and there is a flourishing local trade in cork, wine and olive oil. The administrative district of Castello Branco coincides with the south-eastern part of Beira; pop. (1930), 265,573; (est. 1935) 278,778; (1940) 299,670; area, 2,588 sq.mi.

CASTELLÓN DE LA PLANA, a province of eastern Spain, formed in 1833 of districts formerly included in Valencia; bounded on the north by Teruel and Tarragona, east by the Mediterranean sea, south by Valencia, and west by Teruel. Pop. (1940) 312,475; area, 2,579 sq.mi. The province is mainly occupied by mountains which increase in height westward and culminate in the peak called Peñagolosa (5,945 ft.). Lowlands occur only along a narrow coastal belt and up some of the river valleys. The interior is dissected by the valleys of many streams flowing to the Mediterranean. The chief rivers are the Cenia, the Vinaroz and the Mijares with its tributary the Monlleo, separated from the Palancia by the Sierras de Espina and de Espadan. The coast-line is unbroken by any marked inlet and there is no first-class harbour. The climate is cold and variable in the hilly districts, temperate in winter and very warm in summer in the lowlands. Here irrigation supplements the scanty rainfall and cereals, including rice, the vine and olive, vegetables and hemp are cultivated but fruit and, above all, oranges are the chief products. Cork and locust beans are obtained from the mountain regions where marble is quarried, and fishing is important off the coast. Lead, zinc and iron and other ores are known to be present, but only limited mining operations are carried on. The chief industries are fish-curing and the manufacture of woollen, linen and silk goods and of porcelain. Oranges, wine, oil and beans are exported. The Barcelona-Valencia railway skirts the coast, passing through Castellón, the capital; the Calatayúd-Sagunto line crosses the southern extremity of the province. A light railway from Onda links Castellón with its port of El Grao. Chief towns (pop. 1940) are Castellón (*q.v.*) (42,324), Villarreal (*q.v.*) (16,777), Burriana (*q.v.*) (15,725), Peñiscola (2,833), a town of some historical interest, Vall de Uxó (9,612), Vinaroz (8,267), Villafamés (1,560), Almazora (7,804), Benicarló (9,001), Onda (6,483), Segorbe (6,048), Nules (5,925), Alcalá de Chisbert (4,399) and Morella (2,466) (*See* also VALENCIA.)

CASTELLÓN DE LA PLANA, a city of eastern Spain, capital of the province described above, on the Barcelona-Valencia railway, 4 mi. from the Mediterranean sea. Pop. (1940) 42,324 (mun., 46,876). Castellón lies on a fertile plain irrigated from the Mijures estuary, 5 mi. S.E., by a rock-hewn Moorish aqueduct. The town, partly encircled by ruined walls, is mainly modern, but contains several ancient convents, an old octagonal bell-tower, 130 ft. high, and a 14th century church with an interior painting by Francisco Ribalta, who was born there in 1555. Castellón manufactures porcelain, leather, rope, paper and clothing. Its harbour, El Gráo de Castellón, 4 mi. E., and improved, is annually entered by some 400 small vessels, ordinarily engaged in shipping oranges, almonds and locust beans to Britain and hemp to other parts of Spain. The chief imports are coal and chemical manures. A light railway from Onda connects Castellón and its port with the orange groves to the southwest. Under the Moors Castellón occupied a hill to the north; its removal to the plain by James I of Aragon (1213–76) gave the town its name "Castellón of the Plain." It fell to the nationalists June 15, 1938, in the campaign on Valencia.

CASTELLORIZO, the ancient Megiste called Castelrosso by the Italians, an island of the Dodecanese. Area, 4 sq mi. It was included by the Turks in the privileged group known as "the Dodecanese" (*q.v.*), but did not form part of the Italian "Dodecanese" occupied during the Libyan War of 1912. The outbreak of hostilities against Turkey during World War I gave the Italians an opportunity of adding Castellorizo to their Dodecanesian possessions, after the French had occupied it on Dec. 27, 1915. Articles 122 of the treaty of Sèvres in 1920 and 15 of the second treaty of Lausanne in 1923 provided that "Turkey renounces in favour of Italy all rights and title . . . over the island of Castellorizo." Its population is entirely Greek; in 1936 it numbered 2,238.

CASTELNAU, EDOUARD DE CURIERES DE (1851–1944), French soldier, was born at Saint-Affrique, Aveyron Dec. 24, 1851, third son of the Marquis de Curières de Castelnau. He entered the military school of St. Cyr, near Versailles, in 1869; and during the Franco-German War took part in the Loire campaign. Captain in 1876 and commandant in 1889, he was appointed by Gen. de Miribel in 1893 to a post in the chief department of the general staff; later, as head of the department he built up the vast system of French mobilization. In 1910 he became general of division, and in June 1911 assistant to the chief of the general staff. On the outbreak of the World War he commanded the II. Army in Lorraine. After the French offensive had failed at Morhange in Aug. 1914, General Castelnau in turn successfully repulsed the Germans at the Trouée de Charmes and the heights of the Grand Couronné. On Sept. 18 the II. Army was moved to the west between the Somme and the Oise in the abortive attempt to outflank the German armies—known as the "race to the sea."

On June 13, 1915, Gen. Castelnau took command of the group of four armies which constituted the French centre, and directed the September offensive in Champagne. In the following December he became chief of the general staff under General Joffre. He was next sent to Salonika on a tour of inspection, returning by way of Athens and Rome. Three days after the opening of the German attack at Verdun on Feb. 21, 1916, Castelnau was sent there on an emergency mission, with full powers, and appreciating the danger, gave orders that the right bank of the Meuse be held at all cost; he returned to Joffre's headquarters only when the position was secure. On the appointment of Nivelle in place of Joffre, Castelnau was sent on a mission to St. Petersburg in Jan. 1917. On his return he was given command of the group of armies in the east with a view to directing the large-scale operations which were anticipated in November 1918, and which the Armistice forestalled. After the war General Castelnau entered the Chamber as deputy for Aveyron; he acted as president of the army committee, and allied himself to the group known as the *Entente démocratique et sociale*. *See* Victor Giraud, *Castelnau* (1921).

CASTELNAU, MICHEL DE, SIEUR DE LA MAUVISSIERE (*c.* 1520–1592), French soldier and diplomatist, was born in Touraine. After some service in the French army in Italy he entered the service of the Cardinal of Lorraine. He was employed on a series of important diplomatic missions, and after the death of Francis II. accompanied his widow, Mary Stuart, to Scotland in 1561. During that year he sought in vain to effect a reconciliation between Mary and Elizabeth. During the next ten years he was employed alternately in the army and in diplomacy. In 1572 he was sent to England by Charles IX. to allay the excitement created by the massacre of St. Bartholomew, and the same year he was sent to Germany and Switzerland. Two years later he was reappointed by Henry III. ambassador to Queen Elizabeth, and he remained at her court for ten years. Castelnau used his influence to promote the marriage of the queen with the duke of Alençon, but Elizabeth made so many promises only to break them that at last he refused to accept them or communicate them to his Government. On his return to France he found that his château of La Mauvissière had been destroyed in the civil war; and as he refused to recognize the authority of the league, the duke of Guise deprived him of the governorship of Saint-Dizier. He was thus brought almost to a state of destitution. But on the accession of Henry IV., the king, who knew his worth, and was confident that although he was a Catholic he might rely on his fidelity, gave him a command in the army, and entrusted him with various confidential missions.

Castelnau died at Joinville in 1592. His *Mémoires* rank very high among the original authorities for the period they cover, the 11 years between 1559 and 1570. They were written during his last embassy in England for the benefit of his son; and they possess the merits of clearness, veracity and impartiality. They were first printed in 1621; again, with additions by Le Laboureur, in 1659; and a third time, still further enlarged by Jean Godefroy, in 1731. Castelnau translated into French the Latin work of Ramus, *On the Manners and Customs of the Ancient Gauls*. Various letters of his are preserved in the Cottonian and Harleian collections in the British Museum.

His grandson, JACQUES DE CASTELNAU (1620–1658) distinguished himself in the war against Austria and Spain during the ministries of Richelieu and Mazarin, and died marshal of France.

See G. Hubault, *Ambassade de Castelnau en Angleterre* (1850); *Relations politiques de la France . . . avec l'Écosse au seizième siècle*, edited by J. B. A. T. Teulet (1862); and De la Ferrière, *Les Projets de mariage d'Elisabeth* (1883).

CASTELNAUDARY, a town of south-western France, in the department of Aude, 22 m. W.N.W. of Carcassonne, on the railway to Toulouse. Pop. (1936) 6,862. It probably represents the ancient town of *Sostomagus*, taken during the 5th century by the Visigoths, who, it is conjectured, rebuilt the town, calling it *Castrum Novum Arianorum*, whence the present name. Early in the 13th century the town was the scene of several struggles during the war against the Albigenses. It is finely situated on rising ground in the midst of a fertile and well-cultivated plain, on the Canal du Midi, which here widens out into an extensive basin lined with warehouses. The church of St. Michel (14th century) has a street running beneath its tower. There are a number of flour-mills, as well as manufactories of earthenware and tiles; trade is in lime, timber, grain, fruits, wine, cattle and farm implements.

CASTELSARRASIN, a town of south-western France, capital of an arrondissement in the department of Tarn-et-Garonne, 12m. W. of Montauban. Pop. (1936), 3,616. The name appears in the 13th century. Castrum Cerrucium, Castel-sur-Azine (from the neighbouring stream, Azine) and Castellum Sarracenum are suggested derivations. The town is situated on the left bank of the lateral canal of the Garonne about a mile from the right bank of the river. Promenades occupy the site of the old fortifications. Its chief building is the 13th century brick church of St. Sauveur, typical of the Tolosan style.

CASTI, GIOVANNI BATTISTA (1724–1803), Italian poet, a native of Acquapendente, entered the church, but surrendered his chance of preferment to the pleasure of visiting the courts of Europe. From 1790–96 he was poet-laureate at the Austrian court. The rest of his life was spent in Paris, where he died on Feb. 6, 1803. He wrote lyrics, the libretti of many cantatas and operas and a satire in 26 cantos, *Gli Animali parlanti* (1802), which was translated into many languages (Eng. version by W. S. Rose, *Court and Parliament of Beasts*, 1819).

CASTIGLIONE, BALDASSARE (1478–1529), Italian diplomatist and author of *Il Cortegiano*, was born at Casanatico near Mantua, and was educated at Milan under the famous professors Merula and Chalcondyles. In 1496 he entered the service of Lodovico Sforza, duke of Milan, returning to Mantua in 1500 when Lodovico was carried prisoner into France. In 1504 he was attached to the court of Guidobaldo Malatesta, duke of Urbino, and in 1506 he was sent by that prince on a mission to Henry VII. of England. He also served Malatesta's successor, Francesco Maria della Rovere, for whom he obtained the command of the papal troops. Charged with the arrangement of the dispute between Clement VII. (Medici) and Charles V., Castiglione crossed, in 1524, into Spain, where he was received with honour, being afterwards naturalized, and made bishop of Avila. In 1527, however, Rome was seized and sacked by the Imperialists under Bourbon, and in July of the same year the surrender of the castle of Sant' Angelo placed Clement in their hands. Castiglione had been tricked by the emperor, but there were not wanting accusations of treachery against himself. He had, however, placed fidelity highest among the virtues of his ideal "courtier," and when he died at Toledo on Feb. 7, 1529 it was said that he had died of grief and shame at the imputation. The emperor mourned him as "one of the world's best cavaliers."

Castiglione wrote little, but that little is of rare merit. His verses, in Latin and Italian, are elegant in the extreme; his letters (Padua, 1769–71) are full of grace and finesse. But the book by which he is best remembered is the famous treatise, *Il Cortegiano*, written in 1514, published at Venice by Aldus in 1528, and translated into English by Thomas Hoby, the *Courtyer of Count Baldessar Castilio* as early as 1561. This book, called by the Italians *Il Libro d'oro*, is one of the great books of 16th century European prose literature; it describes the Italian gentleman of the Renaissance under his brightest and fairest aspect, and gives a charming picture of the court of Guidobaldo, duke of Urbino, "confessedly the purest and most elevated court in Italy." In the form of a discussion held in the duchess's drawing-room—with Elizabeth Gonzaga, Pietro Bembo, Bernardo Bibbiena, Giuliano de' Medici, Emilia Pia, and Ceretino the Unique among the speakers—the question, what constitutes a perfect courtier, is debated. With but few differences, the type determined on is the ideal gentleman of the present day.

The best edition of *Il Cortegiano* is that of V. Cian (Florence, 1894). *See* P. L. Ginguené, *Histoire littéraire de l'Italie*, vi., vii.; J. A. Symonds, *The Renaissance in Italy* (1875); C. Hare, *Courts and Camps of the Italian Renaissance* (1908); Julia Cartwright, *B. Castiglione, the Perfect Courtier* (1908, bibl.); *The Book of the Courtier*, Everyman ed. (1928).

CASTIGLIONE, CARLO OTTAVIO, Count (1784–1849), Italian philologist, was born at Milan, and died at Genoa on April 10, 1849. He assisted Cardinal Mai in editing the fragments of Ulphilas's Gothic version of the Scriptures discovered by the cardinal in 1817, and himself edited separately between 1829 and 1839 the Gothic texts of various books of the New Testament.

See Biondelli, *Carlo Ottavio Castiglione* (Milan, 1856).

CASTIGLIONE, GIOVANNI BENEDETTO (1616–1670), called in Italy Il Grechetto, and in France Le Benédette, Italian painter of the Genoese school, was born in Genoa, and studied for some time under Vandyck. He painted portraits, historical pieces and landscapes, but chiefly excelled in fairs, markets and rural scenes with animals. Noah and the animals entering the Ark was a favourite subject. He also executed a number of etchings, which earned for Castiglione the name of "a second Rembrandt." "Diogenes searching for a Man" is one of the principal of these. The *Presepio* (nativity of Jesus) in the church of San Luca, Genoa, ranks among his most celebrated paintings, the Louvre contains eight characteristic examples, and works of his are also to be found in Rome, Venice, Naples, Florence, Genoa and Mantua. In his closing years he lived in Mantua, painting for the court, and died there in 1670. His brother Salvatore and his son Francesco excelled in the same subjects.

CASTIGLIONE DELLE STIVIERE, a town in Lombardy, 22 miles N.W. of Mantua, was the scene of a battle on Aug. 5, 1796, between the French Army of Italy under Napoleon Bonaparte and the Austrians under Wurmser. The latter's attempt to relieve the fortress of Mantua, which had been besieged by the French since the middle of July, by an advance in two columns on both sides of Lake Garda, met with such initial success that Bonaparte had been compelled to raise the siege. Having defeated the Austrian right column at Lonato, he then turned eastwards against Wurmser, who with his left column had entered Mantua on Aug. 1, and now deployed his 25,000 men for battle with his right at Solferino and his left at Medole. Bonaparte, who had in all some 31,000 men at his disposal, now made use for the first time of a plan of battle typically his own; it consisted in a series of holding attacks along the whole of the enemy's front, to pin down his forward troops and induce him to engage his reserves; a thrust into the rear of one of his wings by a detached force called up from a distance to the battlefield designed to shake his morale and disorganize him; and a decisive frontal assault on the hostile wing so threatened, which completed his defeat. On this occasion Bonaparte deployed Masséna and Augereau against Wurmser's front, while Serurier's blockading troops, which after the raising of the siege of Mantua had retired to Marcaria, some 15 miles south of Medole, and had been ordered to march all night, struck into his rear at Guidizzolo. Wurmser was taken by surprise by the sudden appearance of this new enemy, and Bonaparte seized his opportunity to throw a picked force of grenadiers under Kilmaine against the Austrian left centre.

The result was the complete defeat of the Austrian army, which having lost 2,000 men and 18 guns, retreated eastward over the Mincio into Tirol. Strategically Wurmser had in part achieved his object in securing an additional lease of life for the fortress he had been sent to relieve; but he had failed to seize the chance offered him of decisively defeating the French, whose brilliant recovery from an apparently desperate situation and tactical victory on the battlefield left the honours of the campaign with them, and greatly enhanced their morale and prestige. (*See* further French Revolutionary Wars.) Pop. (1936) 4,127 (town), 8,353 (commune).

CASTIGLIONE OLONA, a village of Lombardy, Italy, in the province of Varese, 27 mi. N.E. of Milan by rail. Pop. (1936) 1,219 (town), 3,090 (commune). The choir of the collegiate church, erected about 1428 by Cardinal Branda Castiglioni, contains fine frescoes by Masolino of Florence. There are other works by the same master in the baptistery. The tomb of the cardinal (1443) is good. The church of S. Sepolcro is also in the village.

CASTILE, an ancient kingdom of Spain, bounded on the north by the Bay of Biscay, northeast by the modern Basque provinces and Navarre, east by Aragon, southeast by Valencia and Murcia, south by Andalusia, west by Estremadura and León, and northwest by Asturias. Area, 53,307 sq.mi.

The name is said to have been derived from the many frontier forts (*castillos*), erected as a defense against the Moors The territorial extent of mediaeval Castile grew with progressive conquests from the Moors. From a mere county in the north (Old Castile) the kingdom extended to include the whole of central Spain. The final successful resistance of Asturias was followed by the liberation of Galicia and León and in the time of Ferdinand I of Castile (1035–1065) the kingdoms of León and Castile were united. New territories were annexed on the south and the capture of Toledo in 1085 saw the formation of New Castile.

The centre of Old Castile is the basin of the Upper Douro, that of New Castile the trench-like upper basins of the Tagus and Guadiana. In 1833 Old Castile was divided into the provinces of Avila, Burgos, Logroño, Palencia, Santander, Segovia, Soria and Valladolid; while New Castile was similarly divided into Ciudad Real, Cuenca, Guadalajara, Madrid and Toledo (*qq.v.*). The entire area extends for about 300 m. from north to south, and 160 m. from east to west. It is a plateau, with average altitude about 2,500ft. and a natural frontier of high mountains on all sides, except on the borders of León, Estremadura and Murcia. On the north-west are the Sierra de Culebra and the high plains of Leon, on the north the Cantabrian mountains, on the east the Sierra del Demanda and its offshoots. The Sierra de Gaudarrama, Sierra de Gredos and Sierra de Gata extend across the centre in a south-westerly direction, forming the southern boundary of Old Castile. The Sierra de Albarracin and Sierra de Cuenca continue the mountain girdle of New Castile on the east, with parts of the Sierra Morena forming its southern boundary. The mountains on the south-west are less definite and include the minor ranges that more or less unite the Sierra de Gredos, Sierra de Guadelupe and Sierra Morena. This highland region, shut off from the sea, is exposed to extremities of heat and cold. Snow falls early and lies late on the mountains of the north and there is a heavy rainfall in the north-west The southern regions of New Castile are more arid with a rainfall rarely exceeding 10 inches in the year. The country is swept by bitter gales in winter and scorching dust-laden winds in summer. In both the Castiles the plateau-soil is naturally fertile, and after rain a luxuriant vegetation appears; but drought is common. In the neighbourhood of Valladolid, Palencia and in the Mesa de Ocaña, where heavy loam underlies the porous surface, moisture which elsewhere is absorbed remains available. On the mountains surrounding the plateau vast tracts are useless except as pasture for sheep, and the severe winters drive the sheep to migrate yearly into Estremadura (*q.v.*). On the wheat-growing lands arose centrally situated cities, like Valladolid, Palencia and Toledo, while arranged around them at the foot of the mountain passes grew up a ring of smaller centres, mediaeval market towns where the produce of the plains was exchanged for that of the highlands. In Old Castile we have León, Burgos, Segovia, Avila and Salamanca; in New Castile, Guadalajara, Cuenca, Albacete and Ciudad Real. Salamanca, linked with the Moorish south, became the historic university of Christian Spain, while Toledo was a link between north and south—Christian and Moor. At Alcala de Henares was established in 1510 another university.

Castilian is the literary language of Spain, and with certain differences, of Spanish America also. It is spoken in Old and New Castile, Aragon, Estremadura and the greater part of León; in Andalusia it is subject to modifications of accent and pronunciation. Cut off on all sides from the sea and full of memories of the bitter struggle with the Moors, this region has preserved many mediaeval features in its life. Madrid (*q.v.*) grew up following the defeat of the Moors, and has little relation to the evolution of Castile.

CASTILHO, ANTONIO FELICIANO DE (1800–1875), Portuguese man of letters, was born at Lisbon. He lost his sight at the age of six, but the devotion of his brother Augusto, aided by a retentive memory, enabled him to go through his school and university course with success; and he acquired an almost complete mastery of the Latin language and literature. His first work of importance, the *Cartas de Echo e Narciso* (1821), belongs to the pseudo-classical school, but his romantic leanings became apparent in the *Primavera* (1822) and in *Amor e Melancholia* (1823), two volumes of honeyed and prolix bucolic poetry. In the poetic legends *A noite de Castello* (1836) and *Cuimes do bardo* (1838) Castilho appeared as a full-blown Romanticist. A fulsome epic on the succession of King John VI. brought him an office of profit at Coimbra. Going to Brazil in 1854, he there wrote his famous "Letter to the Empress." Though Castilho's lack of strong individuality and his over-great respect for authority prevented him from achieving original work of real merit, yet his translations of Anacreon, Ovid and Virgil, and the *Chave do Enigma*, explaining the romantic incidents that led to his first marriage with D. Maria de Baena, a niece of the satirical poet, Tolentino, and a descendant of Antonio Ferreira, reveal him as a master of form and a purist in language.

See *Memorias de Castilho*, ed. Julio de Castilho (1881–1903); Innocencio da Silva in *Diccionario bibliographico Portuguez*, i. 130 and viii. 132; Latino Coelho's study in the *Revista contemporanea de Portugal e Brazil* vols. i. and ii.; Theophilo Braga, *Historia do Romantismo* (1880); and F. de Figueiredo, *Historia da litteratura romantica portuguesa 1825–70* (1913).

CASTILLEJO, CRISTÓBAL DE (1400–1550), Spanish poet, was born at Ciudad Rodrigo. When quite young he entered a Carthusian monastery, but in 1525 he became secretary to Charles V.'s brother, Ferdinand of Austria, in whose service he spent the rest of his life, mostly outside Spain. He died and was buried at Vienna. Castillejo's poems are interesting, not merely because of their intrinsic excellence, but also as being the most powerful protest against the metrical innovations imported from Italy by Boscán and Garcilaso de la Vega. He adheres to the native metres except when parodying the new school—as in the lines *Contra los que dejan los metros castellanos*. He excels by virtue of his charming simplicity and his ingenious wit, sometimes cynical and sometimes urbane. His plays are lost; the best text of his verses is that printed at Madrid in 1926.

See C. L. Nicolay, *The Life and Works of Cristóbal de Castillejo* (1910).

CASTILLO SOLÓRZANO, ALONSO DE (1584?–1647), Spanish novelist and playwright, issued his first work, *Donaires del Parnaso*, two volumes of humorous poems, in 1624–25, but his *Tardes entretenidas* (1625) and *Jornadas alegres* (1626) proved that he was a novelist by vocation. He published in quick succession three clever picaresque novels, two of which, *La Niña de los embustes, Teresa de Manzanares* (1634) and *Las Aventuras del Bachiller Trapaza* (1637), were used by Lesage in *Gil Blas*. To these shrewd cynical stories he owes his reputation. He was also popular as a playwright both at home and abroad. His *Marqués del Cigarral* and *El Mayorazgo figurón* are the sources respectively of Scarron's *Don Jophet d'Arménie* and *L'Héritier ridicule.* Among his numerous remaining works may be mentioned *Las Harpías en Madrid* (1633), *Fiestas del Jardín* (1634), *Los Alivios de Casandra* (1640) and the posthumous *Quinta de Laurel* (1649); the witty observation of these books forms a singular contrast to the prim devotion of his *Sagrario de Valencia* (1635).

CASTING or **FOUNDING.** The process of giving shape to or reproducing an object by pouring its material in liquid form into a mould.

(*See* FOUNDING; SCULPTURE TECHNIQUE.)

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